



IAEA

Joint FAO/IAEA Programme  
Nuclear Techniques in Food and Agriculture

# Nuclear Applications in Agriculture

## Success Stories from **Asia** and the **Pacific** in facts and figures

The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture - key to the successful and unique FAO-IAEA partnership - helps countries develop capacity to optimise the use of nuclear and related technologies for food and agricultural development. The following facts and figures illustrate select impacts of this work in Asia and the Pacific.

**65** TECHNICAL  
COOPERATION PROJECTS

ongoing in the field of food and agriculture in 2015. The Joint FAO/IAEA Division works to build partnerships, strengthen regional cooperation and build human and institutional capacity in the sustainable application of nuclear technology for food and agricultural development.

**24**  
countries



request and receive one or more services from at least one of the FAO/IAEA Agriculture & Biotechnology Laboratories each biennium, reflecting the importance of these services to Member States and an indication of their unique alignment with the food and agricultural issues faced by the concerned countries.

**128**

research contract  
holders

benefit from the Joint FAO/IAEA Division's global network of almost 500 research institutes and experimental stations, increasing their R&D capacity as a result of coordinated research projects managed by the Joint FAO/IAEA Division, making it one of the largest collaborative agricultural research networks worldwide.

**1912** mutant  
varieties

developed in 162 different crop species and released to farmers. Of the 3 234 mutant varieties registered in the FAO/IAEA Mutant Variety Database, more than 60% originate in this region. Most productive is **China** with 810 varieties, followed by **Japan** with 481 and **India** with 331.

**422**  
trainees

participated in 28 training courses and workshops in 2015 and learned to apply one or more nuclear technologies in the field of food and agriculture.

**12**  
Countries

participate in a regional technical cooperation project aimed at building capacity and awareness about integrated vector management approaches for dengue-transmitting mosquito and disease control, involving as one component the sterile insect technique. Through this distinctive approach, the objective is to curtail the 3 million infections and 6 000 deaths that are estimated to occur annually in southeast Asia.

# 11.8

## Billion m<sup>3</sup>

the amount of water that could potentially be saved through deficit irrigation on the 98 000 km<sup>2</sup> in the North **China** Plains currently growing maize, leaving sufficient water to irrigate an additional area twice that size or substantially alleviating the current dramatic annual fall of three meters of the water table. Current water losses were 65% during the sowing and early crop maturation stages and 40% at maturity.

# 35.5 t/ha/yr

the 44% reduction in soil eroding from degraded hillsides in an ecological restoration study in **China** – from 81 t/ha/yr to 45.5 t/ha/yr – when no-tillage and ½-meter stubble was maintained for four years as compared to conventional tillage. This compared to 14% erosion losses with terracing and 34% with contoured tillage. The findings have been adopted by policymakers involved in developing best land-use and management practices.



# 2000 litres of milk

the minimum daily volume required to ensure the sustainability of the self-financing community-based dairy veterinary service (CDVS) in Bangladesh. In Satkhira, the **Bangladesh** Rural Advancement Committee pays CDVS US \$62 000 annually for 7 000 litres of milk per day, sufficient to pay the salary of three vets, a field assistant, 69 part-time milk collectors, rents for three veterinary offices and the cost of vaccines and anthelmintics for all community farm animals.

# 2000 USD /ha/yr

the additional income achieved by farmers in **Bangladesh** and implemented on 13 000 ha by combining saline-tolerant crops for a second harvest during the dry Monga season with the use of brackish water drip irrigation, reducing at the same time salinity to 1.5 ppt compared with 6.9 on fallow land. Potential value of an additional crop in the dry season is expected to exceed US \$1.4 to US \$4 billion annually.



# 205 Million USD

the total export earning of **Sri Lanka's** shrimp industry after it almost doubled following ISO 17025 certification of the Antibiotic and Microbiological Contamination Laboratory's services. This certification ensures that products are certified to internationally recognised standards and enables commercial producers to access lucrative US, EU and Japanese markets.

# 20 years

the length of time that exports of mangoes from **India** to the US had been banned because of quarantine concerns over pest infestation and pesticide use. The ban was finally lifted when India agreed to irradiate its mangoes before export. The Indian irradiation plant is also used to delay sprouting of onions and for microbial decontamination of spices and other dry ingredients.

