

Agriculture and Food Security The IAEA Contribution

The IAEA, in partnership with the Food and Agriculture Organization of the United Nations (FAO), helps Member States to produce more, better and safer food using nuclear technology, while promoting the sustainable use of agricultural resources.

Eight Millennium Development Goals (MDGs) have been adopted by the international community as a foundation for global development activities. These goals aim to make significant steps to combat poverty, hunger, disease, illiteracy, environmental degradation and discrimination against women. Efforts to improve agriculture and enhance food security contribute to the MDGs by increasing food production and food diversity, offering solutions to environmental degradation and supporting the development of partnerships at every level to sustain the benefits from agriculture in the longer term.

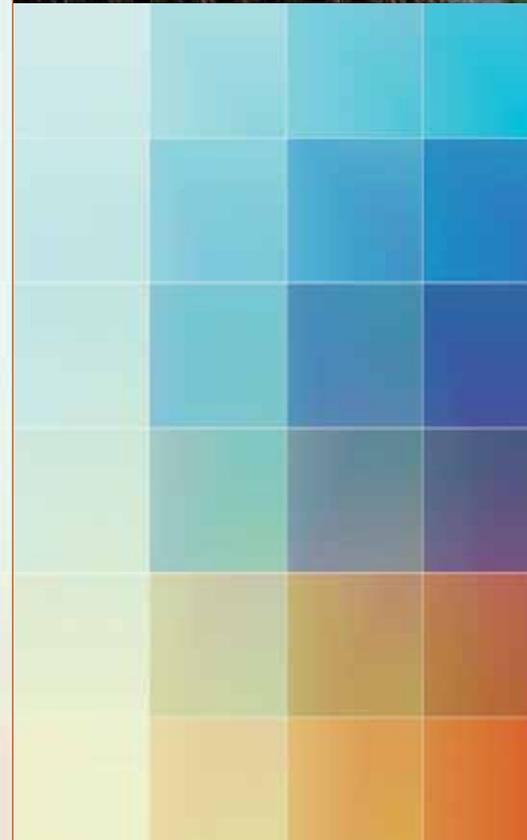
The International Atomic Energy Agency's Statute states that the IAEA shall seek to accelerate and enlarge the contribution of atomic energy for peace, health and prosperity throughout the world. The strategic goal of the IAEA's technical cooperation programme builds on this mandate, promoting tangible socioeconomic impact by contributing directly in a cost effective manner to the achievement of the major sustainable development priorities of each country.

TC projects help Member States enhance agricultural productivity and improve food security

People around the globe share a common need for a safe, nutritious and reliable supply of food. Agriculture is of fundamental importance to developing countries, because a well functioning agricultural sector is essential to ensuring food security, and agricultural products are a major source of national income.

Low crop and livestock productivity, a rise in the cost of fertilizer and seeds, and changes in land use patterns due to desertification, salinity and climate change affect the availability of food and increase food prices, which may push millions of people deeper into poverty.

Through its technical cooperation programme, the IAEA helps Member States to implement modern and competitive plant breeding programmes using radiation induced mutation and efficiency enhancing biomolecular and molecular technologies such as in vitro



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techniques, molecular markers, genomics and reverse genetics. Efforts focus on improving yield and quality by enhancing the diversification and adaptability of crops for domestic use as well as for export markets, which contributes to income generation and socioeconomic development. Technical cooperation projects also help Member States to reduce pesticide use and to decrease the crop losses caused by pests and diseases, as well as to overcome phytosanitary (plant health) barriers to trade. This contributes to food security, more efficient use of agricultural resources, and increased trading opportunities.

The IAEA also helps Member States to improve their national food security through improved livestock productivity. Projects concentrate on efficient use of locally available feed resources, adequate management practices and breeding programmes for indigenous and other animals, as well as on pest control and diagnostic tools and prophylactic measures for the control and prevention of animal and zoonotic diseases.

