IPM Networking in Sub-Saharan Africa

Proceedings of the IPM Networking in Sub-Saharan Africa Workshop

14-16 October 1996
Addis-Ababa/Nazreth, Ethiopia

Office of International Research and Development (OIRD)
Outreach Division of the Office of the University Provost

Virginia Tech

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Cover Picture: Workshop participants in front of the headquarters of the Institute of Agricultural Research (IAR), which hosted the workshop.

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This publication was made possible through support provided by the U.S. Agency for International Development, Bureau for Africa, under terms of Agreement No. LAG-4196-G-00-5001-00 made to Virginia Polytechnic Institute and State University (Virginia Tech).

The opinions expressed herein are those of the IPM Networking in Sub-Saharan Africa Workshop Participants and do not necessarily reflect the views of the U.S. Agency for International Development.

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Preface

Integrated Pest Management (IPM) is gaining more popularity in Africa with several African countries having active national IPM programs. These national programs can benefit a lot from the experiences of each other. For this to happen, IPM activities across countries in Africa have to be better coordinated and exchange of IPM information has to improve for the mutual benefit of all. This workshop was a step towards initiating and strengthening greater collaboration among African national IPM units as well as other stakeholders on IPM in Africa.

The Institute of Agricultural Research (IAR) of Ethiopia served as the host and provided the facilities for holding the workshop. Major financial support for the NARS participants of the workshop came from the IPM Consultative Network (ICN), a joint initiative of the IPM CRSP / Office of International Research and Development / Virginia Tech and the U.S. Agency for International Development, Bureau for Africa, Office of Sustainable Development, Division of Productive Sector Growth & Environment (USAID/AFR/SD/PSGE). Participants from other CRSPs, IARCs, NGOs, and USAID covered their own costs.

The workshop was jointly organized by Brhane Gebrekidan (IPM CRSP) and Tsedeke Abate (IAR). We take this opportunity to acknowledge the contribution of all organizations and individuals that enabled us to implement the workshop. We hope that the recommendations of the workshop will be instrumental in initiating and strengthening IPM networks in sub-Saharan Africa.

Brhane Gebrekidan, IPM CRSP / OIRD / Virginia Tech
Tsedeke Abate, IAR, Nazreth Research Center

Welcome and Opening Address

Tadesse Gebremedhin
General Manager, Institute of Agricultural Research, Addis Ababa, Ethiopia.

Dear Participants,
Ladies and Gentlemen!

It gives me great pleasure to participate in the opening ceremony of this timely and important workshop and to welcome you all to our beautiful country, Ethiopia, on the occasion of this workshop.

Dear Participants,
Ladies and Gentlemen!

At the outset, I would like to congratulate the Integrated Pest Management Collaborative Research Support Program (IPM CRSP) and the organizing committee of this workshop for making it possible for this workshop to be held in our country. I would like to interpret this initiative by IPM CRSP to hold the workshop in Ethiopia as a gesture of recognition to the reputation of our national agricultural research system and to the scientific achievements of our scientists in agricultural research in general, and in crop protection in particular. And it is my sincere hope that IAR and our scientists will live up to your expectations.

Please allow me to say a few words about our country and about the importance of agriculture in the Ethiopian economy. Ethiopia, with an estimated land area of about 1.1 million square kilometers is the ninth largest country in Africa. Some 66% of our land is potentially suitable for one or another form of agricultural activities, but only less than 15% is cultivated at present, of which annual crops account for about 13% and perennials a little less than 2%. Ethiopia enjoys a wide range of agroecological diversity with corresponding diversity in flora and fauna, for many of which it is the original home. Despite this, however, our country has become synonymous with hunger and

poverty over the last two decades or so. We grow a wide range of crops but the yields our farmers harvest are extremely low compared to what is achieved on experimental plots and even in field demonstrations. Pests are among the major causes of such low yields.

Agriculture is the mainstay of the national economy and the main source of livelihood for over 85% of the population. It contributes about 45% to the Gross Domestic Product (GDP) and accounts for about 85% of the annual export earnings. Crop production dominates agricultural production in the country and accounts for 60% of the Agricultural Gross Domestic Product (AGDP).

As such, agriculture in our country has the following broad objectives:

- increased food and cash crop production;
- increased nutritional level of the people;
- improved quality of life of the rural populace through increased income from crops and livestock;
- expanded employment opportunities through agro-based industries;
- increased exports of diversified agricultural products;
- reduced dependence on imports of food;
- protection, management, and harnessing of natural resources to achieve integrated development whilst safeguarding the environment.

The Government of Ethiopia has been taking giant steps towards achieving these goals both during the transition period and currently under the Federal system. I am not going to dwell too much on this point here, but I must point out a few examples of the steps taken by our government in recent years: policies on agriculture and agricultural research, establishment of the National Agricultural Research Council, improved budget allocation to research, just to mention a few. Efforts to further strengthen our national agricultural research system for a better coordination and impact (formation of the Ethiopian Agricultural Research Organization or EARO) are also under way.

Dear Participants,
Ladies and Gentlemen!

As I stated earlier, the centre of our agricultural development plan in Ethiopia is the smallholder. This workshop could not have taken place at a more opportune moment! It is a gratifying coincidence that this workshop is being launched at a time when the Government of Federal Democratic Republic of Ethiopia has been undertaking an aggressive five year agricultural plan that can make significant contributions towards agricultural development in our country.

Experience with "green revolution", for which high external inputs use is a pre-requisite, in South East Asia shows some shortcomings in spite of the spectacular achievements in agricultural productivity in those countries during the last three decades or so.

Included among these are:

- less suitability of new technologies to resource-poor environments;
- less applicability of the technologies to small or marginal holdings;
- extensive mono-cropping that made production more vulnerable to environmental stresses and shocks;
- evidence of diminishing returns from intensive production with high-yielding varieties; etc.

I am aware of the fact that we are very far from this scenario, for now, but we should learn lessons from this situation and therefore our future thinking in agricultural research and development should take sustainability of agricultural production into account. In other words, we should be able to successfully manage our agricultural resources (our agrobiodiversity in particular) to satisfy our changing needs while maintaining or enhancing the quality of our environment and conserving natural resources for the future generation.

It is also gratifying that the Government of Federal Republic of Ethiopia recognizes the importance of crop protection in agricultural

research and development and puts the highest priority on Integrated Pest Management (IPM) approaches as can be noted from the recent draft national crop protection strategy document where IPM is adopted as the national crop protection strategy. My own institution, the Institute of Agricultural Research (IAR) also gives the highest priority to IPM. Thus we have recently appointed a national IPM coordinator to help strengthen the research, coordination and popularization of this approach in our country. It is my hope that your workshop will go a long way in helping us to achieve our goals of strengthening our national IPM program.

Dear Participants,
Ladies and Gentlemen!

Once again, may I take this opportunity to thank the IPM CRSP program and the organizing committee of this workshop and wish you all a pleasant and fruitful stay in our beautiful country.

Finally, I declare this workshop on "IPM Networking in Sub-Saharan Africa" open and wish you all the best in your deliberations.

I thank you!

Purpose and Objectives of the Workshop

Brhane Gebrekidan
IPM CRSP, OIRD, Virginia Tech, Blacksburg, Virginia, USA.

Mr. Chairman, the General Manager of the IAR and Colleagues, on behalf of the joint organizers of this workshop, Dr. Tsedeke Abate and myself, it is my pleasure to comment on the purpose and objectives of the Workshop.

As you all know this workshop is entitled "IPM Networking in sub-Saharan Africa" and is being held in Ethiopia under the joint sponsorship of the IAR and the IPM CRSP/ICN/OIRD/Virginia Tech. Why is the workshop being held in Ethiopia? Early this year, the IAR and the IPM CRSP/Virginia Tech signed a MOU to collaborate in the overall area of IPM research, training, and promotion of IPM. As requested upon in that MOU, the IAR invited the IPM CRSP to hold this workshop in Ethiopia. We accepted the offer with pleasure and agreed to join the IAR in jointly organizing the workshop here.

Looking at the current global position and importance of IPM, it has become increasingly prominent as an effective and environment-friendly strategy for managing pest problems globally. There are lots and lots of efforts and resources going into planning and implementing IPM activities globally. Africa is one of the high priority regions for the IPM CRSP. Currently the IPM CRSP has on-going activities in both eastern and west Africa, with Uganda and Mali as the focal sites. The IPM CRSP intends to extend the lessons learned from these sites to other parts of Africa. This workshop is expected to be on of the avenues of regionalizing the IPM concept in Africa.

For the purpose of this workshop, pest means all biotic factors that contribute to reduction of quantity and quality of crop yields, thus this definition covers insects, diseases, weeds, nematodes, birds, rodents, etc. Under this definition, covering all crops, pests, and

environments is obviously not practical. Hence, any meaningful discussion of IPM must specify the crop/pest/environment combination.

Prior to the popularization of IPM strategies, pest control or management approaches generally relied on a single tactic such as pest resistant varieties, cultural practices, biological control, use of pesticides and so on. It is obvious that no single approach is a satisfactory solution for all pest problems everywhere. The IPM strategy promotes the deployment of multiple pest management tactics economically, socially, and technically suitable for a specific pest of a selected crop in a given environment. By the end of the workshop, I trust that we will get a good feel and appreciation of this strategy.

As a background to the development and growth of IPM, it is worth noting that pesticide use in crop production in developed countries has been steadily increasing, often resulting in

- increased resistance of pests to pesticides (resulting in pesticide treadmill);
- elimination of beneficial insects;
- deterioration of environmental quality;
- adverse effects on human and animal health.

Many countries are now responding to these adverse effects of excessive pesticide use by promoting IPM as a national strategy. For example, the US government is committed to IPM as a national policy and is contributing millions of dollars to its implementation and has declared as a national goal that at least 75% of the US crop area must by under IPM by the year 2000. Effective progress is being made towards this goal.

In Africa, the adoption of IPM as a national strategy and the commitment of national governments to the strategy is generally weak, although there are some IPM efforts in selected countries and in a few cash and plantation crops such as cotton and vegetables where excessive pesticides have been used for decades. The adverse effects of excessive and indiscriminate use of pesticides, as in cotton in

Africa, are well known to you, Africa should learn from the expensive and painful experiences of countries that have fallen into the trap of the pesticide treadmill. Now is the appropriate time for most African countries to embrace IPM as a national policy.
We hope to hear in this workshop about the status of IPM and extent of pesticide use in each of the countries represented here. With these reports as starting points and utilizing the collective experiences of the workshop participants we should get a fairly good picture of the current status of IPM in sub-Saharan Africa.

For example it is recognized that there are several IPM efforts currently underway in Africa, although not well coordinated. All of the following have IPM programs in Africa:

- NARSs;
- CG Centers - CIAT, ICRISAT, CIMMYT, CIP, ICIPE, WARDA, ICARDA (Inter Center IPM Initiatives with IITA as convener);
- CRSPs - Bean / Cowpea, INTSORMIL, Peanut, and IPM (InterCRSP NRM with IPM CRSP as convener);
- NGOs - promoters of organic farming;
- Others - commodity networks, donor agencies such as GTZ and USAID.

USAID's commitment and support to IPM in Africa is substantial, for example:

- Global Bureau - IPM CRSP, commodity CRSPs;
- Africa Bureau - supports ICN and Africa IPM Link through the IPM CRSP.

