

**PROMOTION OF PRODUCTIVITY AND TRADE
OF FRUITS AND VEGETABLES
THROUGH MANAGEMENT OF AFRICA FRUIT FLIES (AFFI)**

Abstract

*The abstract should provide the following information:
the project title, the main research outcomes/impacts, the replicability perspectives (scaling-up/out) and
the overall context in which the research has been conducted
(geographical, political, socio-cultural and economic dimensions).*

In Africa horticulture is recognized as having the potential to become a major source of income for smallholders and various national development plans have accorded high priority to the development of these activities. However, the expansion of fruit production and export is greatly increasing the risk of transferring African fruit flies both within Africa and to other regions of the world; heavy fruit fly infestation seriously reduces the quantity of marketable fruit and increases production costs. In addition, the lack of local expertise, affordable technologies and adequate quarantine services for the management of fruit flies makes African fruit growers vulnerable to invasion by alien fruit flies from other tropical regions. The research project No. 426 “*Initiative to promote productivity and trade of fruits and vegetables through management of African fruit flies -AFFI-*” (phase I) was established to directly address the primary constraints in quality fruit production in Africa by providing suitable fruit fly management technologies and skills through extensive farmer training and local and regional capacity-building. The project through a phased programme of activities was involved in developing and testing, cost-effective and environmentally-friendly package of fruit fly control/management options. The initiative represented a unique multi-disciplinary and multi-institutional effort to develop, test and adapt fruit protection technologies for African fruit growers through applied/adaptive research. Research activities were conducted in benchmark sites in participating African countries in East, South, West and Central Africa where fruit flies are widespread and where there has been lack of substantial investments in fruit fly research and control techniques. Smallholder fruit growers in the selected localities are severely affected by fruit fly infestation and participatory field activities benefited the growers in all aspects of fruit fly management. The project registered significant impacts in aspects of human capital (e.g. increased knowledge and technical skills of local growers, scientists and students on bait-based techniques, marketing, post-harvest, quarantine strategies and fruit fly biology), social capital (e.g. stronger networking among NARS, research centers, NGOs, local producers and regional organizations) and natural capital (e.g. reduction of environmental degradation and increased diversification of agriculture production systems).

In 2003 IFAD and ICIPE launched the second phase of the project (AFFI phase two: Grant No. 653) with the aim of developing:

- IPM components for fruit fly management;
- Broader training, networking and local and national capacity-building for fruit fly management through the creation of national fruit fly team and Mobile fruit fly school in collaboration with relevant international quarantine and commodities bodies;
- Broader dissemination and commercialization of investigated techniques;
- On-farm technology demonstrations and technology evaluations.

**Main successful technical
components of the
research programme:**

- Description of the fruit fly pests profile in target African countries and assessment of yield loss caused by them
- Testing, development and adaptation of bait-based techniques for fruit fly management;
- Development of Biological Control Agents for fruit fly management;
- Development of quarantine sensitive tools – distribution maps, taxonomic keys;
- Smallholder assessment of fruit fly management packages;
- Post-harvest treatment and, quarantine awareness.

SECTION ONE: THE INSTITUTIONAL CONTEXT

The project within the IFAD context, relevance to/linkages with other IFAD programmes/initiatives, implementing partners and main activities carried out.

- Existing linkages with other IFAD initiatives:
 - Grants:
 - Grant No. 653 – ICIPE: *AFFI*, phase II.
 - Loans:
 - *Mara Region Farmer's Initiative Project*, Tanzania;
 - *Agricultural and Environmental Management Project*, Tanzania;
 - *Eastern Province Horticulture and Traditional Food Crops Project*, Kenya;
 - *Eastern Province Agriculture Development Programme*, Uganda.
- Target regions and implementing partners:
 - East/South Africa (Tanzania, Zanzibar, Kenya, Uganda, Namibia, South Africa) and West/Central Africa (Côte d'Ivoire, Nigeria).
 - ICIPE as the implementing institution, NARS (MOA, KARI, KEPHIS and HCDA NMK in Kenya, MOA and ARI in Tanzania, PPD in Zanzibar, MAFF, Uganda; CNRA in Côte d'Ivoire, IAR, Zaria-Nigeria; ARC and PPRI, South Africa) and Regional Organizations (IAPSC, TFNet and Intergovernmental subgroup on tropical fruit -FAO).

