# Symposium on Peaceful Uses of Nuclear Technology

**February 24TH, 2015**

## 1. Nuclear Applications in Agriculture

I would like to start thanking the Permanent Mission of Japan for hosting this symposium on the **Peaceful Uses of Nuclear Energy**, and for inviting me to say a few words about the experience in applications in agriculture and food safety in my country.

As we approach the Review Conference of the Non Proliferation Treaty, we reaffirm our commitment with all three pillars of the NPT: Disarmament, Non Proliferation and the Peaceful Uses of Nuclear Energy. This activity today allows us to provide some insights about these peaceful uses and its contribution to the development and wellbeing of our citizens.

Since its beginning, the Chilean Commission of Nuclear Energy, there has been a national demand for studies and research linked to the agricultural sector. These studies gave rise to the agriculture section, research area that has deployed nuclear techniques to improve agricultural practices, achieving benefits in terms of production, promoting the care of the environment in small and large farms, focusing on the good management of soil, protection of aquifers, optimizing the resources of agricultural production.

The agriculture division of Chilean Commission of Nuclear Energy generates information to resolve production issues looking for profitable and sustainable agro-ecological means. Through the research and development of agro-environmental techniques, it is possible to optimize and make efficient production of crops, evaluating the efficiency in the management of soil, water and external products applied as agrochemicals (fertilizers and pesticides).

Promoting technological innovation and the transfer of knowledge to sectors such as universities, research institutions, public and private companies has proven the utility provided by this technology in the productive sector, providing a direct quantitative measurement of influence of different factors of agricultural management on the environment.

The agriculture division manages the generation of knowledge and training in the area of application of isotopic techniques, using face-to-face interaction with international organizations as well as using bibliographic and multimedia resources, making it easier to act on the following lines of work:

- Evaluation of genotypes, root activity and absorption of nitrogen and phosphorus fertilizers on fruit trees and annual crops.

- ***Quantification of the contribution of legumes as a source of biological fixation of nitrogen (FBN) in a crop rotation, and potential savings of external inputs.***

- ***Studies of adsorption, desorption and degradation half-life of pesticides in soils, evaluating the final destination of the same.***

- Estimation of the dynamics of mineralization and immobilization of nitrogen (MIT) in soils.

- Diffuse pollution in waters (not efficient application of agrochemicals product).

- Measurement of rates of redistribution of soil (erosion), by spectrometry range technique.

- Quantification of effect gas emission greenhouse and carbon sequestration in the ecosystem, new line is working on joint project with other agencies as the agriculture and livestock Service (SAG) and others.

The dynamics of the agricultural life, together with the needs of satisfaction of production yields and quality as determined by the requirements of national and international strengthens the need for research in collaboration with sectorial stakeholders.

New isotopic techniques, developed in Chile by Chilean Commission of Nuclear Energy, make up an accurate tool to get data on these matters. Chilean Commission of Nuclear Energy researchers conduct studies with radioactive tools to address the agricultural problems, obtaining accurate data on the use of fertilizers, pesticides and their potential impact on indirect or diffuse pollution.

**Some examples:**

We would now like to highlight some specific projects developed by the Chilean Commission of Nuclear Energy in the agriculture sector.

## *Erosion in Apalta Vineyards (sixth Region)*

"Application of isotope techniques for the evaluation of incidental factors in the sustainability of the natural resources in agricultural watersheds", is a project developed jointly by CCHEN, SAG and the University of Chile, supported by the IAEA and concentrated in the Apalta Valley aimed to quantify the erosion of soils related to the use of pesticides and to verify the possible contamination of surface water.

## *Grain Corn (Las Cabras, Region VI)*

"Improvement of soil fertility and management of crops to sustainable food production and improve the income of resource-poor farmers".

This project is supported by the IAEA, based on the optimization of the application of nitrogen fertilizer to corn, to improve productivity, improving the net margin of small farmers. This study began the 2010, and is focused on the sixth Region, which has the largest number of land dedicated to the production of corn, with an average yield in the region of 123 quintals per hectare, and where a large percentage is being produced by small farmers with higher average yields.

## *Tijeral and Traiguén (ninth Region) project*

Currently, CCHEN, together with SAG, the Austral University, Catholic University of Temuco and Universidad Mayor, carries out a project initiated by the United Nations Organization for food and agriculture, FAO and the international organization of atomic energy, IAEA, RLA7019 "Development of indicators to determine the effect of pesticides, heavy metals and pollutants emerging in continental aquatic ecosystems important for agriculture and agro-industry".