One of the activities planned under the ICN is the organization of this workshop with the following primary objectives:

- forge closer linkages among various commodity networks operating in sub-Saharan Africa, with special focus on IPM;

- organize an inter-Africa IPM group meeting for strengthening and regionalizing IPM in Africa;
- promote sharing of IPM experiences among IPM practitioners in sub-Saharan Africa, establish stronger ties among national IPM coordinators, and create Africa-wide forum for promoting IPM;
- identify and assist in regionalizing specific areas of strength in IPM of various African NARSs;
- initiate electronic IPM information exchange in Africa;
- synthesize IPM information relevant to Africa and transmit it through electronic means, primarily through USAID's "Africa Link" connectivities.

This workshop will address all of these objectives.

To recap, the main purpose of the workshop is to initiate and strengthen IPM linkages and share experiences among national IPM coordinators of west and eastern Africa. The workshop will examine and understand the status of IPM activities and networks in selected countries of the continent.

Some comments on the overall plan for this workshop follow:

- The workshop program has been structured to address the objectives and the purpose I have outlined.
- Overview of IPM activities in Africa will be given by various groups.
- National programs will report on the status of IPM in their respective countries.
- The potentials of electronic communication in IPM in Africa will be demonstrated and discussed with the active participation of the partners of the "Africa IPM Link" initiative.
- A field visit to an experiment station and perhaps to farmers' fields is planned.
- There should be plenty of opportunities for active discussion throughout the workshop.
- A special panel discussion on the prospects of initiating an IPM network in Africa is planned.

- Finally, we hope to develop workshop recommendations that can serve as a springboard for pursuing future opportunities for advancing the concept of IPM networking in sub-Saharan Africa.

I am looking forward to an interesting and fruitful workshop

Thank you very much for your attention.

Overview of IPM CRSP and ICN Activities with Special Focus on Sub-Saharan Africa

Brhane Gebrekidan
IPM CRSP, OIRD, Virginia Tech, Blacksburg, Virginia, USA.

IPM CRSP Overview

The overall purpose of the IPM CRSP (Integrated Pest Management Collaborative Research Support Program) is to foster IPM through collaborative research between US and LDC institutions for their mutual benefit by improving their abilities to develop and implement economically and environmentally sound crop protection methods. Our emphasis is in developing and implementing a replicable approach to IPM that will help reduce: (1) agricultural losses due to pests, (2) damage to national ecosystems, and (3) pollution and contamination in food and water supplies. The end result should be a stronger global IPM research and education network and improved quality of life in both developing and developed countries.

The IPM CRSP focuses on four production research regimes: off-season horticultural export crop production in Latin America, winter export vegetable production in the Caribbean, transitional semi-arid agricultural production systems in the Sahel, and innovative IPM research for transitional rice-based systems in Asia. The primary horticultural export-crop regime sites are Guatemala and Jamaica, whereas the primary site for the transitional agricultural production system regime is in Mali, and the primary innovative research site is in the Philippines. At the end of the third year, the CRSP became fully operational in the four primary sites, and partially operational in some satellite sites, with the ultimate aim of globalizing the IPM concepts and technologies generated at these sites.

In terms of operational management, Virginia Tech is the Management Entity (ME) for the IPM CRSP and is the primary grantee of USAID.

Virginia Tech subgrants have been made to the following US and host country institutions/organizations involved as IPM CRSP partners:

US Institutions	**Host Country Institutions/Organizations**
1. Lincoln University	1. Agrilab, Guatemala
2. Montana State University	2. Altertec, Guatemala
3. Ohio State University	3. CARE, Guatemala
4. Penn State University	4. ICTA, Guatemala
5. Purdue University	5. Zamorano, Honduras
6. University of Georgia	6. CARDI, Jamaica
7. USDA Vegetable Lab	7. IER, Mali
8. Virginia Tech	8. INRAN, Niger
	9. IRRI, Philippines
	10. PhilRice/NCPC, UPLB Philippines
	11. Makerere University, Uganda
	12. Ministry of Agriculture, Eritrea

Work in each of the four primary sites is managed and conducted by a site committee that is led by a site committee Chair and Vice Chair chosen from the U.S. university partners. Each site committee is composed of representatives from the institutions working in the site, so that the workplans are developed and carried out by the scientists themselves. For each site, an on-site coordinator has been selected from among the representatives of the host country institutions. Three of the four site committee chairs and all four of the vice chairs have been selected from institutions other than Virginia Tech in order to promote collaboration among institutions and ensure widespread involvement in the development of workplans and budgets.

The IPM CRSP uses a participatory approach to solving pest problems. Among other things, this approach means the people who will use the new knowledge generated by the IPM CRSP have a say in setting the research agenda.

Program goals are met by:

- identifying and describing the technical factors affecting pest management;
- identifying and describing the social, economic, political, and institutional factors affecting pest management;
- working with participating groups to design, test, and evaluate appropriate IPM strategies;
- working with participating groups to promote training and information exchange on participatory IPM; and
- working with participating groups to foster policy and institutional changes.

In Africa, the CRSP has activities in three countries: Mali, Uganda, and Eritrea, with Mali as the prime site. We have on-going activities in each country. The following highlights from each country are given to indicate the priority areas we are dealing with in each country.

Mali

- We completed Participatory Appraisals in two Malian villages (Mourdiah and Sirakorola); developed inter-disciplinary research questionnaire, sample frame, and sample identification for base line research; and completed pre-testing of questionnaire and training of field investigators.
- An integrated approach to IPM that considers in totality the household crops production-pest system constraints and gender roles relevant to these crop culture activities would have sustainable impacts to achieve IPM goals as well as household food security.
- In Mali, IPM CRSP found that the neem extract Azatin EC resulted in a 53% increase in early and main season millet yields. The increase in millet yield obtained in these trials has significant potential to improve village food supplies, especially in drier areas more dependent on millet.
- *Striga* IPM research on millet in Mali involving integration of millet/cowpea intercropping, cultural practices combined with the

use of organic and mineral fertilizers on local Souna millet, and improved *Striga* resistant IT89KD245 cowpea variety from IITA have given promising results for developing locally suitable IPM tactics.

Uganda

- In Uganda, the CRSP has facilitated the establishment of National IPM network under the leadership of Makerere University, the IPM CRSP partner institution.
- Two research areas, Iganga and Kumi Districts, were selected for the field participatory assessment and future IPM CRSP activities following discussions with Ugandan stakeholders. These two districts were viewed to be representative of the two predominant cereal/legume production systems in eastern Uganda. A decision was made to focus on cereals and legumes based on the recognition that IPM with these crops was still at an early stage of development.
- For all crops a follow-up program of surveillance and monitoring is advised to better understand seasonal infestations, pest biology, and to educate farmers in understanding the concept of threshold problem identification.
- A prototypical collaborative research and delivery system involving researchers, extensionists, and NGOs was demonstrated. Contact with NGOs and farmers was coordinated by the Uganda IPM Network and its representatives.
- The following describes crops and primary pests that will be addressed in follow-up activities:

Crops	**Key Pests Selected for Research Emphasis**
Maize (Iganga)	Stalk Borers and Termites
Beans (Iganga)	Aphids and Post-harvests Pests
Groundnuts (Iganga & Kumi)	Aphids and Rosette Disease
Millet (Kumi)	Weeds (Striga & Wild Finger Millet), Borers and Grasshoppers
Sorghum (Kumi)	Striga and Stalk Borers
Cowpeas (Kumi)	Pod & Flower Pest Complex
Multi-Crops (Iganga)	Mole Rat

Eritrea

- The CRSP and the Eritrean Ministry of Agriculture completed in 1996 plans and implementation of training 90 Eritrean researchers, extension agents, and development workers IPM and Crop Protection.

In conclusion, the IPM CRSP is aware that strong USAID Mission support is critical to success, and has involved the local Missions in all that they have done. Strong host country support has resulted in the signing of Memoranda of Understanding (MOUs) by national institutions in four Africa countries (Mali, Uganda, Eritrea, and Ethiopia) officially allowing the CRSP to work in these countries.

Another Africa related IPM initiative of the IPM CRSP is the ICN. Under the financial support of the Africa Bureau of USAID, the IPM CRSP/Office of International Research and Development/Virginia Tech initiated the Integrated Pest Management Consultative Network (ICN) for Africa early in 1995.

The overall objectives of the ICN for Africa are to:

- provide advisory services to USAID and host countries on IPM techniques and strategies.
- disseminate knowledge on IPM in Africa
- institutionalize IPM approaches in Africa
- act as a center for information exchange on IPM in Africa

Planned Activities

1. Establish and Manage an IPM Consultative Network (ICN) and Initiate Program Coordination

- focus on establishing the ICN coordination office and initiation of program coordination;
- initiate active collaboration with other organizations with interest on IPM;

- strengthen the IPM capacities of the NARSs through supply of publications and other means;
- initiate synthesizing existing IPM reports and disseminate knowledge on IPM to our collaborators in Africa.

2. Participate in NGO Workshop on Sustainable Agriculture and IPM, and Develop Linkages with NGOs

- establish and maintain linkages with NGOs that have interest in IPM and Africa. (The ICN coordinator attended the NGO Workshop on Sustainable Agriculture and IPM in Bamako in October 1994 and established linkages with a large number of African NGOs with interest in IPM);
- the workshop recommended to establish one independent Pesticide Action Network (PAN) Africa office, in Bamako or Dakar. The PAN office has now been established in Dakar with Dr. Abou Thaim as the Coordinator.

3. Organize Participatory Appraisal (PA) Workshop and Field PA in Eastern Africa Uganda)

- extend the lessons learned from the IPM CRSP work in Mali to eastern Africa with initial focus on Uganda. (The Uganda PA and Workshop were held in July 95 under the leadership of Ohio State University);
- Uganda is envisioned to serve as the Anglophone IPM activity center while Mali will continue to serve as the Francophone center.

4. Organize IPM Strengthening Network Group Meeting in Africa with the following objectives:

- forge closer linkages among various commodity networks operating in west, eastern, and southern Africa, with special focus on national IPM coordinators. (Representatives from the Regional Networks, IPM National coordinators, CRSPs, and IARCs are expected to participate in the meeting);

- organize the group meeting as the primary means of strengthening and regionalizing the ICN;
- share IPM experiences across the various commodity networks, establish strong ties among national IPM coordinators, create Africa-wide forum for promoting IPM;
- identify and regionalize specific areas of strength of IPM of various African NARSs.

This workshop has been organized to meet the objectives mentioned above.

5. Future Planned Actions of the ICN

- initiating electronic IPM information communication in and between selected regional centers of Africa;
- synthesizing IPM information relevant to Africa and transmitting it through electronic means, primarily through Africa IPMLink connectivities.

Pest Management Research in Ethiopia: An Overview

Tsedeke Abate
IAR, Nazreth Research Centre, Nazreth, Ethiopia.

Country Background

Ethiopia is a relatively large country with a total land mass of approximately 1.1 km^2 and possesses huge agroecological and biological diversity and agricultural complexity. The implications of such agroecological variation for pest management strategies are obvious.

As in many developing countries in Africa and elsewhere, agriculture plays a key role in Ethiopia's economy and the livelihood of its people. It provides employment for more than 80 percent of the country's population and contributes to nearly 50 percent of its gross domestic product.

The major crops produced include cereals, legumes, oil seeds, roots and tubers, vegetables, fruit crops, coffee, spices, and cotton. About 95% of food production in Ethiopia comes from the peasant sector, where production technologies are primarily traditional. Land preparation is done by oxen drawn local plough (the *maresha*) or by manually operated hand tools; seeding is done by broadcasting; weeding is dependent upon labor intensive practices (Stroud & Mekuria 1992). Use of irrigation, improved seed and other external inputs such as pesticides is minimal.

