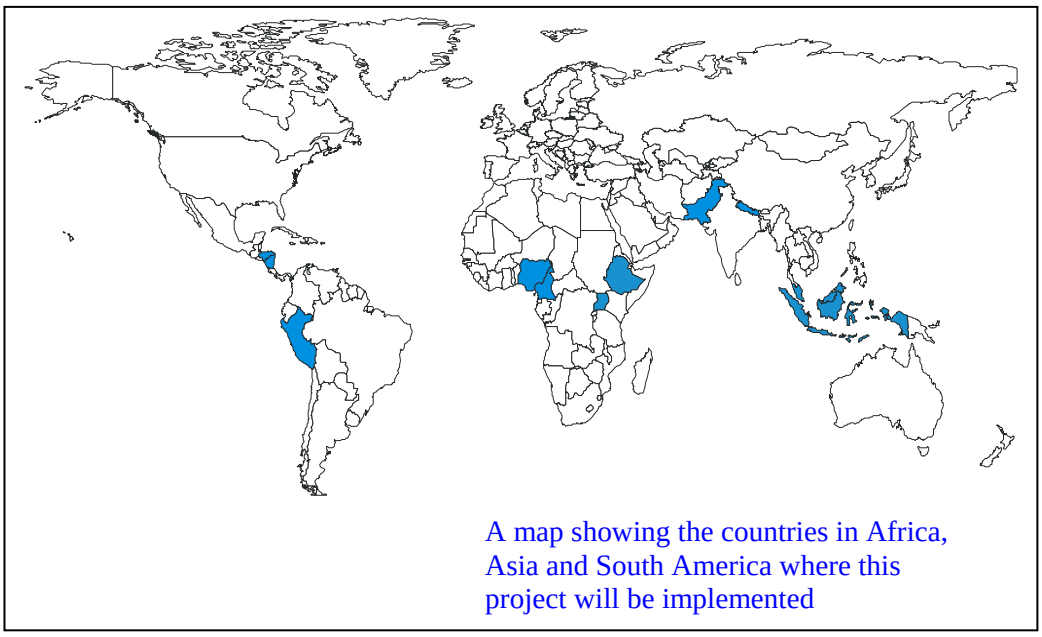
BETTER LIVES FROM HEALTHY SOILS: INTEGRATED PEST MANAGEMENT IN SOILS OF PLANTATION CROPS AND PERENNIAL WOODY PLANTS IN THE TROPICS AND SUBTROPICS



A map showing the countries in Africa, Asia and South America where this project will be implemented

IARC PARTNERS

CABI - *Center for Agriculture and Biosciences International*
INIBAP/IPGRI - *International Network for the Improvement of Banana and Plantain / International Plant Genetic Resources Institute*
IITA - *International Institute for Tropical Agriculture*
ICRAF - *World Agroforestry Centre*
TSBF/CIAT – *The Tropical Soil Biology and Fertility Institute / Centro Internacional de Agricultura Tropical*

COORDINATING CENTER:

CABI - *Center for Agriculture and Biosciences International*

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 cropping systems of plantation crops and perennial woody plants (PC & PWP) in most of Asia, Africa and Latin America are characterised by smallholder farming. In such settings PC & PWP can be seen both as informal stands or single specimen plants about the homestead or naturally occurring within fields and along field margins. In these systems, the full diversity of PC & PWP species comes into the frame, extending from multi-purpose to single-use indigenous and exotic species, alongside crops more generally valued as plantation crops. That many so-called plantation crops hold value within informal smallholder systems is a significant fact. Indeed, some large-scale plantations may, on closer analysis, be seen to be conurbations of smallholders that network through community actions and a central processing resource, for example, coconut and oil palm in Indonesia. Similarly, banana in Uganda is generally a smallholder crop that, whilst dominating large swaths of land, is seen primarily as a staple food. In this widest context, PC & PWP hold both cultural and commercial value amongst the resource poor in providing food (particularly high nutrient food, in terms of protein, oil, vitamins and minerals), building material, medicinal products, oils, firewood, charcoal and wood for carving. From the environmental perspective PC & PWP contribute by reducing soil erosion, increase nitrogen, build soil organic matter and add aesthetic beauty with value to tourism.

