Distribution: Restricted **EB 98/64/R.25** 12 August 1998
Original: English **Agenda Item 10(a)** English

IFAD
INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT
Executive Board - Sixty-Fourth Session
Rome, 9-10 September 1998

REPORT AND RECOMMENDATION OF THE PRESIDENT

TO THE EXECUTIVE BOARD ON PROPOSED

TECHNICAL ASSISTANCE GRANTS

FOR

AGRICULTURAL RESEARCH AND TRAINING

BY

CGIAR-SUPPORTED INTERNATIONAL CENTRES

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CIP	International Potato Centre (*Centro Internacional de la Papa)*
CPL	Country programme leader
CGM	Cassava green mite (*Mononychellus tanajoa*)
DANIDA	Danish International Development Assistance
FFS	Farmers' field schools
FIDAMERICA	Interact-based System of Information Exchange for IFAD Programmes throughout Latin America
GILB	Global Initiative on Late Blight
GIS	Geographic information systems
IITA	International Institute of Tropical Agriculture
IPM	Integrated pest management
IPM-LB	Integrated pest management for potato late blight disease
LB	Potato late blight disease (*Phytophthora infestans)*
NARES	National agricultural research and extension systems
NGO	Non-governmental organization
TAG	Technical assistance grant
ToT	Training of trainers

REPORT AND RECOMMENDATION OF THE PRESIDENT OF IFAD TO THE EXECUTIVE BOARD ON PROPOSED TECHNICAL ASSISTANCE GRANTS FOR AGRICULTURAL RESEARCH AND TRAINING BY CGIAR-SUPPORTED INTERNATIONAL CENTRES

I submit the following Report and Recommendation on two proposed technical assistance grants for agricultural research and training to CGIAR-supported international centres in the amount of USD 2 550 000.

PART I - INTRODUCTION

1. This report recommends the provision of IFAD support to the research and training programmes of two supported international centres: the International Potato Centre (CIP) and the International Institute of Tropical Agriculture (IITA).

2. The documents of the technical assistance grants (TAGs) for approval by the Executive Board are contained in the annexes to this report:

I. The International Potato Centre (CIP): Integrated Management of Potato Late Blight Disease: Refining and Implementing Local Strategies through Farmers' Field Schools

II. The International Institute of Tropical Agriculture (IITA): Development and Application of a Biological Control Programme for the Cassava Green Mite in Africa

3. The objectives and content of these applied research programmes are in line with the evolving strategic objectives of IFAD, and the policy and criteria of its TAG programme for agricultural research and training.

4. The strategic objectives of IFAD's support for technology development relate to: (a) IFAD's target groups and their household food-security strategies, specifically in remote and marginalized agro-ecological areas; (b) technologies that build on traditional knowledge systems, are gender-responsive, and enhance and diversify the productive potential of resource-poor farming systems by improving productivity and addressing production bottlenecks; (c) access to productive assets (land and water, financial services, labour and technology, including indigenous technology) and sustainable and productive management of such resources; (d) a policy framework that provides the rural poor with an incentive to reach higher levels of productivity, thereby reducing their dependence on transfers; and (e) an institutional framework within which formal and informal, public and private-sector, local and national institutions provide services to the economically vulnerable, according to their comparative advantage. Within this framework, IFAD also intends to develop commodity-based approaches to rural poverty alleviation, specifically targeting those items that are produced and consumed by the rural poor. Finally, the establishment of a consolidated network for knowledge-gathering and dissemination will enhance the Fund's capacity to establish long-term strategic linkages with its development partners and to multiply the effect of its agricultural research and training programme.

5. The TAGs proposed in this document respond to the foregoing strategic objectives. (a) and (b), to the extent that they address important constraints on the productivity of resource-poor farming systems. They do so by promoting the development of economically viable and environmentally sustainable technologies to deal with serious pests that undermine production and the income levels of poor smallholders of such food-security crops as potatoes and cassava in marginal areas of all the developing regions of the world.