Historical Development

Although the importance of crop protection research in Ethiopia has been recognized in the early 1950s, concerted efforts began when the Institute of Agricultural Research (IAR) was established in 1966. At present, crop protection research is an integral part of crop improvement or crop production practices of the Ethiopian national agricultural research and extension system.

Pest management research efforts initially focused on survey and identification of pests. These are fairly well documented and pests of economically important crops are recognized (see Table 1). Table 2 summarizes yield loss estimates due to various pests of selected crops. A fair amount of knowledge also exists on the identity and geographic distribution of parasitoids and predators of insect pests in Ethiopia (Abate 1991), although no survey has been initiated on indigenous pathogens of insects, disease causing organisms and weeds.

Initial studies on control measures focused on screening and use of pesticides (Crowe & Shitaye 1977); studies on non-chemical control measures such as cultural practices, host plant resistance, biological control, and use of selective insecticides were initiated in recent years (Abate 1995).

Examples of Successful IPM in Ethiopia

A detailed review of IPM in Ethiopia has been made by Abate (1995). The strategies used in IPM programs in this country centered around cultural practices, host plant resistance, and use of pesticides (especially for high value crops such as cotton, coffee, and citrus).

The pink bollworm *(Pectinophora gossypiella)* was a major pest of cotton in Ethiopia during the early 1970s. The use of "closed" season, coupled with the collection and destruction of larvae on a trap crop (cotton) planted in mid-April, has successfully kept the pest population below economic level and it has been considered a minor pest of cotton in this country (Abate 1982). Results of studies on the biology and cultural practices have also helped to reduce the frequency of insecticide sprays on other bollworm species *(Helicoverpa armigera, Earias biplaga, E. insulana, Diparopsis watersi).* The introduction of long staple "Acala" type cotton cultivars relegated the cotton leafhoppers (*Empoasca* spp.) to minor status.

Table 1: Examples of important pests of major food crops in Ethiopia.

Crop	Insect	Disease	Weed
Tef	"Degeza" Grasshoppers	Rust	Complex
Maize	Stalkborers Weevils	Leaf blight Strea k virus Rust	Striga
Sorghum	Stalkborers Weevils	Smut Grain mold Anthracnose	Striga
Wheat	Aphids	Rusts	Complex
Barley	Barley fly Aphids	Scald Net blotch	Complex
Beans	Stem maggot Bruchids	CBB ALS Rust	Complex
Enset	Not known	Bacterial wilt	Not known
Tomato	Fruit worms	Early blight Late blight Viruses	Orobanche
Potato	Tuber moth	Late blight Viruses	Complex
Coffee	Antestia Borer	CBD Rust	Perennial grasses
Cotton	Bollworms Whitefly Aphids	Black arm	Complex

Table 2: Pre-harvest yield loss estimates due to insects, diseases and weeds in selected crops in Ethiopia.

Crops	Loss (percentages) due to		
	Insects	Diseases	Weeds
Cereals	21-44	40-46	20-47
Legumes	16-29	25-40	32-57
Oilseeds	9-13	37	na
Vegetables	17-39	39-48	30-100
Root crops	38-50	3-81	na
Citrus	2-9	na	na
Coffee	na	1-81	62
Cotton	22-32	na	70-74

Source; Anon (1993), na=not available

The coffee berry disease (CBD) caused by *Colletotrichum coffeanum* became the major pest of plantation coffee in Ethiopia after its accidental introduction from neighboring countries during the early 1970s and caused the equivalent of US$ 140 thousand in control costs in 1975 alone (Merdassa 1986). The importance of CBD declined significantly with the selection and development of resistant coffee strains that are commonly found in forest coffee.

The red scale *(Aonidiella aurantii)* became the major pest of citrus orchards in the state farms during the late 1970s. It was not uncommon to observe monthly or even fortnightly blanket applications of organophosphate insecticides such as methidathion against this and other insects. An IPM program based on the understanding of the population dynamics of the pest and its natural enemies, and identification of selective insecticides was soon launched. The population dynamics studies were conducted between 1981 and 1983. Breeding peaks were reached following the rains, one in October-November and the other in March-April. A large number of parasitoids and predators were also recorded; native species of *Aphytis* were the most important parasitoids; the ladybirds in the genera *Chilocorus, Hyperaspis,* etc. were important predators and their abundance increased with the increase in pest numbers. Mineral oil (white oil) at the rate of 1.5-2.0% a.i. was found to give effective control. It has thus been recommended that a maximum of three

sprays (1-2 in October-November, 1 in March-April) of white oil be applied per year (Abate 1983). These recommendations have been followed and at present the pest is no more a great threat to the citrus industry of Ethiopia. Significant savings must have been realized from reductions in the frequency of pesticide applications; there must have also been obvious savings in terms of environmental safety.

Future Prospects for IPM

The following four thrusts will be the focus of IPM research and development in Ethiopia. These are: 1) onfarm testing of technologies in the pipeline; 2) establishing baseline information; 3) generation of adoptable technologies; and 4) improving IPM coordination.

1. On-farming Testing of Technologies

There are a good number of technologies that have been developed through research over the last several years. These have to be tested and validated in farmers' fields before they can be recommended for general use. Examples are:

- resistant, high-yielding haricot bean varieties against stem maggots, major diseases;
- resistant, high-yielding tomato varieties against fruitworms;
- botanicals against storage pests;
- IPM packages against striga on sorghum; and
- IPM packages against sorghum smuts.

2. Establishing Baseline Information

The following areas will be given emphasis:

- determining status of major pests in farmers' fields;
- characterization of role of natural enemies in traditional agriculture;
- characterization of biological control agents against major pests;
- characterization of rust races and their virulence on wheat;

- ecology and characterization of maize streak virus isolates;
- characterization of "enset" streak virus; and
- characterization of bacterial wilt of "enset".

3. Generation of Adoptable Technologies

The major areas of focus under this category are:

- host plant resistance against major pests;
- the relationship between soil fertility & host plant resistance against stem maggots and root rot of haricot bean;
- the relationship between host plant resistance and soil fertility levels against striga on sorghum;
- the influence of cultural practices against striga on sorghum; and
- testing integrated management packages against major pests.

Improving IPM Coordination

Currently little or no linkages exist among the stakeholders of IPM in Ethiopia. This situation has to be improved through creation of mechanisms that will foster linkages among various groups. I propose that we, in Ethiopia, establish: 1) a National IPM Steering Committee (NISC); and 2) a National IPM Network (IPMNET).

The objectives of NISC will be:

- promotion of IPM (through publications, media, seminars);
- supporting development of teaching materials in IPM;
- overseeing that proper training is organized and implemented (for researchers, extension trainers, farmers, policy makers);
- reviewing and supporting viable IPM proposals; and
- seeking ways and means of strengthening IPM coordination and collaboration.

Similarly, the IPMNET will:

- serve as a forum for exchange of information;
- provide a platform for teaching-learning process;
- enhance public awareness about IPM;
- facilitate implementation of IPM technologies and strategies; and
- strengthen coordination and collaboration efforts.

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Current Status of IPM in Eritrea

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The Eritrean IPM program was initiated in 1994 by preparing a project document for staff and lead farmers training in general plant protection concepts. The project document was received positively by USAID for funding. The program has been collaboratively organized and implemented by the Eritrean Ministry of Agriculture and the IPM CRSP, Virginia Tech. Since its start in March 1996, many results have been gained, especially on staff development in IPM know-how. We had planned to begin the program through training of individuals who are directly involved in agricultural activities.

The program implementation started with schedules of activities and visits by Dr. Bob Hedlund, IPM CRSP Project Manager, USAID/Washington D.C. and Dr. Brhane Gebrekidan, Program Director, IPM CRSP, Virginia Tech. The primary purpose of the visits was to establish linkages with official staff of the Ministry of Agriculture and the USAID mission in Asmara and to discuss and finalize the IPM CRSP training plans for plant protection workers and lead farmers. In March 1996, two Eritrean plant protection experts (Kidane Ghebrekidan and Mehari Tesfayohannes) visited two IPM implementing institutions in the USA (Virginia Tech and Ohio State universities), and also attended the U.S. National IPM Symposium in Washington D.C..

At the end of 1995 a Memorandum of Understanding (MOU) between The Ministry of Agriculture of The State of Eritrea and IPM CRSP was finalized and signed. In this MOU, in the Planning and Implementation part it is indicated that: "the MOA and the IPM CRSP will take the necessary and appropriate initiatives for engaging other institutions that could strengthen this collaboration, in accordance with the linkages each party may already have and in accordance with the planning and implementation needs of each

project activity". This provision allows other institutions that would like to participate and assist in meeting the overall IPM objectives in Eritrea.

Next, I would like to focus on the two IPM training sessions that have been completed in Eritrea. Our overall training schedule was generally organized for three levels of qualifications, ranging from university graduate researchers to farmers with elementary school education only.

The first two sessions were designed to train the trainers. In these programs, beside the separate IPM training, general crop protection principles and practices were covered and highlighted separately. The IPM training has been useful to participants who had accepted chemical protection as the first and the best choice in pest control.

First session

In this first training session, there were 30 trainees representing all zones of Eritrea. All the trainees had college degrees or diplomas. Twenty eight of the trainees received their diplomas from various colleges in Ethiopia and had work experience as research technicians or extension workers, most of them having over 5 years of practical experience. This training background and experience prepared the trainees well for the training program.

There were also 10 trainers; 6 of which were from Eritrea, including four from the Ministry of Agriculture and two from Asmara University. One trainer from DLCO/EA-Kenya Office served as the main resource person for the entire period and three trainers from the IPM CRSP served in different capacities. Ten crop protection topics were covered by the trainers in the one month training program.

Training was delivered through lectures, slides, video presentations, and open discussions. The trainers prepared training materials and distributed them to the trainees. The first session was successfully completed as planned.

Second session

This session was organized for development agents of the Ministry of Agriculture. All the 49 trainees who participated in this training session, except 6, were high-school graduates with several years of job experience in general agriculture. This session took 20 days and the outcome was as successful as session 1. Trainers for this session were all selected from trainees of session 1.

IPM research possibilities in Eritrea

In Eritrea there is plenty of opportunity for conducting IPM research on different crops. Some of the high priority areas can be on sorghum and maize, for stalk borers and striga. As sorghum is the main crop both in the lowland and mid altitudes of the country, it can be chosen as the high priority crop for IPM research on stalk borers and striga.

The Major Crop Pests (Insects, Diseases, and Weeds) of Eritrea are given below:

Major Migratory Pests

Desert Locust
African Migratory Locust
Tree Locust

Army worms
Quelea
Rats

Major Sedentary Pests

CROPS	INSECTS	DISEASES	WEEDS
Sorghum Pearl millet Maize	Stem borers: • *Busseola fusca* • *Chilo partellus* • *Sesamia* spp. Aphids Stink bugs Shootfly Weevils Moths	Smuts: • loose • covered • long Rust Blight	*Striga hermonthica* Wild sorghum Broadleaf and grasses
Wheat Barley Tef	Shootfly	Smut Rust *Aschochyta* *Cercospora*	Wild oats Broadleaf and grasses
Pulses	Boll worms Bruchids	*Anthracnose* *Aschochyta* Bacterial leaf diseases	Broadleaf and grasses
Sesame	Chinchbug		
Cotton	Boll insects Leaf insects		
Tomato Eggplant Potato	Bollworm Cutworms Whitefly Fruit and stem borers Potato moth	Late blight *Fusarium* wilt Nematodes Fruit rot	*Orobanche*
Onion Hot pepper	Thrips Fruit worms Whitefly	*Fusarium* wilt *Alternaria*	
Cabbage Swiss chard	Diamondback moth White butterfly Loopers Aphids		
Citrus	Scale insects Fruit insects		

Current Status of Integrated Pest Management in Uganda

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Introduction

Agriculture is the backbone of Uganda's economy. Of the approximately 17 million people eighty nine percent are rural. The agriculture sector accounts for 51% of GDP, and over 90% of exports and employs 84% of the employed household population. According to the World Bank (1993) agricultural output comes almost exclusively from about 2.5 million small holders, 80% of whom have less than 2 hectares. Only tea and sugar are grown on large estates. Food Crop production accounts for 71%, livestock products 17% and export crops 5% of the agricultural GDP.