SECTION TWO : THE PROGRAMME IMPLEMENTATION

The research programme:

Description of the technology/participatory methodology/approach developed, costs of the inputs used to implement the research programme, rural areas and context where the research has been implemented (specifying environmental conditions)

- The research programme carried out during the first phase comprised a range of activities separated into four specific components mutually dependent and interlinked:
 - I. Development and adaptation of bait-based techniques for fruit fly management;
 - II. Development of biological control agents for fruit fly management;
 - III. Smallholder assessments of fruit fly management packages;
 - IV. Post-harvest and quarantine.
- The project activities had a strong capacity-building component and the specific technical object has been to introduce fruit fly management strategies which would allow growing quality fruits with no or only minimal pesticides use;
- The work has been implemented with the close participation of smallholder fruit producers and has focused on the adaptation of fly management options by combining elements that were not specific to only one species of fruit fly and thus suitable for other tropical regions. These elements included: baiting, physical protection of fruit, post-harvest treatments and preventing measures such as sanitation or quarantine systems;
- In the first phase, major research thrust comprised aspects of fruit fly biology relevant to technology understanding and development. Hence, a carefully focused study on fruit fly behavior, ecology, genetics, geographic distribution and host range were undertaken;

- Specific technical research activities included:
 - Analysis of the pest status, basic ecology and distribution of fruit flies in Africa and their response to selected standard lures;
 - Exploration for sources of new attractants for those African fruit flies which do not respond to the standard lures;
 - Development of simple methods for monitoring the target fruit flies on smallholder fields;
 - On-farm evaluation of food-based localized baiting stations for fruit fly suppression;
 - Development of biological control agents for fruit fly control (exploration and testing of pathogens for the control of pupariating larvae, adult fruit flies and new fruit fly parasitoids).
 - Characterization of the farming structure and fruit production patterns in selected trial sites;
 - Development of tools for Quarantine and IPM;
 - Establishment of Fruit fly colonies.

Although the technical packages and processes have been mainly focused on mango, it is expected that they will be adaptable to other fruit of direct relevance to African smallholders.

Target group and impact:

Description of the target group, the beneficiaries and the benefits and the main research outcomes/impacts (vulnerable groups, project impacts and effects on the human, social and natural capital).

- *Impacts on the human capital:*
- *Impacts on the social capital:*
- *Impacts on the natural capital:*

Project target group :

Producers, processors and marketers of fruits in Africa., NARS and quarantine specialists in target African countries

Impacts on the human capital:

- Increased knowledge of local producers on: bait-based techniques, post-harvest and quarantine strategies;
- Increased technical skills of regional scientists on fruit fly management;
- Increased scientific knowledge of students on fruit fly biology and management (6 PhD and several MS students have been trained).

Impacts on the social capital:

- Enhanced capacity of local institutions and regional policy-making bodies for improving fruit production, and access to lucrative exports market;
- Stronger networking among NARS, research centers, NGOs, local producers and regional organizations (i.e. for the first time the International Fruit Fly Symposium has been organized in Africa).

Impacts on the natural capital:

- Reduction in environmental degradation (mainly caused by the heavy reliance on pesticides);
- Increased diversification of agriculture production systems and strengthened marginal ecosystems;
- Improved production of fruit trees and better quality of fruit;
- Enhanced biodiversity.

The gender dimension:

Women's role in the research programme, impacts on the gender equity and women's empowerment.

- Horticultural crops are traditionally “women’s crops” in many countries (i.e. Tanzania, Kenya);
- The improved productivity and quality of fruit trees have led to an increase of women incomes;
- Incentives to expand production have been less where women did not control incomes from their activities.

Accessibility:

Identification of the physical availability of the research outputs in different time and places as well as their affordability by the rural poor.

- The costly chemical control measures commonly used by farmers before the AFFI programme have been substituted by more affordable techniques based on the bait-based technology and application of biological control being developed at benchmark sites
- Fruit flies database generated is easily accessible to any user in Africa or from any part of the world;
- Research outputs (publications, thesis, posters) from project Scientists and PhD students readily available for public access in various international journals and libraries in different parts of the world.

Constraints faced during the programme implementation:

Difficulties faced during the implementation of the research programme, specifying the internal (limited infrastructure, lack of inputs etc) and the external (socio-political and environmental aspects) constraints.

Constraints related to:

- *Internal conditions:*
- *External conditions:*

In multinational programmes, the progress made in each country heavily hinged upon the level of local commitment and specific constraints faced during the implementation activities. However the following general constraints have been identified:

Constraints related to the internal conditions:

- Difficulties in linking regional and national operations (except for the Zanzibar case)
- The perennial nature of the target crop - mango (e.g. seasonal fluctuation (high, low, and complete loss) in target countries affecting project operations)
- Lack of updated and detailed national and regional statistics (especially with regard to pest damage, export reject, trade, phytosanitary management);
- Initial lack of references materials for fruit flies identification and problems associated with outsourcing of experts.

Constraints related to the external conditions:

- Local political instability (especially in Côte d'Ivoire);
- High costs of inputs (baits have been imported);
- Inadequate infrastructures in phytosanitary management;
- Poor collaboration between national key players.

