

Food and Agriculture

Objective

To enhance capabilities within Member States for alleviating constraints to sustainable food security by the application of nuclear techniques.

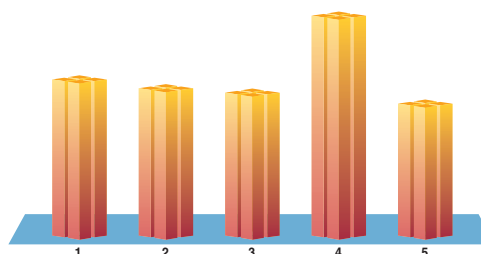
Key Issues and Highlights

- Capacity building was strengthened at both technical and policy levels to promote informed decision making on nuclear applications.
- Africa was the focus of increased Agency efforts in support of the United Nations 'Millennium Development Goals'. Significant progress was made at political, institutional and technical levels in tackling three strategically important constraints to sustainable agriculture in the region, i.e. the tsetse fly and trypanosomosis through the sterile insect technique (SIT), rinderpest and low reproductive efficiency of livestock through better diagnostic and intervention packages, and the low productivity of crops and cropping systems by developing improved varieties, cultivars and management practices using mutations and isotope techniques.
- The International Consultative Group on Food Irradiation (ICGFI) requested its Joint FAO–WHO–IAEA Secretariat to determine the interest among Member States in contributing to a new inter-governmental forum on food irradiation for improving the quality and safety of food supplies.

Soil and Water Management and Crop Nutrition

Many developing countries are coming under increasing pressure to intensify their agricultural production systems to meet their food requirements, but without degrading the environment. To meet this strategic goal, they need to identify and deploy management practices that promote both efficient and sustainable uses of their land and water resources. This integrated approach was successfully developed in

Regular budget expenditure: \$10 033 871
(including \$1 846 321 from FAO)
Extrabudgetary expenditure
(excluding FAO): \$263 532 (not included in chart)



1. Soil and Water Management and Crop Nutrition: \$1 969 237
2. Plant Breeding and Genetics: \$1 853 169
3. Animal Production and Health: \$1 798 299
4. Insect and Pest Control: \$2 745 731
5. Food Quality and Safety: \$1 667 435

eight countries of Latin America and the Caribbean and implemented through a network of multi-disciplinary, inter-institutional teams that conducted 42 field trials to test new management approaches. For example, the introduction of conservation farming practices such as zero-tillage and incorporation of crop residues reduced soil erosion and increased wheat yields and fertilizer use efficiency in southern Chile, compared with traditional cereal monoculture under intensive tillage with straw burning. Local farmers' associations promoted these technologies through media campaigns. Other major achievements included training of over 200 agricultural scientists, recognition of six isotope analytical laboratories by the Agency as regional laboratories for isotope analyses and the preparation of technical publications.

The high cost and limited supplies of manufactured fertilizers are major barriers to improving soil fertility and agricultural productivity in many developing countries. These problems can be alleviated by management practices that allow farmers to reduce costs by making the best use of all the nutrient sources available to them. Application of sewage sludge to agricultural land in Egypt raised yields of oilseed crops in sandy desert soils through the increased supply of nutrients and improved soil water-holding capacity.

Gamma irradiation of this sewage sludge and wastewater eliminated human pathogens.

The efficient use of scarce water resources is vital for agricultural productivity in many developing countries with arid and semi-arid climates. A technical co-operation project in eight countries of the West Asia region demonstrated that drip irrigation of vegetable crops and cotton saved as much as 30% of irrigation water without loss of crop yield or quality. In addition, delivery of soluble fertilizers through drip irrigation systems reduced nutrient losses, optimized crop uptake and minimized adverse effects on the environment. The results of this project influenced government policy in the Syrian Arab Republic and Jordan to restrict inefficient surface irrigation practices in favour of drip irrigation systems (Fig. 1).

Seven publications, including three technical documents, the proceedings of an international symposium, one training manual, one FAO Water Reports Series monograph and a special issue of the journal *Nutrient Cycling in Agroecosystems*, were issued in response to the growing demand from Member States for latest information about applications of nuclear techniques for improving the management of natural resources in agriculture.

