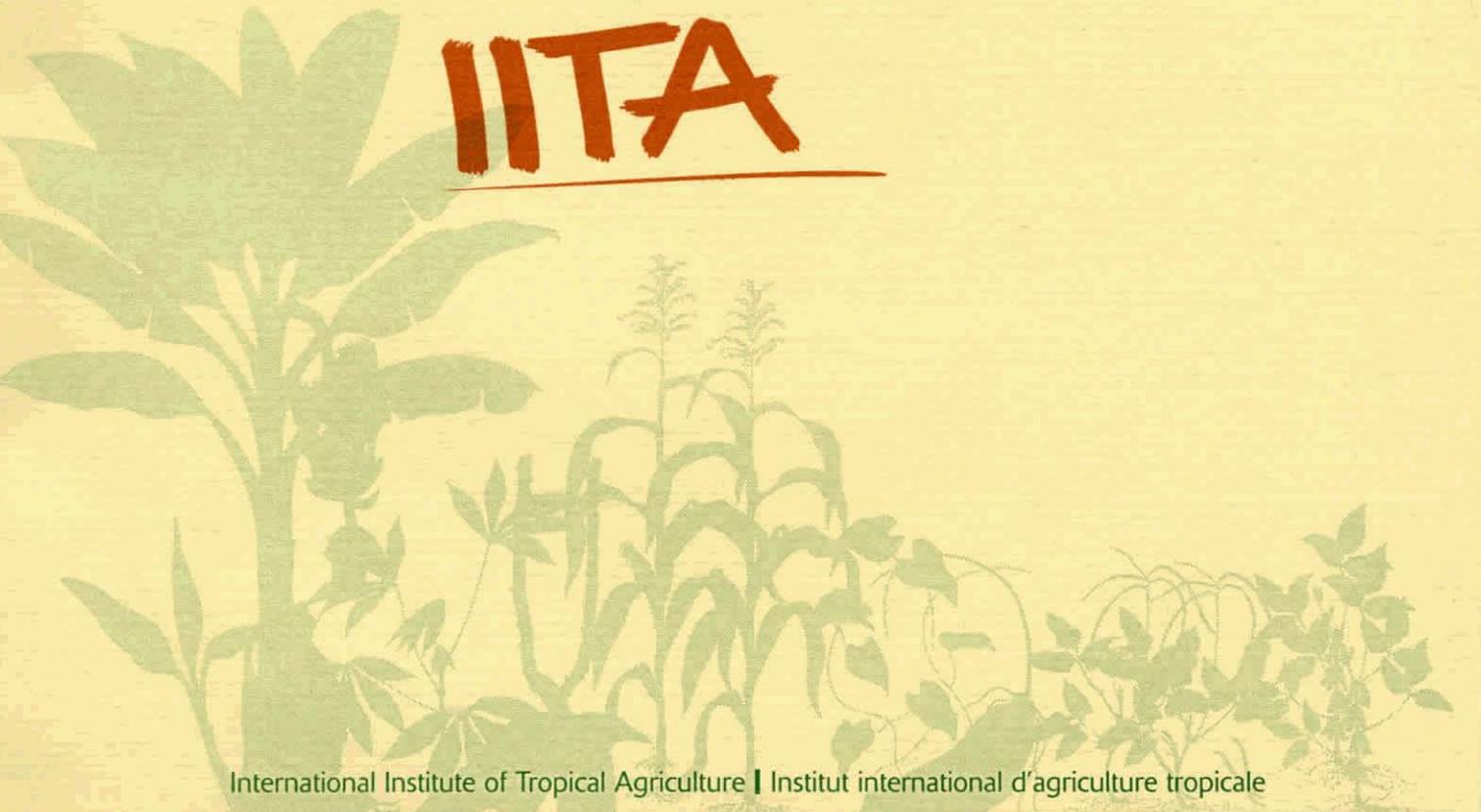


Research to Nourish Africa

Overview of the
2003–2005 Medium-term Plan



IITA



International Institute of Tropical Agriculture | Institut international d'agriculture tropicale

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Overview of the 2003–2005 Medium-term Plan



International Institute of Tropical Agriculture

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Delivering the African agricultural development potential: the IITA vision and strategic plan for 2001–2010

Discussions on the future of the CGIAR advanced during the annual general meeting (AGM) held in Washington, DC, in October 2001. As a consequence, the Board approved the publication, towards the end of 2001, of the IITA Strategic Plan 2001–2010 entitled “Delivering the African agricultural development potential: the IITA vision.” This Strategic Plan takes as its starting point the strategies and priorities for regional research and collaboration of the three subregional organizations of SSA: CORAF/WECARD (le Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles), ASARECA (Association for Strengthening Agricultural Research in East and Central Africa), and SACCAR (Southern Africa Centre for Cooperation in Agricultural Research).

The Strategic Plan acknowledges that IITA’s comparative advantage lies in its proven ability to develop and deliver technological options to improve food systems that can be specifically directed to the assistance of the rural poor. The strategy calls for the employment of suitable environmental health and poverty indicators. Moreover, since IITA continues to be committed to a systems approach, these indicators will be supplemented with additional subjective indicators determined together with farmers and other clients of research. These will attempt to capture improvement in rural livelihoods, including that of women and children, gained as a result of the technological options offered by IITA and its partners. Such indicators are increasingly reflected in the revised milestones of the modified project portfolio outlined below and summarized in Annex 2.

The research agenda will continue to focus on sustainable production and utilization increases in SSA, together with the diversification and increased commercialization of farming and agroindustrial enterprises. While maintaining a primary focus on key food crops, this will require IITA to pay increased attention to the totality of farming systems prevailing in the different agroecologies and including the role of cash crops within them. With an increased focus on poverty alleviation and reduction, greater emphasis will also be placed on market analysis within a food systems approach to ensure responsiveness to changing demands from the rural, urban, and expanding commercial sectors. The strategy also requires IITA to take advantage of “new” science, particularly in the areas of biotechnology and information technology, both through increased in-house capacity and through expanded partnerships in the implementation of its research agenda.

The IITA research agenda: consolidation and a revised project portfolio

In 2001, IITA examined practical options for implementing the Strategic Plan 2001–2010. It reviewed its research agenda; its compartmentalization into projects, the structure needed to manage these projects and the decentralized stations of the Institute. This exercise considered feedback received from both staff and the External Program and Management Review (EPMR), which had been completed earlier in 2001. These included the need to strengthen the agroecological zone approach as put forward in the Strategic Plan, to simplify the structure and so reduce, to the extent possible, the involvement of scientists in administrative and managerial tasks.

IITA reaffirmed that the research agenda should be driven by the needs of the agroecologies that it serves together with needed science driven research and training

balanced against the human and financial resources available for the implementation of the agenda. Note was thus taken of the anticipated human and financial resources available to the Institute for 2002 and beyond.

Based on such considerations and the evolving strategic issues related to agricultural research and development in SSA that were identified and articulated in the strategic plan, the following consolidation of the research projects was proposed:

Compartmentalization of the research agenda into projects

1. Disciplinary projects

- A. Preserving and enhancing germplasm and agrobiodiversity with conventional and biotechnological tools.
- B. Developing biologically-based pest, disease, and weed management options and conserving biodiversity for sustainable agriculture.
- C. Assessing impact, formulating policy options, and systems analysis.

2. Agroecological zone projects

- D. Promoting income generation and food security through enterprise development and sustainable production of starchy and grain staples in eastern and southern Africa.
- E. A Future through farming: enhancing livelihoods, improving the resource base and protecting the environment through starchy staple, peri-urban and tree crop systems of the humid and subhumid zones of West and Central Africa.
- F. Intensifying grain-based systems in the West African savanna for improved food security, income generation, and livelihoods.

To create the interdisciplinarity in the project teams needed to implement the three agroecological zone projects (D, E, and F), it was proposed that these be supported by staff from the relevant IITA stations as follows:

- D. Starchy and grain staples in Eastern and Southern Africa: *Uganda*—Eastern & Southern Africa Regional Center (ESARC); *Malawi, Mozambique, and Tanzania*—Southern African Root and Tuber Regional Research Network (SARRNET); *Kenya*—International Livestock Research Institute (ILRI) (High Throughput) Genomics Laboratory (through a CGIAR joint staff appointment); *Nigeria*—Ibadan; and *Benin*—Biological Control Center for Africa (BCCA).
- E. Starchy staple, peri-urban and tree crop systems of the humid and subhumid zones of West and Central Africa: *Cameroon*—Humid Forest Ecoregional Center (HFC), also the “home” of the Sustainable Tree Crops Program—STCP); *Nigeria*—Onne, Abuja, and Ibadan; and *Benin*—BCCA.
- F. Grain-based systems in the West African savanna: *Nigeria*—Kano, Abuja, and Ibadan; *Benin*—BCCA; *Côte d’Ivoire*—West and Central Africa Collaborative Maize Research Network (WECAMAN); *Ghana*—West Africa Seed Network (WASNET) and IITA/GTZ West Africa Seed Development Unit (WASDU).