The objective of the project is to define a methodology for the implementation of monitoring early warning in areas of high intensity of uses of pesticides by specific biomarkers. So, the final purpose is to know the effects of pollutants and agrochemicals emerging (using conventional and isotopic analysis), in environmental compartments as a source of development of bio-indicators.

This methodology is used in order to contribute to the adoption of systems of monitoring and evaluation of agricultural production, reducing the negative impact of the application of pesticides in the agricultural management, without affecting productivity.

The study which carried out in aquatic environments will allow experts to determine the impact of pesticides in basins of the agricultural zone, based mainly in the production of Apple trees for export in Traiguén, area that incorporates annual crops for feeding pigs for meat export.

An analysis of the application of agrochemicals and their management will help contribute to the sustainability by evaluating the processes of sedimentation and pollution by agrochemicals.

***Greenhouse gas quantification project (RM and Region VI) (2014-2016)***

This project has the support of the IAEA, aims to evaluate the contribution of farming to the formation and/or mitigation of the production of greenhouse gases (GHG). It involves from the experimental design in farmland, whereas the selection of cultivation study, focusing surface, the economic importance of culture, the associated agricultural group, the use of agrochemicals.

***Project for improvement of agricultural production through the efficient use of resources (Cauquenes, VII Region)***

In this project the Agriculture Division supports the Institute of agricultural research (INIA), whose objective is to evaluate the efficiency of use of nitrogen fertilizers and its relationship with biological fixation of nitrogen by legumes, as a natural source of nitrogen in areas where rotating crops, providing an improvement in soil fertility achieving sustainability in production and lowering applications of fertilizers that could potentially generate a diffuse pollution to irrigation water.

## 2. Food Safety

I would also like to say a few things about nuclear applications that help to certificate Food Safety in Chile, through the cooperation between the IAEA and the Food and Livestock Service.

The need for healthy and safe food has motivated countries to improve and strengthen the different levels of control and regulation of residuals and contaminants that may be present in agricultural products (animal and vegetable) intended for human consumption.

The demand of consumers and international trade for primary food regulations has involved the development of national programs by the State to control and ensure food safety, which has included the implementation of analytical laboratories that they can assess the presence of residues and contaminants, which require to have adequate equipment

and technical knowledge to achieve the levels of detection and sensitivity required for these diagnosis.

For this purpose, the Agriculture and Livestock Service, with the support of the programs of technical cooperation of the IAEA, implemented in 2005, **the laboratory of environmental chemistry and food (QAA),** laboratory for the detection of residues and contaminants in livestock products, which currently serves as the official laboratory of the SAG of the national program of control of residues in livestock products.

The cooperation of the IAEA, through national projects, has allowed the training of the staff in laboratories in Europe and in the in the Latin American region. As well we should count the equipment for liquid chromatography and gases, among other technical improvements.

The QAA Laboratory, received its ISO 17025 accreditation 7 years ago, and has been successfully audited by various official missions from different countries where Chile exports its products, including the European Union.

This laboratory has also participated in different quality assessment mechanisms, as the international inter-laboratory analysis of residues of Progetto Trieste (Italy), FAPAS and others organized by LANAGRO (Brazil) and SENASA (Argentina) with satisfactory results which validate and give guaranty of its capabilities.

Also, the laboratory of QAA, with the support of the IAEA, has been the regional main responsible partner in two regional projects that intended to promote, and establish regional cooperation networks between laboratories in the region, with direct participation from 13 countries.

These projects have allowed the training of over 140 technicians of the region of Latin America, in areas such as: development of methodologies, validation and application of different analytical techniques for analysis of residues in food, as well as in regional workshops in systems of quality assurance, validation, and calculation of uncertainty in analytical tests.

Likewise, the laboratory of QAA has supported direct training of IAEA fellows, from other countries of Latin America and as far as Angola, and supporting experts from laboratories of other countries and internally to the formation of young science student's support in opening laboratories for internship and thesis address.

The laboratory of environmental chemistry and food as official Agriculture and Livestock Service laboratory fulfills an important contribution to the food security of Chile, by ensuring the quality and safety of agricultural products of the country reaching more than 100 markets of different countries of the world with its function. At the same time, it supervises, directs, and gives guidelines to the network of private laboratories authorized by the Agriculture and Livestock Service, which complement and support the certification of exports. In these achievements, the support and contributions of IAEA technical cooperation programs have been the basis of its development and consolidation, projecting his work both nationally and internationally.