# 55%

equivalent to 8 000 t/ha/yr of eroded soil in a catchment originating from mixed cropping in **Malaysia**, mainly due to poor farming practices, while 10% originated from a large sugarcane plantation and 35% from rubber plantations planted on sloping lands. This became part of a knowledge transfer programme by the Malaysian Agriculture Department to promote soil conservation by farmers and rural communities, increase agricultural productivity and implement improved land management strategies.

# 500 families

growing banana in **Sri Lanka** increased their income by up to 25-fold through the cultivation of virus-free mutant tissue culture banana plants. The Sri Lankan Ministry of Science and Technology recognized the project as a model for agrobiotechnology implementation.

# 1 Lanka cherry

a mutant tomato variety, with the desired small size, colour, taste, high yield and stem quality, identified within only four growing seasons in a unique farmer-participation selection process and released in **Sri Lanka** in 2010.



**23** US \$  
per sheep

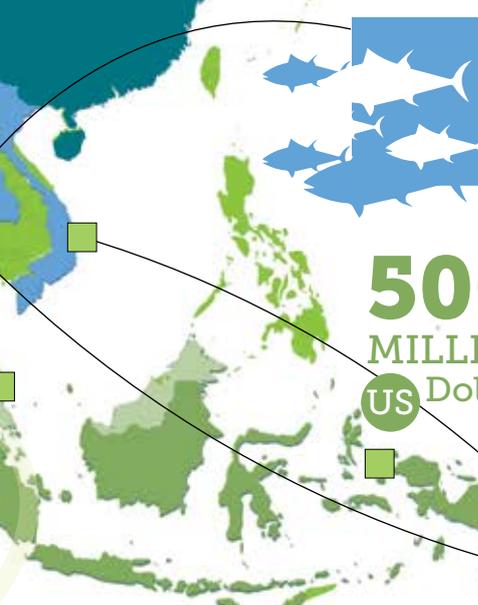


**24.8**  
million animals

the increase in farmers' income in **Mongolia** due to enzyme treatments of crop residues and improved feed formulations that improved digestibility, enhanced body condition, boosted productivity and increased sheep weight by up to 13%. Projected to Mongolia's 18.4 million sheep, this would mean additional farmer incomes of more than US \$400 million per year.

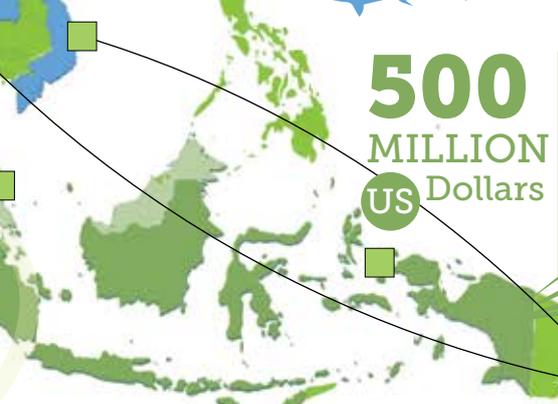
vaccinated against foot-and-mouth disease in **Mongolia** in 2013 following the transfer and implementation of improved diagnostic capacities that enabled Mongolia to successfully contain outbreaks of this disease in the 2013-2014 season.

**2000** tonnes



the amount of mango exported each year from **Thailand's** Pichit Province to Japan, one of the most rigorous markets for compliance with phytosanitary regulations against quarantine pests. This was achieved through control of the Oriental fruit fly and the guava fruit fly by integrating pre-harvest measures to suppress fruit fly populations in mango orchards, including the sterile insect technique, with postharvest treatment, leading to the award of the necessary phytosanitary certificate.

**500**  
MILLION  
US Dollars



the additional income per year achieved with three mutant rice varieties (*Mira1*, *Bestari* and *Inpari Sidenuk*) in **Indonesia**. With a total of twenty released mutant rice varieties, Indonesia is the originator of 10% of all mutant rice varieties registered in the FAO/IAEA Mutant Variety Database.

**945%**



the increase in milk production in a dairy farming community in **Myanmar** achieved through ten years of community-based developments, including local processing and marketing of a range of dairy products and the implementation of suitable management practices.