Plant Breeding and Genetics

The cut flower market has an annual turnover of around \$20 000 million. Many developing countries are trying to enter this lucrative and highly competitive global market in an effort to diversify and improve the overall competitiveness of their agricultural sectors. Malaysia and Thailand embarked on efforts to



FIG. 1. On the basis of results from an Agency technical co-operation project, drip irrigation systems are beginning to replace surface irrigation schemes in arid areas. Shown here is a drip irrigation system in the Syrian Arab Republic.

improve the competitiveness of their floriculture industries by developing new varieties with desired flower characteristics using gamma irradiation to produce mutations. A gamma growth chamber established at the Nuclear Technology Centre of Kasetsart University in Thailand has led to the official release of 22 mutant varieties of canna, six in chrysanthemum and many promising mutants in curcuma and other ornamentals. In Malaysia, one *Dendrobium* mutant was recently released and a 'gamma greenhouse' is now under construction to extend the approach to other flowering plants. The sustainability of the techniques has been promoted through a training programme on mutation assisted breeding for growers of ornamental flowers.

Wheat is an essential crop for household food security in Kenya but its yield is low in drought prone areas. The Kenyan Agricultural Research Institute (KARI) was supported through a national and a regional technical co-operation project to develop wheat varieties that are more tolerant to drought. Seven years after seeds of the late maturing and tall wheat variety 'Pasa' were treated with mutagens, the breeding line KM 14 was developed. After evaluation for three seasons it was released in Kenya as Njoro-BW1 (BW = bread wheat), with many of the characteristics demanded by farmers and consumers alike, including short stature, early maturity under lowland conditions, good seed yield, moderate resistance to rust, high protein content, and good milling and baking qualities. In 2002, 300 multiplication plots of Njoro-BW1 were set up on farmers' fields. Other breeding lines developed through mutations are currently part of the Kenyan National Wheat Performance Trials.

About 900 million hectares of land worldwide have low crop productivity because of salinity and the poor quality of water used for irrigation. Considerable efforts have been made to increase the tolerance of rice to salt through conventional breeding, but progress has been slow because of the complex genetic nature of the tolerance trait. As an alternative approach, the Agency's Laboratories at Seibersdorf have pursued mutation induction using gamma irradiation. Seeds of two popular rice varieties, Bicol and IR29, were used for mutation induction, and after several generations six mutants of Bicol showing higher tolerance than the parent and two salt tolerant IR29 mutants were selected for further evaluation using molecular methods and in field trials. Using DNA techniques, a molecular tag for identifying mutant germplasm in future breeding programmes was developed. However, further investigations on genetically segregating mutant populations are needed

to confirm whether and to what extent the molecular markers are linked to the genes responsible for salinity tolerance.

Animal Production and Health

The control of transboundary animal diseases requires, amongst other things, reliable diagnostic methods based on reagents that can be produced in national or regional laboratories. During 2002, the Agency established sustainable production in over 15 African Member States of diagnostic kits for rinderpest and African swine fever based on immunoassay technology. The capability for differential diagnosis of rinderpest from other diseases using molecular methods was established in seven countries in Asia, seven in Africa and four in Latin America.

Through the production of CD based training materials and the provision of specialized training on quality systems management, over 25 Member States now have the ability to meet internationally agreed requirements for freedom from rinderpest. Six laboratories are already on the way towards accreditation under the ISO/IEC 17025 standard.

A further constraint to efficient livestock productivity in developing countries is the low genetic potential of their indigenous breeds of animals to produce milk and meat. This potential can be improved by the efficient delivery of artificial insemination services and the training of farmers in breeding management. These were promoted by the Agency through the transfer of progesterone radioimmunoassay (RIA). Inputs focused on enhancing the ability to sustain the use of RIA through local production of standards and quality controls in national laboratories and the production of iodine-125 labelled progesterone tracer in regional laboratories. Over 25 laboratories are now providing diagnostic support to veterinarians, technicians and farmers.

International trade issues concerned with the residues of veterinary drugs in animal derived food commodities are important for developing Member States seeking export markets for their produce. A number of laboratories were assisted by the Agency during 2002 in developing their capacity to screen for a range of these residues. Some now have quality systems in place, and laboratories in Malaysia and South Africa have achieved accreditation by recognized national authorities, thereby meeting export requirements.

Insect and Pest Control

The Agency continued its support to African Member States and the African Union to implement the Pan African Tsetse and Trypanosomosis Eradication Campaign (PATTEC) through one regional and six national technical co-operation projects. It encouraged close subregional co-operation through the development of binational or subregional strategic planning for integrated and area wide intervention campaigns using SIT (Fig. 2). It also joined FAO and WHO in the Programme Against African Trypanosomiasis (PAAT), which is a forum of major stakeholders to develop and implement technically sound standards and guidelines and harmonize efforts on tsetse and trypanosomosis interventions at the field level.

