

## AN SP-IPM GLOBAL INITIATIVE PROJECT

# BETTER LIVES FROM HEALTHY SOILS: INTEGRATED PEST MANAGEMENT IN SOIL AGROECOSYSTEMS



### IARC PARTNERS

**AVRDC** - Asian Vegetables Research and Development Center

**CABI** - Center for Agriculture and Biosciences International

**CIAT** - Centro Internacional de Agricultura Tropical

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

**CIP** - International Potato Center

**ICARDA** - International Center for Agricultural Research in the Dry Areas

**ICRAF** - World Agroforestry Centre

**ICRISAT** - International Crops Research Institute for the Semi-Arid Tropics

**IITA** - International Institute for Tropical Agriculture

**IRRI** - International Rice Research Institute

**INIBAP** - International Network for the Improvement of Banana and Plantain

**WARDA** - West Africa Rice Development Association

### COORDINATING CENTER:

**CIAT** - Centro Internacional de Agricultura Tropical

### 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**

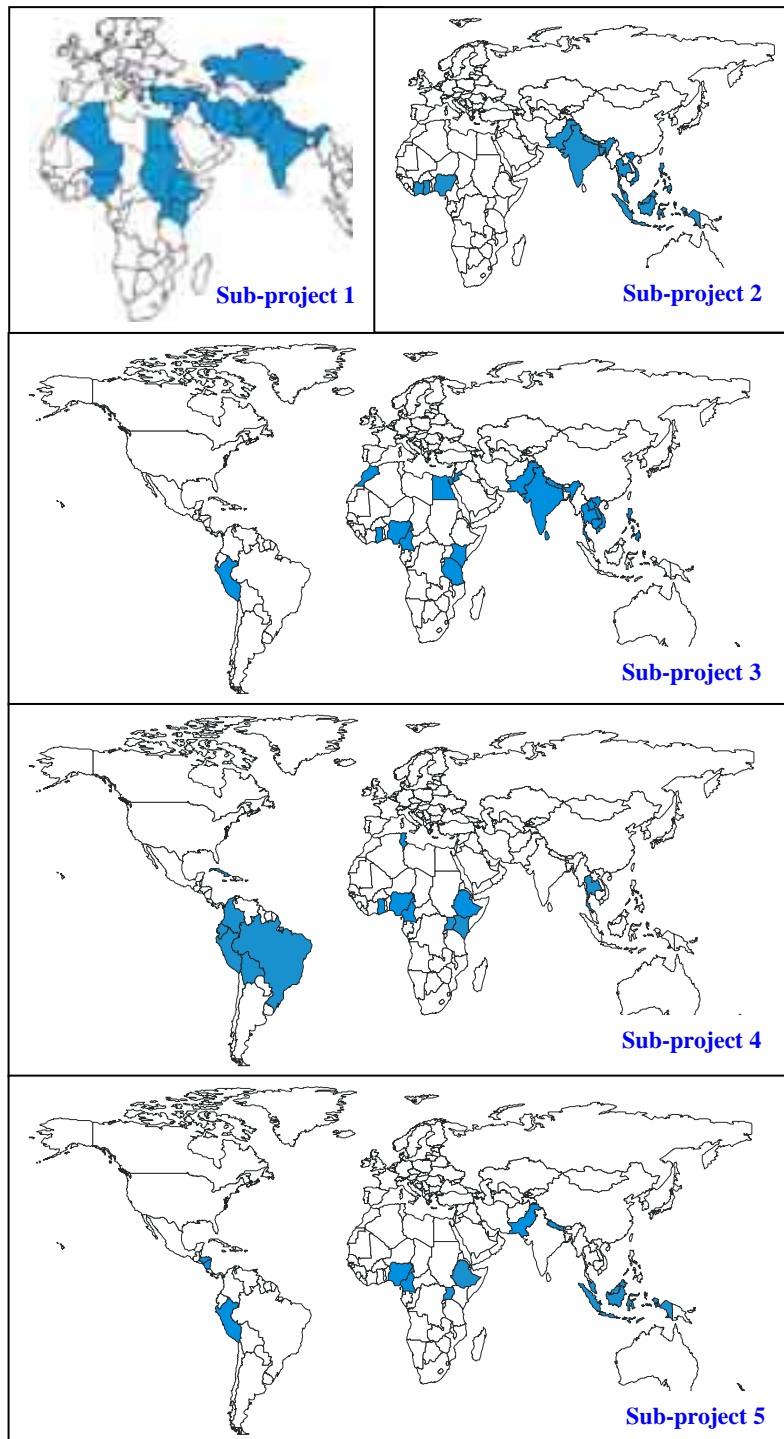
The development of crop production systems to meet the needs of the increasing population of developing countries in Asia, Africa and Latin America poses major challenges for international agricultural research. The stability and environment friendliness of the cropping systems in these regions need to be improved if they are to continue to function sustainably. Soil-borne pests are a limiting factor for crop production in all five cropping systems that will be covered by this project. The major challenge is to develop more resilient and sustainable productive cropping systems without disrupting the traditional practices that are in harmony with their environment.

