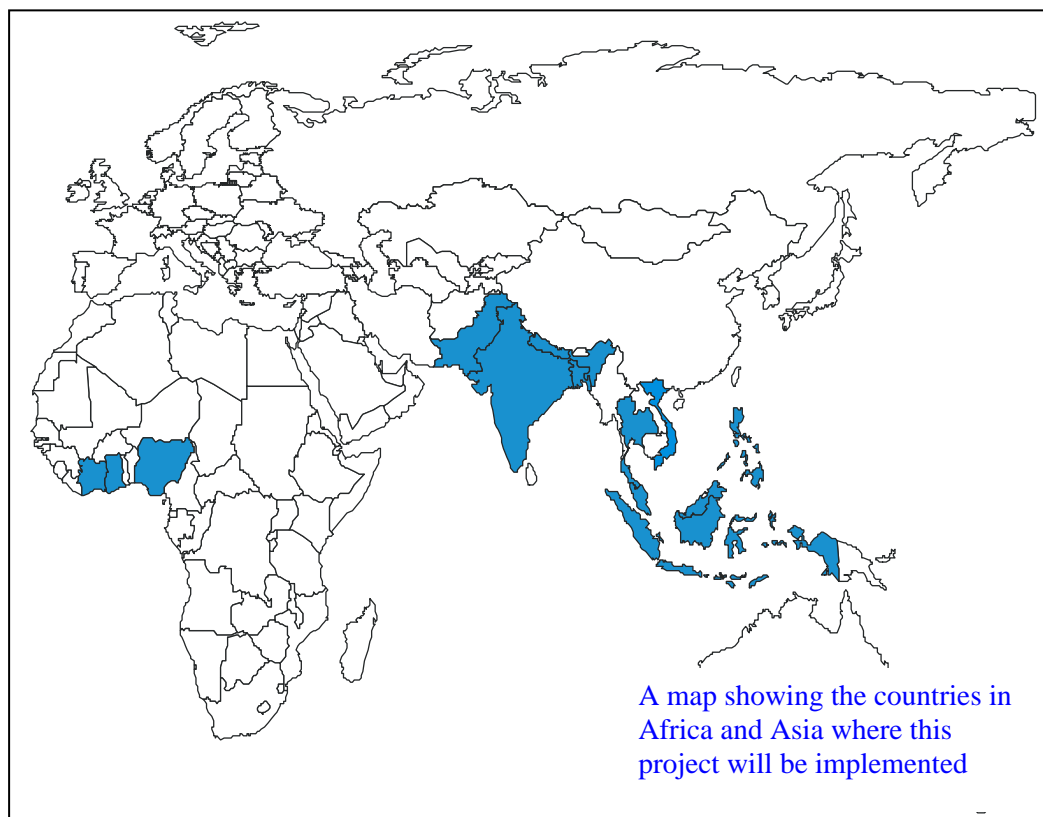


BETTER LIVES FROM HEALTHY SOILS: INTEGRATED PEST MANAGEMENT IN SOILS OF CEREAL (RICE, WHEAT AND MAIZE) CROPPING SYSTEMS IN THE HUMID TROPICS AND SUB-TROPICS UNDER CONSERVATION AGRICULTURE



IARC PARTNERS

IRRI - *International Rice Research Institute*

CIMMYT - *Centro Internacional de Mejoramiento de Maiz y Trigo*

WARDA - *West Africa Rice Development Association*

TSBF/CIAT – *The Tropical Soil Biology and Fertility Institute / Centro Internacional de Agricultura Tropical*

CABI - *Center for Agriculture and Biosciences International*

COORDINATING CENTER:

CIMMYT - *Centro Internacional de Mejoramiento de Maiz y Trigo*

Systemwide Program on Integrated Pest Management (SP-IPM)

A CGIAR global effort to improve livelihood of poor farmers by reducing crop losses and producing more food in a sustainable way

INTRODUCTION

The majority of farmers in the humid tropics and sub-tropics in Asia and Africa are resource-poor and risk averse, not maximized productivity is a major concern. The rice/wheat cropping system is very characteristic of the humid tropics in Africa and Asia. A growing body of evidence suggests that soil-mediated problems are increasing due to more intensive or monoculture based cropping systems. For example, the 12 M ha of rice/wheat system in South Asia are showing signs of yield stagnation and interacting root health problems appear to be associated with this phenomenon. The challenge is to develop more resilient and sustainable productive cropping system without disrupting the traditional practices that are in harmony with their environment.