Institutional sustainability and degree of farmers' involvement in the research programme:

Underlying the degree of farmers' meaningful involvement in the definition and implementation of the main research steps/research process - which determines also the level of social and psychological acceptability- and explanation of the measures taken to support the institutional, organizational and professional changes at all levels.

- The programme has been conceived and executed as a network-based exercise, closely involving over 200 participants among farmers, technicians, students, scientists, policy makers and donors. The participants had broadly diverse cultural and institutional backgrounds, experiences, qualifications and expectations ensuring a dynamic exchange process at all levels;
- A broad AFFI network has been created comprising partners from the participating African countries at three different levels: smallholders, local technical staff and scientist and designed representatives from the local ministries of agriculture;
- At the community level, the social and psychological acceptability of the developed techniques has been enhanced by the farmers' involvement both in project formulation and execution (initial surveys investigating the socio-economical aspects of the fruit production in the smallholder communities have been done involving local growers). However there was an initial gap in the baseline knowledge about the key fruit fly pest across Africa due to the long neglect of fruit fly problems;
- In-depth analysis on the baiting stations have been carried out through a farmer-driven adaptation approach and a participatory evaluation process allowing participants to contribute to the overall research process;
- Adaptation and validation trials have been carried out by scientists and growers on small farmers' fields in typical African locations that could be also representative of other regions;
- On the basis of the network-based and collaborative approach, all participants in the local fruit production and export chain are now aware that without the implementation of appropriate fruit fly management techniques, the current share of the overall African fruit producers will be forced out of the European market.

Dissemination pathways:

Description of the ways through which the project results are made available at the village level and at the national/international level (workshops, reports, seminars etc).

- *The communication strategies at the village level:*
- *The communication strategies at the national and international level:*

The communication strategies at the village level:

- Farmer-to-farmer dissemination and demonstration plots;
- Local training and meetings;
- Informative tools describing the distribution, taxonomy and invasive potential of African fruit flies for fruit growers and quarantine agents.

The communication strategies at the national and international level:

- Publication of scientific papers, progress and final project reports;
- Organization of national and international conferences, seminars and workshops;
- Publication of PhD and M.S. theses;
- Web-based database for fruit fly pests that could be converted into posters.

Further research needs:

Identification of the new areas considered to be relevant and needed to be taken into account since they influence the adoption and/or the relevance of the research results (new problems or links not investigated by the research).

- Developing technologies based on locally available raw materials as alternative to imported baits that are effective, low-cost, profitable and sustainable for control of fruit flies, with minimal use of insecticides and minimal risk to health;
- Describing the role parasitoids in suppressing exotic fruit fly species;
- Develop post harvest treatment regimes/parameters for fruits and fruit flies (hot-water or cold treatment) to facilitate export to sensitive markets;
- Investigating the constraints (socioeconomic) that hamper improved control of fruit flies at the farm level optimising fruit fly management at farm and village level;
- Further testing and adaptation (improvement of formulation of local bait and pathogen and large-scale multilocational testing) before proceeding with the wider dissemination of fruit flies managements techniques;

- Generate eco- and mammalian toxicity data to move the pest management science (bait and pathogen) into commercialization path
- More efforts and cooperative spirits are needed from all partners in order to strengthen the synergies benefits arising from the close collaboration.

SECTION THREE: USEFUL INFORMATION

Vocabulary:

Fruit Flies: insects of major quarantine importance in agriculture often having negative effects on agriculture production (e.g. various species of fruit fly cause damage to fruit and to other plants).

BAT: Bait Application Technique using protein food bait, needed by the flies, mixed with a small amount of insecticide to attract and kill adults.

Keywords:

Fruit flies, horticulture, mango, bait-based techniques, pathogens, quarantine, diptera, fruit damaging insects.

Useful links:

www.icipe.org/research_areas/plant_health/index.html : ICIPE, research areas and AFFI

www.arc.agric.za/home.asp?PID=1&ToolID=63&ItemID=1794 : AFFI in Zanzibar

www.ippc.int: International Phytosanitary Portal

References:

Technical publications, project final report, scientific papers, Ph.D. and M.S. Theses - available at ICIPE and IFAD upon request.

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Acronyms:

International Centers:

- ICIPE: International Centre of Insect Physiology and Ecology
- IFAD: International Fund for Agricultural Development

NARS:

- ARI: Agricultural Research Institute, Tanzania
- CNRA: Centre national de recherche agricole, Côte d’Ivoire
- HCDA: Horticulture Crop Development Authority, Kenya
- KARI: Kenya Agricultural Research Institute
- KEPHIS: Kenya Plant Health Inspectorate Service
- PPD: Plant Protection Division, Zanzibar

Regional Organizations:

- IAPSC: InterAfrican PhytoSanitary Council
- TFNet: International Tropical Fruit Network