- 925 million people do not have enough to eat - more than the combined populations of the USA, Canada and the European Union.
- With world population expected to reach 9 billion by 2050, ensuring food security demands significant advances in agricultural productivity and competitiveness.
- Within the next 10 years some African countries may see farm harvests drop by up to 50 per cent due to water scarcity.
- At the start of 2011, the FAO Food Price Index was at its highest point since the index was backtracked to 1990.
- The tsetse fly carries a disease called trypanosomiasis, which threatens some 60 million people and causes about 3 million deaths in cattle each year, and costs the agriculture industry in sub-Saharan Africa some US \$4.75 billion.
- Optimal fertilizer use saves at least US \$6 billion per year.
- Land degradation threatens nearly a billion people in some 100 countries and it is estimated that around a third of the world's land area is experiencing desertification¹.
- Climate models in Africa show that 600 000 square kilometres classified as moderately water constrained will experience severe water limitations. By 2020, between 75 and 250 million people in Africa are projected to be exposed to an increase of water stress due to climate change².

¹ UNEP News Centre, <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=589&ArticleID=6219&l=en>

² IPCC Fourth Assessment Report: Climate Change 2007, Synthesis Report, p.50.



Controlling and eradicating insect pests

Insect pests threaten both livestock and high value fruit and vegetable crops. An important strategic component to raise productivity and promote global food security is investment in pest management practices that sustain the natural balance and reduce reliance on pesticides. Nuclear technology can help in the effective and environmentally friendly control of insect pests. The IAEA works in collaboration with partners on comprehensive approaches to pest suppression, containment and eradication.

One highly successful nuclear technique is the sterile insect technique (SIT), which has been used as part of an integrated pest management approach in many parts of the world against insect pests such as fruit flies, moths, screw worm flies and tsetse flies. The technique is a form of biological pest birth control, involving the mass breeding, sterilization and systematic release of huge numbers of male insects. The sterile males compete with insects in the wild, and through mating with wild females, contribute to reducing overall pest numbers.

Increasing livestock productivity

Livestock play a vital role in the economies of the developing world. Better feed and improved breeding practices help these countries to protect their animal resources from diseases and pests and to increase livestock productivity.

IAEA technical cooperation projects focus on further increasing animal productivity. Projects can include the selection of animals with advantageous phenotypic traits that yield more meat and milk, show disease resistance or heat tolerance and maximize breeding potential. Nuclear applications and isotopic techniques play an important and often indispensable role in the management of animal nutrition, reproduction, breeding and health.

- **Diagnosing and preventing disease**

Animal diseases hinder trade in agricultural products, affecting the economy of developing countries. The high level of sensitivity and specificity of isotope and molecular techniques offer significant advantages over other methods in diagnosing, controlling and eradicating diseases that impair livestock productivity and hinder trade.

Nuclear and related technologies are used to identify diseases precisely and rapidly and can monitor the effectiveness of disease control and eradication programmes. IAEA technical cooperation projects provide Member States with training, expertise and tools such as standardized protocols and procedures for animal disease diagnosis.



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- **Monitoring and improving nutrition**

Low feed quality is a major obstacle to optimal livestock production. Ensuring that livestock receive good quality nutrition is a challenge for many countries. Nuclear technologies can be used to measure the nutrient intake or energy balance of animals, to formulate balanced diets and to achieve efficient growth and production.

IAEA technical cooperation projects work to improve livestock productivity without adversely affecting the environment, concentrating on improved feed strategies, better management of nutrient waste on farms and the reduction of methane emissions. Projects also improve the nutrition and health conditions of cattle by identifying locally available feedstuffs and developing low cost feeding strategies that enhance the efficiency and productivity of milk and beef production, and bring greater returns for farmers.