The Program Committee of the BOT discussed these proposals at length. The BOT endorsed the overall direction and recommended that the proposals be further examined and elaborated upon by all staff during Work Planning Week (WPW). Scientists attending WPW for 2002 held in November/December 2001, discussed and refined the proposed project portfolio and after agreeing on the compartmentalisation of the research agenda into six new projects, prioritized project outputs and activities and prepared project summaries (Annex 2).

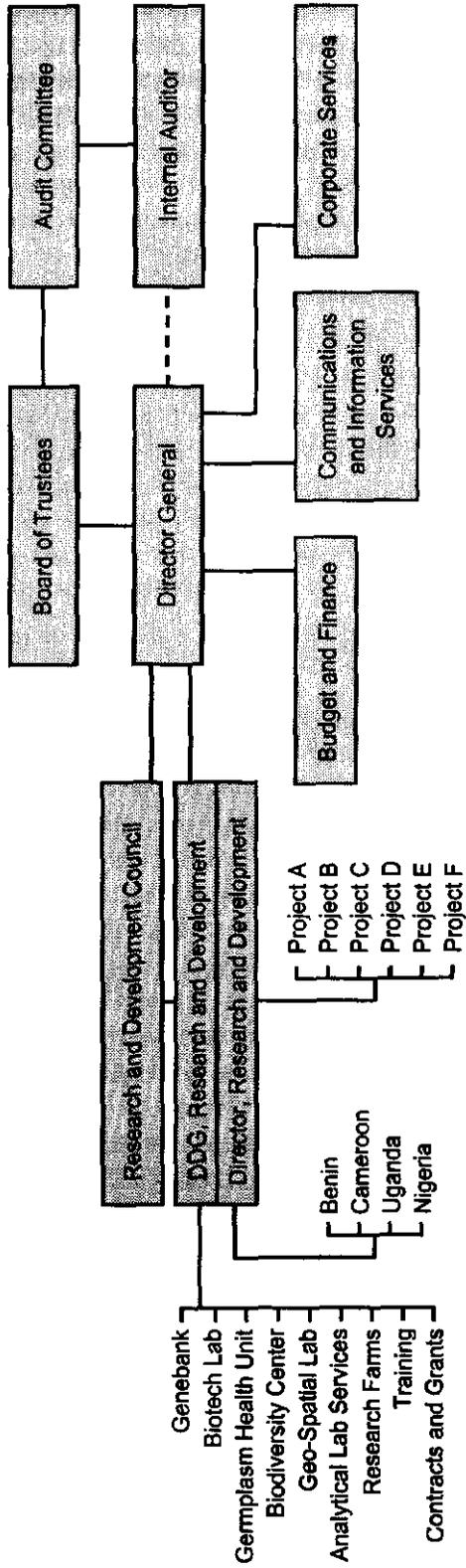
The future

These changes in the project portfolio enable a market/demand driven approach to be followed in all projects and an INRM approach specifically in Projects D, E, and F, linked where applicable to the use of new science. This also means that added attention can be paid to the quality and quantity of crops and products in an increased effort to assist in the further commercialization of agriculture as a viable means of alleviating poverty. Further commercialization of agriculture will require added attention to marketing and agroprocessing. To facilitate and stimulate the expansion of agro-industries, competitive raw materials (crops) must be produced and supported by increased research efforts on all aspects of production and productivity. Policy research, institutional reform and business development will also need to become an integral part of the research for development agenda.

Attention to food and product quality will, in addition to some of the antinutritional and postharvest aspects which the Institute is currently researching, include aspects of vitamin and micronutrient content and will strengthen necessary linkages between agriculture, human nutrition, and human health which the Institute wishes to explore further. Increased understanding of and involvement in the links between agriculture, human nutrition, and health, together with continued concerns over the social organization and availability of labor will provide the entry points to interact with malaria and HIV/AIDS prevention initiatives across sub-Saharan Africa (SSA). The Institute, in collaboration with others, will also continue to analyze the potential effects of climate change on agriculture. A large proportion of IITA's research agenda is directed towards generating a range of options for farmer adaptation and adoption that are likely to contribute to their capabilities to cope with the possible negative effects of climate change in the different agroecologies of SSA. The ability of farmers to cope with climate change will require the support of plant breeders, and scientists of other disciplines, who will continue to exploit biotechnological tools in support of more conventional plant breeding activities. IITA will, during this Medium-term Plan, increase its own research capacity in selected aspects of biotechnology and further strengthen relevant linkages with others. As the current lead institution in the Systemwide Program on Integrated Pest Management, IITA will continue to strengthen its plant health management capacities by developing synergies with other centers and international institutions, fully aware that the solutions to many pest problems can only be found through a global approach.

These more comprehensive approaches to responding to the agricultural research needs in SSA should help the agriculture sector to better contribute to economic and social development in SSA. Also, and by pursuing these new approaches through the revised project portfolio, IITA considers that it is well placed to fully participate in the development and implementation of those CGIAR Challenge Programs that will be relevant to the priority needs of agricultural research for development in SSA.

IITA Organogram (as of 1 December 2002)



The new research management arrangement

IITA has operated since 10 July 2002 with a new organogram, which reflects the new management style of the Institute. The Research & Development Council (RDC) represents the highest research-for-development ideals of IITA and serves to guard its scientific and programmatic quality across the Institute. The RDC—with 3 members elected by peers and 2 members appointed by management (including the Deputy-Director General, Research for Development, who acts as the RDC chair)—does not include specific representation of any agroecological zone or project because it strives to be more forward looking, concentrating on quality of science issues, broad institutional research-for-development strategies, and competitiveness. Furthermore, the new RDC ensures quality, advices on tactical directions, and helps scientists identify relevant funding sources.

Research at IITA is now being implemented through these six projects. Special projects financed through restricted core contributions are assigned to one or more of the six projects.

In the new research management arrangement, the six project coordinators, who are elected by project members, provide research leadership and assist in mentoring researchers, particularly the young ones, within the projects they are coordinating. Researchers within the six projects benefit from frequent interactions with their respective project coordinators, who as research leaders, provide guidance in research methods and ensure project colleagues publish high quality articles or disseminate easily, timely research results and other information to the broad range of clients IITA serves in Africa: farmers, entrepreneurs, and end-users, as well as other stakeholders and development investors of the Institute. Also, the project coordinators assist, together with RDC and the Contracts and Grant Office, project members by suggesting sources of funding for their project ideas. The project coordinators, who now report—through the Director Research for Development (R for D)—to the RDC, assist the Director General, RDC councilors, and R for D managers to accomplish competitiveness in the evolving environment in which they work, regional presence through networks and multi-country projects in sub-Saharan Africa, improved performance within IITA and while interacting with partners elsewhere, public awareness of IITA impact in rural development (together with Communications and Information Services, CIS), plus intelligence and marketing network in Africa.

The six projects group staff according to the project in which they do most of their R&D work. Staff can participate in other projects but this grouping appears most appropriate to help the project coordinators provide research leadership, mentoring, and monitoring, and to appraise for their work in R for D.

All IITA staff working on R for D report to their respective project coordinators, while for administrative purposes, they report to the officers in charge of their station as follows:

- Officer in Charge (OiC), BCCA if working in Benin Republic (i.e., West Africa)
- OiC, HFC if working in Cameroon or STCP and soon in Democratic Republic of Congo (i.e., Central Africa).
- OiC, ESARC if working in Malawi, Mozambique, Tanzania, Uganda and soon in Kenya (i.e., Eastern and Southern Africa).
- Director Research & Development if working in Nigeria, Côte d'Ivoire (WECA-MAN), and Ghana (WASDU, WASNET) (i.e., Nigeria and regional networks or projects within CORAF/WECARD).

Human resources, decentralization/ecoregionality

Human resource needs

The human resources available to implement the 2003–2005 MTP are based on actual staffing levels in 2002, which are lower than those anticipated in the 2002–2004 MTP. Given the current financial climate, it is difficult to predict the financial status of the Institute in 2005 and hence this plan is based on a static staffing level. Any staff increase that would allow for either an expansion of or acceleration in the implementation of this plan is likely to come from additional restricted core funding which the Institute will continue to actively seek.