SOIL HEALTH AND PLANT HEALTH

There is a strong relationship between soil fertility and plant health, in the sense of ability of the plant to resist pest attack. Poor land management and declining soil fertility often result in a negative feedback cycle characterised 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 the 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 speed up decomposition of organic matter and toxic compounds, and improve nutrient cycling and soil structure.

HIDDEN ENEMIES

A number of pests often attack plants from below the soil surface causing serious losses. However, it is frequently realised that farmers' perceptions of soil pests are poor, yield loss data anecdotal and those controls recommended inadequately based on sound science

The following are a few of the major pests that attack PC & PWP:

Banana provides a staple food and cash income to many smallscale farmers globally. For this crop productivity is particularly affected by a diverse range of soil pests, notably a complex of nematode sp., Fusarium wilt, bacterial wilts and weevils. It is observed that stand longevity has been markedly reduced to 5 – 10 years in some region. The emergence of Banana Xanthomonas Wilt in Uganda

and neighbouring nations posses a new soil- related threat to farmer livelihoods. The need for improved recommendations as to how farmers can mitigate soil pests of banana is urgently needed.

Coffee is a primary commercial crop for smallholders. In recent years the re-emergence of Fusarium wilt (*Fusarium xylarioides*) across East Africa has affected 90% and 30% of farms in Uganda and Ethiopia, respectively. It has been estimated that affected coffee households are facing a reduction by a third of their income due to this disease. The aetiology of this soil-borne disease remains poorly understood.

Oil Palm cultivation in Malaysia and Indonesia accounts for approximately 80% of the world's production. Much of this production is by small-holders; some 1 and 2 million ha of land in Indonesia and Malaysia, respectively. Of the pest constraints, Basal Stem Rot (BSR) caused by Ganoderma sp. is the most severe, causing stand losses of up to 85% within 15 years of planting. A critical component in the control of BSR is how to manage infected lands so as to allow successful replanting schemes. If we achieve this we will also support government efforts to reduce natural forest destruction through reducing the need for oil palm production on virgin soils.

Dalbergia sissoo is a tree of significant value to the resource poor in Pakistan and Nepal. The recent emergence of Shisham Dieback, particularly in central Punjab, has been a matter of serious concern to foresters and farmers. Although the spread of this disorder has not been epidemic, the sporadic attacks have created a great deal of damage on private and public lands. To date the aetiology of this disorder remains unknown, although soil biotic factors are considered the most probable cause.

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

Harvesting coffee and farmer field school

Farmer field school in mixed plantation with Ganoderma fruiting bodies (inset) erupting from oil palm trunk.

Sissoo dieback in Nepal

AN URGENT NEED FOR SAFE MANAGEMENT SYSTEMS

There is a global need today for safe systems for pest management. This sub-project will do just that, by offering sustainable solutions to improve soil health and consequently crop health based on sound science. 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 approach will lead to reduction in contamination of the environment, food and workers by toxic chemicals.

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 and can only be used by scientists. 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 PC & PWP, and provide tools to measure soil health and management solutions to overcome soil limitations in order to create a more productive and sustainable cropping system.

Extensionists and farmers in Honduras

WHAT CAN BE ACCOMPLISHED

It is expected that the project will achieve the following objectives in a five years period:

a. Establish an international network on soil biota, fertility and plant health.
b. Characterize soil-based constraints for the PC & PWP 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 five IARCs (CABI, INIBAP, ICRAF, TSBF-CIAT) and NARS institutions of three countries in Africa (Cameroon, Ethiopia, Uganda), four countries in Asia (Malaysia, Nepal, Pakistan, Indonesia), three countries in Latin America (Honduras, Nicaragua, Peru) and various advanced institutions. A holistic approach will be followed through a multidisciplinary team including entomologists, nematologists, pathologists, soil and weed scientists, agronomists, physiologists, extension workers and socio-economists.

ESTIMATED BUDGET

The estimated budget for the project for a five years period is 1.72 million US dollars, and will be implemented in two phases. The estimated cost for the first phase (2 years) is 0.69 million US dollars, and for the second phase (3 years) is 1.03 million US dollars.