Uganda's population growth rate is between 2.8 - 3.0 percent resulting in the population almost trebling in 30 years. This rate of growth is expected to continue and it is en predicted that it will reach 55 million by 2025 (World Resources Institute, 1990). Consequently, there will be continued pressure on resources to produce ever larger amounts of food. Therefore any attempt to reduce food losses due pests and disease are important in ensuring increased food production in the country.

Crops Produced in Uganda

Good climatic conditions and relatively fertile soils throughout most of Uganda enable the production of a diversity of crops. Tables 1 and 2 give the production trends of food and cash crops in Uganda. It is worth noting that banana, millet, sorghum, cassava, sweet potatoes, beans, maize and groundnuts are the main food crops of Uganda and are given the highest priority in research; pigeon pea, cowpeas, simsim and horticultural crops are also important food crops, and are given

medium priorities. The main traditional export crops in Uganda include coffee, cotton, tea, sugar-cane and tobacco. Coffee and cotton have a higher research priority ranking than tea, sugarcane and tobacco.

How much of a constraint are pests in Uganda?

Analysis of the crop production trends in Tables 1 and 2 shows that most crop yields are below those expected from research centers, suggesting that there are constraints limiting optimal crop production. The extent agricultural production in Uganda is constrained by pests is a matter of speculation. Crop loss assessment data is generally not available. The surveys that have been conducted indicate that pests and diseases are important biological constraints to agricultural production, ranking above drought, soil fertility and varietal inferiority (Tukahirwa 1991, UNBP 1988, 1987).

The methods of pest control currently available to farmers are use of chemical insecticides and cultural practice. Government extension tends to recommend insecticides because reliable information on cultural controls are lacking.

It is important to note that agriculture in Uganda is in a transitional state; shifting from subsistence to commercial agricultural production. The quest by farmers to increase agricultural production is bound to increase the need to protect their produce against losses due to pests. This is expected to increase the demand for pesticides.

As observed by Meltzer et al.(1994), the use of pesticides on crops is still very low, although there are substantial amounts being applied to coffee, cotton, banana, groundnuts and horticultural crops. Problems regarding their use include lack of information, illiteracy, and unavailability. The range of pesticides available is also limited and market prices are prohibitive for many small scale farmers (Baliddawa 1993). Methods of application are dangerous; some farmers apply insecticides from cans and basins, and do not wear protective clothing. These problems indicate that proper utilization of pesticides for management of field pests is still in the future, and will require a lot of education at farmers' level.

IPM Status In Uganda

Although the economic and social benefits of IPM are well known, its potential in Uganda is still unrealized. The Uganda government has not explicitly endorsed IPM. Over the last decades farmers have had to largely rely on non-chemical pest management methods. For example, Antestia bugs on arabica coffee were controlled by pruning to reduce shading, pest surveillance and limited pesticide application. Insecticide applications were based on an economic injury level (2 bugs per tree) and only during the dry season. Similarly the cotton bollworm (*Heliothis armigera*) and the cotton stainer (*Dysdercus nigrotasciatus*) have been managed with IPM knowledge. The stainer was being controlled through the destruction of old cotton seed, uprooting and burning of old cotton plants, observance of closed season, and spraying with insecticides when populations were high. This was an IPM system. These control measures were effective and only collapsed during Uganda's period of turmoil.

In an attempt to address some of the above problems the government has commissioned the Uganda Pesticide Board, to regulate the importation and use of pesticides. Increasing environmental awareness will ensure greater enforcement and implementation of these regulations. The provisions in the Uganda's pesticide regulations (Part IX Regulation 35) specify that:

a) agricultural chemicals shall be used only when it cannot be avoided;
b) the use of the least damaging agricultural chemical materials to the environment shall be encouraged; and
c) non target species shall be protected.

If these regulations are enforced, they could be an effective tool for promoting environmentally desirable pest management approaches including integrated pest management (IPM) (Meltzer et al.,1994).

Table 1: Area ('000 ha.) and production of major food crops ('000 tonnes) in Uganda, 1981/1989

Crop	Area/81	Prod/81	Area/84	Prod/84	Area/86	Prod/86	Area/88	Prod/88	Area/89	Prod/89
Millet	293	479	332	263	341	349	371	578	374	598
Maize	260	342	346	279	321	285	394	560	566	1019
Sorghum	170	320	205	164	207	279	256	378	245	368
Rice	12	14	17	19	18	20	17	23	73	33
Wheat	4	8	4	7	5	8	6	13	4	10
Banana	1125	5899	1209	6461	1210	6660	1341	7863	1349	7963
Sweetpotato	33	1299	385	1790	407	1864	417	1715	300	1231
Irishpotato	24	175	17	78	19	98	27	190	35	246
Cassava	309	2999	400	1881	361	1870	360	3271	495	4518
Beans	289	239	384	264	396	267	428	355	431	431
Field peas	18	8	15	12	17	9	23	11	27	13
Cowpeas	40	18	48	38	49	38	46	38	46	37
Groundnut	110	79	171	118	176	117	157	126	217	174
Pigeon peas	54	24	72	24	66	30	64	42	67	47
Soya beans	5	5	11	8	11	9	16	14	20	18
Simsim	70	25	86	38	70	34	80	36	133	66

Table 2: Area ('000 ha) and production ('000 tonnes) of cash crops in Uganda, 1984-1990.

Crop	1984	1985	1986	1987	1988	1989	1990
Coffee							
Area	224	224	224	224	224	237	240
Production	155	143	143	160	156	188	189
Cotton							
Area	199	160	180	140	98	106	69
Production	65	54	48	31	26	26	31
Cocoa							
Area	14	14	14	14	14	10	10
Production	271	186	69	100	224	461	100
Tobacco							
Area	3	3	2	1	2	2	3
Production	1022	1959	1594	932	1287	2468	3833
Tea							
Area	21	21	21	21	21	21	21
Production	64	35	35	19	22	19	26

Why did this IPM system collapse? It would appear that the farmers, who were the beneficiaries, were not well educated as to why they were doing what they were doing. The control methods were enforced by laws, and when the legal system collapsed, they ceased being used. Therefore a new approach is required to effectively implement IPM programs. The introduction by the IPM CRSP of farmer participatory IPM is a new approach that promises enhanced sustainability.

IPM Research In Uganda

Before 1992, agricultural research in Uganda was conducted in an uncoordinated manner by different research centers under the Ministry of Agriculture. In 1992, however, the National Agriculture Research Organization (NARO), was created to involve farmers, cooperatives, agrobased industries and scientists in coordinated planning and efficient execution of agriculture, livestock and forestry research. NARO is responsible for research and development of sustainable pest and disease control technologies.

Under NARO, there are three institutes which are conducting research on crops including Kawanda, Namulonge and Serere Agricultural Research Institutes. Kawanda Agricultural Research Institute (KARI) is responsible for research on bananas, coffee and horticultural crops. Namulonge Agricultural Research Station (NARI) is responsible for research on maize beans, sweet potatoes, cassava, while Serere Research Station Institute (SARI) conducts research on cereals (sorghum, millet and bullrash millet), cowpeas, groundnuts and cotton.

Besides NARO, agricultural research is also conducted at Makerere University in the Faculty of Agriculture and Forestry. The faculty has the mandate to conduct research on any crop as long as funds are available. Currently, there are four major research projects that are oriented towards developing IPM technology for small-scale farmers including projects on beans, cowpea, banana and cassava mosaic.

Until 1994, research on IPM in Uganda was fragmented and lacked a focused approach. Until then most of the research work undertaken at KARI, SARI and NARI to develop control measures for the mandated crops was pesticide oriented and screening germplasm for resistance to insect pests and diseases. Well planned experiments to study population dynamics and seasonal distributions of pests and their natural enemies; and, the nature and influence of interacting biotic factors on pest populations are still lacking. Furthermore, contacts with farmers was very minimal.

In 1994 two important things happened in our country that are now changing IPM trends. In that year NARO recognized the need to review its on-going IPM research projects and contracted a consultant to undertake the task. The report of the consultant brought out a number of issues that are being considered in developing IPM research projects in NARO.

The other, and perhaps most important activity that took place was the holding of a one day IPM stakeholders meeting, sponsored by the IPM/CRSP and facilitated by the Ohio State University. In this one day meeting, problems facing IPM research, development and application in the country were identified. Among the major problems identified at that time were:

(i) lack of technical information on ecology, biology, indigenous regulatory mechanism, damage/yield relationships and tactics of control;
(ii) lack of focused approach to IPM. It was recognized there was a general lack of strategy in IPM research and procedural problem of what to do, who to do it and where to start;
(iii) prevalence of single rather than multi-disciplinary approach to IPM;
(iv) lack of policy.

In recognition of these problems a network called Uganda IPM-net work was formed to bring together scientists working on IPM-related activities.

As a follow up of the IPM-stakeholders meeting, the IPM/CRSP organized a one week IPM workshop in July 1995, to help focus on problem identification and implementation of participatory IPM research. Since this workshop, there has been a new sense of direction in as far as IPM research is being conducted. Recently, late October 1996, NARO hosted a week-long IPM workshop to set priorities for IPM research activities.

On-going IPM research activities

Although the above discussion may give an impression that nothing positive has been done, it is important to indicate that there are some notable IPM programmes going on in the country.

(i) the post harvest IPM programme at KARI;
(ii) the IPM of cotton pests programme at SARI;
(iii) the Cassava pests IPM programme at NARI;
(iv) the IPM of bean pest programme at NARI.

The above research programmes are, in my opinion, well focused. They all have four built-in activities that characterize a good IPM programme that is : studying the ecology and biology of the pest, developing tactics for controlling the pest, and defining an IPM strategy and involvement of farmers.

IPM Networking in Uganda

As indicated above, IPM Networking is a new idea which was initiated by the IPM/CRSP. The first organized IPM effort was the Uganda IPM network which was initiated in December 1994. Although faced with problems of funding, it has both focused and brought attention to IPM from NARO, the Ministry of Agriculture and Makerere University. With funding from IPM/CRSP, the Uganda IPM-Network is conducting participatory IPM on pests of beans, cowpeas, groundnuts, maize, millet and sorghum. One of the objectives of these activities is to involve farmers in research activities leading to development of IPM. For example, extension agents are assisting farmers to monitor the incidence of pests in their fields. This is helping farmers to understand the pest problems better.

Another IPM network is operated by GTZ and it is focusing on horticulture production. This brings together scientists working on pests of horticultural crops in East Africa. There is also the beanfly research network in Eastern Africa run by CIAT. Most recently, EAFRINET, a biosystematic network was formulated to promote biosystematics research in the region with the aim of fostering IPM and biodiversity conservation.

Effecting IPM Network in Africa

Networks are good for capacity building and efficient utilization of resources. Nevertheless for efficient running they need to be well focused on particular problems and must have the activities well defined. To address this issue, it is important to define the network; whether it is an information exchange network or a research and information exchange network. Once this is determined then the source of funding has to be identified. These are the key elements in promoting networks.