The actual staffing levels in 2002, and those available for the implementation of this plan, consist of a total of 101.3 international staff years comprising 48.3 unrestricted core financed positions, complemented by an additional 18.9 positions funded from restricted core contributions, plus a total of about 34.1 postdoctoral fellows, visiting scientists and associate professionals. This compares with the total of 117 international staff, comprising 55.75 unrestricted core financed position, 25.5 positions funded from restricted core contributions and a total of 35 postdoctoral fellows, visiting scientists and associated professionals available in 2001.

The staffing levels for 2003 through 2005 are anticipated to continue at about 33 unrestricted core financed scientists, between 20 and 26 scientists funded from restricted core contributions, supported by 15 research support and administrative core staff, and about 40 postdoctoral fellows, visiting scientists, and associate scientists.

Decentralization/ecoregionality

To fully implement the IITA strategy for 2001–2010 and the 2003–2005 MTP research agenda it will be necessary for IITA to continue to refocus its decentralized approach around the disciplinary needs of the selected agroecological zones and the corresponding projects. Thus at the IITA stations supporting the different projects, as listed above, a disciplinary mix will need to be maintained/adjusted so as to respond to the

International staff positions 2001–2005.

	Past 2001	Current 2002	Plant 2003	Plan + 1 2004	Plan + 2 2005
Scientists					
Unrestricted core	35.25	33.1	33	33	33
Restricted core	25.5	18.9	25.5	22.2	20.2
Sub-total	60.75	52	58.5	55.2	53.2
Research support and administration (core)	20.5	15.2	15	15	15
Postdocs, visiting scientists, and associate professionals	35.75	34.1	41.4	37.1	36.1
Total, international staff	117	101.3	114.9	107.3	104.3

research needs of the respective agroecological zones and to undertake the prioritized project activities. A nucleus of IITA international staff will be complemented/strengthened with IITA nationally recruited technical staff and with staff from NARS and other collaborating partners so as to cover the range of disciplines required and to establish a critical mass for the ecoregional teams.

Financial highlights

Project cost components

The proposed expenditure budget for 2003 is US\$35.745 million, of which US\$20.481 million is projected to come from targeted funds. Pressure on unrestricted operations has continued since 1996, with donor funds dropping from US\$13–14 million to the US\$10 million range. This situation will continue through 2002 and 2003 (Table 7, Annex 3) unless additional funds are forthcoming.

Project costs are made up of two essential components, direct and indirect support costs (as shown on Table 3, Annex 3). The latter includes an allocation for administration and depreciation. Direct costs of projects are based on actual costs incurred including staff time attributed to each.

IITA's standard overhead rate for targeted projects is 22.8%. The 2002 budget for external overhead stands at US\$1.600 million, which if calculated on the entire targeted budget equates to only 8.7%. The same situation exists for 2003, with overhead budgeted at US\$1.7 million.

In-kind contributions to IITA include cost of French scientists seconded to the Institute. IITA has an increasing number of joint venture/cost sharing arrangements, with costs of two scientists being split between ILRI and NRI on one hand and IITA on the other. In addition, junior professional officers from Denmark (2), Belgium (4), Italy (1), Germany (1), Sweden (1), and the Netherlands (2) are strengthening the Institute's research capacity.

Minor inflation factors have been included in our estimates for 2002, with any additional cost increases precipitating a reduction in ongoing activities. The expectation in Nigeria is currently that the naira will remain at between 115 and 118 naira per dollar, and for francophone countries, IITA has used an exchange rate of 720 CFA per dollar. For 2002, and beyond, we have included inflation at roughly 6% on total staff costs, 5% on general services, 3% on supplies, 5% on operational travel and finance costs, and 8% on training.

Financial indicators and capital investments

Ratios

The IITA operating fund decreased to US\$4.691 million at 2001 year-end (audited), resulting from a deficit of US\$1.486 million in 2001. The cash position remained strong due to early disbursement of the World Bank contribution, and continued receipt of payments in advance for targeted activities.

The current estimate for the 2002 financial year is a deficit of US\$2.536 million, and US\$1.822 million for 2003. The various tables in this document have been prepared using a cost estimate of US\$35.745 million for 2003. Projection on the *status quo* based on the present cost estimates are as follows:

The current trend of deficit spending will continue beyond 2003. IITA Management will implement a fund raising strategy to address the deficit issue and implement a cost reduction plan. The plan calls for streamlining operations in support services with minimum impact on the quality of work of research activities. Though the plan addresses the reduction of the Institute's budget deficit in 2002 and 2003, it calls for

stabilisation of our operations in 2004 and beyond. IITA will continue to explore cost savings in 2003 and beyond to achieve a balanced budget in 2005.

Capital budget

IITA continues to limit capital spending, to amounts less than anticipated depreciation charges for each year in the plan. IITA has fully implemented the revised CGIAR accounting policies and reporting practices.

Working Capital

	(\$000's)					
	2000	2001	Estimate			
	Actual	Actual	2002	2003	2004	2005
Current Assets	25,334	23,317	20,838	18,866	16,220	15,089
Current Liabilities	13,237	13,065	15,550	15,400	15,400	17,922
Working Capital	12,097	10,252	5,288	3,466	820	(2,833)
Working Capital - Days	149	110	61	38	9	(30)

Operating Fund

	(\$000's)					
	2000	2001	Estimate			
	Actual	Actual	2002	2003	2004	2005
Fund at 1 January	6,006	6,177	4,691	2,155	333	(2,313)
Surplus (Deficit)	171	(1,486)	(2,536)	(1,822)	(2,646)	(3,653)
Prior period adjustment	-	-	-	-	-	-
Operating Fund 31 December	6,177	4,691	2,155	333	(2,313)	(5,966)
Operating Fund - Days	76	50	25	4	(25)	(64)

**Capital Fund and Depreciation
(Unrestricted Core Only)**

	(\$000's)					
	2000	2001	Estimate			
	Actual	Actual	2002	2003	2004	2005
Capital Expenditure [†]	1,801	2,399	4,428	2,000	2,000	2,000
Depreciation Charge	2,418	2,015	2,000	2,000	2,000	2,000
Net difference into Capital Fund	617	(384)	(2,428)	-	-	-
Other Increase (Decrease)	135	25	-	-	-	-
Prior Period Adjustment	-	-	-	-	-	-
Capital Fund Balance at Year End*	5,920	5,561	3,133	3,133	3,133	3,133

[†]Excludes Commitments.

Capital Invested in Fixed Assets

	(\$000's)					
	2000	2001	Estimate			
	Actual	[‡] Actual	2002	2003	2004	2005
Fixed Assets (beginning of the year)						
Cost	76,145	37,929	39,849	44,277	46,277	48,277
Accum. Depreciation	(45,571)	(30,783)	(32,344)	(34,344)	(36,344)	(38,344)
Net	30,574	7,146	6,801	9,229	9,229	9,229
Acquisitions (Note 1)	1,801	2,399	4,428	2,000	2,000	2,000
Disposals	(988)	(479)	-	-	-	-
Depreciation Charge (Note 2)	(1,513)	(1,561)	(2,000)	(2,000)	(2,000)	(2,000)
Write-off	(22,728)	(704)				
Net Fixed Assets (end of the year)	7,146	6,801	9,229	9,229	9,229	9,229

[‡]Audited figures.

Notes:

1. Acquisitions exclude commitments.
2. Calculated at varying rates per asset category, net of disposals.

Summary of 2001 research results

Project 1. Conservation and use of genetic biodiversity

A core collection of cowpea comprising 1926 accessions which are representative of morphological diversity and geographical origin was selected from over 12 000 accessions of the world cowpea collection.

One hundred and twenty seven local cultivars of cassava and 44 yam cultivars were collected in Sierra Leone, and added to the IITA germplasm collection.

Experiments on cryopreservation of cassava shoot-tips, using encapsulation-vitrification and fast freezing method, gave recovery rates of about 60% in certain genotypes.

Studies on population growth and stability of in situ wild yam populations in a forest reserve in Ibadan, monitored over a 3-year period, showed a slight increase in population sizes, but no significant change in the gene frequency of selected morphological markers.

Studies on segregation patterns of mutants in crosses between cowpea varieties confirmed the existence of transposable elements that inhibit or excite gene expression.

Musa genetic diversity studies showed amplified fragment length polymorphism (AFLP) as more powerful than random amplified polymorphic DNAs (RAPDs) in the discrimination of genotypes and the identification of genetic relationships. Plantains from Cameroon were genetically distinct from those of West Africa. Genome composition of all breeding lines and African landraces of *Musa* has been determined. Sukali Ndizi considered a diploid is a triploid with AAB genome composition.