PART II - RECOMMENDATION

6. I recommend that the Executive Board approve the proposed technical assistance grants in terms of the following resolutions:

RESOLVED: that the Fund, in order to finance, in part, the Integrated Management of Potato Late Blight Disease: Refining and Implementing Local Strategies through Farmers' Field Schools, shall make a grant not exceeding one million fifty thousand United States dollars (USD 1 050 000) to the International Potato Centre (CIP) upon such terms and conditions as shall be substantially in accordance with the terms and conditions presented to the Executive Board in this Report and Recommendation of the President.

FURTHER RESOLVED: that the Fund, in order to finance, in part, the Development and Application of a Biological Control Programme for the Cassava Green Mite in Africa, shall make a grant not exceeding one million five hundred thousand United States dollars (USD 1 500 000) to the International Institute of Tropical Agriculture (IITA) upon such terms and conditions as shall be substantially in accordance with the terms and conditions presented to the Executive Board in this Report and Recommendation of the President.

Fawzi H. Al-Sultan
President

THE INTERNATIONAL POTATO CENTRE (CIP): INTEGRATED MANAGEMENT OF POTATO LATE BLIGHT DISEASE: REFINING AND IMPLEMENTING LOCAL STRATEGIES THROUGH FARMERS' FIELD SCHOOLS

I. BACKGROUND

1. Potatoes are the world's fourth most important food crop after wheat, rice and maize. The crop originated in the highland tropics of South America, where it has been a major staple for centuries. Over the past 30 years, new varieties with broader environmental adaptation have been identified and developed. The crop has been adopted as a "small-farmer crop" in many tropical and subtropical developing countries, initially in those with highland areas, but more recently at lower altitudes as well, as heat-tolerant varieties are developed. Since the early 1960s, the area planted to potatoes in developing countries has grown more than for any other major food crop (from 11 to 31%, to its current level of 85 million tonnes; production continues to grow at an annual rate of 3.6%). Today, potatoes play an important role in the daily nutrition of many poor farm families. In Bolivia, China, Ecuador, Nepal, Peru, Rwanda, per capita consumption of potatoes surpasses 200 kg/year. For these people, sustainable potato production is a key food-security issue. Potatoes have a high nutritional value, and the crop has tremendous yield potential: 50-60 tonnes per hectare are obtained under optimal management in Andean highlands.

2. Potato late blight (LB), which is caused by the fungus *Phytophthora infestans*, is the world's most important food-crop disease. In developing countries, annual losses from LB are estimated at USD 2.4 billion, and an additional USD 742 million is spent on fungicides. LB is a particularly important threat to food security in the potato-growing areas of the highland tropics and lowland subtropics of Asia, Africa and Latin America, mainly because resource-poor farmers have limited capacity to control the disease and because sources of infection are continuously present due to year-round potato cultivation and the presence of alternate hosts (solonaceous crops, such as tomato, peppers, etc.).

3. Very recently, new virulent strains of LB that are resistant to generally available fungicides are spreading around the world, and have already reached many developing countries. Their continued spread is almost inevitable and the International Potato Centre (CIP) has made the development of improved LB-management systems for developing countries a top priority. In this connection, it has organized the Global Initiative on Late Blight (GILB) to intensify efforts to control this devastating disease and develop integrated-pest-management (IPM) strategies for present and future pathogen populations in tropical and subtropical agro-ecosystems. To achieve this objective, and to develop and implement effective and environmentally sound crop-protection methods, stronger linkages need to be forged between researchers, extensionists and farmers. The proposed programme for integrated LB management based on refining and implementing local strategies through farmers' field schools would be an integral part of the GILB.

II. THE PROPOSED PROGRAMME

4. The overall objectives of the proposed three-year programme are to increase and stabilize potato production in developing countries and reduce the negative effects of pesticide dependency through the development and implementation of integrated methods for managing LB in tropical agro-ecosystems. Activities will be focused in Bangladesh, Bolivia, China, Ethiopia, Peru, Uganda – all important potato-producing countries, and all immediately vulnerable to LB – and will be linked to ongoing potato-development programmes in these and neighbouring potato-producing countries.