The other crucial element in developing regional networks, is to have in-country networks well organized and strengthened so that they form a strong base for the regional ones.

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The Status of IPM in Ghana

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Introduction

Integrated Pest Management (IPM) has been recognized as one of the practical alternate measures that could be used to deal with the many problems emanating from increasing pesticide use, especially at the farm level. However, its implementation had been restricted to few isolated crops in the developed world.

Recent developments, however, have shown that IPM could be more practical and field oriented to the benefits of the ordinary farmer. Especially when it is adopted not as a technology, but as an approach and a strategy for developing technologies, for solving pest and disease problems as and when they occur (Kiss and Meerman, 1991).

Since 1991, Ghana's Agricultural Research System has been re-structured with the establishment of the National Agricultural Research Project (NARP). NARP comprises all institutions engaged in agricultural research in Ghana and these include the universities, research institutions under the Council for Scientific and Industrial Research (CSIR), the Ministry of Food and Agriculture (MOFA), and farmer representatives. Hitherto these had been working independent of each other. Under NARP commodity and factor committees are in place to advise and direct the activities of commodity based multidisciplinary and inter-institutional research teams. Each of these teams conduct research into IPM problems of the commodities concerned.

Following the West African IPM workshop at the Accra Conference Centre in Accra in 1992 (under the auspices of the IPM Forum), the

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* Now with the Ministry of Food and Agriculture as National IPM Coordinator

National Plant Protection and Pesticide Regulatory Committee of the National Agricultural Research Project (NARP) submitted a memorandum to the NARP Secretariat pushing adoption of IPM as a major component of Ghana's Plant Production/Protection Strategy. This was in recognition of the fact that excessive use of pesticides especially on crops like vegetables (tomato, cabbage and garden eggs) had led to unacceptable residues in market produce resulting in risks to consumers and commodity rejection at the international market. Increasing incidence of farmer poisoning and long term effects of pesticides on aquatic and terrestrial ecosystems were further causing concern to agriculturists and environmentalists.

The need to reduce dependence on chemical pesticides and the development and implementation of alternative pest control measures were therefore of urgent priority. In addition to the memorandum, a National Biological Control Committee (NBCC) was formed with the assistance of the International Institute of Tropical Agriculture (IITA).

The NBCC which is IPM oriented, established a number of multidisciplinary crop-based working groups. Members of these groups include leading scientists engaged in agricultural research (from Ghanaian Research Institutions), Technical Officers and Extensionists from the Ministry of Food and Agriculture and importantly, local farmers. These groups have been working to identify pest problems and recommend environmentally friendly and sustainable strategies for controlling them. The targets are crops and pests known to be associated with over use or abuse of pesticides and for which an adequate knowledge base is available (preferably with local research support). Major pests include variegated grasshoppers, *(Zonocerus variegatus),* larger grain borer, mango mealybug, water hyacinth and the plantain/banana weevil *(Cosmo qitessordidus).* Targeted crops are cereals and vegetables such as tomatoes, garden eggs and cabbage.

In August/September 1993, two IPM specialists (Dr. G.A. Dixon, Director, Plant Protection and Regulatory Services Department of MOFA and Prof. K. Afreh-Nuamah of the University of Ghana, Legon) were sent to represent Ghana at the Global IPM meeting (and study tour) in Bangkok, Thailand. They noted the widespread

adoption of participatory IPM (as national strategies) in south-east Asia rice fields and the subsequent considerable reduction in the amount of pesticide used.

As a follow-up, a national IPM Advisory Committee (ie. the National Integrated Crop Protection Advisory Committee) was formed in 1995. This committee chaired by the Honourable Deputy Minister of Food and Agriculture (MOFA) in charge of crops, consists of prominent scientists concerned with IPM from the universities and research institutions, directors of relevant departments of MOFA (i.e. Extension Services, Crop Services and Plant Protection and Regulatory Services), agro-chemical sellers and farmers.

In addition, a number of proposals for funding by the FAO were initiated but because of the experience of the participatory IPM on rice, the FAO accepted to fund a pilot project for the adaptation of the Asian IPM training methodology (the IPM farmer field schools (FFS) concept) to Ghanaian conditions, under a Ghana/FAO Technical Cooperation Programme (TCP/GHA/4553 - Rice IPM). This pilot project sited at the Dawhenya Irrigation Project brought together 28 field extension personnel, 24 of whom were drawn from four relevant technical departments of the Ministry of Food and Agriculture (PPRSD, Crop Services, DAES and GIDA), three from the Côte d'Ivoire and one from Burkina Faso.

The personnel from Ghana were drawn from six irrigation project sites in the country in different ecological zones (Tono in the Upper East Region; Bontanga, Northern Region; Afife, Volta Region, Asutsuare, Eastern and Dawhenya and Ashaiman in the Greater Accra Region). The idea was to train them as trainers of trainers (TOTs) in rice production (starting from land preparation, nursery establishment and transplanting through to harvesting) and thereby expose them to the critical stages and major constraints in rice production. At the end of this training, these trainers were expected to go back to their communities and extend the knowledge acquired to rice farmers. Simultaneously, a group of seventy-five rice farmers from Dawhenya project site were organised in three groups of twenty-five in a farmer field school for training by the trainee TOT'S every Friday, also throughout the whole crop cycle.

Under the TCP, one IPM training consultant from the FAO Inter-country Rice IPM in Asia and two trainers from the Philippines National IPM Programme were brought in to conduct the training from 31st May to 6th October 1995. The West African Rice Development Association (WARDA) provided the technical backstopping. Experts in different disciplines in rice from the National Agricultural Research System together with Scientists from WARDA served as the resource persons on special topics in rice production.

The responsibility for the overall management of the IPM training project was under a national project oversight committee set up by the Minister of Food and Agriculture. This committee chaired by the Director of the Department of Agricultural Extension Services met frequently to oversee and facilitate the implementation of project activities. Other members of the committee were Directors, Department of Plant Protection and Regulatory Services (PPRSD), Crop Services Department and the Irrigation Development Authority, all of the Ministry of Food and Agriculture, Prof. K Afreh-Nuamah, Secretary to the committee from the University of Ghana, Legon, and Mr S. S. Mboob, the Senior Plant Protection Officer of the FAO Regional Office for Africa.

Follow-up training programme for rice farmers were established at five irrigation project sites from were the trainers (facilitators) were drawn from. The main objective of these follow-up programmes being to extend the experience gained from Dawhenya to other regions so that farmers on these projects can benefit from IPM training. At each of these irrigation sites, two farmer field schools were set up with twenty-five farmers in each school. Thus, about 50 farmers were trained at each of the five sites. Together with the 75 farmers previously trained at Dawhenya last year (1995), a total of 325 farmers have been trained in rice IPM in Ghana. The results from both the pilot project at Dawhenya in 1995 and the follow-up training programmes at the five irrigation projects showed marked similarities between Asia and Ghanaian-irrigated rice ecosystems. For example, a wide variety of insect pests and their natural enemies have been observed, and without use of pesticides, rice yields were increased, a good indication that IPM as practiced in Asia would also work in Ghanaian irrigated rice systems.

The IPM Farmers' Field Schools Training Methodology

The training programmes were preceded by baseline surveys at each of the irrigation sites, where the facilitators interviewed a cross section of the farmers to determine the prevailing farming practices at each locality. Some of the important factors documented during the survey include the following:

- socio-cultural: age, sex ratio, language, taboo days and land holding;
- agronomic practices: main varieties of rice grown, planting method, average yield, and net returns;
- agro-chemical use and other inputs: fertilizer requirements, types and frequency of pesticides used;
- crop protection problems;
- general farm problems.

Basis for Farmer Selection

Farmer participants at the field schools were selected according to the following
considerations:

- full-time farmers working on rice production at the irrigated sites.
- energetic farmers fit to undergo field activities;
- willingness to be available once a week for the entire crop cycle of rice;
- no gender discrimination. Male:female ratio to reflect actual situation at the site;
- farmers from contiguous area to foster group/ team building and cooperation;
- sectional representations.

Program of Activities for each FFS Day

A typical program of an FFS session is as below:

- opening prayer, registration and briefing;
- Agro-Ecosystem Analysis (AESA), field work, discussion and presentation of field data and observations;
- group dynamics or ice breaker;
- special topic and assessment of performance for the day;
- refreshment and closing prayer and departure.

a) Agro-Ecosystem Analysis (AESA): Agro Ecosystem Analysis is a tool for empowering trainees in the management of their own rice ecosystems through proper decision making based on critical analysis of actual field situations. Every week, trainees made and recorded field observations, processed and analyzed these observations and made decisions regarding the proper management of the field to be evaluated during next re-entry in the field.

AESA usually involved:

1. Observations and data collection on crop growth characteristic (agronomic) and insect/ spider number counts (entomological)
2. Processing of collected data with recommendations
3. Presentation of results
4. Implementation of recommendations in the field (including field work).

The following were some steps involved in the collection of the weekly data:

Step 1: Collection of General Information

- variety planted;
- number of days after sowing (DAS);
- number of days after transplanting (DAT);
- the crop growth stage.

Step 2: Collection of Agronomic Information

Five hills per plot were selected diagonally and pegged. These were sampled weekly for the following information to observe the performance of the rice.

- average plant height per hill;
- average number of tillers per hill;
- average number of productive tillers per hill at booting;
- average number of unproductive tillers per hill at booting;
- average number of panicles per hill at heading;
- average water depth around the pegged hills.

Step 3: Collection of Entomological Information

Ten hills per plant were sampled diagonally. In each hill the following observations were made:

- number and types of insect pests present;
- numbers and types of natural enemies.

This information was collected by observations on plants, within the tillers and in the water.
Ten sweeps of a sweeping net were made to collect insects.

Step 4: General Field Observations

The following were also observed for discussions

- the weather
- crop performance
- level of weed infestation
- water depth
- insect pest and natural enemy population ratio
- rodent infestations
- others

b) Special Topics: Technical special topics crucial and relevant for the proper understanding of the management of the agro-ecosystem were based on local needs, identified by farmers and facilitators in the field. Thus, there were weekly variations. These included:

- Ballot Box Test (pre and post evaluations). This was a way of determining the depth of knowledge the farmers had about the crop before and after the FFS programme.
- rice physiology (including crop compensation studies)
- land preparation
- Insect Pests and Natural Enemy Management (including establishment of insect zoos). Defoliators and detillerers.
- disease, weed and vertebrate management
- water and fertilizer management
- panicle initiation, booting and the role of nitrogen
- pesticides and human health
- yield components

Apart from technical special topics, the training included educational and program management special topics that aimed to elaborate on how to extend the training to other farmers. These special topics included:

- non-formal education
- community organization

c) Group Dynamics: This aimed to strengthen group cohesion among the farmers. These exercises emphasize group processes that play an important role in the implementation of local IPM programmes in the field such as:

- team building
- cooperation
- problem solving
- decision making
- leadership

d) "What is This": This is an approach to communicate and train farmers through dialogue. During the process the training facilitators tried not to answer direct questions such as "What is this insect" with a direct answer like "This is a variegated grasshopper", but to establish information about the insect by asking a series of questions that focus on the insect and its function in the ecosystem: for example, questions like "Where did you find it?", "what was it doing?" etc. were asked to stimulate the sense of observation of the farmers.

