Evaluate and assess the effeciency of current fertilization and irrigation practices using nuclear and related techniques

- The researchers finished collecting data for the first of four croppings needed to validate their findings on fertilizer techniques such as soil test kits, minus-one element technique, nutrient omission plot trial, among others.
- Analyses of various rice irrigation techniques such as alternate wetting and drying,aerobic rice techniques are ongoing.
- Assessment of more efficient practices for furrow irrigation of corn crops, was successful, pinpointing proper intervals, length of furrows and irrigation time

Preparation of ^{15}N isotope microplot for tracing fertilizer use efficiency

Isotopic analysis ofsamples using the isotope ratio mass spectrometer (IRMS)

Corn experiment for fertilizer application response

For more information, please contact:

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Nuclear Techniques for Efficient Nutrient and Water Management for Rice and Corn Production

Problem

Rice and corn has served as the Filipinos' staple food since time immemorial. Around 70 % of the country's total area of rice paddies are irrigated, and 80% of the total water used is allocated to irrigation.

Rice experimental field for ^{15}N isotope labeled fertilizer application

However, inefficiencies in fertilizer use and obsolete irrigation practices and structures lead to around 700-millon m^3 of wasted water worth P3.5-billion and 6-million kg of fertilizer costing P200-million in losses. Using nitrogen isotopes and neutron probes to analyze nutrient intake and soil water absorption, the DOST-funded project seeks to promote smart-farming alternatives and refinement of obsolete methods.

Outcome

Refined fertilizer recommendation for efficient nutrient utilization and increased yield

Nuclear analytic techniques are crucial for knowing just the right amount of fertilizer needed to supplement the natural soil nutrients, minimizing loss by around 25%, and in turn increasing crop yield and quality.

Established correlations between the soil test value and the response of crop to fertilizers in terms of growth performance and yield

Researchers established a higher response of low-nutrient soil for the same amount of fertilizer given to high-nutrient soil. While there is same yield for the same fertilizer amount, the inefficient excess for high-nutrient soil dem-onstrated higher efficiency for the lower-nutrient soil.

Efficient irrigation techniques and procedural manual for water management

PNRI researchers are preparing a procedural manual for making furrow irrigation for corn crops more efficient. The use of nuclear-based techniques allowed for precise measurements and proven practices

Strategies

Use of nuclear analytical techniques in improving the soil tests calibration and fertilizer recommendation

Analyses were based primaily on the ^{15}N and ^{13}C isotopes and the Soil Moisture Neutron Probe

Advantages of ^{15}N stable isotope technique

- Nitrogen is one of the most common elements used in fertilizers.
- The ^{15}N isotope is distinct from ^{14}N found in soil nutrients but just as safe and stable.
- Unlike conventional methods, it shows the percentage of ^{15}N from fertilizer and natural ^{14}N, tracing absorbed nutrients better

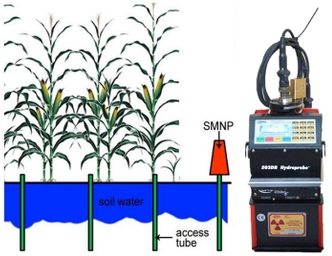
Air moisture collection for 18O isotope analysis used in evapotranspiration measurements

Use of ^{13}C isotope discrimination

- ^{13}C is heavier than normal plant carbon
- It helps correlate the ^{15}N soil test with the crop's response through its carbon dioxide (CO^2) intake

Advantages of Soil Moisture Neutron Probe

- Relies on the neutron-scattering hydrogen nuclei from soil water; very useful for irrigation
- Non-destructive



Collaboration with farmers and research institutions

PNRI coordinates with various agencies and institutions concerned with the development of crops serving as the country's most prominent staple food:

- Department of Agriculture - Bureau of Soils and Water Management (DA-BSWM)
- University of the Philippines Los Baños
- Central Luzon State University (CLSU)
- Philippine Rice Research Institute (PhilRice)

These smart-farming projects are funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development Center (PCAARRD) and the International Atomic Energy Agency (IAEA).

Actions

Conduct actual field experiments on-site at different agro-ecological and climatic zones in collaborations with other research agencies

- Nine farmers cooperated with the project, using farms in Isabela and Cagayan Valley in Region 2 as experimental sites for ^{15}N microplots
- PhilRice established an experimental field in their Central Experimenal Station in Muñoz, Nueva Ecija. Analysis was done in both PNRI and PhilRice laboratories.

Field evaluation and site visit during the late reproductive stage of corn in Bacnor, Isabela