SOIL HEALTH AND PLANT HEALTH

There is a strong relationship between soil fertility and plant health, in the sense of plants ability to resist pests' attack. Poor land management and declining soil fertility often result in a negative feedback cycle characterized in part by an increase in soil-borne pests. Since plant health is intimately linked to soil health, managing the soil in ways that conserve and enhance a fully functional soil biota can improve crop yields and quality. A diverse soil community will not only help reduce losses due to soil-borne pests, but also regulate decomposition of organic matter and toxic compounds, and thereby improve nutrient cycling and soil structure.

HIDDEN ENEMIES

A number of pests often attack plants from below the soil surface. The following are the major pests which attach the cereals cropping systems in the humid tropics and sub-tropics:

Nematodes
Root rots
Root aphids

Wheat ground beetle
Termites



Root knot nematode. Females and symptoms on roots:
Left: Female nematodes and eggs inside rice root gall.
Right: Characteristic hooked, root tip galls on rice.



Rice root aphid (*Rhopalosiphum rufiabdominale*): Alate

The above-mentioned pests often cause serious crop losses, but precise loss data is not available for most countries. Nematodes are reported to cause 20-25% yield loss in both wheat and rice crops in some regions of the humid and sub-humid tropics. Similarly, many fungal pathogens (*Sclerotinia*, *Fusarium*, *Rhizoctonia* and *Gaeumamomyces*) are known to invade the root system of both rice and wheat, and in South Asia where around 12 M ha follow an intensive rice-wheat rotation, serious losses are reported to be caused by such root pathogens.

AN URGENT NEED FOR SAFE MANAGEMENT SYSTEMS

Today there is a global need for safe and effective systems for pest management. This sub-project does just that, by offering sustainable solutions to improve soil health and consequently crop health. This is accomplished by focusing on biologically-based means of preventing and managing pests, such as host resistance, biological pest control using natural enemies and cultural practices. Pesticides are used only when other approaches fail to manage the soil-borne pests. Such an approach will lead to reductions in contamination by toxic chemicals of the environment and food and will safeguard the health of land users.

LINKING SCIENCE TO PRACTICE

Through research activities, this sub-project will develop a better understanding of the soil ecosystem and identify tools that can improve its management. Some of these tools require specialized knowledge and equipment for use by technicians. However, in order to link science to practice it is essential to also develop simple indicators of soil quality and health that can be used by farmers. The best way of achieving this is by the use of participatory research strategies using simple on-farm techniques. This sub-project aims to highlight for farmers, limits of the present techniques used in the management of the soils of the cereal production system, and to provide tools to measure soil health and management solutions to overcome soil limitations.

WHAT CAN BE ACCOMPLISHED

It is expected that the project will achieve the following objectives over a five year period:

- a. Establish an international network on soil biota, fertility and plant health.
- b. Characterize soil-based constraints for the cereal/legume production systems.
- c. Improve the understanding of the dynamics of crops, soil biota and soil fertility interactions.
- d. Identify and evaluate management components for soil-borne pests.
- e. Identify and validate integrated pest and soil fertility management practices.
- f. Enhance farmers' capacity in soil management through knowledge development and exchange.

A GLOBAL EFFORT

Achievements of this sub-project will be through scientists from CIMMYT/IRRI/WARDA/TSBF-CIAT/CABI and leading ARIs in the USA (Cornell University), Europe (CABI, University of Louvain Belgium) and Germany (University of Bonn).

ESTIMATED BUDGET

The estimated budget for the project for a five years period is 1.91 million US dollars, and will be implemented in two phases. The estimated cost for the first phase (2 years) is 0.76 million US dollars, and for the second phase (3 years) is 1.15 million US dollars.