Germplasm material from genebanks and breeders were provided to national agricultural research and extension systems (NARES) on request. The West and Central Africa Collaborative Maize Research Network (WECAMAN) dispatched 169 kg of maize seed to NARS based on superior performance of varieties tested in 2000. Fifty-eight sets of maize regional uniform variety trials and 26 sets of the regional *Striga* variety trials in the extra-early maturity groups were also distributed to NARES collaborators in West, Central, eastern, and southern Africa. Forty sets of soybean international trials were supplied to 21 NARES collaborators in Africa, 3 in Asia, and 1 in the US. Over 10 000 disease-free cassava in vitro plantlets were given to NARES in 6 African countries, 2 European countries, and the US. In addition, 1400 disease-free in vitro yam plantlets and 13 211 yam mini-tubers were given to NARES worldwide.

Staining techniques for the isolation and identification of the rust fungi and other microorganisms from infected leaf surfaces of soybean were standardized. *Colletotrichum gloeosporioides* strains causing foliar infection of *Dioscorea* species were classified.

Project 2. Improving plantain- and banana-based systems

Tetraploid (4n) × diploid (2n) crosses mostly produce triploid (3n) progeny while 2n × –4n crosses mostly produce 2n progeny, showing that ploidy in offsprings is controlled by paternal microsporogenesis.

A secondary 3n cooking banana hybrid (TM3x30456 [612-74 × 8075-7]) with excellent plant and fruit traits was selected in Nigeria. Another 3n selection was obtained from 2n parents (TMB2x 9722-1 × TMB2x 9128-3) in Uganda, demonstrating that unilateral sexual polyploidization can be used to improve East African highland bananas (EAHB).

Total DNA analysis revealed 3 genetic subspecies in *Musa acuminata* and 2 forms in *M. balbisiana*, suggesting that there are at least 3 A genomes and 2 B genomes. A quantitative assay based on AFLP analysis of ribosomal RNA genes for discrimination of A and B genomes was developed.

Transmission of *Beauveria bassiana* from infected to uninfected banana weevils was demonstrated while resistance to the pest was identified in Calcutta 4, TMB2x7197-2, and TMB2x8075-7.

Long-lasting reduction in nematode infestation by hot-water treatment (HWT) of planting materials was demonstrated. Fertilizer application also suppressed nematodes, particularly without HWT. Resistant progenies (TMHx 660K-1 and TMHx 917K-2) from crosses between Enzirabahima (susceptible) and Calcutta 4 (resistant) were identified, increasing prospects for breeding resistance in EAHB.

Stable integration of reporter genes was achieved for the control of banana viruses in prelude to genetic transformation against banana streak virus (BSV) and putative nematode vectors of banana die-back virus (BDBV) were identified.

Significant progress was made in establishing *Musa* breeding operations in the Cameroon benchmark and in the duplication of hybrid propagation for distribution at Ibadan, marking a major shift in the operational mode of plantain research in West and Central Africa. *Musa* breeding and nematology research capacity in Uganda for eastern and southern Africa was restored.

Three workshops were held to facilitate the delivery of improved hybrids to farmers and large-scale, on-farm variety demonstration plots were established in 11 states across the Nigerian plantain belt.

Project 3. Improving cowpea–cereal systems in the dry savannas

A total of 595 new cowpea breeding lines were developed and tested in the moist savanna, dry savanna, and the Sahel. Over 60 promising lines combining high yield potential and resistance to diseases, insect pests, and *Striga* were selected. Of these, IT97K-568-11, IT97K-568-18, IT568-19, IT98K-491-4, IT98K-128-3, IT98K-131-1, IT98K-506-1, IT98K-589-2, IT98K-598-4, IT99K-381-6, IT99K-453-1, IT99K-718-6, IT99K-856-19, IT99K-1152-28, and IT99K-1258 were most promising.

Improved *Striga* resistant cowpea variety IT97K-499-38 yielded 50% to 300% higher than the local varieties in *Striga* infested fields in Benin Republic. It also caused high percentage of suicidal germination of *Striga hermonthica* seeds.

Bruchid resistant cowpea varieties showed 3–5 eggs/g seed and 12–18% adult emergence compared to 10–20 eggs/g seed and 55%–68% adult emergence in the susceptible varieties. Seed size, color, and texture had no effect on oviposition and adult emergence.

Drought-tolerant cowpea varieties such as IT97K-499-39, IT97K-1075-7, IT97K-634, and IT97K-819-118, and heat tolerant varieties such as IT99K-1058, IT99K-1059, IT99K-1060, IT88D-643-1, IT88D-867-11, and TVu 4552 were developed.

Some cowpea varieties were screened for shade tolerance. A 60% reduction in light caused a 56% reduction in grain yield. IT90K-277-2, IT93K-452-1, and IT89KD-391 were more shade tolerant than other varieties.

A multiple cropping system involving a wheat crop from November to March, heat-tolerant cowpea from March to June, and rice from July to October was developed and tested at Kadawa (Nigeria) irrigation scheme for 2 years with an annual food production of 8 to 9 t/ha.

The IITA/ICRISAT/ILRI improved crop–livestock system was adopted by a large number of farmers. Supplementary feeding of only 200 g cowpea haulms per day along with sorghum stover to young rams doubled their weight gain compared to feeding them sorghum stover alone.

Significant genetic differences were observed among cowpea varieties for seed quality. The Aloka local cowpea had the hardest seed (9 kg crushing weight) and took longest to cook (57.5 minutes).

A total of 294 sets of cowpea international trials comprising over 100 improved breeding lines were sent, on request, to national collaborators.

Project 4. Improving maize–grain legume production systems in West and Central Africa

To identify varieties high in micronutrient content, 20 early-maturing maize varieties grown in 3 diverse locations were evaluated for iron, zinc, and β -carotene content. One of these varieties grown at Ikenne showed 45% more iron bioavailability than a control variety widely grown in Nigeria. The results indicate that the potential exists to breed early-maturing maize varieties for high and stable mineral content across diverse growing conditions.

In collaboration with the United States Department of Agriculture (USDA) and various universities and institutions in Nigeria, IITA conducted a national food consumption and nutrition survey. Data were collected on household composition, socioeconomic characteristics, food security, household food consumption expenditure, and health care issues. Nutrition status was assessed and biological samples collected. Data entry and laboratory analysis of biological samples are in progress.

An experiment was conducted at Ikenne to compare the performance of 24 early-maturing improved maize varieties developed at IITA and CIMMYT with 25 early-maturing farmers' ecotypes from Senegal under controlled drought stress and sufficient moisture supply. As a group, the improved open-pollinated (OP) varieties out-yielded the local ecotypes by 112% under drought stress and by 94% under sufficient moisture supply.

A trial consisting of 15 maize varieties was evaluated at 3 levels of nitrogen (N) application in Mokwa and Zaria, Nigeria. The four top-ranking varieties, DTSR-W, LNPC3, ACR8328C7, and LNTP produced higher yields than a widely grown OP variety, TZB-SR, at 30 kg/ha N application. They did not differ from other varieties at 90 kg/ha N.

Three soybean breeding lines (TGX1909-7F, TGX 1910-10F, and TGX 1910-11F) which fix about 10% more nitrogen than the current best variety (TGX 1448-2E) were developed. Also, 15 dual-purpose soybean lines with 2–2.5 t/ha grain and 2.5–3.5 t/ha stover yields were identified for distribution to the NARS.

Extra-early (2000 Syn EE-W) and early (EV DT 97 STR C1) maturing *Striga* resistant varieties evaluated at Férkessedougou outyielded the respective best non-*Striga* resistant varieties by as high as 46% under artificial *Striga* infestation.

Project 5. Improving yam-based systems

Farmers in Oyo and Kwara states of Nigeria were satisfied with the hot-water (53 °C) therapy of seed yams for reducing nematode symptoms and improving germination, tuber quality, and market value. Under high infestation the therapy more than doubled net profit. Users' constraints were evaluated.

Dioscorea rotundata Poir. (white yam) accession TDr 1640 as well as *D. alata* L. (water yam) accessions TDa 291 and TDa 289 are resistant to *D. alata* virus (DAV); *D. alata* bacilliform virus (DaBV); and cucumber mosaic virus (CMV).

Two gibberellin inhibitors, uniconazole-P (UP) and prohexadione-calcium (PC), coupled with tuber storage at 30 °C, shortened tuber dormancy in *D. alata* accessions TDa 99/00049 and TDa 95/00328.

Three IITA-derived clones of *D. rotundata* (TDr 89/02461, TDr 89/02565, and TDr 89/02677) were formally released as new varieties in Nigeria.

About 30 000 seed tubers of new *D. rotundata* varieties were delivered to over 300 farmers of 10 districts in Uganda for farmer-participatory testing.