Farmers' Field Schools

These IPM training programmes were conducted in what is termed IPM farmers' field schools (FFS). Each field school comprised 25 farmers who agreed to meet for at least once a week for about half a day (4-5 hours), during the entire cropping season. These 25 farmers were subdivided into groups of five with a leader. During each FFS day, these sub-groups conducted their own observations and a member of each subgroup presented their observations with recommendations to the school.

Training Approach

The whole training curriculum was experiential and discovery-based aimed at making farmers experts in decision making on their own fields. The method of study was learning by doing.

About 50% of training time was spent in the field, where farmers worked, observed and shared ideas together. Presentations and discussions of observations were held under a tree as in Ashaiman or under a shed with canopy as in Tono, Dawhenya, Afife and Bontanga.

Exchange of information and sharing of experiences among farmers were facilitated through discussions within and among small farmers groups.

Trainers were primarily facilitators of learning and only introduced new information when it seemed necessary and appropriate.

Three main areas of learning, 'work', 'interaction' and 'empowerment' were emphasized in the training programme.

The general purposes associated with 'work' included knowledge relevant to making management decisions, concerning agronomic and ecological factors that must be made by a farmer practicing IPM strategies. The following guidelines derived from the Indonesian National IPM programme were adopted in the implementation of the programme:

1. grow a healthy crop
2. preserve natural enemies
3. regular field observations
4. farmers as experts

Growing a healthy crop requires basic agronomic skills like seed selection, soil preparation, planting and nursing/transplanting. Thus, the farmer must be conversant with the cropping calendar so that the crop potential could be achieved.

'Preserving natural enemies' is a positive way of saying 'reduce pesticide use'. To be able to do this requires the ability to recognize different factors in the crop ecosystem and to understand their interactions. This involves setting up zoos to enable the farmer to appreciate the difference between insect pests and the natural enemies (friendly insects). It also helps the farmer to appreciate the damage caused by blanket spray of chemical pesticides.

Regular field observations concern learning how to make observations in the field. Observations are based on the collection and analysis of field data. In the learning situations farmers used a formal process to gain these observational skills. In their own fields these skills would be applied without the formality of the learning process. In so doing, they will become experts in their own farm operations, able to make inductive decisions from observations in the field.

The purpose of 'interaction' involved the social aspects of IPM, such as motivating and helping other farmers to know and apply IPM or establishing IPM farmers' groups.

Finally, the purpose associated with 'empowerment' aspects of the training related to the developmental process necessary to enable farmers to identify factors which inhibit or hamper their lives and to find ways to resolve such issues. Farmers ought to discriminate between technologies made available to them by the research system, and to empower themselves to make their own decisions about their farm management activities so that they may employ the IPM principles that they have learned.

Participatory Action Research (PAR) in the Farmer Field Schools

Participatory Action Research aimed to provide farmers with analytical ability and skills to investigate the cause-effect relationships of local farming problems and thereby to stimulate them to design a set of actions for solving problems in the field.

Participatory Action Research included insect zoo studies and field trials on:

- crop protection
- crop compensation (defoliation and detillering)

On each project site about 0.2 ha of irrigated plots were made available for FFS activities ie (1) field based experiential learning and (2) Participation Action Research.

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Activities of the IPM CRSP in Sub-Saharan Africa

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Introduction:

I am a Rural Sociologist by training and one of sociology's research domains is organizational behavior. One of the prime generalizations that emanates from this area of study is that strong and clearly defined linkages are vital for system maintenance and sustainability. I believe this workshop is helping to establish intra-Africa linkages. I hope one of the outcomes of the workshop is to further define these linkages, and the role for each one of us, in maintaining them.

IPM has become, as of late, a mainstream approach for increasing and/or sustaining food crop production in sub-Saharan Africa and around the world. It has been embraced by most of the major multi-lateral and bi-lateral development organizations and by most National Agricultural Research Systems.

What makes IPM so attractive is its potential for sustaining and improving yields, lowering dependence on pesticides, lowering costs of production, while simultaneously lowering negative impacts on the environment and human populations.

Another attractive feature of IPM is its emphasis on the concept: integration. Integration needs to occur at several different levels: It needs to integrate various disciplines; needs to integrate research, extension and farmers; and, it needs to integrate the various components of production into a systems approach.

A criticism of agricultural sciences has been that they are largely efforts in scientific reductionism - or the dissection of problems in to smaller and simpler components - and that this has led to an unnatural separation between agricultural science and its real world context and

application. IPM provides us with a mechanism to reconstruct agricultural science into a systems approach and to bring back local knowledge into formal knowledge production for agriculture. The hope behind IPM is that it can truly provide the basis for a truly integrated, reconstructive approach, to applied problem solving.

However, according to some we aren't quite there yet. Sulayman M'boob, Senior Regional Crop Protection Officer for the FAO states that African farmers have gained little from 20 years of IPM research. He goes on to describe several factors that have constrained IPM work.

- First, are the weak links between research scientists and farmers.
- Second, most IPM programs have not integrated the social and biological sciences very well. He says, that successful IPM programs always take into consideration the socioeconomic conditions of farmers.
- A third constraint is a lack of coordination among research, extension and crop protection practitioners resulting in a fragmentation of effort.
- Fourth, resulting from all of the above, IPM research generally ignores farmers needs and is narrow in scope.

From this critique, we come to understand that the promise of integration in IPM, particularly, I believe with farmers, is still to be achieved.

Function and Structure of IPM CRSP

It is against this backdrop that I want to begin discussing the efforts of the IPM CRSP in Africa: its structure, activities, and some of the lessons learned. The IPM CRSP is the newest CRSP supported by USAID. It began in late 1993 and is thus really only three years old. We are currently operating in two countries: Mali and Uganda. We decided at the onset to only work in two countries because of funding limitations: we wanted to try and maximize our resources in two places.

The US-based institutions collaborating with the Africa Site are: Virginia Tech University, The Ohio State University, Purdue University, and Montana State University. There are 9 scientists from these universities, representing 7 disciplines. This is the first integrative challenge.

We are collaborating in Mali with IER. Madame Gamby is the Research Coordinator and Dr. Amadou Diarra is the Administrative Coordinator. We are also working with OHVN, a semi autonomous development organization, PV a crop protection agency associated with the Ministry of Agriculture, and an NGO, Group for Research and Technical Application (GRAT). We have also received collaborative inputs in the form of germplasm from ICRISAT and IITA and more recently suggested post-harvest technological suggestions from the Bean Cowpea CRSP.

In Uganda we are working with Makerere University, Faculty of Agriculture and Forestry, and Dr. S. Kyamanywa is the Site Coordinator there. We are also working with the Ministry of Agriculture (MOA) crop protection agents, the National Agricultural Research Organizations (NARO) research stations Serere and Namulonge, and four NGOs including BUWOSA (Bukeda Women's Struggle Association), Uganda National Farmers Association (UNFA), and two other independent farmer associations. Discussions have also been held with ICRISAT, ICIPE, and the Bean/Cowpea CRSP.

The IPM CRSP has as its goal in sub-Saharan Africa the development of more effective, low cost, pest controls, for high risk, semi-subsistence production systems. Some don't think that more effective and low cost go together. Others think that it will be quite difficult, or low potential in developing technology for resource poor farmers.

This provides us with a formidable challenge. Our approach for addressing this challenge is to implement a participatory IPM research strategy. Participatory research is differentiated from other research strategies by inclusion of farmers throughout the research process. The idea is that this will result in technologies adapted to, and adopted by, farmers.

Our first activity at each site was to hold a stakeholders meeting. The purpose of the stakeholders meeting was to familiarize interested groups with the IPM CRSP, to discuss crop and pest priorities and potential research sites with host country scientists, and to begin the process of team building.

The second activity was to implement a field participatory assessment with farmers at the research sites and with US and national scientists. The main purpose of the PA was to initiate a participatory research process focused on IPM. As part of the participatory process we wanted to learn from farmers what they perceived as their priority crops and priority pests on each crop and methods, if any, they were using to control these pests.

From the PA and with further discussions with our researcher colleagues we designed our workplan for the following year that initially included the collection of additional biological and socioeconomic baseline information and on-farm trials to begin the process of adaptive research and to test recommendations from various sources including farmers (indigenous knowledge), ideas from researchers' past experience, ideas borrowed from the other CRSPs, and, in one case in Uganda, an idea that came from some of the old colonial research journals.

Each year in May/June we assemble our workplan for the next growing season(s). These are collaborative workplans where for each activity we involve US and host-country researchers in plan design and implementation.

Since this is a participatory IPM effort we also involve the farmers in the design, evaluation, and redesign of trials and workplans. Finally, at the end of each year we assemble an annual report that discusses findings, impediments and suggestions for the next year. This then, is the generic structure we are following.

Activities

We are in the middle of our second season of field trials in Mali. We will begin field trials next year in Uganda. In Mali we are:

1. Monitoring insect populations using light traps;
2. Applying neem on early and late millet to control blister beetles. We are using the industrial neem product Azatin EC to serve as a benchmark for the locally produced neem extract using the neem press supplied by a local NGO;
3. Evaluating maize as a trap crop for blister beetles near millet fields;
4. Implementing integrated striga trials. The components of these trials were suggested by previous research. However, the idea of combining them came from one of our Malian colleagues, Bourema Dembele. In combination, there may be a greater benefit brought about by synergy among the components;
5. Conducting trials using striga resistant sorghum varieties;
6. Conducting trials using millet varieties with non-preference resistance to blister beetles and lepidopterous head borer;
7. Evaluating various technologies including neem to control bruchid damage in stored cowpea.

Cutting across these field activities are several socioeconomic and participatory activities designed to maintain farmer involvement and to assess the impact of socioeconomic variables, including gender, on crop production and pest management. We conducted a farmer evaluation of the previous year field trials in Mali. A few of the interesting results that came out are as follows:

1. Farmers like the neem application and are very interested in learning how to prepare the extract themselves.
2. Regarding the integrated striga trials farmers acknowledged the better yields and lower counts and weights of striga when all component technologies were used compared to farmer control practices. However, they also mentioned that the combined trial required much more labor, and that they were unsure as to the cost-benefit trade-offs of the new technology.

3. Farmers liked the light traps. However, they liked them, not for the insect monitoring, but as a control practice.

Another example comes from Uganda where we have implemented a farmer crop pest monitoring system, where farmers on a weekly basis were trained to do sampling and monitoring of pests. They also recorded the information on specially prepared data forms. Twice monthly they are visited by crop protection extension agents, and once monthly they are visited by researchers from Makerere University or NARO. This system has trained farmers in pest identification, integrated them into the research process, provided a clear component for extension involvement, and saved time and money in the provision of logistical support for researchers. Farmers, thus far, are very supportive of the system.

Lessons Learned

Regarding lessons we have learned, I would prefer to describe these as things that are working well for us thus far. Since the IPM CRSP is only three years old, it is a bit premature to portray these as conclusive results. Most of the lessons to date are related more to process rather than to identifiable impact.

The first lesson, is that the participatory research process is vital to our approach and success. Thus, we remain committed to it. Quoting Dr. Norman Uphoff: "Any country seeking these days to improve the performance of its system of agricultural research and extension, if it wants to benefit from experience worldwide over the past four decades, has to be concerned with how it can establish solid institutional linkages that engage and involve farmers, as they are the end-users of our efforts". The participatory research process, provided we are faithful to it - provided we don't once again allow on-station or top down research to supersede the interests of farmers - provides us with this link.

In both Mali and Uganda we are attempting to retain and maintain this link with the farmer. The main difficulty has been that it is, time consuming and more expensive in the short-run, to maintain links with farmers in remote and often times, inaccessible areas. No wonder

there is an urban and on-station bias to research: it is easier, cheaper, and usually better quality science. The only problem is that it is often of low relevance to farmers and thus has only marginal impacts.

