Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Nuclear Applications in Agriculture Success Stories from **Near East and North 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 Near East and North Africa.

19 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.

18 of the 19 countries in this region 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.

83 trainees participated in 22 training courses and workshops in 2015 and learned to apply one or more nuclear technologies in the field of food and agriculture.

5

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.

26 Million US Dollars

the potential additional earning to small-scale farmers on 42 000 ha of abandoned, barren land in **Algeria** by way of effective water management through irrigation scheduling, efficient use of saline water and the introduction of salt-tolerant barley and oats. Achieved yields of 2.5 t/ha would provide a corresponding saving in foreign exchange food imports.

ISO-17025 accreditation

of the Central Veterinary Laboratory in Alger, **Algeria**, with substantial support from the Joint FAO/IAEA Division, including the establishment of internationally recognized standard operating procedures for the diagnosis of animal and zoonotic diseases. Accredited laboratories are crucial in the accurate and rapid diagnosis especially of transboundary and emerging diseases.

1 reference centre

the École nationale de médecine vétérinaire in Sidi Thabet, **Tunisia**, has been designated as a regional training centre on livestock reproduction and artificial insemination. Currently more than 80% of all regional trainees receive training at this centre.

150 CO-OPERATIVES

in **Morocco** that produce more than 700 tonnes of Argan oil, one of the most expensive edible oils in the world, can rest assured that the authenticity of this unique commodity is ensured through two stable isotope methods that were developed specifically to confirm the origin and improve the traceability of this oil. The government now plans to regenerate 200 000 hectares of Argan forest, a key step also in averting desert encroachment.

6 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 mountainous Tetouan region in **Morocco**, the use of fallout radionuclide technologies identified the most erosion prone areas and, through appropriate conservation agriculture practices, reduced soil erosion in the watersheds by 40% and greatly diminished sedimentation of local water reservoirs.

100 000 ha

the area in the Agadir region of **Morocco** for which the National Plant Protection Office, the Regional Office of Agriculture in Souss Massa (ORNVA-SM) and the Moroccan Citrus Producers (Maroc Citrus) signed an agreement under the Minister of Agriculture to establish an area-wide sterile insect technique (SIT) programme against medfly. The agreement is the result of a successful 5000 ha pilot project to control the medfly in the Souss Valley, where Morocco produces most of its citrus fruits.

40% less water and one-sixth of nitrogen fertiliser

used to generate a 2- to 3-fold increase in potato yield in **Libya** by drip irrigation/fertigation. This could potentially reduce freshwater demand of Libyan agriculture from 1000 m³/ha to 400 m³ or less, help ensure long term freshwater availability and reduce salinization of agricultural soils.

41 induced mutant crop varieties

have been officially released to farmers in this region. A particularly successful and high-impact example was the release in **Egypt** of three high yielding, disease resistant mutant varieties of sesame, Taka 1, Taka 2 and Taka 3, which contribute about US $6.2 million to the national economy. Similarly, the safflower mutant varieties Inshas 10 and 11 with high yield and oleic acid content now provide farmers with substantial additional income.

1500 US dollars

the net increase in profit per hectare for primarily women farmers in the Kassala region of **Sudan** through a low-cost drip irrigation system that increased onion yield from 20 t/ha to 27.4 t/ha with drip irrigation, while decreasing water needs from 16 000 to 9600 m³/ha.

78 MILLION STERILE INSECTS

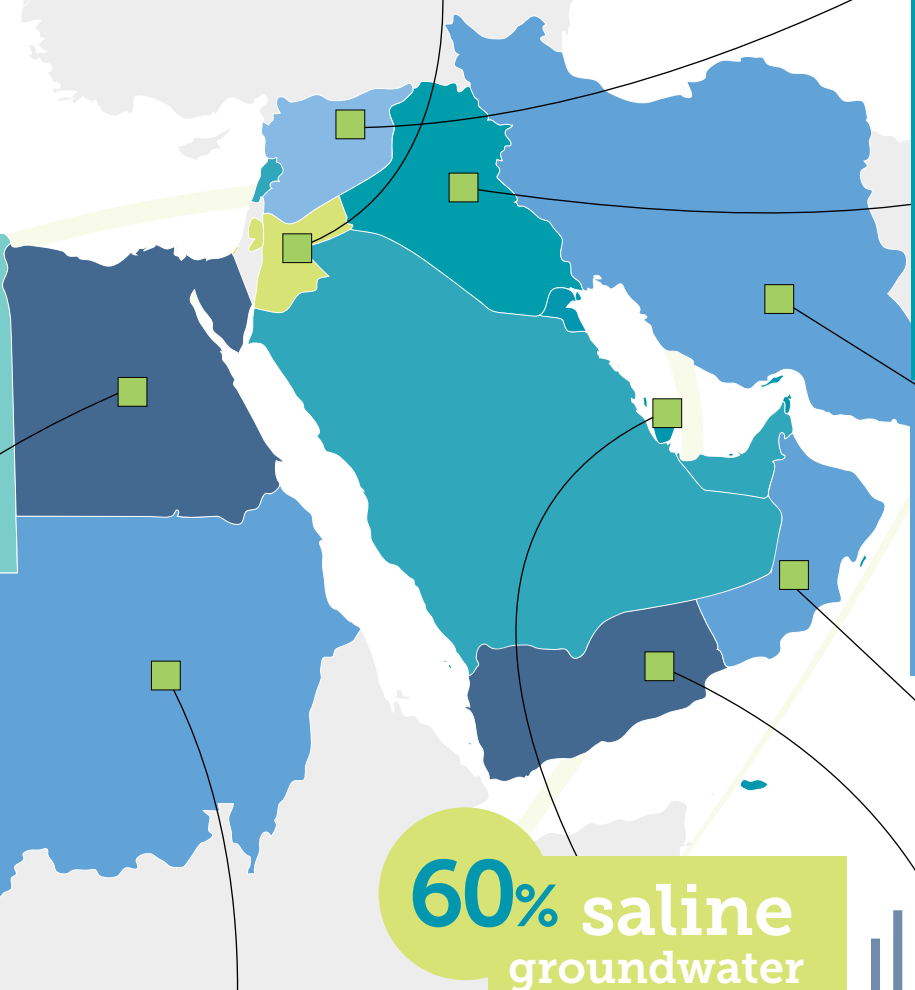
released annually in commercial orchards in **Jordan** and the **West Bank** to protect stone fruit from the devastating ravages of the Mediterranean fruit fly. In this "*bridge to peace*" alliance – the flies are produced in Israel – the use of sterile medflies is part of an integrated pest management approach that has substantially reduced fruit damage and increased fruit supply for local communities without the use of insecticides.