**374** million  
US\$



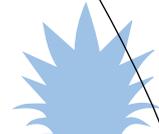
the annual additional income generated in **Viet Nam** within four years of the saline-tolerant mutant rice variety *Khang Dan* being released to farmers. By then it was grown on 30% of the rice production area in the Mekong Delta.

**2002**  
pallets



the amount of fresh fruits and vegetables irradiated in **Australia** during the 2014/15 season to address export restrictions due to phytosanitary pests. Globally, more than 60 countries have approved irradiation for one or more food products. An estimated 500 000 tonnes of food are irradiated each year for international trade, including spices, grains, chicken, beef, seafood, fruits and vegetables. More than 200 commercial irradiation facilities operate worldwide.

**59%**



the decrease in soil erosion rates achieved when using terraced vegetable farming on 7-10° slopes in **Viet Nam**. Intercropping of pineapple with cashews on 25° slopes and contour farming on 18-20° slopes in tea plantations decreased soil erosion rates by 36%; mini-catchments at the base of coffee trees by 42%; and contour farming plus intercropping of mulberry with maize by 54%.

**70%**



the reduction in soil water evaporation in coffee plantations in **Viet Nam** achieved during the flowering season through mulching. Projected to the 290 000 ha of coffee plantations in the Tây Nguyên Central Highlands, this could essentially save 62 million m<sup>3</sup> of water annually in a region suffering increasingly from droughts and water shortages, equivalent to US \$550/ha/yr or US \$160 million/year.

# 4.360 mutant lines

established following mutagenic treatment aiming to develop crop varieties adaptable to climate change. This regional 2012-2015 project, in which 14 countries collaborated, has to date resulted in 351 advanced mutant lines, 28 of which have so far been officially released as mutant varieties. Improved characteristics include drought, salinity and heat stress tolerance, early maturity and other quality features.

# 194 methods

for analysing and reliably monitoring veterinary drug and pesticide residues in food and environmental samples have been validated by the Joint FAO/IAEA Division and transferred to Member States. The methods are made freely available and can be accessed online through the Joint FAO/IAEA database on Food Contaminant Residue Information System.

# >300 scientists

from 25 countries, sponsored in part by the Joint FAO/IAEA Division, sequenced in just six years the cow genome. This is generating

extensive excitement among scientists, cattle breeders and farmers globally because it offers the chance to select for special features, such as high-quality milk and other promising qualities.

# 60 million hectares



the acreage of grain legumes cultivated in the Asia and Pacific region, representing about 40% of the world's total legume production, the main source of protein in many countries. Globally, grain legumes biologically fix an estimated 44 million tonnes of nitrogen per year, demonstrating that the inclusion of legumes in cropping systems results in nitrogen deposits worth approximately US \$19 billion/year, equal to more than 40% of the annual nitrogen fertilizer requirement of all developing countries.

# 25-40%

the increase in calving frequency achieved in 12 countries through the use of iodine-125 labelled radioimmunoassay progesterone kits to identify factors affecting the efficiency of artificial insemination and the conception rate in cattle. This increase in calves, milk and beef represents a considerable improvement in the livelihood of farmers and the availability of animal products on local markets.

# 1 mudslide

in **Indonesia**, the urgent need for emergency food rations and the desire for nutritious well-tasting local recipes for innumerable displaced people, inspired the Indonesian institute to provide irradiated rations of spicy rendang beef and tofu-based dishes. Sixteen countries, including Indonesia, had previously developed irradiated 'homemade' ration packs: **China** - spicy sausages and noodles, **South Korea** - the national dish kimchi and **Pakistan** - several meat and vegetable specialities.

# 17 national veterinary diagnostic institutions

work together within the Asian 'VETLAB network' to control transboundary animal diseases. Initially developed during the global rinderpest eradication campaign, the VETLAB network has become a critical platform for the sustainable transfer of technologies, the enhancement of laboratory infrastructure and staff proficiency, and the alignment to internationally recognized standards.

# 1 prototype

an online information and decision-support system for depicting and evaluating radionuclide concentrations in agricultural products after a nuclear or radiological emergency. The final system will assist decision makers in issuing and visualizing food restrictions to ensure food safety and technical personnel in assigning analytical tasks and sampling locations.



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