



IAEA

International Atomic Energy Agency
Atoms for Peace

FOOD FOR THE FUTURE



SUMMARY OF THE IAEA SCIENTIFIC FORUM

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Using nuclear science to ensure safe and sufficient food

The world faces a conundrum: the need to reduce hunger and feed more people but also to protect from exhaustion resources such as water and soil, whose use is already overstretched.

By 2050, when it's predicted that the world's population will total ten billion people, 70 per cent more food will be required to feed them. At present, almost one billion people go to bed hungry. Yet 1.3 billion tonnes of food, almost a third of what's produced, is lost or wasted each year.

The theme of the IAEA's 2012 Scientific Forum was Food for the Future: Meeting the Challenges with Nuclear Applications. The two-day event, a regular feature of the IAEA's annual General Conference, brought together prominent policy makers, scientists, development experts and governmental officials, to review how strategies integrating nuclear and other techniques are contributing to food security.

The IAEA puts into the hands of its Member States a range of highly effective nuclear solutions to help farmers produce more food. The Scientific Forum focused on three areas in which IAEA-supported science and technology interventions are assisting farmers in closing the gap between demand and the supply of safe and wholesome food, and providing the means to improve production:

Increasing Food Production: Solutions robust enough to help feed the anticipated increase in human population using fewer resources, even under difficult conditions, are now available. Nuclear technologies are providing higher yielding, hardier crops and helping to increase livestock productivity.

Ensuring Food Protection: Environmentally friendly nuclear based plant and animal pest control is strengthening world agricultural output. Diseases and pests reduce yields, both before and after harvest, by 30 to 40 per cent. Some of the diseases which kill or harm livestock also put the health of farmers at risk. Invasive animal and plant diseases and pests further threaten food security. Costly control measures, including the use of pesticides, can add to food insecurity.

Enhancing Food Safety: The IAEA plays a key role in developing systems to control chemical contaminants and food-borne bacteria. Exposure to them is a serious threat to the health of millions of people worldwide, particularly those in developing countries with poor nutritional status. Food irradiation is one of the few technologies that can improve food quality and safety.

Film



Food for the Future

Meeting the Challenges with Nuclear Applications

The high Andes of Peru, the busy streets of Jakarta and the dusty Cameroon bush — all very different places, in diverse parts of the world, with one thing in common: the people here are all benefiting from nuclear science and the support of the IAEA to produce and protect food and make it safer.



Keynote Address by IAEA Director General Yukiya Amano

When I am asked why I decided to focus on food at this year's IAEA Scientific Forum, my answer is simple: there are nearly one billion people on this planet who do not have enough to eat. All of us have a responsibility to do everything we can to help them.


The IAEA is in the unique position of being able to make nuclear technology available to developing countries. We help them to grow more food, fight animal and plant pests and diseases, and ensure the safety of food products.

Nuclear technology makes a powerful and critical contribution. Working closely with our partners at the Food and Agriculture Organization of the United Nations (FAO), the IAEA supports over 200 projects in more than 100 countries. You saw some examples in the film a moment ago.

I hope that this Scientific Forum will encourage countries already familiar with nuclear techniques related to food to make more use of them. And I hope more countries will take advantage of the IAEA services in this area.

This mandarin comes from a region of Croatia where 90 per cent of the people are involved in the citrus fruit industry. The value of citrus production in this area is estimated at around 30 million euros a year.

However, around a third of the annual crop is destroyed by fruit flies. We therefore deployed the sterile insect technique. It is essentially a form of birth control. Millions of male flies are sterilized using gamma rays. They are released into the wild, where they mate with females. Because the males are sterile, there is no reproduction.



The result has been a drop of no less than 75 per cent in fruit fly damage in the region concerned. Farmers are able to reduce significantly their use of insecticide, so there are also environmental benefits. This mandarin is free of fruit flies.