50%

higher growth rate obtained in **Jordan** with lambs and kids born from genetically superior rams and bucks in artificial insemination programmes. It also facilitates synchronization of lambing and kidding to coincide timely with peak demand at religious and cultural festivities when prices often double. A scaling up of this technology will substantially benefit the livestock industry and farmer's livelihoods.

93%

the increase in irrigation water efficiency in **Syria**, based on cotton dry matter yield, using fertigation, the application of fertilizers through an irrigation system. Seed-cotton yield increased by 22% as a consequence, showing fertigation to be a highly efficient technique in cotton farming.



40 dS/m

reduced from a soil salinity of 80 dS/m through the introduction of surface drainage to flush and leach water and soluble salts out of the soil, growing of salt-tolerant legumes and application of mineral amendments in **Iraq**. Adopted at an early stage by about 100 farmers on 5000 ha, and potentially applicable to a large part of the 4M ha salt affected lands of the Lower Mesopotamian Plain, net incomes of US $1200/ha/yr were achieved on previously abandoned lands.

30%

the nitrogen fertilizer recovery achieved using drip irrigation of tomatoes in **Iran**, up from 5% when nitrogen fertilizer was applied separately. At the same time, drip irrigation saved about 50% of the irrigation water traditionally used in tomato farming.

21 scientists

from **Oman** trained at three national training workshops in pesticide residue analyses of fruit, vegetable and fish products as well as in anti-microbial and veterinary drug analysis of fish and fishery products. These enable food safety analysis to be done rapidly in-house rather than through time consuming and expensive contracting to foreign laboratories.

60% saline groundwater

with 40% treated sewage water reduced overall need for groundwater by 20-30% in **Qatar** and resulted in 50-60% reduction in the amount of salt added to soil. The Ministry of Environment is planning to use about 100M m³ of saline groundwater and about 60M m³ of treated sewage water to irrigate 83 000 ha of highly saline coastal and inland Sabkha lands, currently rated as unsuitable for cultivation, to produce fodder and shrub for livestock, essentially increasing arable land from 8000 to 91 000 ha.

Rev-1

the live attenuated and irradiated *Brucella* strain used in trials in **Sudan** to develop irradiated vaccines against brucellosis in sheep. Irradiation technology offers a unique opportunity to produce metabolically active but non-replicating bacteria that are capable of efficiently inducing long-lasting T-cell immune response in treated animals with anticipated minimal side effects.

20% of the wheat growing area

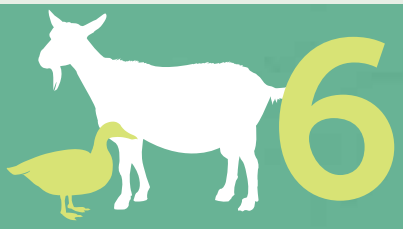
of Amran, **Yemen**, is covered by the high-yielding Bouth-1 mutant variety, widely adopted by Yemeni farmers even before its official release and providing an estimated benefit to farmers of US $280 per hectare. A second mutant variety, Improved Sonalika, occupies 10% of the wheat growing area in Dhamar with very similar benefits to farmers. Several other mutant varieties have been developed and are currently awaiting official release.

1 BILLION
US Dollars

the estimated annual savings to Africa alone 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.

10 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 transfer to human populations.



6 national veterinary diagnostic institutions

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

8 artificial insemination centres

established in Jordan, Iraq, Syria and Yemen for small ruminants and further enhanced for cattle semen production in Algeria, Morocco and Tunisia. In Jordan, the Al-Musherfeh station in Al-Karak has successfully identified rams, especially of the Awassi breed, based on their breeding performance and has the potential to become an international training centre for artificial insemination in sheep.

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.

>200 scientists and technicians

trained within three years both locally and at the FAO/IAEA Agriculture & Biotechnology Laboratories on state-of-the-art technologies relating to animal breeding and artificial insemination, including semen processing, molecular genetic tools, radioimmunoassays, and genetic characterization of indigenous livestock breeds using DNA markers. Such training is crucial to ensure sustainable livestock farming.

8 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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