The programme will begin with a stakeholders workshop, which will be attended by personnel from IFAD and IFAD-financed projects, with a view to identifying such project areas as sites for field work. Once the sites for on-farm trials have been selected, the main thrust of the programme will begin: testing of resistant varieties, and development and/or adjustment of crop-production technologies and crop-development practices through on-farm activities with the participation of farmers. During this phase, farmers' practices and extension mechanisms will be studied with an eye to developing training methods and materials for facilitators and farmers, who will together participate in farmers' field schools (FFS). Monitoring and evaluation of the impact of LB and of the improved pest-management practices will be an ongoing activity throughout the life of the programme.

5. The proposed research programme will include the following activities:

Site selection, development of strategies for deployment of LB-resistant potato varieties and collection of baseline data

6. The stakeholders meeting, involving representatives of the national agricultural research and extension systems (NARES), will agree on locations for the integration and implementation studies, based on the importance of potato production for low-income farmers, the importance of LB as a constraint on potato production and food security, and the capacity of local extension services (government agencies and/or non-governmental organizations) to carry out IPM-LB activities. At the meeting, NARES representatives will describe the structure of their countries' potato seed system, and programme participants will discuss and refine strategies for the rapid deployment of resistant potato varieties through the various channels of the system, once they have been tested and proven. Farmers' needs will be assessed in order to allow for local adaptation of the IPM-LB strategy, and baseline data will be collected for impact assessment and cross-site comparisons. Information on farmers' conditions, knowledge, preferences and decision-making regarding varietal choices and disease management will be collected, using a standard set of variables for all sites. Participatory rural appraisals, surveys and direct observation are the methodologies that will be used.[1] Existing data from a study financed by the Organization of the Petroleum Exporting Countries (OPEC) will be complemented as necessary, and surveys will be initiated in Ethiopia and China. The incidence and severity of late blight disease, yield losses and fungicide use will be documented for the regions in which studies are conducted. This information will be collected and compiled by local partners in collaboration with CIP social scientists. Standardized disease-assessment techniques will permit comparisons across sites and seasons. The information needed for carrying out an in-depth cost/benefit analysis will be collected during the programme so that the analysis can be conducted during the final semester of the programme.

Tailoring of IPM-LB strategies to specific agro-ecosystems

7. The IPM-LB strategy will be tailored to the specific conditions of each potato production zone through the use of information technologies. Simulation modelling and geographic information systems (GIS) will be utilized, together with socio-economic data and other information, to determine which strategies are likely to be the most effective. Agro-ecological zones will be characterized using historical primary data on climate, altitude, soil etc. Climatic data will also be collected at each site throughout the course of the study. Crop and epidemic models coupled with GIS technology will be used to develop site-specific management strategies and cross-site comparisons of disease severity and epidemiology. The CIP and its partners will make testable estimates of the regional and global

[1] Baseline surveys are currently being conducted in Bangladesh, Bolivia, Ecuador, Peru and Uganda with the support of the OPEC Fund for International Development.

impact of IPM-LB strategies and component technologies as a tool for setting future research priorities.

Research and training through farmers' field schools (FFS), and farmer-driven research on the integration of disease management methods

8. Farmers will be encouraged to design their own studies for devising IPM-LB methods suited to local conditions and for selecting suitable varieties. On-farm trials by farmers will allow the technology to be tested in a wide range of environments, make for greater involvement of farmers in varietal selection, and provide a mechanism for the dissemination of desirable clones. During the first season of a two-season FFS, farmers will learn about experimental methods, conduct a series of experiments in plastic boxes, and perform a set of field experiments aimed at understanding and testing component technologies for IPM-LB. During the second season, the farmer groups will decide on a research agenda, and they will be encouraged to integrate the concepts learned during the first season into a local IPM-LB strategy through the design and conduct of on-farm trials. Farmers will be encouraged to exchange visits and ideas, and conduct further training. The results of farmer studies conducted in different locations will be compiled and exchanged. Farmer-based research will be complemented by on-station experiments run by national programme scientists and/or CIP researchers (but only where absolutely essential).

