



Nuclear applications in animal production and health



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The Joint Food and Agriculture Organization of the United Nations (FAO)/International Atomic Energy Agency (IAEA) Division of Nuclear Techniques in Food and Agriculture assists member countries, through the use of nuclear and nuclear-related technologies, to improve livestock productivity through the efficient use of locally available or alternative feed resources, the optimal utilization of livestock reproduction and breeding practices, and the development and transfer of technologies for detection of transboundary animal and zoonotic diseases, including those that pose a potential bio-threat.

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What FAO does

- Assists in the development and transfer of capacity in the use of nuclear and nuclear-derived/related techniques for development, evaluation and validation of technologies enhancing animal production and sustainable implementation in national laboratories;
- Develops radioimmunoassays to measure and trace hormones in female animals that control the reproductive cycle, and thus enhance artificial insemination, embryo transfer and breeding strategies;
- Improves immunological and molecular diagnostic techniques using isotopic labelling to trace, monitor and characterize transboundary animal, zoonotic and bio-threat pathogens;
- Uses irradiation to attenuate or inactivate animal, zoonotic and bio-threat pathogens for use in livestock vaccines;
- Uses isotopic labelling to trace and investigate metabolic pathways of ingested livestock nutrients to determine energy conversion;
- Uses stable isotope ratios to investigate migratory routes, primarily of birds, and the potential of these to carry diseases;
- Delivers individual and group capacity building through training courses and workshops;
- Transfers guidance and knowhow through scientific visits, expert services, in-field implementation support and the provision of diagnostic emergency toolkits, equipment, reagents and consumables to laboratories in member countries;
- Established and continuously expands the 'VETLAB' network to support veterinary diagnostic laboratories, to share knowledge and expertise, to integrate and utilize common approaches, to harmonize procedures, to support the implementation of international standards and to apply high level bio-security, as well as to integrate nuclear and related techniques into the national strategic plans of member countries. This network has now 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.



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Understanding the context

The world is facing serious socio-economic problems with substantial impact on the entire human population, including food insecurity, inefficient livestock productivity, erosion of animal biodiversity and depredation of wild animals, which result in increased threats and outbreaks of transboundary and zoonotic animal diseases, including those that potentially pose a bio-threat. The agricultural and livestock sector must become more resilient and more efficient at producing more and better quality crops, meat, milk and eggs per unit of farm area while promoting climate-smart agriculture and protecting the environment through the educated use of land, water and other natural resources. It must also effectively manage the bio-security and bio-safety constraints imposed by climate change through transboundary animal and zoonotic diseases in order to improve farmers' livelihoods and to achieve sustainable food production.

Nuclear and related technologies, in conjunction with conventional approaches and through collaborative work with member countries, other UN organizations and leading research institutes, have contributed substantially to improving livestock productivity,



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controlling and preventing transboundary animal and zoonotic diseases, and protecting the environment. These technologies, including the ELISA that facilitated discrimination between rinderpest-infected animals, vaccine-protected animals and unexposed animals, were crucial to the success of the rinderpest eradication programme that is estimated to save Africa US \$1 billion per year.

With technical support by the Joint FAO/IAEA Division, Cameroon effectively uses radioimmunoassay, immunological and molecular diagnostics and genetic screening in its livestock reproduction, breeding, artificial insemination and disease control programmes. A key outcome of this programme was the increase in milk production from 500 litres in local zebu breeds to 1 500 litres in crosses between *Bos taurus* and *Bos indicus* breeds. Prevalence of Brucellosis was also reduced dramatically as a result of this programme. A three-fold increase in milk production would potentially generate additional farmer income of US \$110 million per year.



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