- **Improving reproduction**

An integrated approach that includes nuclear techniques supports improved livestock reproduction. Isotopic methods are used to monitor reproductive status for better breeding management. Artificial insemination can increase the efficiency of cattle breeding, decrease costs to the farmer and reduce the likelihood of disease transmission between animals. Cross-breeding can increase the production of beef and milk. Progesterone measurement can diagnose non-pregnancy and ultrasonography can be used for diagnosis and treatment of infertility and reproductive disorders.

IAEA technical cooperation activities support an integrated approach to improving animal reproduction. Improvements in livestock productivity lead to higher earnings for farmers and increase the availability of meat and meat products to the public.

Better crops and improved land and water management

Efficient land use and healthy soils are important for food security. Integrated land and water management practices improve agricultural production and enhance soil productivity and its resilience against desertification and other impacts of climate change and variability. If developing countries are to benefit from enhanced crop varieties and better soil fertility practices, then sustainable fertilizer and soil-water management are essential.

IAEA technical cooperation projects help Member States to improve crops. They also help to support soil conservation and optimize fertilizer usage.

- **Enhancing crop varieties**

Many developing countries have limited water resources for irrigation and are susceptible to environmental problems such as drought or



high levels of soil salinity. Water constraints are also exacerbated by climate change and variations in wind patterns. Induced mutation, using nuclear techniques, can be used to develop crops that are better adapted to these challenges. Induced mutation accelerates the natural process of spontaneous change that occur in plants, resulting in enhanced varieties that are, for example, tolerant to irregular highs and lows in temperatures, resistant to pests or disease, or able to thrive in saline soil or during droughts.

Through its technical cooperation programme, the IAEA provides Member States with the tools and expertise to produce improved, adaptable, high-yielding plants, as well as with skills for improved soil, water and cropping practices that increase production. Today, improved crops resulting from mutation induction are being grown all over the world. The economic benefit in terms of annual additional income to farmers totals billions of dollars per year.

- **Reducing soil erosion**

Soil degradation and erosion threaten agricultural productivity, food security and environmental sustainability. Soil is naturally eroded by water or winds, but 'accelerated' soil erosion, the loss of soil at a rate much faster than it is formed, results from poor soil, water and cultivation practices.

Radionuclide and stable isotopic techniques can be used to study soil erosion and land degradation problems. Nuclear technology can also help countries to assess and improve their soil and water management practices. IAEA technical cooperation projects assist Member States to improve soil fertility and increase crop yields, and build capacities for soil conservation, land use planning and decision making and the promotion of soil conservation techniques.

- **Optimizing fertilizer and water use**

Fertilizers and water are very important to agricultural production, but excessive use or inappropriate application harms the environment and can pollute the water supply.

IAEA projects use environmentally friendly tracer elements to effectively determine optimal placement and timing of fertilizers and water, to identify crop residue management practices and to determine how much nitrogen plants can capture from the atmosphere within a given cropping rotation. IAEA projects also assist Member States with fertigation, the delivery of both water and nitrogen fertilizer through irrigation systems that optimize the use of limited water supplies, save farmers money and preserve and conserve healthy soils by limiting damage to the environment from nitrogen pollution.



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Food safety

Food contamination can pose a food safety threat and endanger human health. Chemical contamination hazards in the agricultural food chain can stem from residues of agrochemicals (such as veterinary drugs and pesticides), natural toxins (e.g. mycotoxins) and radionuclides. Microbiological contamination of food with harmful food-borne microorganisms such as salmonella and e.coli. is also dangerous to human health. Authorities need tools to detect, monitor and control these contaminants and to trace the origin of food products and contaminants in order to identify and implement corrective actions.

Nuclear applications and isotope techniques provide an advantage in the development of analytical methodologies for food traceability and quality assurance. Radioisotopes are ideally suited as tracers to investigate food contaminants and can be used as tools to improve laboratory management and control programmes.

- **Controlling food contaminants**

Efforts to increase food production have led to an increase in the use of agrochemicals, including veterinary drugs and growth promoters. In order to ensure that animal products are safe and marketable, countries need to be able to detect drug residues in food animals and their products.