Use of LB training materials for farmers and extensionists

9. A "field guide" has been developed and tested for extension personnel involved with farmers' field schools, following models provided by successful IPM programmes. FFS facilitators will use these materials in the training programmes, which involve 13 half-day sessions. The farmers will conduct a set of field experiments and be involved in hands-on learning activities, including experiments (conducted in "humid chambers" -- disposable plastic boxes), discussions, observations and games. Other training materials include modules on: the pathogen and its life cycle; interaction of the environment and disease; components of disease management; the use of fungicides; varietal resistance; varietal evaluation; planting material ("seed"). These materials will provide farmers with sufficient knowledge to enable them to conduct experiments and develop their own integrated methodology.

Ensuring the availability of planting material

10. It will be necessary to multiply sufficient quantities of high-quality LB-resistant planting material for the on-farm testing programme. So that the work programme can start immediately, the first FFS cycle will be conducted using the genotypes available in each country. Meanwhile, the CIP will produce seed of LB-resistant genotypes suited to the conditions of each country and exchange elite resistant lines with breeding programmes in the participating countries. In order to make planting material of cultivars proven by the on-farm testing programme available at each representative site, seed-flow paths and seed replacement and multiplication methods will be analysed, and a strategy will be designed to maximize the penetration of resistant genotypes by means of both formal and informal systems. Earlier farmer access to new varieties during participatory on-farm trials within the FFS will facilitate the entry of resistant genotypes into informal seed systems and accelerate their dissemination.

III. EXPECTED OUTPUTS

11. The major outputs from the programme would be new potato cultivars with high and stable resistance to late blight disease and desirable agronomic qualities. Adoption of these cultivars would result in less crop loss, improved food security and less need for fungicides (with associated benefits

for farmers' and consumers' health, and lower production costs). Additional outputs would be an improved "menu" of component technologies for disease management (derived from on-farm testing with farmer collaboration) and documented farmers' knowledge, including perceptions of pest and disease management. Extension services would benefit by having personnel trained in FFS techniques and equipped with training materials, who would be ready to expand testing activities into new regions. The information on local formal and informal seed systems collected during the FFSs will result in strategies that will allow farm-tested LB-resistant cultivars to be further multiplied for use by farmers.

IV. IMPLEMENTATION ARRANGEMENTS

12. The implementing institution will be the International Potato Centre (CIP), which will have overall responsibility for all programme components. Field work will focus on selected countries in Asia (Bangladesh and China), eastern Africa (Ethiopia and Uganda) and South America (Bolivia and Peru). The programme will be coordinated by country programme leaders (CPLs) through a steering committee to be set up at the first stakeholders meeting. Each CPL will see to the programme's legal, technical and organizational needs in their respective countries in accordance with memoranda of understanding drawn up between the CIP and each cooperating institution and satisfactory to IFAD. CPLs will be selected in such a way as to represent a range of key disciplines in both the biological and the social sciences to ensure that the steering committee is broad-based. In China, the CIP will work with the Yunnan Normal University and Hebei Agricultural University (with which it has worked for a number of years), and in Bangladesh, it will work with the Bangladesh Agricultural Research Institute and the non-governmental organization (NGO) CARE. In Uganda, the CIP will work with the National Agricultural Research Organization and NGOs (Africare and CARE). In Ethiopia, the CIP will use its own locally-based outreach project and may link up with Sasakawa-Global 2000, an NGO that has an ongoing FFS programme there. In Peru, the CIP will work with the *Instituto Nacional de Investigaciones Agropecuarias* and CARE; in Bolivia, it will work with the *Instituto Boliviano de Tecnología Agropecuaria* and local NGOs. Links will be made with neighbouring countries so that secondary impacts can be developed as soon as cultivars and disease-management systems have been proven in the target countries. Secondary impact countries in Asia will be Laos, The Philippines and Viet Nam; in Africa, they will be Kenya and Rwanda; and in Latin America, Ecuador. Intersite collaboration will be fostered by the programme, so that the experience and expertise developed at each site can be made available to those working at other sites. Exchange visits by programme personnel, the sharing of reports, and similar activities will be an important aspect of the programme. Links will be established with IFAD-financed projects in the focus countries with a view to close collaboration; project staff will be invited to participate in the stakeholders workshop. Projects identified for such collaboration include the Agricultural Research and Training Project in Ethiopia, the Hoima-Kibaale District Development Support Programme in Uganda, the Smallholder Crop Improvement Project in Bangladesh, and the Northeast Sichuan and Quinghai/Haidong Integrated Agricultural Development Project in China. In Latin America, the programme will link up with FIDAMERICA so that information compiled by the programme can be disseminated rapidly to IFAD projects in the region. The CIP will be responsible for programme's, financial management including reporting. Grant expenditures will be audited as an integral part of the CIP's annual audit by its independent auditor.