Second, we want to move "on-the-shelf-technology" out to the field for farmer trial and evaluation. Thus we are trending towards more trials like the integrated striga trials where we combine components suggested by local researchers, farmers, IARCS, and other CRSPs.

Third, IPM provides an excellent mechanism for integrating research with extension, and social and biological scientists activities. We will continue to try and integrate research efforts across disciplinary boundaries. The farmer evaluation exercises have been quite useful at merging the efforts of the disciplines along with those of farmers.

Fourth, communication is vital to maintaining these long distance research linkages. Broadening our communication linkages through networking is also very important. Networking can conceivably increase information input and output. Thus, this workshop is extremely important for all of our efforts at promoting IPM in sub-Saharan Africa.

Africa IPM-Link: An Initiative to Facilitate IPM Information Networking in Africa

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Africa IPM-Link is a new initiative funded by U.S. Agency for International Development's Bureau for Africa (USAID/AFR/SD) to promote the adoption and use of electronic communication and networking in Africa to foster the development and implementation of sustainable integrated pest management (IPM) systems appropriate for local economic, sociological and environmental situations. Collaborating organizations include the (a) the Integrated Pest Management Collaborative Research Support Program (IPM CRSP), Virginia Tech, (b) Consortium for International Crop Protection (CICP), and (c) AfricaLink activity, USAID Bureau for Africa.

IPM is a knowledge-intensive process which by definition requires readily available, site-specific, informational resources for its successful implementation. Among major constraints to the implementation of IPM in Africa, particularly within subsistence and emergent agricultural systems, are the lack of IPM training and knowledge, a need for specific pest/crop and pesticide management information, and restricted ability to access voluminous, world-wide information on alternative control practices. Ready access to a wealth of IPM knowledge becomes key to sustainable crop protection in Africa.

Africa IPM-Link will be working in close collaboration with AfricaLink personnel to promote low-cost resource nodes and networks for the electronic transmission of relevant information to-, between-, and within- African nations. AfricaLink will be key in realizing the objectives of this activity, that is the timely and regular exchange of information among IPM specialists in Africa. The proposed means is via "telematics" - the use of computers to communicate IPM information. A necessary prior condition is the physical electronic linking of IPM colleagues within the selected African nations and between other nations in Africa and elsewhere in the world. A process will be initiated to accomplish the physical link to the Internet and then to commence the exchange of information.

Within the context of the country's existing infrastructural and regulatory environment, AfricaLink implements simple strategies to help end users obtain electronic mail access as quickly as possible. As a general principle, AfricaLink encourages networks to obtain electronic mail access through a local service provider. Characteristics of the systems will include economic feasibility, targeted audiences, and participatory development. These systems will include built-in feedback mechanisms to assure a user-friendly system relevance.

USAID is engaged in a number of activities to facilitate access to the Internet and other electronic communications media, to promote better information flow between its partners. Worldwide, public access to electronic mail connectivity is least developed in Africa: 15 countries lack even the most basic access. In 1989, there existed no NGO computer communication in Africa. The situation is changing rapidly, however, and as the telecommunication infrastructure continues to be upgraded, as is happening in many countries, networks will take advantage of the changing situation. In 1994, 13 networks in Africa were using FIDONET technology. Nine national networking initiatives were operating at least at minimal levels in the same year. Of these countries, Senegal, Uganda, Kenya, and Zimbabwe now have public servers providing WWW access, although Kenya has temporarily fallen behind due to excessive regulation. Other targeted countries, which include Mali and Ethiopia, are operating with FIDONET. As reported more recently by the AfricaLink Initiative, the "telematic" capabilities of many African countries continues to

grow and they are gaining ground on their access to the rapidly growing resources on the Internet.

Because of the limited financial resources available to this initiative, as well as its prototypic nature, initial efforts are expected to be limited to six or seven countries: Senegal, Mali, Ghana, Uganda, Ethiopia, Kenya, and Zimbabwe (Figure 1). Factors to be considered in selecting countries include: their present network status and capability, high priority country for USAID activities, perceived interest and participation, and the presence of other organizations with related activities.

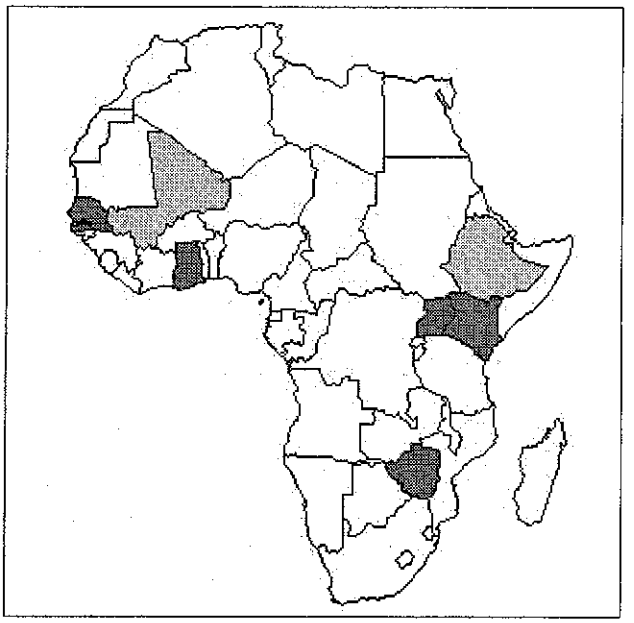

Figure 1: Key Target Countries.
Dark shading: countries with full-time satellite Internet access as of June 1996.
Light shading: countries with access to store-and-forward systems.

The resources budgeted for the immediate Africa IPM-Link will be inadequate for a long-term coordinated networking activity. Success of the present activity and the effective use of scarce resources,

therefore, can only be accomplished if conducted on a highly targeted, cost-effective, and cost-sharing basis in cooperation with global partners and other organizations involved in information transfer. A number of related USAID Africa-Bureau supported initiatives have potential for complementing the activities of Africa IPM-Link. These include:

- Regional Agricultural Commodity Research Networks - mainly WARDA, ICRAF, and SACCAR: Regional agricultural and natural resources research networks funded by USAID, the World Bank, and other donors are natural partners in forging complementary investments in connectivity. The West African Rice Research and Development Association (WARDA) and the International Center for Research on Agroforestry (ICRAF) have received AfricaLink funding from USAID to encourage connectivity of existing agricultural research interests in West and East Africa, respectively. Major support for Southern African agricultural research networking is being coordinated through SACCAR, the Southern Africa Coordinating Centre for Agricultural Research. SACCAR receives funding from USAID to support documentation and information sharing in the Southern African Development Community, and is applying some of these funds to support electronic networking.

- International Center for Insect Physiology and Ecology (ICIPE) Information Networking: ICIPE's PESTNET and related regional collaborative research activities offer a strong foundation upon which to build an electronic connectivity strategy. ICIPE has also received a small grant from USAID/AFR to promote this concept in coordination with Africa IPM-Link.

- PAN/ENDA Regional Center for Africa - NGO Support Center for Sustainable Agriculture. In Dakar, a network has been created with a modest grant from USAID/AFR to support African NGOs working on sustainable agriculture and alternatives to pesticides. This includes a component for promoting electronic communications, and will also benefit by coordination with Africa IPM-Link.

GTZ IPM Horticulture Project for Eastern and Southern African Region: Concepts, Operational Approach and Activities

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Abstract

The primary objective of the project is to foster IPM in horticultural production in Eastern and Southern African region and to enhance interaction and exchange of information between horticultural researchers within the region. The project operates in Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia and Zimbabwe by supporting research activities directed at economically important pests of brassicas, citrus, French beans and tomatoes. The research priorities were determined and are annually reviewed by stakeholders in regional planning workshops. This paper reports on the concepts and activities of the project and discusses the possibility of collaboration between IPM networks in the region.

Introduction

IPM Horticulture Project is funded by the German Ministry of Economic Cooperation and Development and is executed by the German Agency for Technical Cooperation (GTZ). The project was initiated in 1994 with its headquarters based in Nairobi, Kenya. It has a regional mandate covering seven countries in Eastern and Southern African including Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia and Zimbabwe. In these countries the project is collaborating with 28 institutions which include universities, national research centres, extension departments of Ministry of Agriculture, Asian Vegetable Research and Development Centre (AVRDC), Africa Programme and International Centre of Insect Physiology and Ecology (ICIPE) as international institutions, non-governmental organizations

(NGOs), exporters and farmers' groups. Inclusion of ICIPE was considered pertinent to sustainable coordination of networking in the region after expiry of the project.

The specialist theme for the project is IPM for horticultural crops with emphasis on small-holder production, and presently the target crops include brassicas, citrus, French beans, and tomatoes.

Concepts and Objectives of the Project

Horticultural research has been and is still neglected in most countries in the region. This is understandable in context of the chronology of agricultural research in the region during pre- and post-independence eras:

- Colonial administrations focused on research on plantation crops for export (coffee, cotton, pyrethrum, sisal, tea, and tobacco);
- During the post-independence period there was a shift in research priorities with emphasis on small-holder production of staples (cereals, pulses and root crops) in order to attain self-sufficiency in food. Research on plantation crops was assigned to special institutions/boards (coffee board, cotton board, etc.).

With ever increasing demand for horticultural produce for both local and export markets, the economic importance of horticulture was recognized in most of the countries. This is particularly so for peri- and pre-urban horticultural production. For example, in Kenya, horticultural products rank second in foreign exchange earnings after tourism. In 1994, the total value of horticultural exports reached about USD 149 million (MoALDM, 1995). French bean exports were valued at 18% of the total, and about 50,000 small-holder families are involved in production and another half a million derive income directly from exports of this commodity (Swanberg, 1995).

Horticultural production specially of vegetables is intensive involving continuous planting throughout the year under irrigation. Such a production system creates an ideal environment for a build-up of

pests, and thereby prompting an excessive usage of pesticides. However, with current awareness of the negative effects of injudicious use of pesticides on biodiversity, environment and human health, IPM has a critical role to play, particularly in providing sustainable, user and environmentally friendly pest management options. On this basis, therefore, the goal of this project is two fold:

1. To foster IPM in horticultural production in the East and Southern African region. This involves generation and implementation of pest management strategies less dependent on pesticides, training of researchers, extensionists and farmers on IPM
2. To enhance interaction between horticultural researchers within the region and elsewhere. This also includes networking between collaborating institutions in mandated area using available information pathways (fax, e-mail and Internet).

Operational Approach of the Project

Participatory approach involving all stakeholders (chemical companies, exporters, extensionists, farmers, NGOs, policy makers, researchers and universities) is routinely used in regional planning workshops to decide upon priority research activities. The status of research activities is regularly reviewed and adjustments made as deemed necessary by the stakeholders.

IPM technologies generated by scientists are then tested on-farm and also through farmers' schools. The technologies are crop and site specific, and the information is compiled and made available to all collaborating countries and institutions. Information flow to and interaction between researchers in national institutions within and between collaborating countries constitute a top priority of the project in its Phase 2 which will start in January, 1997. However, the project has already provided electronic facilities (computers and e-mail) to four out of seven collaborating countries.

On-Going Research Activities on Mandated Crops

Brassicas:

- Seasonality of major pests and inventory of their natural enemies. This study is undertaken in six collaborating countries and in each country there are up to three sites at different elevations. No pesticides are used and the research protocols in all sites are standardized. Additional observations are also made in small-holder plots where pesticides are routinely applied.
- Determination of intervention thresholds of diamondback moth and yield loss. This activity is carried out at Bvumbwe Horticultural Research Station in Malawi.
- Control of aphids and diamondback moth using neem based pesticides. This work is done in Kenya by the Kenyatta University. · Chemical control of *Hellula undalis* in Mozambique. The research is conducted by the Instituto Nacional de Investigação Agronómica.