Two cultivars of *D. rotundata* planted in December 1999 were harvested in September or December 2000 and stored at ambient conditions until March 2001. Both groups sprouted about the same time but tuber weight loss, spoilage, and edible food losses were greater in the September batch. Better quality foods were made from the December batch. Peeling loss increased, tuber moisture content decreased, and oil absorption of fried yam chips reduced with storage.

Twelve graduate students conducted research on yams and the entries in a yam R & D personnel directory now exceed 200.

The IFAD/WECARD/IITA Yam Project organized a work-planning workshop, a workshop on analytical skills for yam economists, and toured yam research activities in Côte d'Ivoire.

Project 6. Improving cassava-based systems

Over 10 000 tissue culture plantlets of elite cassava germplasm were distributed to collaborators in 5 African and 3 non-African countries, while over 284 000 seeds from

1100 families were distributed to 9 national programs in Africa. In addition, large-scale seedling nurseries with over 100 000 botanical seeds were established at high disease pressure sites at Kenya, Malawi, Mozambique, and Tanzania to intensify the screening effort and accelerate the deployment of improved varieties resistant to cassava brown streak disease in East and southern Africa.

Benefits from calculated the Uganda cassava multiplication project to combat the cassava mosaic disease pandemic using the Dynamic Research Evaluation for Management (DREAM) impact model of IFPRI were approximately US\$36 million over 4 years (1998–2001) for an investment of US\$0.8 million.

Cassava plant regeneration efficiency through organogenesis was doubled with the addition of 8 mg/l silver nitrate and an increase (0.8%) of agar concentration in the culture medium. Results from flow cytometry and chromosome counts of field-established cassava regenerants showed few abnormalities. .

The assessment of pasting profiles and granular characteristics of starch of 11 cassava clones indicate considerable differences in starch functionality; peak viscosity (181.9–456.3 RVU), setback viscosity (53.6–111.4 RVU), final viscosity (193.3 and 255.1 RVU), pasting temperature (73.6–75.3 °C), and starch granule sizes (9–20 µm, oval, rounded, and truncated). These results provide directions for cassava selection and improvement for cassava starch-based products, and processing variables.

Cumulative cassava leaf litter dry matter production in southern Benin over two 12-month periods ranged from 2.4 t/ha (in a low rainfall year without fertilizer) to 4.1 t/ha (in an adequate rainfall year with fertilizer), indicating the potential of cassava to contribute to maintaining soil properties.

IITA has expanded its collaboration with CIAT, Colombia, to enhance the Southern Africa Root Crops Research Network (SARRNET's) potential to promote expanded utilization, commercialization, and national and regional trade of cassava and sweetpotato. A public–private sector consortium has been formed to provide linkages between research and private sector partners.

A training course for agro-enterprise development was held for 27 participants in Uganda. Over 100 researchers, technicians, and extension personnel in the region were trained in report and proposal writing, rapid multiplication techniques, and postharvest technology of cassava and sweetpotato. SARRNET has provided 16 cassava processing equipment to its member countries for demonstrations to farmers and the private industry.

Project 7. Biological control and functional biodiversity

A major international workshop on biopesticide regulatory frameworks for African countries, jointly organized by IITA and Virginia Polytechnic Institute (VPI) with financial support from the US Agency for International Development (USAID), was held at the IITA Benin station from 29 January to 2 February. Consequently, Comité inter-Etat de lutte contre la sécheresse dans le Sahel (CILSS) established a framework for the registration of biopesticides and Green Muscle® obtained temporary sales permission of Comité Sahélien des Pesticides, the last step before full registration in nine CILSS countries.

Biological Control Products (BCP), the South African commercial partner of Lutte Biologique contre les Locustes et Sauteriaux (LUBILOSA), has shipped the first large Green Muscle® order to Niger.

In Mali, several NGOs have committed themselves to the regular use of Green Muscle® for grasshopper control. Green Muscle® will be ordered on a regular basis with the support of donors.

Plutella xylostella granulovirus has been imported from Kenya to Benin, an important step towards improved control of *P. xylostella* in West Africa.

Scientists and government representatives improved their understanding on aspects of biodiversity, biotechnology, and law of the convention of biological diversity and its implementation during a West African Network for Taxonomy (WAFRINET) workshop, coorganized with the Global Biodiversity Institute (GBDI).

More than 250 isolates of fungal pathogens of water hyacinth were collected across 3 major river systems in West Africa in different ecological zones.

The impact of classical biological control of water hyacinth and mango mealybug has been studied, demonstrated, and published.

Results of a survey on the distribution of African root and tuber scale *Stictococcus vayssierei* across a range of different vegetation types and non-crop host plant species indicate that this pest can be controlled through appropriate fallow management.

The acquisition and preservation of 19 000 new specimens from faunistic surveys in Benin, Cameroon, Ghana, Nigeria, and Togo collected by IITA's insect museum strengthens its leading position in the provision of taxonomic support to NARES within West Africa.

Project 8. Integrated management of legume pests and diseases

Synthetic sex pheromones of *Maruca vitrata* were used to monitor field populations at 3 locations. In central Benin, a good correlation was found between adult catches in the traps and larval populations in the field, indicating the possibility of using the traps as a tool to time pest control interventions. However, adult catches from both Tamale and Kano were low in spite of substantial field infestations, indicating possible behavioral/physiological differences in migrating *M. vitrata* populations.

The investigation of natural enemies of the cowpea aphid (*Aphis craccivora*) in southern and central Benin revealed spectacular epizootics of the entomopathogenic fungus *Neozygites* sp. in the Ouémé valley which wiped out aphid colonies. The total absence of hymenopterous parasitoids was confirmed, indicating a potential "off the shelf" biocontrol project.

During 2 consecutive years, the early maturing soybean line TGX 1835-10E was confirmed as moderately resistant to soybean rust (*Phakopsora pachyrhizi*). Some early varieties with relatively shorter pod filling duration had less yield loss in spite of high disease incidence.

A regional adoption survey (120 farm households per country) showed that neem extracts are being used by 7, 32, and 38% of farmers in Niger, Nigeria and Ghana, respectively, and papaya extracts by 47% of farmers in Benin. The constraint is mainly labor-intensive processing of leaves. Key factors affecting adoption of cowpea integrated pest management (IPM) are access to extension, profitability, off-farm incomes, farm labor supply, and level of education.

A study of cowpea IPM technologies in Benin revealed that botanical insecticides are more profitable when applied on improved cowpea varieties (high yielding or pest/disease resistant). The net benefits ranged from US\$10/ha (local varieties), to US\$110/ha (improved varieties), and up to US\$200/ha with improved market access.

Farmer field schools (FFS) trained 1112 farmers and 60 NGO and extension agents in cowpea IPM in the 9 PRONAF countries. In northern Ghana farmer-to-farmer diffusion of knowledge following FFS is increasing.

Project 9. Integrated management of maize pests and diseases

A medical epidemiology survey in the southern Guinea savanna of Benin and Togo revealed that 99% of 479 children were aflatoxin-positive, 33% showed stunted growth, and 29% were underweight. Exposure to aflatoxin was correlated with aflatoxin content of maize, maternal education and socioeconomic status, consumption of maize-based weaning food, and number of L-strain *Aspergillus flavus* colonies in the maize.

Aflatoxin accumulation in selected IITA maize inbred lines was tested using a kernel screening assay in collaboration with the laboratory of the US Department of Agriculture (USDA) in New Orleans, and was found to be much lower (< 50 ng/g) than the best US resistant line (> 200 ng/g).

Public awareness campaigns on aflatoxin were launched in Benin, Ghana, and Togo in collaboration with senior national policymakers, ministers of agriculture and of health, representatives of the diplomatic corps, the FAO Regional Office on Post-harvest, and Rotary International.

Larvae of the maize stem borer *Sesamia calamistis* had a much lower survival rate (1.6%) on new advanced inbred lines 10 days after artificial infestation with 60 eggs/plant.

Three strains of *Trichoderma* species—*T. harzianum*, *T. pseudokoningii*, and *T. hermatum*—persisted in maize stalks co-inoculated with the causal agent of maize stalk rot, *Fusarium verticillioides*, in greenhouse tests. These 3 strains reduced stalk rot and were also effective against the pathogen in in vitro tests. The mechanism appears to be hyperparasitism.

Treating maize plants with neem oil at different concentrations in the greenhouse has reduced that oviposition by *S. calamistis* by three-quarters even at the lowest concentration tested.

Project 10. Integrated management of cassava pests and diseases

The exotic phytoseiid predator *Typhlodromalus aripo* continues to persist and further expand its range in 20 countries in sub-Saharan Africa, and is providing effective management of the cassava green mite.