## **PROJECT STRUCTURE**

The global project comprises five sub-projects that respectively target the soils of the following cropping systems: (1) cereals and legumes in dry, semi-arid and sub-humid areas (sub-project 1); (2) rice/wheat/maize cropping system in the humid tropics and sub-tropics (sub-project 2); (3) year round vegetable production systems (periurban) in the tropics and sub-tropics (sub-project 3); (4) root and tuber cropping systems in the tropics and sub-tropics (sub-projects 4); (5) plantation crops and perennial woody plants in the tropics and sub-tropics (sub-project 5).

## **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.



*Maps showing the countries in Africa, Asia and Latin America where the five sub-projects of this global project will be implemented.*

## TARGETING HIDDEN ENEMIES

A number of pests often attack agricultural crops below the soil surface. The nature of the pests vary with the cropping system, and the following are major categories of soil-borne pests which attack the different crops that will be studied in this projects:

Nematodes	Weevils
Fungal and bacterial wilts	Root aphids
Root rots	Termites
White grub	Parasitic weeds



A lentil field heavily infested with the parasitic weed *Orobanche crenata*



Bean seedlings damaged by the bean stem maggot, with the subset showing damage on the tap root



Bacterial wilt disease causing premature ripening and internal rot of banana bunch.



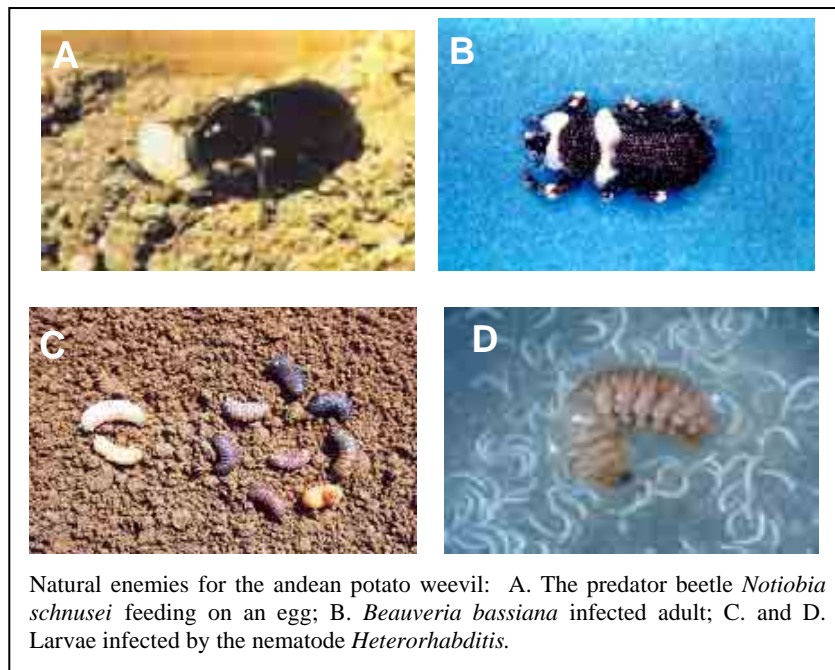
Root knot nematode. Females and symptoms on roots: Left: Female nematodes and eggs inside rice root gall. Right: Characteristic hooked, root tip galls on rice.



Symptoms caused by root knot nematode on tomato roots of resistant (left) and susceptible (right) varieties

## AN URGENT NEED FOR AN ENVIRONMENT-FRIENDLY MANAGEMENT SYSTEMS

Today there is a global need for safe systems for pest management. This 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 production costs and in contamination by toxic chemicals of the environment and food and will safeguard the health of land users.



Natural enemies for the andean potato weevil: A. The predator beetle *Notiobia schnusei* feeding on an egg; B. *Beauveria bassiana* infected adult; C. and D. Larvae infected by the nematode *Heterorhabditis*.

## **LINKING SCIENCE TO PRACTICE**

Through research activities, this 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 project aims to highlight for farmers, limits of the present techniques used in the management of the soils of the different crop production systems, 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 project is through scientists from 12 International Agricultural Research Centers (CIAT, CIP, CIMMYT, ICARDA, IITA, ICRISAT, IITA, INIBAP, ICRAF, WARDA, CABI and AVRDC), around 50 NARS institutions of developing countries in Asia, Africa and South America and 16 advanced research institutions from Australia, Denmark, France, Germany, New Zealand, Spain, United Kingdom and the United states. A holistic approach will be followed through a multidisciplinary team including entomologist, nematologists, pathologists, soil and weed scientists, agronomists, physiologists, extension workers and economists.

## **ESTIMATED BUDGET**

The estimated budget for the project for a five years period is 10.02 million US dollars, and will be implemented in two phases. The estimated cost for the first phase (2 years) is 4.00 million US dollars, and for the second phase (3 years) is 6.02 million US dollars.