V. PROGRAMME COSTS AND FINANCING

13. The total programme costs over the three-year implementation period are shown below. The budget will be finalized once the detailed work programme has been agreed upon at the stakeholders workshop.

Table 1: Indicative Budget for the Potato Late Blight Disease Programme

Item	Total
A. Staff	405 000
B. Travel	141 000
C. Supplies and small equipment	159 000
D. Planting material production	110 000
E. Workshops	53 000
F. Vehicles	70 000
G. Administrative support	112 000
TOTAL	**1 050 000**

ANNEX II

THE INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE (IITA): DEVELOPMENT AND APPLICATION OF A BIOLOGICAL CONTROL PROGRAMME FOR THE CASSAVA GREEN MITE IN AFRICA

I. BACKGROUND

1. Cassava is the dietary staple for over half a billion people in some of the world's poorest tropical and subtropical countries. In Africa alone, over 200 million people depend on this crop for food. Cassava's versatility in food uses and its adaptability to adverse environmental conditions make it an ideal "safety net" crop. However, cassava is threatened by a number of serious pests. In the early 1970s, an exotic pest – the cassava green mite (*Mononychellus tanajoa)* – was accidentally introduced from the Americas. This "spider mite" quickly spread throughout the cassava belt, infesting 27 countries in the sub-Sahelian region. By decimating cassava yields, it has become one of the most serious threats to the continent's food supply. Unfortunately, efforts to control the cassava green mite by chemical methods have proven futile.

2. In 1984, the International Centre for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA), with support from IFAD, initiated a search for natural enemies of this pest, and successfully identified ten promising species of predatory phytoseiids. In late 1993, a joint IITA/CIAT programme financed by IFAD, the United Nations Development Programme, Brazil, Denmark and Germany achieved biological control using the predator mite *Typhlodromalus aripo.* Following encouraging trials, the predator was released and produced up to a 50% reduction in pest populations, resulting in 30% increases in cassava yields in 11 African countries. As a consequence, with more cassava available for domestic consumption and sale, food and livelihood security has improved.

II. RATIONALE

3. Cassava is not only an important food-security crop for IFAD's target group, but it also has the potential for generating cash income for the rural poor, particularly women, through the small-scale processing and marketing of cassava products. This represents an important element of IFAD's strategy for rural poverty eradication and is consistent with the objectives of IFAD's Cassava Task Force, which is developing a global cassava development strategy. The global strategy builds on regional and individual country strategies and fully recognizes the need to support the development of effective, environmentally sustainable and cost-effective bio-control strategies to address specific pests, such as the cassava mealy bug and the cassava green mite (CGM). However, the green mite still infests the crops of millions of African farmers in countries where the predator has not yet been released, i.e., in eastern and southern Africa. Although the predator is effective, its natural rate of geographical propagation is too slow; to achieve comprehensive coverage of the cassava belt, it is necessary to expand the eradication programme by multiplying large numbers of predators and releasing them in new ecozones across the cassava belt. Local crop scientists, extensionists and farmers will be key participants in the programme to monitor the spread of the predator and confirm its efficacy. In the event that CGM control breaks down, the programme would review alternative approaches, such as testing other predators that have already shown themselves to be effective and possibly resuming the search for new predators in South America.

