Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Nuclear applications in agriculture
Success stories from **Africa** 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 Africa.

120 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 for the sustainable application of nuclear technology for food and agricultural development.

34 countries requesting and receiving 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.

559 trainees participated in 34 training courses and workshops in 2015 and learned to apply one or more nuclear technologies in the field of food and agriculture.

70 **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 FAO/IAEA partnership, making it one of the largest collaborative agricultural research networks worldwide.

2.8 million USD

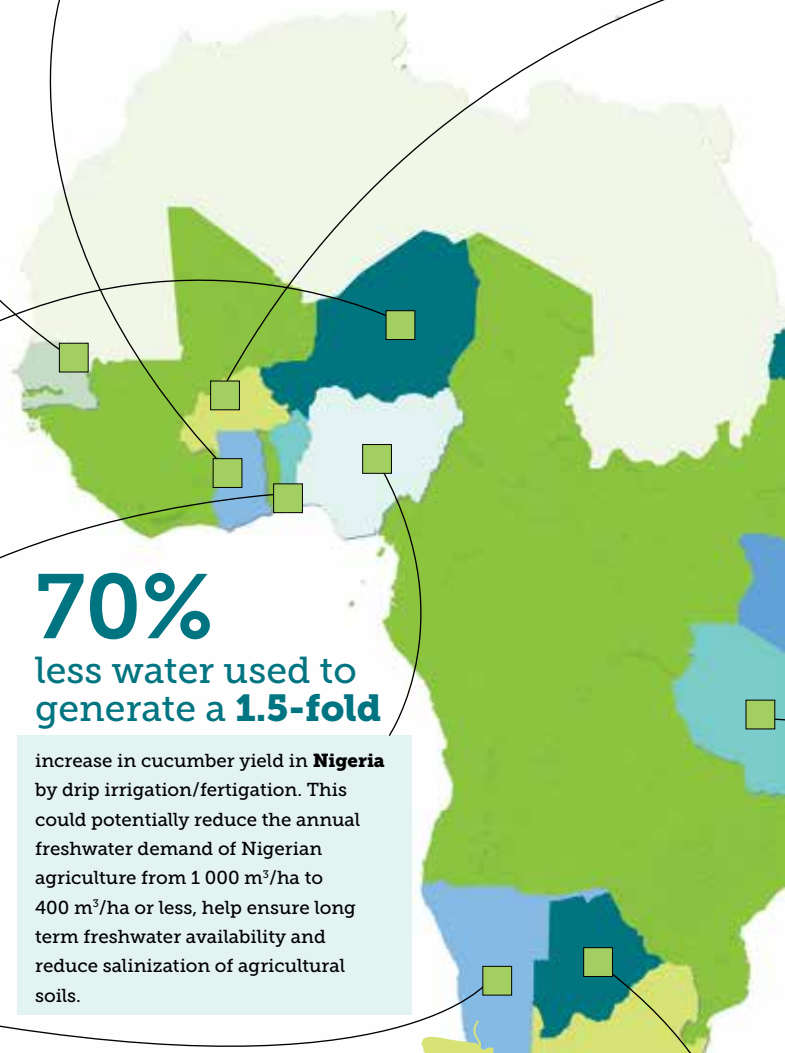
per year, the estimated additional revenue to small-scale farmers in the Niayes region of **Senegal** to be derived through the eradication of the tsetse fly from this area. The ongoing area-wide integrated pest management programme involving the sterile insect technique has to date eliminated wild tsetse flies from block 1, achieved 99% suppression in block 2 and commenced suppression activities in the final block 3. Prevalence of trypanosomosis and the need for trypanocides have decreased dramatically in the entire area, allowing the introduction of more productive cattle breeds.

416 000 cubic metres

the annual water saving attainable on 6 400 ha of peri-urban farming in **Ghana** by changing from sprinkler to drip irrigation, while increasing for example cabbage yield from 32 t/ha to 47 t/ha. By also replacing chemical nitrogen with organic manure, savings to farmers of US $216/ha/yr could be accrued.