The preference of *T. aripo* for hairy cassava tips was shown to be widespread and food web surveys in Malawi and Mozambique confirmed that *T. aripo* is restricted to cassava and only affects CGM populations.

Two Brazilian isolates of *Neozygites tanajoae* introduced in 1999 into cassava fields in southeastern and northern Benin to complement CGM biocontrol by phytoseiid predators continued to persist and produce an average of 25% infection levels in CGM populations in several locations.

In collaboration with the University of Arizona, USA, molecular techniques were used to demonstrate the association of a distinct cassava-colonising genotype of *Bemisia tabaci* with the epidemic of severe CMD in Uganda.

Through an emergency CMD management program in East and Central Africa, IITA, with NARES and NGOs, deployed more than 2000 ha of CMD resistant germplasm, introduced 960 elite CMD resistant clones into open quarantine sites in Kenya and Tanzania and 158 clones in tissue culture to Congo Republic, transferred 7 newly released varieties from Uganda to Tanzania, and evaluated the performance of more than 50 clones with farmers in technology transfer centers in Kenya, Tanzania, and Uganda.

A preliminary impact assessment study of CMD management work in 6 districts of Uganda estimated a net present value benefit of US\$ 36 million shared roughly equally between producers and consumers.

Surveys of the impact of the released predator, *Teretrius nigrescens*, on beetle pests in cassava chip stores in northern Benin, demonstrated reductions in losses from 45–91% in untreated to 15–70% in treated stores.

In addition to cassava, the noncultivated plants *Aframomun danielli*, *Costus afer*, and several wild yam species were identified as common hosts of the African root and tuber scale, *Stictococcus vayssierei*, in fallow and young forest vegetation in western and southern Cameroon.

Project training activities included the completion of 3 MSc and 1 PhD study programs; cassava IPM training of extension workers (and farmers) as follows: 15 (20) in Guinea, 10 (2100) in Kenya, 20 (95) in Malawi, 1000 in Tanzania, 10 (50) in Togo, and 29 (250) in Uganda; the distribution of 300 sets of cassava IPM manuals in Kenya, Tanzania, and Uganda; and the development of an educational leaflet for *T. aripo* conservation.

Project 11. Protection and enhancement of vulnerable cropping systems

In the forest margins benchmark area (FMB), annual maize production in a *Mucuna/Pueraria* cover crop/relay system was sustained for 5 years at 2.5 t/ha. Maize grain yields after *Mucuna* var. *jaspada* were the highest over 3 consecutive years over other *Mucuna* varieties.

Three soybean varieties were identified for various farmer circumstances in the FMB. High nodulation was observed in shorter fallow areas, with consequent higher yields. Farmers in the northern benchmark, where yields exceed 1000 kg/ha without inputs, are now adopting soybean.

In a study in the northern Guinea savanna and derived savanna benchmark areas to identify target options for herbaceous legumes, farmer participation doubled over the previous year. Four field days involving some 130 farmers were held, and new methodologies tested during farmer workshops.

Some 280 kg of herbaceous legume seed consisting of 117 seedlots were distributed to IARCs, NARS, and NGOs.

Successful stakeholders' workshops on weed management strategies were realized in Zaria and Makurdi. Steering committees on *Striga* and *Imperata* were formed to coordinate research. Two seed companies and the Nigerian Participatory Rural Appraisal Network agreed to assist with workshops and scaling-up activities.

Mucuna was shown to suppress speargrass by reducing available solar radiation and other mechanisms.

The Rockefeller Foundation provided a grant to research the effect of genotype and environment on the concentration of L-Dopa in *Mucuna* seed and other plant parts.

For the 2001 growing season, research and development projects in Benin have purchased more than 2000 kg of *Mucuna* from Centre d'information et d'échanges sur les plantes de couverture en Afrique (CIEPCA). The CIEPCA newsletter was produced and posted on the Web, and 4 issues of *Mucuna News* have been produced.

A standpoint survey found *Acacia auriculiformis* woodlots to be the most popular soil fertility enhancing technology coming out of 10 to 15 years of work on improved fallows in southern Benin.

Project 12. Improvement of high-intensity food and forage crop systems

On-farm trials conducted from 1999 to 2000 in 19 *Striga hermonthica*-infested fields in the dry savanna agroecozone of Nigeria showed that integrated *S. hermonthica* control was highly effective, in comparison to traditional practices, both in reducing *S. hermonthica* incidence by more than 70% and in increasing maize grain yields by more than 60%.

Maize herbicide evaluation trials conducted in Ibadan and Ilorin showed that post-emergence application of nicosulfuron at 50 to 400 g a.i./ha resulted in lower *Imperata cylindrica* biomass (4 to 19 g/m²) than in the unweeded control plots (63 g/m²) at crop harvest. The effect of weeding 5 times on *I. cylindrica* biomass was equivalent to that of nicosulfuron at rates of 200 to 400 g a.i./ha.

Comparative economic evaluation and appropriate technology targeting of 10 legume rotation treatments showed that the grain legume and dual-purpose varieties gave cumulative net benefits ranging between US\$914 and US\$1233, an increase of over 150% above the least profitable system at Ibadan fertile derived savanna (DS) site. The same trends were observed in the northern Guinea savanna (NGS) where the most profitable system outperformed the green manure system economically by over 500%.

The monitoring of N and P in Zouzouvou, DS in Benin, indicates that the N balance was negative. N exports through harvest products and removal/burning of crop residues constituted the largest loss term. The annual P balance ranged between a surplus of 42 kg P/ha and a deficit of 30 kg P/ha.

Preliminary maize yield data for the on-farm, farmer-managed demonstration trials confirmed earlier findings that maize grain yields in the sole fertilizer treatment were similar to yields in the mixture treatment in which about 40% of the fertilizer N was substituted by manure. Farmers' practices led to about 30% lower yields than in both other treatments.

Growing maize after soybean resulted in significantly higher grain yield (1.2 to 2.3-fold increase compared to maize control) except for the maize cultivar Oba Super 2 (8644-27) (an N-efficient hybrid).

Project 13. Integrated perennial and annual cropping systems

Efforts to establish tree-based assets on deforested land in southern Cameroon continued. The cocoa hybrids from Côte d'Ivoire have demonstrated significantly superior

establishment vigor and growth and 3 of the 4 hybrids had a significantly greater number of flowers relative to the landraces and local hybrid. The survival of all cocoa seedlings through the second dry season was significantly greater when integrated with shade providing plantain (*Musa* spp.).

In a remote area of the southern Cameroon Atlantic rainforest, the Sustainable Tree Crops Program (STCP) and its partners assisted about 200 small cocoa producers to create a farmers' union of village-based organizations. Cocoa marketed through the union in its initial year yielded 33% higher price than cocoa marketed individually and inputs purchased by the union were bought at a 7% discount. The lessons learned from this are being used by STCP and its partners to reinforce farmer organizations throughout southern Cameroon and West Africa.

An on-farm experiment evaluated the productive capacity of a mature cocoa agroforest after a 2-year abandonment with particular focus on the management of the fungal blackpod disease, the most important constraint to production. Two levels of fungicide treatment were applied and compared to a no fungicide control. A yield of over 300 kg/ha was obtained which is in excess of the average yield for this part of southern Cameroon. Yield at the no fungicide control was less than 50 kg/ha indicating the importance of the constraint.

An on-farm experiment in southern Cameroon compared the decomposition rates in 4 types of land use—the complex cocoa agroforest, forest, *Chromolaena odorata* fallow land, and *Imperata cylindrica* fallow land. The conclusion is that the cocoa agroforest retains more ecosystem functionality when compared to short fallow cropping land-use systems.

Project 14. Impact, policy, and systems analysis

A household expenditure survey in 4 cities of the forest zone of Cameroon confirmed that demand prospects for domestic products (yam, plantain, cassava, maize, and sorghum) are high because they are more desired by urban dwellers than imported products such as rice.

A new micro “Market Information Systems” model developed by FOODNET, with support from the Technical Center for Agricultural and Rural Cooperation (CTA), disseminates the information to about 5 million people in 8 districts of eastern Uganda.

An efficiency analysis of about 560 mixed crop–livestock farms in the northern Guinea savanna of Nigeria showed that the 10% most efficient farms were smaller in size, experienced high pressure on land, were managed by younger farmers, and had higher integration between crops and livestock.

A new, easy, and quick “GPS transect walk” method was successfully tested to quantify the spread and intensity of the adoption and adaptation processes of “best bet” cowpea technologies in the savanna zone of Nigeria.