III. THE PROPOSED PROGRAMME

4. The three-year programme would represent a unique multi-disciplinary and multi-institutional effort to develop, test and adapt sustainable cassava-plant protection technologies. Strategic research thrusts would include the release of natural enemies, evaluation, and the simultaneous strengthening of indigenous knowledge systems. The programme will pursue classical biological control of CGM and enhance national capacity in the area of biological control. The primary biological agents would be phytoseiid predator species that has been successful in some parts of western Africa and newly introduced phytoseiid mites, which are adapted to highland and dry conditions such as those that occur in parts of Kenya, Malawi, Rwanda, The United Republic of Tanzania and north-western Zambia. The programme would also measure the impact on production by means of appropriate studies, including a measurement of the reduction in production losses attributable to programme-developed technologies. The overriding objective is, therefore, to increase the productivity of small-scale cassava production systems in Africa. The specific objectives of the programme are to: (i) establish a programme to release and monitor proven exotic natural enemies that are adapted to the dry savannah and mid-altitude ecozones of Africa; (ii) integrate farmer participation into research and implementation of CGM biological control through farmers' field schools for bio-control research; and (iii) create national capacity for full deployment of biological control technology such means as by establishing links with IFAD-financed investment projects targeting producers of CGM-infested cassava.

5. These objectives translate into the following five components:

Natural-enemy propagation and multiplication

6. The predator *T. aripo* is able to establish itself and multiply in the field with minimum effort. However, to achieve this, a source population must be present. IITA will provide source populations of *T. aripo* to establish cultures at the national level to be used for initial releases. Later, in-field multiplication sites would be established with participating farmers and would become the primary foci from which the predators would spread. Other promising phytoseiids (*T. manihoti* and *N. idaeus)* or other newly found promising phytoseiids, particularly those adapted to highland and dry conditions, will also be provided for in-country multiplication. The IITA-developed cassava-tree and tunnel production technologies that will be needed in order to maintain and mass produce the phytoseiids under the biological control campaign will be introduced into participating countries.

Natural-enemy release and monitoring

7. From the in-field multiplication sites, *T. aripo* will be distributed by collecting and transferring predator-infested shoot tips to CGM-infested fields in the rain forest, transition forest and moist savannah ecozones. In the transition and rain-forest ecozones, *T. manihoti* will be released. Depending on local ecological conditions, the programme will also release, on an experimental basis, other phytoseiid species and strains that are adapted to semi-arid and mid-altitude subtropical ecozones. A minimum of three sites per species, each with three release fields, will be targeted per ecozone during each year of the release programme. A minimum of 5 000 adult female phytoseiids per species will be released in these fields at the beginning either of the dry or the wet season, when CGM densities are highest. Farmers will make further releases of *T. aripo* from FFS-managed multiplication sites. The release fields and the surrounding areas will be monitored for the establishment and spread of the exotic predators at three-month intervals during the release period. Once the natural enemies are established locally, dispersal will be determined by monitoring the movement of exotic phytoseiids in at least three directions away from the original sites. The area covered by the dispersal surveys will depend on the extent of the predator's spread.

Farmer participation

8. Farmer groups, with their associated extension agents, will be trained to handle, propagate, manage and monitor phytoseiid populations and to conduct experiments to generate information on the impact that production practices have on CGM biological control. Farmer training will be preceded by in-country training-of-trainers (ToT) workshops emphasizing participatory learning processes whereby subject matter specialists will provide participants with technical knowledge and facilitation skills on CGM biological control in order to understand the organization and functioning of farmer groups. A second set of ToT workshops will be conducted to enable extension trainers/facilitators to locally produce didactic training/extension materials specific to CGM biological-control training and extension. Through action learning and research at FFSs, the programme will enable farmers to better understand the dynamics of CGM as a cassava-production constraint, undertake biological control interventions, and catalogue related indigenous knowledge/practices in order to grow a healthy cassava crop. The programme will establish at least five FFSs per country. FFS training, which will encourage the participation of women farmers, will last two cropping cycles and will centre on farmer experiments under the immediate guidance of trainers/facilitators trained at ToT workshops. FFS experiments will focus largely on the effects of production practices on the efficiency of phytoseiid natural enemies. In collaboration with the INADES Foundation (an international NGO), FFS farmers will be linked through a national and regional farmers network for the exchange of ideas, practices and experience with biological control in different localities. In response to the need to release *T. aripo* over large areas in a short time, farmer-managed in-field phytoseiid multiplication sites will be established at many FFS villages. These sites will be established with natural-enemy specimens from national insectary cultures and in-field multiplication, and will provide source populations for farmers to spread these natural enemies over large and diverse areas in a short time.