400%

increase in cowpea yield achieved in the Sahel zone of **Niger** through optimal irrigation scheduling, soil fertility management and use of improved cowpea varieties. This indicates a potential in Niger to increase current production from 1.3 to 7M tonnes of cowpea grain, while providing fertiliser saving of US $128 million for resource-poor farmers.



5 000 farmers

in **Benin** were trained on integrated soil fertility management practices, including biological nitrogen fixation, to improve crop yield and soil fertility. As a result, maize yield increased by 50% in rotation with legumes, and soybean production increased by 210%. Fertilizer saving and yield increases on 300 000 ha of land could generate a substantial additional profit for the farmers.

70%

less water used to generate a **1.5-fold**

increase in cucumber yield in **Nigeria** by drip irrigation/fertigation. This could potentially reduce the annual freshwater demand of Nigerian agriculture from 1 000 m^3/ha to 400 m^3/ha or less, help ensure long term freshwater availability and reduce salinization of agricultural soils.

36 advanced mutant lines

generated in **Namibia**, 14 in cowpea and 11 each in sorghum and pearl millet, with higher yields, improved seed shapes and sizes, early maturity and tolerance to drought. The lines are currently undergoing official field testing and, once approved, will be released to farmers. This is a key achievement to drought-prone Namibia and a major step towards national food security and enhanced farmer incomes.

15 MILLION STERILE MOTHS

reared each week in **South Africa** by a public-private partnership to control the false codling moth, a pest that had become resistant to insecticide use, in the 4 000 km^2 Citrusdal Valley – a programme now expanding into other citrus producing areas. The development of the sterile insect technique for this pest and the establishment of the mass-rearing facility were extensively supported by the Joint FAO/IAEA Division.

48 MILLION US Dollars

the estimated loss to **Botswana** following the six-month suspension of its beef exports to the European Union in 2011. Through support, technical guidance and training by the Joint FAO/IAEA Division, Botswana was soon able to resume its exports to the European Union and the Botswana National Veterinary Laboratory received appropriate ISO/IEC 17025 accreditation.

10 000 Goats

and 6 000 sheep, the number of animals that were phenotypically characterized, and of which 133 goats and 123 sheep were genotyped, in **Burkina Faso**. When matching DNA analysis data with phenotypes, ear and body size were found to be closely related to the actual breeds of these animals. Using these simple criteria farmers are now themselves able to identify appropriate stock as they move forward in their endeavours to breed high yielding goats and sheep with resistance to trypanosomiasis.

350%

the increase in water-use-efficiency of field tomatoes in **Kenya** using low-cost, small-scale irrigation technology compared to traditional hand watering. This increased tomato yield from 13 t/ha to 32 t/ha with only 55% of the water.

400 MILLION USD/year

per year, the projected additional revenue of **Kenyan** farmers currently growing pigeon pea on 163 000 ha of semi-arid land, attainable by using an improved production system incorporating pigeon pea varieties to capture atmospheric nitrogen, a higher planting density and crop rotation for soil fertility enhancement.

6 national training courses

and the resultant expanded skills of nearly eighty professionals in animal nutrition, artificial insemination and disease diagnosis in **Eritrea**, attracted the excitement of an NGO. Through these enhanced capacities the National Agricultural Research Institute and the NGO are now actively supporting the development of smallholder dairy farming and thus helping to reduce poverty and enhance food security in the country.

2 mutant varieties

of wheat, resistant to the devastating Ug99 black stem rust, developed and released to **Kenyan** farmers. Causing 80-100% crop failure and threatening wheat production, wheat black stem rust globally destroys 8.33M tons of wheat per year, worth US $1.23 billion.

20 years

the duration to date that the Island of Unguja, **Tanzania** has remained free of tsetse flies and tsetse-transmitted diseases since their eradication using an area-wide integrated approach that included the sterile insect technique. This has significantly increased milk and meat production/head, reduced abortion rates, and increased the proportion of more productive livestock breeds. The African Union has called for similar SIT-based projects to eradicate tsetse flies from other areas of Africa.