This device is part of an easy-to-use, portable laboratory. It is making a huge difference in controlling animal diseases such as foot-and-mouth in more than 30 countries in Africa and Asia. It was co-developed by the IAEA using isotopic and nuclear related techniques.

With this device, vets can carry out diagnostic tests on animals in remote areas. The results are known within an hour. Each test costs less than two US dollars. Vets can give immediate advice to farmers, inform the authorities if necessary and help prevent the spread of disease to neighbouring farms and to other countries.



Finally, this is a variety of barley known as Centenario. It was developed using a plant breeding technique that involves irradiation. It grows at altitudes of around 4000 metres in the high Andes and is now Peru's leading barley variety.

Centenario has more protein than other types of barley. It is tasty and resistant to frost. More importantly, it has a higher yield than other barley types and fetches twice the price at market. It is not only improving the diets of remote communities in the high Andes, it is also increasing their incomes.

Clearly, the IAEA cannot solve the world's food problems on its own. But we can make an important contribution.

I am proud of the way in which the IAEA is able to put sophisticated scientific techniques to use and make them available in robust, practical ways in the field. This improves the lives of many thousands of people.

Over the next two days, you will hear from the people who helped to develop these products and from experts with first-hand experience of the nuclear techniques I have described.

This side of the IAEA's work does not get the same public attention as our activities in nuclear safeguards, nuclear safety and nuclear security. But it is just as important.

I hope you will have an interesting and productive meeting. I look forward to learning about the outcome of your discussions tomorrow.



Keynote Speakers

José Graziano da Silva,
Director General,
Food and Agriculture Organization
of the United Nations (FAO)

From a half century of collaboration, the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, based at the IAEA in Vienna, has supported the eradication of rinderpest, formerly a devastating cattle disease, and implemented sterile insect technique (SIT) programmes to suppress insect pest populations in South America and in Europe, as well as the tsetse fly in Africa. It has also developed improved crop varieties that expand agricultural production in harsh environments around the world. FAO Director General José Graziano da Silva praised the FAO/IAEA collaboration.



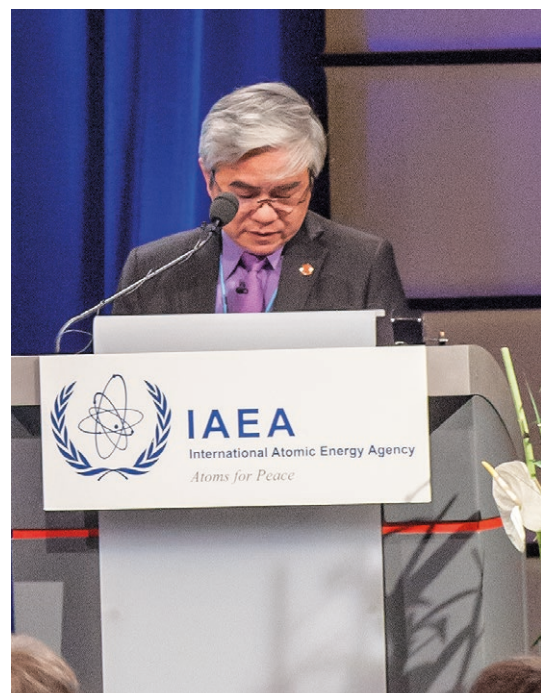
Steven Chu, Secretary of Energy, United States of America

The amount of the world's available arable land is finite, while an expanding global population is estimated to peak at 10 billion inhabitants by 2050 said the United States Secretary of Energy and Nobel Laureate Steven Chu. An enormous challenge looms in finding the means to feed this population sustainably. Two technologies promise to offer an effective response to the growing challenges: plant mutation breeding, a nuclear technique, has long been proven to improve crop yields; and highly sensitive radiotracers for water analysis are used to monitor water reserves and pathways to conserve and protect this irreplaceable resource.