Natural toxins such as mycotoxins can contaminate a wide range of foods and feeds, and include some of the most poisonous toxins known to man. For governments to monitor domestic and imported products for aflatoxins, laboratories need sensitive, accurate and precise methods of analysis and sampling.

IAEA technical cooperation projects help countries to trace food origin, detect adulteration and prove authenticity of food products, monitor residues of chemical contaminants such as veterinary drugs and pesticides and identify the presence of mycotoxins. This helps Member States to ensure food safety and consumer confidence, as well as to meet quality and traceability requirements for international trade.

- **Food irradiation**

Post-harvest applications of food irradiation can destroy the microbes that carry disease, reducing food safety risks and also extending the shelf life of foods. Irradiation can also be used to control quarantined insect pests, reducing the need to use harmful chemicals.

IAEA technical cooperation projects include collaboration in the development of standards for the control of pests in plant and plant products. Educational seminars and training courses, particularly for participants that set policy and regulatory control programmes down to the local level, help Member States to apply international food standards. Technical cooperation projects also help with the



establishment of national and regional food control laboratories and with upgrading preparedness and response capabilities related to nuclear and radiological emergencies at national and international levels.

What the IAEA technical cooperation programme does

Technical cooperation projects assist Member States with expert support, training and equipment for the safe use of radiation for a number of agricultural purposes, from the sterilization of insect pests to the diagnosis of animal diseases, and from the analysis of animal feeds to the development of high yielding crops.

Expert assistance makes available on-the-spot in-country training by a recognized expert. Expert missions may be of a few weeks duration or may extend to a whole year.

Training fellowships prepare local personnel to apply nuclear techniques in the national food and agricultural sector. Fellows are sent abroad for comprehensive training in a suitable institution for periods ranging from a few months to several years.

Conferences, symposia and seminars are designed to support the exchange of ideas between experts and specialists from various countries.

Equipment and materials provided by the IAEA are used to establish or enhance agricultural and food security activities in Member States. When complex equipment is supplied to a country, the project usually includes the visit of an expert to train the staff in the operational and technical aspects of the instrument.



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Partnerships

Technical cooperation projects involve collaboration between governments, IAEA partners and Member States, keeping in mind priority national developmental needs where the IAEA has a unique role to play, where nuclear technology has a comparative advantage or where the IAEA can add value to services from other development partners.

The IAEA strives to establish partnerships and working relationships through consultations and interactions with United Nations system organizations and other potential partners. Collaborative work ensures the coordination and optimization of complementary activities and informs relevant UN organizations of the developmental impacts of the TC programme.

The IAEA addresses agricultural production through the long-running and highly effective Joint FAO/IAEA Programme, focusing on the integration of nuclear technologies and related biotechnologies with conventional techniques.

In partnership with the FAO, the World Organisation for Animal Health (OIE), and the World Health Organization (WHO), the IAEA coordinates strategic and applied research and development activities to develop and validate nuclear techniques. Through the IAEA and FAO, technical cooperation projects ensure integrated national, regional and global programmes for capacity building to ensure increased sustainable agricultural production and greater food security for Member States.

The technical cooperation programme makes full use of long established regional and global networks. Partnerships are forged with the African Union, the Consultative Group on International Agricultural Research (CGIAR), the World Organization for Animal Health (OIE), the Programme Against African Trypanosomiasis (PAAT), the Arab Organization for Agricultural Development (AOAD), the African Union Pan African Tsetse and Trypanosomiasis Eradication Campaign (AU-PATTEC), the Inter-American Institute for Cooperation on Agriculture (IICA), the Regional Plant Protection Organizations (RPPOs), the UN Trust Fund for Human Security (UNTFHS), and the United Nations Fund for International Partnerships (UNFIP).

For more information, please visit:

www.iaea.org/technicalcooperation