A workshop on PAAT–PATTEC harmonization led to the respective roles and responsibilities of the mandated organizations and major stakeholders being identified, criteria being established for identifying priority areas and delineating the approach for intervention against African animal trypanosomosis, namely the area wide integrated pest management



FIG. 2. A tsetse trap set up in the Ethiopian valley system. According to PAAT and PATTEC, this area has very high potential for sustainable, high productive agriculture and livestock development if it was free of tsetse.

concept in the wider context of sustainable agriculture and rural development. The workshop resulted in the first joint press release from the African Union, the Agency, FAO and WHO, and highlighted the consensus reached on joint international action against the tsetse and trypanosomosis problem.

Tsetse mass rearing will play an essential role in supporting the development of tsetse SIT programmes in Africa. A recently completed CRP led to the identification of major improvements to tsetse mass rearing systems and protocols, which are being transferred to rearing centres in Africa.

In other areas of SIT application, progress was made in the New World Screwworm eradication programme in Jamaica, and collaboration continued with the Arab Organization for Agricultural Development and FAO on a feasibility study for area wide intervention against the Old World Screwworm fly in the Middle East.

A regional effort between Israel, Jordan and the Territories Under the Jurisdiction of the Palestinian National Authority to control the Mediterranean fruit fly (medfly) using SIT and prevent the introduction of exotic fruit fly species resulted in a functional field team and a fruit fly identification laboratory being set up in Gaza. Aerial releases of sterile medfly males, jointly carried out by Israel and Jordan over the Arava/Araba Valley, contributed to an increase in exports of commodities to medfly free markets in the USA to \$5 million in 2001 and to \$8 million in 2002. In support of this project, the Agency's Laboratories at Seibersdorf shipped five million sterile male pupae per week to Israel to suppress medfly populations in the area.

In similar pest suppression work, mango growers in a pilot area in Thailand doubled their gross revenues by exporting 60% of their production to countries such as Canada, Malaysia and Singapore after SIT was used to control the Oriental fruit fly.

Food Quality and Safety

International standards are essential for facilitating trade in food and agricultural products between nations and for promoting food quality and safety within national boundaries. The Agency does not set such standards, but in recent years has increased its flow of information to the standard setting process within the relevant mandated international bodies. This was done mainly through scientific and technical

outputs generated from CRPs, in-house research at its laboratories at Seibersdorf and deliberations within the International Consultative Group on Food Irradiation.

Significant progress was made in reaching international consensus on new and improved standards for ensuring the safety and quality of food in trade. With respect to food irradiation, revisions to the Codex General Standard for Irradiated Foods were agreed at the 34th session of the Codex Committee on Food Additives and Contaminants (CCFAC) and will be considered at its next session in 2003 for possible adoption at the 25th Session of the FAO/WHO Codex Alimentarius Commission (CAC).

At its 19th annual meeting in November 2002, ICGFI decided to continue international co-operation in the field of food irradiation by forming an International Forum for Food Irradiation under the aegis of the Agency, FAO and WHO. The legal framework, objectives and areas of activities will be circulated to the constituents of CAC and the International Plant Protection Convention (IPPC) with a view to encouraging broader participation within the agriculture and health sectors of Member States.

In addition to improving food safety, treatment with ionizing radiation is effective in eliminating insect pests of quarantine importance in fresh horticultural commodities in international trade. Recognizing this, as well as the results generated through a recently completed CRP on the subject, the Standards Committee of the IPPC approved *Guidelines for the Use of Irradiation as a Phytosanitary Measure* under the International Standards for Phytosanitary Measures. In related work, a highlight of an FAO/IAEA workshop was a trade trial of irradiated orchids conducted through commercial channels from Thailand to Australia to demonstrate the effectiveness of irradiation as a quarantine treatment against *Thrips palmi*, a target pest of Australia.

In the drive to improve access to information, the Agency implemented a dual Internet/CD-ROM strategy to aid in knowledge acquisition and retrieval of data on key food safety and security issues. The International Database on Insect Disinfestation and Sterilization (IDIDAS) now includes a Worldwide Directory of SIT Facilities and information on 308 pests of economic or quarantine importance. The International Food Contaminant and Residue Information System (INFOCRIS) was also upgraded to facilitate the addition or updating of information over the Internet in multimedia formats, and 560 new

pesticide entities or records were added to improve global availability of information on agrochemicals.

Key elements in the WTO's Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) are the validation and accreditation of analytical methods, which are necessary to ensure the reliability and international acceptance of the results of food contaminant analyses and to remove some of the existing technical barriers to trade for developing countries. In addition to guidelines on method

validation, training courses involving 64 participants from 34 Member States were held to address this problem. Analysis of questionnaires demonstrated that the participants are now better prepared and are applying their knowledge in their home countries. Concrete evidence of this is the growing number of laboratories that have achieved accreditation, including laboratories in Costa Rica and Singapore while laboratories in Colombia, Ecuador, Guatemala and Kenya have established compliance with ISO/IEC standard 17025.