Citrus:

- Biocontrol of the citrus woolly whitefly. Importation and trial releases of *Cales noacki*, the most important parasitoid of this pest are done jointly by the Kawanda and Namulonge Research Stations of the National Agricultural Research Organization of Uganda. Monitoring of the effectiveness of the parasitoid will be undertaken, and if successful, interested National Biological Control Programmes in the region will be supported by the project to carry out biocontrol of the pest in their respective countries.

French beans:

All French beans research activities are carried out in Kenya by the Kenya Agricultural Research Institute, International Centre of Insect Physiology and Ecology, Kenyatta University and University of Nairobi. The activities include the following:

- Chemical seed treatments for the control of beanfly and aphids

- Bio-ecology of bean flower thrips
- Relationship between time of bean rust infection and yield loss
- Potential of chemical seed treatment for the control of bean rust
- Use of neem based pesticides for the control of the major pests of French beans.
- Farmer training on pest and disease problems and IPM using a modified farmers' field school approach.

Tomatoes:

- Screening of accessions/varieties for resistance to root knot nematodes. This research activity is carried out in Zimbabwe at three sites of varying temperature gradients by the Plant Protection Research Institute. The work is done with the collaboration of the AVRDC, Africa Programme, Arusha, Tanzania.
- Management of late blight through manipulation of plant density, staking, reduced dosages and frequency of fungicide application. This work is done by the Kenyatta University, Nairobi, Kenya.
- Surveys on tomato viruses in the mandated countries. National agricultural research institutions in collaboration with AVRDC, Africa Programme, are involved in conducting the surveys.
- Bio-ecology of leafminers. The study is undertaken at ICIPE, Nairobi, Kenya.
- Varietal screening for resistance to red spider mites. The study is carried out by the Jomo Kenyatta University of Agriculture and Technology, Kenya.

In addition the project has currently three PhD and six MSc students addressing some of the aforementioned research topics.

Conclusions

Apparently there is lack of information on IPM Projects/Networks operating in Sub-Saharan Africa and, therefore, it

was felt appropriate to create awareness of GTZ IPM operations in Eastern and Southern Africa for the following reasons:

- To avoid duplication of research activities where there is an overlap; this is particularly important as all projects are financially limited.
- To build-up partnership between the various IPM projects in the region.
- To initiate and enhance collaboration between the various IPM projects in the region in information development and exchange.

Since all the IPM Projects/Networks in the region share the same aspiration, that is, fostering the ideal of integrated pest management, and have limited resources and functional duration, GTZ IPM suggests the following:

- All IPM Projects/Networks to take stock of facilities already in place in the various countries in the region and the purpose(s) the facilities are intended for
- To look into ways of how interlinkage between the various IPM Projects/Networks in the region could be facilitated and, particularly, pooling efforts in accessing collaborating institutions with appropriate electronic information pathways.

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Pesticide Action Network (PAN)

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Pesticide Action Network (PAN), is an international network established by NGOs in 1982 in Malaysia to promote sustainable agriculture practices, food security and social justice, and demand that development agencies and governments redirect support from pesticides to safe alternatives. Today, more than 400 organizations, institutions, individuals from about 60 countries are members of the network. The activities of PAN International are coordinated by regional centers with full and part time staff in:

- Latin America (Colombia)
- North America (San Francisco, USA)
- Europe (England)
- Asia and Pacific (Malaysia)
- Africa (Senegal)

The Regional Center for Africa is the newest member of PAN International; it was established in 1996. The creation of this autonomous entity was decided upon in 1994 in Bamako, Mali during the workshop entitled "Pesticides and Sustainable Agriculture in Africa", which was organized by ENDA-TM (Environnement et Développement du Tiers-Monde) and PAN, and attended by about 70 people representing organizations from 19 African countries (east, south, central, and west).

I should mention that the establishment and the work of the Regional Center for Africa was made possible through the help of USAID and PAN North America.

Priorities for 1996 and 1997 were established during a July workshop organized by PAN Africa Regional Center and held in Mbour, Senegal.

They are as follows:

- to publish a newsletter in French and English called " Pesticides & Alternatives" (4/5 issues);

- to facilitate a survey in selected countries in Africa on the dangerous pesticides featured on the "Dirty Dozen" list, and the World Health Organization's lists Ia and Ib. The work in each country will be carried out by a local NGO;

- to set up a documentation center (French and English) on pesticides, IPM practices, techniques and methods, and other sustainable agriculture practices;

- to help NGOs to gain access to e-mail and communication facilities;

- to support the organic cotton work undertaken by some members of PAN Africa.

The IPM-related work of PAN Africa will mainly focus on gathering data, disseminating information, implementing successful IPM programs, and training NGOs and farmers. We are interested in collaborating with all partners doing work in the different areas mentioned above. We are also open to all suggestions and initiatives that can help us to achieve our principal goal, which is the dissemination of sustainable agriculture pratices in Africa, especially in NGO communities and grass-roots organizations.

Recommendations of the Workshop Participants on IPM Networking in Sub-Saharan Africa. October 14-16, 1996, Addis Ababa, Nazreth, Ethiopia.

At the end of the workshop, a panel discussion was held to focus on prospects for and potentials of IPM Networking in Sub-Saharan Africa, IPM issues for regional collaboration, and the need for strengthning National IPM initiatives. The panelists involved represented African NARSs, CRSPs, and IARCs. Based on the panel discussion as well as contributions from the workshop participants, the following ten recommendations were developed and agreed upon by all those present. Strategies for follow-up and implementation of the workshop recommendations are incorporated in the recommendations themselves.

1. It is recommended that steps be taken to establish a sub-Saharan Africa IPM Network (SSAIPMN) beginning with the establishment of sub-regional IPM networks for west and eastern Africa.

2. It is recommended that the IPM CRSP, in close consultation with other stakeholders such as ICIPE, take the lead in promoting the establishment of the proposed SSAIPMN.

3. All efforts should be made to find ways and means of implementing the proposed SSAIPMN in terms of structure, function, and funding (multi- and bi-lateral sources, national governments, and NGOs).

4. The SSAIPMN should encompass all disciplines relevant to IPM, such as entomology, plant pathology, weed science, crop improvement and management, and socio-economics.

5. Efforts should be made to take inventory of existing national, regional, and international IPM activities in Africa with focus on programs and principal actors.

6. In an effort to encourage IPM information sharing among networking members, steps should be taken to promote communication through various channels including electronic means, bulletins, meetings, workshops, and newsletters. Engage AfricaLink and Africa IPM-Link to facilitate electronic connectivity and communication.

7. The SSAIPMN should focus on strengthening inter-NARS collaboration in IPM, utilizing the comparative advantage of each participating NARS whenever possible. Parallel efforts should be made to strengthen national IPM programs.
8. It is recommended that African NARS intending to be members of the SSAIPNM should adopt IPM as part of their national agricultural development policy. The SSAIPMN should promote both technology generation and transfer.

9. Efforts should be made to promote collaboration among existing IPM projects/activities with interest in sub-Saharan Africa such as the NARS, IARCs, CRSPs, commodity research networks (sorghum, millet , maize, beans, potato, etc.), and NGOs.

10. Efforts should be made to establish regional priority pests for important crops in sub-Saharan Africa.

Workshop Program: IPM Networking in Sub-Saharan Africa

Monday, 14 October 1996

0800-0900		Registration - Headquarters, Institute of Agricultural Research (IAR)
Session 1.		**Opening Session** Chair: Dr. Getnet Gebeyehu Rapporteur: Dr. Tsedeke Abate
0900-0910	1.1	Welcome and Opening Address Dr. Tadesse Gebremedhin, General Manager, IAR
0910-0920	1.2	Purpose and Objectives of the Workshop Dr. Brhane Gebrekidan, Program Director, IPM CRSP
0920-0940	1.3	Overview of Crop Protection and IPM-Related Professional Societies in Ethiopia. Dr. Tsedeke Abate, Ethiopian National IPM Coordinator, IAR
0940-1000		Coffee Break
Session 2.		**Overview of IPM CRSP/ICN and Country Reports** Chair: Dr. Amadou Diarra Rapporteur: Dr. Habtu Assefa
1000-1030	2.1	Overview of IPM CRSP Global Activities and IPM Consultative Network (ICN). Dr. Brhane Gebrekidan
1030-1100	2.2	Ethiopia - Dr. Tsedeke Abate
1100-1130	2.3	Eritrea - Ato Mehari Tesfayohannes
1130-1200	2.4	Mali - Dr. Kadiatou Touré Gamby/ Dr. Amadou Diarra
1200-1230	2.5	Discussion
1230-1400		Lunch
1400-1430	2.6	Uganda - Dr. Sam Kyamanywa
1430-1500	2.7	Ghana - Dr. K. Afreh-Nuamah
1500-1530	2.8	Senegal - Dr. Mamadou Baldé
1530-1700	2.9	Discussion

Tuesday, 15 October 1996

Session 3.		**Description and Results of IPM Activities of CRSPs Working in Sub-Saharan Africa.** Chair: Dr. Sam Kyamanywa Rapporteur: Dr. K. Afreh-Nuamah
0830-0850	3.1	IPM CRSP - Dr. Mark Erbaugh
0850-0910	3.2	INTSORMIL - Dr. R. A. Frederiksen
0910-0940	3.3	USAID Africa Bureau Perspectives - Dr. Walter Knausenberger
0940-1010	3.4	Discussion
1010-1030		Coffee Break
Session 4.		**Description and Results of IPM Activities of IARCs working in Sub-Saharan Africa.** Chair: Dr. Amadou Diarra Rapporteur: Ato Mehari Tesfayohannes
1030-1050	4.1	GTZ - Dr. A.A. Seif
1050-1110	4.2	CIAT - Dr. J.K.O. Ampofo
1110-1130	4.3	ICIPE - Dr. W.A. Overholt
1130-1150	4.4	PAN Africa - Dr. Abou Thiam
1210-1230	4.5	Discussion
1230-1400		Lunch
Session 5. **1400-1500**		**Electronic Communication:** Prospects and Challenges for Electronic IPM Information Exchange and Networking for and in Sub-Saharan Africa. (AfricaLink/ICN/CICP) PADIS - Ato Kibru CICP - Dr. George Schaefers Africa IPM Link/IPM CRSP - Jean-Pierre Amirault
Session 6.		**Field Trip to IAR's Nazreth Research Center**
1530		(Leave for Nazreth and stay overnight.)

Wednesday, 16 October 1996

0800-1200	Visit Nazreth Research Station
1200-1300	Lunch
Session 7. **1300-1400**	**Panel Discussion:** • Prospects and Potentials of IPM Networking in Sub-Saharan Africa • Issues for Regional Collaboration • Needs for Strengthening National IPM Chair: Dr. Brhane Gebrekidan Rapporteur: Dr. Tsedeke Abate Panelists: NARSs - two representatives (Mali and Uganda) CRSPs - one representative (IPM) IARCs - one representative (CIAT)
Session 8. **1400-1500**	**Workshop Recommendations and Closing Remarks** Chair: Dr. Brhane Gebrekidan Rapporteur: Dr. Tsedeke Abate
1500	Leave Nazreth for Addis Ababa

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IPM Networking In Sub-Saharan Africa Workshop
14-16 October 1996, Addis Ababa / Nazreth Ethiopia

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