Human resource development

9. Since most national programmes are insufficiently staffed, trained and funded to implement classical biological control of CGM, the present programme would give the appropriate assistance and training. Developing the necessary human resources in sufficient quantities will be the key to an efficient and effective programme for the production, release and distribution of natural enemies. In-country, group, bench and post-graduate training will be provided in order to enhance national capacity for handling, monitoring, managing and evaluating natural enemies of the cassava green mite. For post-graduate training, a series of research topics concerning natural-enemy selection, dispersal, mechanisms of pest regulation, and single vs. multiple introductions have already been proposed. These topics will also form the basis of collaborative research topics, where feasible, with participating NARES scientists.

Impact evaluation

10. The impact of exotic phytoseiids will be measured in different areas as efforts are made to distribute these predators in new ecozones, countries and regions. The regulatory ability of exotic natural enemies will be evaluated by monitoring their establishment and spread, and by comparing the population dynamics of the pest and the production of cassava in fields in targeted ecological zones where exotic natural enemies were present with fields that were free of them. Population-dynamics studies will be conducted in one representative field per natural-enemy species in each ecozone and will include indigenous natural enemies. Before-and-after comparisons will provide the basis for economic cost/benefit analysis. Chemical exclusion will also be used to determine predator impact on CGM densities where the predators have been established for at least one year.

IV. EXPECTED OUTPUTS

11. The most tangible outputs, which would also benefit neighbouring countries, will be lower numbers of mite pests, increased cassava yields (by one third) with enhanced food security, improved incomes (by USD 100 per ha of production per crop cycle), and sounder marginal ecosystems. The increased biological-control capacity acquired by national programmes could be applied in tackling similar crop-pest problems in the future.

V. IMPLEMENTATION ARRANGEMENTS

7. IITA would be in charge of overall programme coordination in Africa, working closely with NARES, regional research bodies and other interested organizations. Programme implementation will be preceded by a stakeholder participatory workshop to discuss and finalize work plans in consultation with key implementing partners. IFAD-funded projects would be included in the programme as sites for field-level multiplication, release and monitoring. The North-Western Province Area Development Project in Zambia would be a particularly important collaborator, since the programme covers an area where *T. aripo* is at the frontier of its environmental adaptation. Hence, monitoring of the species' establishment, rate of spread, and efficacy will be particularly important. IITA will be responsible for the programme's financial management, including reporting. Grant expenditures will be audited as an integral part of IITA's annual audit by its independent auditor.

VI. PROGRAMME COSTS AND FINANCING

8. The total cost of the programme is estimated at USD 4 074 000. The programme is being cofinanced by the Danish International Development Assistance (DANIDA), which will provide approximately USD 2.25 million, and by local contributions from the governments of participating countries. Most of the local contributions will be made in-kind in the form of salaries and expenses of collaborating scientists and extension workers (see Table 1). IFAD's contribution would total USD 1.5 million, to be allocated as outlined in Table 2. Costs will be defined in greater detail at a participatory workshop during which a refined work plan for each participating country will be prepared and agreed upon by the respective parties.

Table 1: Financing Plan
(USD '000)

	Source of Funds			
Item	**IFAD**	**DANIDA**	**Country Contribution (including in-kind)**	**Total**
A. Research	0	535		535
B. Regional activities	840	304		1 144
C. In-country activities				
- Western Africa	0	854	180	1 034
- Eastern and Southern Africa	340	0	144	484
D. Central services and overhead:				
- IITA	150	156		306
- NARES	20	31		51
E. Capital	150	370		520
TOTAL	**1 500**	**2 250**	**324**	**4 074**

ANNEX II

Table 2: Proposed Budget for IFAD Funds
(USD '000)

Item	Regional	In-Country	Total
Personnel	370	0	370
Supplies, expenses	60	100	160
Travel	40	10	50
Research materials Natural-enemy production and release	120	80	200
Training	150	150	300
Res. monitoring/evaluation	100	0	100
Vehicles and equipment	30	120	150
Central services and administrative overhead	155	15	170
TOTAL	**1 025**	**475**	**1 500**