Positive effects of technological change and policy on the profitability of cowpea systems were found in Couffo département, southern Benin. Financial returns for systems with an improved cowpea variety and botanical insecticide (Neem) to control pest in storage generated a bonus of CFA92250/ha over systems without an improved variety. An additional gain of CFA59305/ha was recorded for systems with improved variety and Neem and located in areas with good road infrastructure.

A landscape model of human and land resources for the forest margins was developed in Cameroon. The model links the “human” side and the “land” side through land tenure systems and combines geo-positioning system (GPS), socioeconomic, and biophysical data in a GIS system.

The capability for the application of GIS techniques by IITA and NARES has greatly improved through special training of 61 scientists in eastern and West Africa. Refresher courses were held for 20 NARES scientists in West Africa on advanced methods for impact and economic analyses while 8 local manufacturers in Tanzania were trained in the maintenance and repair of processing equipment.

Systemwide Program on Integrated Pest Management (SP-IPM)

Characterized the agronomic, socioeconomic, and epidemiological features of whiteflies and whitefly-transmitted viruses in cassava, legumes, and sweetpotato in Latin America, Africa, the Caribbean, and Mexico, and initiated strategic research to develop appropriate IPM options.

Developed vision of farmer participatory research (FPR) and participatory learning (PL) to advise on what would need to be done differently at the level of farmers, community organizations, extension workers, researchers, and policymakers if FPR/PL were to be successful in IPM.

Recorded significant yield gains by farmers at 6 pilot sites in Africa where intercropping, habitat management, crop rotation schemes, and pest-tolerant crop varieties were introduced as best-bet IPM options to control the parasitic weeds *Striga* and *Orobanche* in maize–legume cropping systems. The participatory approach and processes at the sites assisted organizations to develop effective partnerships to increase the understanding and adoption of IPM options.

Increased public and donor awareness of the benefits of IPM through information materials including news stories, a brochure, and a CD-ROM of information resources.

Annex 1
Networks, global and ecoregional programs
in which IITA actively participates

Networks, regional, global and ecoregional programs in which IITA actively participates

Networks and Regional Projects

BARNESA	Banana Research Network for Eastern and Southern Africa
BioNET-International	A Global Network on Biosystematics
CFC-Cassava Flour	Regional Eastern and Southern Africa Project on Cassava Flour Processing and Marketing
EARRNET	East African Root Crops Research Network
FOODNET	Postharvest and Market Research Network for Eastern and Central Africa
GRENEWECA	Genetic Resources Network for West and Central Africa
LUBILOSA	Lutte biologique contre les locustes et sauteriaux
MUSACO	<i>Musa</i> Resarch Network for Western and Central Africa
PASCON	Pan-African <i>Striga</i> Control Network
PESA*	Private Enterprise Support Activities for Eastern and Southern Africa
PEDUNE/PRONAF	Protection écologiquement durable du niébé
PRAISE*	Partnership for Regional Agricultural Initiative Support to Enhance Sustainable Economic Development in Southern Africa
SARRNET	Southern Africa Root Crops Research Network
SPALNA	Soil and Plant Analytical Laboratories Network of Africa
STCP	Sustainable Tree Crop Program
RENACO	West and Central Africa Cowpea Research Network
WASDU	West Africa Seed Development Unit
WASNET	West Africa Seed Network
WECAMAN	West and Central Africa Maize Network

Ecoregional and Systemwide Programs

AHI	African Highlands Initiative
ASB	Global Initiative on Alternatives to Slash-and-Burn
CAPRI	Systemwide Program on Property Rights and Collective Action
CAS-IPR	Systemwide Central Advisory Service on Intellectual Property Rights
CSI	Sytemwide Consortium for Spatial Information
EPHTA	Ecoregional Program for the Humid and Subhumid Tropics of Sub-Saharan Africa
ICIS	International Crop Information System
INRM	Inter-center Working Group on Integrated Natural Resources Management
INTG	IARC-NARS Training Group
IVC	Inland Valley Consortium
PRGA	Systemwide Program on Participatory Research and Gender Analysis
SGRP	Systemwide Genetic Resources Program
SIMA	Systemwide Program on Malaria and Agriculture
SINGER	Systemwide Information Network for Genetic Resources
SIUPA	Systemwide Initiative on Urban and Peri-Urban Agriculture
SLP	Systemwide Livestock Program
SP-IPM	Systemwide Program on Integrated Pest Manag ement
SWI-HIV/AIDS	Systemwide Initiative on HIV/AIDS

*Under development.

Challenge Programs

- Water and agriculture
- Harnessing agricultural technology to improve the health of the poor: biofortified crops to combat micronutrient deficiency
- Sub-Saharan Africa
- Unlocking genetic diversity in crops for the resource poor

Pre-Challenge Programs

- Climate change
- Coastal area
- Desertification
- Rainforest

Annex 2

Summary of each project

Project A. Preserving and enhancing germplasm and agrobiodiversity with conventional and biotechnology tools

Goal

Contribute to sustainable food production and enhanced livelihood in sub-Saharan Africa.

Purpose

Improve genetic resource conservation and utilization, broaden the genetic base of adapted germplasm, and develop efficient methods for crop improvement and germplasm management.

Outputs

1. The genetic resources of selected food crops (cowpea, cassava, yams, plantain and banana, maize, and soybeans), as well as their wild relatives, underutilized or threatened crop species, herbaceous legumes, and multipurpose trees are collected, characterized, evaluated, documented, and conserved according to CGIAR policy and Center's best practices. Improved procedures for germplasm management are developed and made available to NARS. Genetic variation and breeding values of plant genetic resources, gene flow among landraces, improved populations and their wild relatives are elucidated.
2. Genetics of key agronomic and quality traits in breeding populations of cowpea, cassava, yams, plantain, banana, maize, and soybeans are elucidated, and efficient breeding strategies for these traits are developed.
3. Biotechnology tools (e.g., transformation systems, molecular markers, molecular diagnostics) are developed and applied for germplasm management and crop improvement. Safety in international exchange of germplasm is enhanced through the use of appropriate diagnostic tools and the tools are made available to research partners.
4. Source populations and parental lines are selected/developed with resistance to important diseases and pests, desired quality traits, as well as adaptation to specific niches, and made accessible to NARS in sub-Saharan Africa and other research partners.
5. Capacity of NARS for germplasm management and crop improvement is strengthened, e.g., in collection, conservation, and enhancement of plant genetic resources as well as plant health assessment.

Priority activities

- Continue collection and acquisition of genetic resources of priority food crops (cowpea, cassava, yams, plantain and banana, maize, and soybeans) and their wild relatives, underutilized or threatened crop species, and herbaceous legumes, to fill gaps in the collections; rejuvenate, conserve, and distribute germplasm.

- Develop and adapt improved germplasm conservation methods and strategies, including cryopreservation.
- Further characterize and evaluate germplasm to assess genetic diversity and breeding potential, using conventional and molecular tools.
- Improve documentation of both landrace and elite germplasm, using appropriate information technologies for dissemination to users and for placement in the public domain.
- Conduct genetic analysis of important traits.
- Manipulate genomes and ploidy levels to enhance crop performance.
- Investigate G × E interactions, rationalize test sites, and evaluate alternative breeding methods for the priority food crops.
- Develop genetic transformation and/or regeneration systems for cassava, cowpea, plantain and banana, and construct genes for use in crop improvement.
- Develop and use molecular markers and molecular diagnostics to facilitate selection for desirable traits and enhance safety in international germplasm exchange.
- Screen germplasm for resistance to biotic and abiotic stresses, and other desirable agronomic and quality traits, and introgress favorable alleles from wild and exotic germplasm into adapted populations.
- Develop diverse populations, lines, and clones with high yield potential, resistance to diseases and pests and with good nutritional and end-user quality attributes.
- Provide training and technical support to NARS scientists and technicians in plant germplasm research and management, disease diagnostics, biotechnology, development of biosafety guidelines and crop improvement through thesis research, in-service training, workshops, as well as the provision of improved germplasm and collaborative trials.

Gains (Impact)

- Greater food security through enhanced collection and conservation of genetic diversity.
- Greater accessibility and utilization of germplasm collections.
- Increased efficiency of breeding programs through the use of improved breeding strategies and tools of biotechnology.
- Diverse sources of germplasm available to and utilized by NARS.
- Increased exchange of disease-tested planting materials between IITA and research partners.
- Systematic collection, conservation, and utilization of plant genetic resources by NARS in sub-Saharan African.

Duration

Indefinite for aspects of Output 1 (with review every 5 years) and 10 years for other outputs.

