Food and Agriculture

Objective

To contribute to the sustainable intensification of agricultural production and the improvement of global food security by addressing the challenges of food production, food protection and food safety through capacity building and technology transfer to Member States. To increase resilience of livelihoods to threats and crises in agriculture by improving assessment and mitigation of threats and crises in agriculture, including impact of climate change and nuclear or radiological accidents on agriculture, as well as food safety risks. To improve efficient agricultural and food systems for sustainable management and conservation of natural resources, and to enhance the conservation and application of plant and animal biodiversity.

Animal Production and Health

The Agency helps Member States to safely use nuclear and related technologies to improve animal production and health through the early and rapid detection and control of animal and zoonotic diseases. In 2016, it responded quickly to emerging outbreaks of avian influenza in Europe and Africa, and of lumpy skin disease (LSD) in cattle in Eastern Europe and the Balkan region, providing immediate assistance in emergency preparedness for sampling, detection of the pathogen and containment of the disease.

FIG. 1. European veterinary diagnostic staff participating in a training course on lumpy skin disease held at the Agency's Laboratories in Seibersdorf.

LSD is a highly contagious disease of cattle caused by the LSD virus and is transmitted rapidly both by contact between animals and by vector insects such as stable flies. Although until recently LSD was present only in Africa and parts of Asia, in 2016 the disease emerged in Europe, spreading rapidly across the Balkan region (Albania, Bulgaria, Greece, Montenegro, Serbia and the former Yugoslav Republic of Macedonia).

As the first step in combating the outbreak, the Agency provided Bulgaria and Serbia with technical guidance and a toolkit of emergency laboratory reagents and consumables to reinforce their laboratory capacities to prevent further spread. It organized a workshop on the integration of harmonized early detection protocols into country control

plans for LSD, with 59 participants from 33 Member States, and two training courses on the use of nuclear derived techniques for the detection and differentiation of the LSD virus, with 37 participants from 22 European and Balkan Member States. Emergency diagnostic toolkits with reagents for virus detection and a set of harmonized standard operating protocols were delivered to all training course participants. Genetic sequencing services were also provided to all the laboratories involved, enabling an in-depth understanding of the molecular epidemiology of the LSD virus.

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Improving Livestock Performance

In 2016, the Agency initiated a coordinated research project (CRP) entitled 'Application of Nuclear and Genomic Tools to Enable for the Selection of Animals with Enhanced Productivity Traits' to assist Member States in evaluating livestock for disease resistance and tolerance, and breeding potential. During the year, participants used a nuclear technique involving cobalt-60 to construct a radiation hybrid panel for the camel genome; the panel will undergo further analysis and sequencing to prove its use as a genomic tool in animal breeding. In addition, the Agency assisted 19 Member States in building their capacities in molecular and conventional genetic evaluation technologies and in the selection of superior animals for breeding through guidance and implementation of validated technologies and procedures.

Food Authenticity and Traceability to Support Food Safety and Security

The Agency completed the CRP entitled 'Implementation of Nuclear Techniques to Improve Food Traceability' in 2016. The project generated a number of novel food authenticity and traceability datasets. Participants developed new analytical methods and standard operating procedures, and successfully demonstrated the feasibility of using stable isotope analysis to establish the geographical origins of several important food products produced in developing Member States. Government and industry linkages were successfully initiated in a number of Member States, enabling future capacity building in food safety and control.

Developing Generic Irradiation Procedures for Quarantine Treatments of Food Commodities

The results of a CRP on developing new and improving existing phytosanitary irradiation treatments were published in a special issue of *Florida Entomologist* in 2016. New phytosanitary irradiation treatments against specific pests were reported, and generic dose treatments were proposed for moths, butterflies, mealy bugs and weevils. The new irradiation methods are expected to help prevent the spread of pest species and enable trade in fresh agricultural produce that would otherwise be banned. The data generated will also be useful in the implementation of International Plant Protection Convention standards.

Mutation Breeding for Crop Improvement

In 2016, Member States released nine improved mutant varieties of different crops, developed with support from Agency CRPs and technical cooperation projects.

As part of a CRP entitled 'Efficient Screening Techniques to Identify Mutants with Disease Resistance for Coffee and Banana', with a grant from the OPEC Fund for International Development, the Agency is supporting Member States in developing mutation induction methods to increase resistance to coffee leaf rust. In April, six experts attended a workshop on using radiation to develop plant varieties that are resistant to the deadly fungus. Participants were provided with a training manual on coffee mutation induction developed by the Agency.

