IAEA Technical Cooperation Programme

Increasing sustainable crop production and supporting food security in Benin

The challenge

Benin is predominantly an agrarian country. Almost 70% of the country's working population depends on agriculture, most of these being small scale farmers. Maize is among the most important grain crops in the agricultural economy of Benin, occupying nearly 54% of the 1 100 000 hectares used for food crop production. However, high pressure on land, a total dependence on rainfall, soil nutrient mining, difficulties in accessing agricultural inputs, and rapid urban and peri-urban development all pose significant challenges to Benin's agricultural productivity. Other ongoing challenges include poor soil fertility, weed infestation and land degradation.

By integrating the use of nutrients needed for sustainable agricultural production, it is possible to keep soil fertile and to make it more productive. To realize the potential benefits of the association and even the integration of livestock and agriculture, Benin needed to replace unsustainable agricultural practices with economically and ecologically viable farming systems that would increase agricultural production in a sustainable manner. Increasing agricultural production is a key priority for the Government of Benin.

The project

Under an IAEA technical cooperation project established in 2012, a national network of laboratories was set up in Benin. The laboratories were equipped with the technical capacities and know-how to develop integrated crop-livestock systems that could be adapted to the specific urban and peri-urban conditions found throughout the country. Dissemination strategies were developed to share the improved crop-livestock systems among farmers.

To enhance soil fertility and crop productivity, the project promoted the production of specific crops such as maize and yam, and integrated them with the application of livestock manure and the cultivation of legumes such as soybean, cowpea and groundnuts. On-station and on-farm participatory research trials were conducted to

Preparing soybean plants for an experiment using isotopic techniques at the University of Abomey-Calavi, Benin. (Photo: M. Gaspar/IAEA)

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assess and improve the existing farming practices of local cultivators.

IAEA fellowships and scientific visits were used to transfer relevant expertise to young scientists and technicians. The training focused on the use of isotopic techniques in a variety of areas in the field of integrated cropping-livestock systems, including soil fertility management, soil biology, ration formulation, feed evaluation and determination, the identification of dual-purpose legumes with nitrogen fixing ability, and crop productivity.

The impact

Benin's national capacity to improve the health and the productivity of maize and yam-based crops was dramatically strengthened. As a result, unhealthy soils can now be reclaimed and used, which has enhanced the country's competitiveness in international markets, and improved the future prospects of small- and large-scale farmers across the country.

The application of inoculation and phosphorus in the integrated crop-livestock system has enabled the highest possible nitrogen fixation and has resulted in an increase of 50% in maize yield, when grown in rotation with legumes. In addition, the use of appropriate soil and water conservation practices in maize and yam-based crops has not only helped smallholder farmers to improve their crop yields and soil productivity, but has also contributed to a better management of soil and water resources at the national level.

For the farmers, this increase in output translates to an approximate fivefold increase in income. The increase in production has also allowed farmers to use grains as feed for their cattle.

Thanks to the training provided through the project, the personnel of the newly established network of laboratories now have an in-depth understanding of existing crop-livestock systems, and the necessary competencies to continue developing integrated crop systems for the various regional, peri-urban environments found in Benin. Moreover, the scientists and technicians can now share their experience with other laboratories and farmers in the country.

Overall, the project has contributed to enhanced food security in Benin and to the introduction of economically and ecologically viable farming systems.

PROJECT INFORMATION

Project No: BEN5007

Project title: Soil, Crop and Livestock Integration for Sustainable Agriculture Development Through the Establishment of a National Laboratory Network

Duration: 2012–2015 (4 years)

Budget: €250 000

Contributing to:

Partnerships and counterparts

The project was implemented by the IAEA in partnership with the Food and Agriculture Organization of the United Nations (FAO), and in collaboration with the Faculty of Agronomic Sciences of the University of Abomey-Calavi, as well as the National Institute of Agricultural Researches in Benin (INRAB).

Facts and figures

- Maize yield increased by 50% from 1325 to 2097 kg/ha when cultivated in rotation with legumes.
- Legume yield increased by four to six times when inoculated.
- Farmers' income increased approximately fivefold.

The science

Livestock manure and legumes are natural fertilizers. They optimize soil, water and nutrient-use efficiency and enhance agricultural productivity. Legumes absorb nitrogen from the atmosphere, and convert it into plant nitrogen. This remains in the soil and serves as a natural fertilizer for subsequent crops. This process is called nitrogen fixation.

Isotopic techniques are used to produce reliable data on nitrogen availability for crops, and to improve our understanding of the processes behind biological nitrogen fixation and nitrogen loss. With this information, the efficiency of soil, water and nutrient use in integrated cropping-livestock systems can be optimized.

Nuclear techniques are also used to determine soil organic matter dynamics and soil status, and to assess the contribution of the different components of the cropping-livestock systems to soil organic matter. Nuclear and related conventional techniques are also used to assess the impact of crop-livestock integration on the soil water balance.

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