Nguyen Quan, Minister for Science and Technology, Vietnam

After an extended period of agricultural progress, Vietnam now needs to adapt to the consequences of climate change through sustainable agricultural production, said Vietnam's Minister for Science and Technology, Nguyen Quan. National programmes have been implemented using nuclear technologies to develop new rice varieties, in turn broadening the knowledge base and bringing about the transfer of technologies to local communities to improve agricultural production practices.





Kilemi Mwiria, Assistant Minister for Higher Education, Science and Technology, Kenya

Nine out of ten Kenyans are involved in agriculture and the risk to their prosperity from adverse weather and rainfall variability has a sweeping impact on the population, said Kenya's Assistant Minister for Higher Education, Science and Technology, Kilemi Mwiria. In collaboration with the IAEA, Kenya is enhancing the production of hardy seed varieties, expanding land use through improved irrigation practices, and reducing livestock disease by taking a multidisciplinary approach. The dissemination and transfer of such knowledge and cost effective technologies to rural communities will continue to be a challenge.



Suyono Haryono, Director of the Agency for Agricultural Research and Development, Indonesia

Indonesia's geographical diversity, comprising more than 10 000 islands, its rapidly growing population, coupled with the added challenge of different climatic zones and varying agricultural practices, present a complex set of challenges. The Director of Indonesia's Agency for Agricultural Research and Development, Suyono Haryono, said that mitigating and adapting to climate change is an issue being addressed in collaboration with the IAEA, leading to the development of new rice varieties that have increased yields from five to eight tonnes of rice per hectare. The use of food irradiation to preserve and increase the shelf life of foods and fresh produce was also noted as a rapidly developing technology that is being adopted by many food industries in the country.



The Birth of Centenario

Farming in the high Andes

Few plants thrive at altitudes of over 4000 metres, where soil is poor, water scarce and the winters harsh. But farmers in the high Andes of Peru can grow varieties of sturdy grains, such as barley, that can survive under extreme weather conditions. These have been developed with a plant breeding technique that uses radiation on seeds to induce changes in plants.





Increasing Food Production

Panellists

- Luz Gómez-Pando, National Agrarian University La Molina, Peru
- J. Perry Gustafson, University of Missouri, United States of America
- Steven Chu, Secretary of Energy, United States of America
- Winfried E.H. Blum, University of Natural Resources and Life Sciences, Austria
- Ren Wang, Chinese Academy of Agricultural Sciences, China
- Oswin Perera, University of Peradeniya, Sri Lanka
- Bob Ørskov, International Feed Resources Institute, United Kingdom

The 'arithmetic' of global food security is such that by 2050, to feed the world's anticipated population of ten billion people, 70 per cent more food will need to be produced. But its production cannot impose a footprint beyond the limits of the land, water and energy to sustain it. And every year millions of hectares of arable land are being lost to worsening degradation. Poor agricultural practices are to blame and by 1990 there had been a 38 per cent decline in the availability of cropland worldwide. Since then the loss has continued at a rate of five to six million hectares of land every year. To further complicate the challenge, climate change is expected to bring more destructive weather events that may dramatically reduce crop yields. Rain patterns are changing, leading to longer droughts and diminished harvests; there is already greater reliance on limited




fresh water reserves, such as underground aquifers; rising sea levels will increase the salinity of coastal soils and this can reduce yields. A warming world is resulting in disease bearing insect pests migrating beyond their present boundaries, affecting crops, livestock and people.

The impact of climate change and soil erosion will continue to rob farmers as populations grow – requiring new and improved technologies to increase food production. Worldwide, there are about 500 million smallholder farmers, whose subsistence on limited amounts of land depends upon the crops they grow and the animals they rear. These farmers are the primary source of food for more than two billion people, or about one third of humanity. An investment in improving the resilience of their farming techniques to adapt to climatic disruptions, as well as to increase the yields they achieve, will reduce rural poverty and strengthen food security for the most vulnerable segment of the global population.