The Agency published two books containing protocols for mutation breeding of plants in 2016. The first, *Biotechnologies for Plant Mutation Breeding*, offers a wide range of protocols for the use of induced mutation in crop breeding and functional genomics studies using both forward and reverse genetic approaches. The second, *Protocols for Pre-Field Screening of Mutants for Salt Tolerance in Rice, Wheat and Barley*, presents techniques required for mutation breeding to develop crop varieties adaptable to temperature variations and climate change.

Increasing the Efficiency of the Lepidoptera Sterile Insect Technique

In 2016, the results of the CRP entitled 'Increasing the Efficiency of Lepidoptera Sterile Insect Technique by Enhanced Quality Control' were published in a special issue of *Florida Entomologist*. The project led to significant improvements in the identification of factors affecting the field performance of sterile male moths, and in developing quality control methods for the rearing and handling of moths.

Emergency Assistance for Mediterranean Fruit Fly Outbreak in the Caribbean

The Agency, in cooperation with the Food and Agriculture Organization of the United Nations (FAO), InterAmerican Institute for Cooperation on Agriculture, International Regional Organization for Plant and Animal Health and United States Department of Agriculture, continued to support efforts to manage an outbreak of Mediterranean fruit fly in the Dominican Republic. After the country lost an estimated US $40 million in horticultural exports, it began a campaign of country-wide surveillance, followed by containment, suppression and eradication actions using an area-wide integrated approach including the aerial release of sterile male Mediterranean fruit fly pupae shipped from the Moscamed Programme in Guatemala.

In 2016, the pest was confined to the east of the country, where eradication actions were conducted over a 300 square kilometre area (Fig. 2). During the year, the export ban by the United States Department of Agriculture was lifted in 23 of 30 provinces.

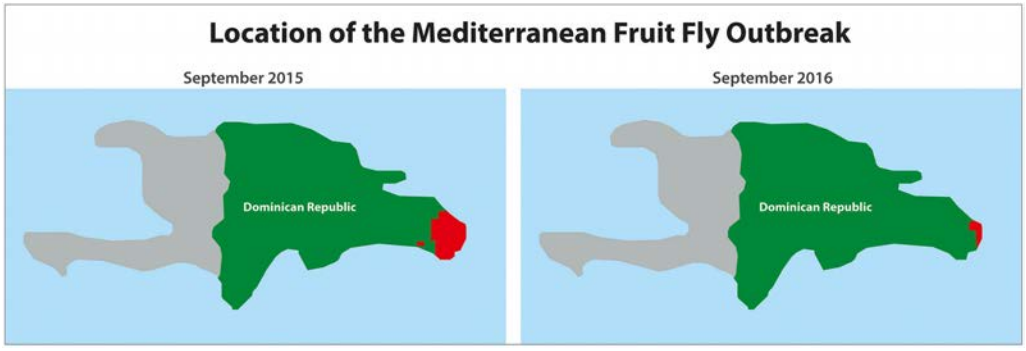

FIG. 2. Area of the Dominican Republic affected by the Mediterranean fruit fly (shown in red) in September 2015 (left) and September 2016 (right).

Managing Irrigation Water to Enhance Crop Productivity in the Sudan

In 2016, the Agency helped female farmers in the eastern region of the Sudan to increase vegetable production and improve food supply, despite the region's increasing water scarcity. An international research network established under a CRP entitled 'Managing Irrigation Water to Enhance Crop Productivity under Water-limiting Conditions: A Role for Isotopic Techniques' provided the technology to help rural female farmers in the Kassala region to use low cost drip irrigation combined with fertilizer to optimize vegetable production. Experts from the Agency and FAO trained scientists from Sudan's Agricultural Research Corporation in the use of nuclear and isotopic techniques to determine crop water requirements and to optimize nitrogen fertilizer use. The scientists then trained female farmers in the region to use the low cost drip irrigation system and to properly apply fertilizer (Fig. 3). To date, this drip irrigation technology has been adopted by more than 1000 family farmers. In 2016, the Sudanese Red Crescent, in collaboration with the United Nations High Commissioner for Refugees (UNHCR), joined the initiative to assist in scaling up the technology for climate change adaptation to improve rural livelihoods and alleviate poverty in the Sudan.

FIG. 3. Female farmers in the Kassala region of the Sudan harvest vegetables grown using a low cost drip irrigation system introduced as part of a CRP entitled 'Managing Irrigation Water to Enhance Crop Productivity under Water-limiting Conditions: A Role for Isotopic Techniques'.