57 mutant varieties

developed in nine different crop species and released to farmers. A particularly successful and high-impact example was the release of the tasty and aromatic 'SUPA BC' rice mutant variety in Zanzibar, **Tanzania**, which raised rice yield from 4 to 7 tonnes per hectare. Using this improved variety farmers now produce enough grain to meet local family needs and to generate additional revenue on local markets.

13 000 US dollars

the net increase in profit per hectare for farmers in **Mauritius** achieved through the use of a low-cost drip fertigation system that increased cauliflower yield from 23.5 t/ha to 48.7 t/ha, while decreasing water needs from 4 850 to 1 940 m^3/ha.

25 000 cows

artificially inseminated each year in **Tanzania** in ongoing endeavours that have led to crossbred animals with more than twice the milk production compared to local dairy animals. Several Maasai communities are participating actively and have produced nearly 300 crossbred calves with potential for higher milk yield.

8 500 KG/HA

the tea yield achieved in **Tanzania** with drip irrigation using only half the water compared to 4 200 kg/ha with sprinkler irrigation and 600 kg/ha when rain-fed. This technology holds enormous potential on the 80% of lands depending entirely on rainfall and suffering from recurrent droughts and could have major impacts on the sustainability and incomes of small-scale farmers and on export revenues.

12 countries

use fallout radionuclides to assess the magnitude of soil erosion and implement appropriate soil and water conservation management practices to effectively combat soil erosion. In the eastern central highland of **Madagascar**, the use of fallout radionuclide technologies showed that traditional Malagasy soil terracing was able to reduce soil erosion by more than 50% and hence provides efficient protection of agricultural soil resources in the Madagascar highlands.

1 BILLION
US Dollars

the estimated annual savings to Africa through the eradication of rinderpest, the first-ever animal disease to be globally eradicated – and only the second after the eradication of human smallpox. Nuclear related technology, including the ELISA that facilitated the discrimination between infected animals, vaccine-protected animals and unexposed animals, was crucial to the success of this eradication programme.

40 Countries

use animal disease diagnostic techniques developed or validated by the Joint FAO/IAEA Division to support the prevention, early detection, control and eradication of animal diseases, such as foot-and-mouth disease, African swine fever, avian influenza and Rift Valley fever. These diagnostic tools are used in conjunction with other control measures also in the health programmes of WHO, OIE, FAO and CG-centres to combat dangerous zoonotic diseases and decrease the risks of their transmission to human populations.

32 institutes

in 23 countries work with the Joint FAO/IAEA Division and worldwide partners to develop and implement technology packages for food traceability in order to authenticate such food and/or to trace its geographical origin. Food fraud is estimated to cost the global food industry US $10 - $15 billion per year, affecting approximately 10% of all commercially sold products. Effective traceability systems are also essential to deal with food safety incidents caused by unintentionally mislabelled or contaminated foods.

125 methods

for analysing food have been validated by the Joint FAO/IAEA Division and transferred to Member States. These help to reliably monitor veterinary drug, pesticide, heavy metal and mycotoxin residues and contaminants. The methods are made freely available using the internet as a platform and are shared through the Joint FAO/IAEA database on Food Contaminant Residue Information System.

40 national veterinary diagnostic institutions

work together within the **African** '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.

9 laboratories

in four countries aiming for International Organization for Standardization (ISO) accreditation. Five have already obtained such accreditation and are supporting other countries in the region to rapidly and reliably diagnose animal disease outbreaks. This is a major step in global endeavours to control transboundary and zoonotic animal diseases, including avian influenza.

25 national agricultural research institutes

and extension services use isotope techniques, under a range of cropping systems and agro-climatic conditions, to quantify the nitrogen fixation potential of grain and forage legumes that have the potential globally to fix some 33 million tonnes of atmospheric nitrogen each year. The Joint FAO/IAEA Division helps to make biological nitrogen fixation a cornerstone of today's soil fertility, quality and nutrient management systems, thereby supplementing the use of chemical fertilizers worth billions of dollars annually.

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