Although drought further amplifies the problems related to land loss, since one third of the global population lives in drought areas, by changing soil management, the soil will hold much more rainwater, increasing crop yields and lessening the risk of erosion and pollutant run-offs that threaten fresh water supplies. Using nuclear techniques, isotopes in soils, crops, waters, fertilizers and animal manure can be tracked to determine their movement in farmlands and measure soil erosion and nutrient and water use by crops.

Strains of plants that are tolerant to more adverse climatic conditions, as well as to plant diseases, should continue being



developed by plant breeders using nuclear techniques to find resistant strains. Plant diseases are migrating into new ecological niches owing to shifting temperature patterns and globalized trade. Transboundary diseases that decimate crops move further, placing a larger region at risk, posing a further threat to food security.

The panellists agreed that mutation breeding has a critical role to play in increasing crop production. Nuclear technologies provide improved management practices that increase crop yield and improve the quality of seeds provided to farmers. In addition to improved crop production practices, improved animal production practices were considered as an important component of overall food security.

The panellists also underlined the fact that education and extension play a key role in providing agricultural producers with the knowledge and incentive for the management of soil productivity.

Data obtained with the help of nuclear techniques assist Member States identify solutions to enhance soil and water conservation and to improve land productivity. For instance, sustainable soil management ensures minimal soil nutrient loss and preserves the environmental services that healthy soils provide, such as storing carbon. These services, in turn, help mitigate climate change.

More Food
with Better Soil

Using Isotope
Techniques
to Improve
Soil Quality



The tiny Austrian village of Grabenegg may be a world apart and miles away from the African savannahs, the Asian deltas or the fields of South America, but research being conducted here by IAEA soil scientists could, in the future, help farmers in these parts of the world to grow more and better crops. The aim is to develop simple, cost effective farming practices that improve soil fertility.





Ensuring Food Protection

Panellists

- Martyn Jeggo, Animal Health Laboratory, Australia
- Modibo Traoré, Food and Agriculture Organization of the United Nations (FAO)
- Kazuaki Miyagishima, World Organization for Animal Health (OIE)
- Miriam Kinyua, Moi University, Kenya
- Pedro Rendon, Guatemala-Mexico-USA Moscamed Cooperative Programme, Guatemala
- Kenneth Bloem, United States Department of Agriculture, United States of America
- Hassane Mahamat Hassane, African Union

The livelihoods of nearly one fifth of the world's population, 1.3 billion mostly rural poor people in developing countries, depend wholly or partly on livestock. However, an unprecedented increase of invasive animal and plant diseases is threatening animals, crops and economies with dire consequences. In addition, there is an increasing public health threat from zoonotic diseases (transmitted from animals to people) that not only endanger public health but also raise barriers to agricultural trade.

Insect pests that attack animals and plants also threaten food security yet current costly control measures that rely on chemical insecticides are unsustainable. They result in outbreaks of secondary pests, contamination of soil, water and air, toxic chemical residues

on food, and the development of pesticide and drug resistance. Only one per cent of the chemical insecticide applied will commonly reach its intended target, while many beneficial organisms are killed, including pollinating insects and natural enemies of insect pests. The practise can give rise to new pest problems and to serious contamination of soil, water and air.

Nuclear methodologies efficiently manage or defeat crop diseases and pests; the sterile insect technique (SIT) integrated with other suppression techniques can reduce crop losses by eradicating invasive insect pests and open doors to international trade. Unlike insecticides, SIT targets specific species — sterile insects released will only mate with their own species, causing no harm to other insect species or organisms.



Protecting Africa's Lifblood

Controlling Animal Disease in Cameroon



Livestock are the lifblood of African society, providing financial and food security for around 300 million people. However, it's estimated that 25 per cent of animals die annually from preventable diseases. In countries such as Cameroon, nuclear and nuclear related technologies are playing an essential role in maintaining animal health and protecting vulnerable communities from outbreaks of disease.





Nuclear and related techniques have enabled the development of invaluable tools for managing animal disease and improving breeding and reproduction, a boon to smallholders' productivity and prosperity. The development, testing and transfer to Member States of diagnostic techniques are undertaken by the IAEA's Animal Production and Health Laboratory, which helps Member States improve livestock productivity by developing strategies to protect livestock and provide a safe and sustainable environment for their offspring. For instance, nuclear techniques provide early and rapid disease diagnosis and control and protect animals and people. They also offer certification that agricultural products for trade on international markets meet health standards.

The panellists agreed that nuclear techniques developed and transferred to developing countries by the FAO/IAEA are providing effective, targeted and environmentally friendly, animal and plant pest and disease control. The laboratories of the FAO/IAEA Joint Division play an important role in the development and dissemination of



nuclear methodologies that efficiently manage or defeat crop diseases and pests. The development and transfer of rapid and advanced diagnostic technologies to Member States should be further expanded, the panellists said.

They encouraged the FAO/IAEA to make more use of the IAEA's Coordinated Research Project network (involving laboratories in a number of Member States) to expand and increase the development of early and rapid conventional and advanced diagnostic and other technologies, for example in differentiating between animal diseases of a similar nature. The Laboratories were encouraged to enhance the development and improvement of irradiated vaccines to protect animals from diseases such as trypanosomosis and African Swine fever and expand research and methods for using SIT against other major insect pests.

Panellists also advised the FAO/IAEA to pursue mutation breeding and associated techniques for better plant disease management, as well as developing higher yield crop strains that are locally suited and do not damage the environment by depleting available resources.

Better Fruit for Neretva Valley



Farmers in Croatia are using nuclear technology to tackle the Mediterranean fruit fly, a common pest that poses a serious threat to the country's lucrative fruit industry. With the support of the IAEA and the FAO, Croatia is implementing the SIT.





Enhancing Food Safety

Panellists

- Arun Kumar Sharma, Bhabha Atomic Research Centre, India
- Suresh Pillai, Texas A&M University, United States of America
- Karen Hulebak, Resolution Strategy, LLC, United States of America
- Frans Verstraete, European Commission
- Elizabeth Carazo Rojas, University of Costa Rica, Costa Rica
- Ezzeddine Boutrif, Consultant, Food Safety Policy, Tunisia
- Chris Elliott, Queen's University Belfast, United Kingdom

Indonesia, with a growing population of around 250 million people, is among 60 countries currently using food irradiation to improve the safety and quality of food. Food irradiation prevents food poisoning, extends food shelf-life and provides a safe diet for people with suppressed immune systems.

Exposure to chemicals and pathogens in food represents a serious threat to the health of millions of people worldwide, particularly those in developing countries with poor nutritional status. The WHO estimates that foodborne and waterborne diarrhoeal diseases together kill about 2.2 million people every year, 1.9 million of whom are children. In addition, according to the FAO, approximately one third, or 1.3 billion tonnes, of the total food produced for human consumption every year is lost or wasted.

Food irradiation is one of the few technologies that can improve food quality and safety by virtue of its ability to control spoilage and food-borne pathogenic microorganisms, as well as harmful insect pests, without significantly affecting its quality. Irradiated foods are not radioactive and are as safe as any microwaved food or beverage.

The IAEA supports food irradiation as a proven and effective post-harvest treatment, improving food safety and maintaining quality by reducing bacterial contamination or controlling insect pests in agricultural commodities without the need for chemicals or additives.

In many cases, it enables developing countries to sell their harvest overseas and earn foreign exchange and it can also be used to protect both packaged and unpackaged products from microbiological hazards.

The consensus is that food irradiation is a safe and valuable technology. Foods that have been irradiated broaden the range of foods that can be safely offered to people whose immune systems may be weakened. Irradiation also improves food quality by increasing shelf-life and protecting against various pests or pathogens.

Panellists agreed that the sanitary benefits of food irradiation could contribute to preventing food wastage and they encouraged further use of such techniques.

Safer Food for a Growing Population

Using Food Irradiation in Indonesia



Indonesia is one of 60 countries currently using food irradiation to improve food safety and quality. This tropical country, with a growing population of around 250 million, uses this nuclear technology to prevent food poisoning, extend the shelf-life of food and provide a safe diet for people with suppressed immune systems.





The panellists agreed that the IAEA can also help address consumer concerns by fostering research and developing standards related to machine source electron beam and X ray applications of irradiation technology instead of radioactive sources.

The IAEA also plays a key role in the development of systems for the control of contaminants in food. Analytical methods and techniques are developed that underpin and verify traceability systems to identify and manage emerging food safety problems and trends, and to provide information on food origin and authenticity as part of a holistic 'farm to fork' food control approach that can help ensure food safety throughout the entire food production chain.



The ability of nuclear techniques to trace the specific source, provenance and authenticity of food products and to detect residues of agrochemicals in them, providing information to regulators and farmers, was also highlighted. Ensuring food safety from 'farm to fork' has become increasingly difficult since multiple stakeholders and sources are involved along the production chain. With nuclear techniques, rapid alert systems can be established to help ensure public health and to prevent so-called food fraud. At least ten per cent of food in the current market is associated with fraud, laced with dangerous substances, tainted or mislabelled – some estimates are much higher. Isotopic techniques are among the best techniques to detect fraud and to control the risks associated with food contaminated with antibiotics, pesticides, dioxins and other dangerous chemicals.

Panellists encouraged the IAEA to play a prominent role to ensure food safety and

facilitate international trade as a coordinator of a global network of food safety laboratories, and through the development and dissemination of traceability and contaminant control technologies and increased collaboration between multiple stakeholders throughout the food production chain.

Food safety experts from the IAEA are conducting research using nuclear techniques to evaluate the impact of pesticide use in food products and on the environment. The project aims to improve agricultural management practices, raise awareness on pesticide monitoring and ultimately develop a simple, 'rapid alert' test for controlling potential contamination from pesticides to help ensure safe food and a sustainable environment.



Proper Pesticide Use

Monitoring the Impact of Pesticides with Nuclear Techniques



Food safety experts from the IAEA are conducting research using nuclear techniques to evaluate the impact of pesticide use on the environment, in food products and in surface waters. The project aims to improve agricultural management practices, raise awareness on pesticide monitoring and, ultimately, develop a simple, 'rapid alert' test for measuring potential contamination from pesticides.

Film



Conclusions

Poverty and hunger will not disappear overnight, and there is no 'quick fix' to the problems the Scientific Forum addressed. But the fundamental issue to keep in focus is the fact that nearly one billion people do not have enough to eat.

The IAEA cannot, on its own, solve the problem. However, it is committed to doing everything in its power, working with its partners, to make maximum use of nuclear technology to address the problem. The IAEA will continue to work in partnership with its Member States in providing assistance to help them fulfil projects they are undertaking.

Another measure of the IAEA's commitment is the pledge by its Director General to modernize the IAEA's Nuclear Sciences and Applications Laboratories in Seibersdorf, Austria, and to bring them up to the latest international standards. Scientific research conducted in the laboratories is making a difference to the lives of people in developing countries and modernization will enable the IAEA to offer even better services to its 159 Member States.

On the initiative of the Directors General of the IAEA and the FAO, the IAEA has become a member of the United Nations Secretary-General's High Level Task Force on the Global Food Security Crisis. This will help to make world leaders more aware of the IAEA's work in addressing the food issue and recognition would open up new possibilities for partnerships and cooperation.

The IAEA will examine carefully the key concerns discussed at the Forum in order to address them in the most efficient, safest and fastest way and to continue informing governments about its activities to make food more abundant and fight plant and animal diseases.



Photo Exhibit

The Scientific Forum also included a photo exhibit that provided insights into the IAEA's work in supporting Member States in ensuring food protection and food safety.





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