Milestones

2002

- In vitro genebank collections of yams, cassava, and *Musa* increased to about 2500 accessions.
- Protocols for testing seed-propagated crops for viruses documented.
- The extent of outcrossing between cowpea and its wild relatives quantified.
- Germplasm databases of cowpea, wild *Vigna*, yams, cassava, *Musa* and herbaceous legumes widely disseminated and used.
- Computerized databases of pathogens of cassava, yams, and herbaceous legumes established.
- At least 10 new genotypes each of yam and cassava certified for international distribution and 4000 plantlets of each crop as well as 5000 yam minitubers distributed.
- Genetics of resistance to *Ascochyta* blight elucidated.
- Linkage map of cowpea with at least 250 DNA markers available.
- Transgenic cowpea developed with test construct.
- Two diploid *Musa* hybrids with resistance to BLS and nematodes registered in the public domain as genetics stocks.
- At least 5 cowpea varieties with 50% higher grain yield and 30% higher fodder yield, compared to farmers varieties, available.
- Advanced cowpea breeding lines with resistance to 5 *Striga* strains and high yield potential developed.
- Sources of resistance to cassava root scale insect identified and incorporated into breeding populations.
- Cassava lines with improved nutritional quality and specific functional characteristics identified.
- Open-pollinated maize varieties that surpass ACR95 TZMSR-W by 10% or TZEMSR-W by 5% in yield, and disease and pest resistance available for testing in the midaltitude ecologies.
- At least three stem borer resistant open-pollinated populations of maize improved through one cycle of recurrent selection available for testing in the forest ecology.
- At least 10 inbred lines of maize with resistance to *Sesamia* and/or *Eldana* available and used to initiate inheritance studies.
- White and yellow inbred lines of maize with at least 15% better combining ability for yield and higher resistance to diseases and pests than 1368 and KU1414, respectively, available for the savannas.
- At least 5 inbred lines of maize with better performance and in hybrid combination under N stress than 9450 and KU1414-SR or under drought stress than KU1414 and 5012 available.
- Maize hybrids with at least 5% greater performance under drought than Oba Super II available.
- Nutritional status and nutrient intake of women and children in Nigeria established and at least 2 novel food products from maize promoted for consumption at the village level.

- Elite soybean lines with high capacity to cause suicidal germination of *Striga hermonthica* and/or tolerance to low P soils identified.
- Six pilot multiplication centers established in Nigeria to facilitate distribution of improved plantain and banana hybrids to farmers.
- Three pilot multiplication centers established in Ghana to facilitate distribution of improved plantain and banana hybrids to farmers.
- At least 500 farmers trained in rapid plant multiplication techniques and pre- and postharvest management of plantain in Nigeria.
- Regional exchange of cassava germplasm facilitated among at least 15 collaborating countries.
- At least 50 advanced clones of *Dioscorea rotundata* and 20 of *D. alata* with high yield and pest resistance delivered to NARS collaborators in West Africa.
- At least 10 new soybean varieties with superior grain and stover yields and enhanced nitrogen fixation distributed to at least 20 NARS collaborators in Africa for evaluation and local use.
- At least 10 improved plantain and banana hybrids distributed to not fewer than 50 farming communities in Nigeria.

2003

- Diagnostics for all currently characterized viruses infecting yams available and used.
- Available germplasm accessions of vegetable cowpea evaluated and Bambara groundnut rejuvenated.
- Protocols for cryopreservation of cassava and yam shoot tips available for routine use.
- Field genebank of yams increased to over 3500 accessions and a core collection of yams constituted.
- Databases of germplasm of IITA's mandate crops widely disseminated, including via the Internet.
- At least 50 improved cowpea breeding lines distributed to NARS.
- Fungicides effective against *Colletotrichum* spp. and *Macrophomina phaseolina* in cowpea and soybean seeds identified.
- At least 10 new genotypes each of yam and cassava certified for international distribution and 4000 plantlets of each crop as well as 5000 yam minitubers distributed.
- At least 5 improved plantain and banana hybrids distributed to 10 farming communities in Ghana.
- Heterosis for grain and fodder yields of cowpea under intercropping estimated.
- Mechanism of resistance to the Nigeria strain of *Phakospora pachyrhizi* in soybean elucidated.
- Influences of varietal provenance, tuber storage environment, and planting site on the period of tuber dormancy and flowering behavior in *D. rotundata* documented.
- Differential series of *D. alata* genotypes established for studies on yam anthracnose disease.

- Combining ability and stability of resistance mechanisms to *S. hermonthica* in elite maize germplasm established.
- Mechanisms of *Striga* resistance determined for at least 20 elite maize genotypes derived from different genetic backgrounds.
- Combining ability and inheritance of resistance to *Sesamia* and/*Eldana* elucidated in ten inbred lines of maize.
- QTLs with effects on nitrogen fixation, tolerance to low P soils, and capacity to cause suicidal germination of *S. hermonthica* identified.
- DNA markers linked to loci controlling resistance to anthracnose disease in *D. alata* and yam mosaic virus in *D. rotundata* validated.
- Transgenic *Musa* with “resistance” to banana streak virus field tested in Nigeria.
- Transgenic *Musa* with antifungal protein genes for disease resistance tested in Kenya.
- Transgenic cassava with marker genes produced.
- Molecular markers for genes conferring resistance to at least cassava mosaic disease (ACMV, EACMV, and UgV) identified and used in marker-assisted selection.
- At least 2 IITA-derived varieties of *D. rotundata* nominated for formal release in Nigeria and Ghana.
- Two or more secondary triploid *Musa* hybrids with multiple disease resistance and high yield and fruit quality registered in the public domain.
- Six diploid *Musa* hybrids with resistance to BLS and nematodes registered in the public domain as genetic stocks.
- Two maize OPVs with improved drought tolerance and 10% better yield than 8644-27 are available.
- Stem borer resistant maize populations with at least 5% better yield and stem borer resistance level than TZBR Eld 3 C2 available.
- Existing maize varieties with high micronutrient content identified and distributed to NARS.
- Market potential of fortified maize products with improved nutritional quality established.
- Food fortification techniques for small- to medium-scale processors developed.
- At least 2 early maturing soybean varieties with 10% higher grain and stover yields, and larger seed size than TGx 1485-1D developed.
- At least 2 medium to late maturing soybean varieties with 10% higher grain and stover yields, and larger seed size than TGx 1448-2E developed.
- At least 15 NARS partners trained in legume breeding and production technologies at a workshop.
- *Musa* breeding technology transferred to the national banana research program in Côte d’Ivoire through training, supply of parental stocks, and collaboration, based on polycross.
- At least 10 cassava genotypes recommended for release in not fewer than 5 countries.

- At least 20 midaltitude inbred lines of maize with 20% better combining ability for yield and resistance to diseases than TZMI 102 distributed to NARES.

2004

- Shoot tips of at least 100 accessions each of cassava and yams conserved in liquid nitrogen.
- Monoclonal antibodies against a range of geminiviruses validated and available.
- Molecular characterization of the core collection of cowpea documented.
- Effect of selection pressure on bulbil size in the process of yam domestication elucidated.
- Polyclonals for detection of *Xanthomonas manihotis* and *X. cassavae* available.
- At least 10 new genotypes each of yam and cassava certified for international distribution and 4000 plantlets of each crop as well as 5000 yam minitubers distributed.
- Genetics of resistance to nematode (*M. incognita*) and tolerance to low P soils in soybean elucidated.
- Genetics of plant pigmentation and seed coat color in cowpea elucidated.
- Maize inbred lines with different mechanisms of resistance to *S. hermonthica* identified.
- Transgenic insect resistant cowpea plants available for breeding program.
- Efficient cassava transformation and regeneration system available.
- At least 2 improved *Musa* hybrids adopted by farmers and officially released in Nigeria.
- Superior performance of new varieties of *D. alata* in anthracnose resistance and *D. rotundata* in virus resistance demonstrated on-farm in relation to popular local cultivars in West Africa.
- At least two new *D. alata* varieties adopted by farmers in Nigeria and Côte d'Ivoire.
- At least 20 midaltitude and 20 savanna inbred lines of maize with 20% better combining ability for yield and resistance to diseases than TZMI 407 and TZI 3, respectively, available to NARES.
- A pair of stem borer resistant maize populations advanced to C2 and at least 5 of such populations improved through one cycle of reciprocal recurrent selection.
- *Musa* breeding technology transferred to the national banana research program in Ghana through training, supply of parental stocks and collaboration, based on polycross breeding.
- Two pilot multiplication centers established in Côte d'Ivoire and 2 plantain hybrids distributed to farmers.
- At least 50 cowpea breeding lines combining drought and heat tolerance with resistance to major diseases and insect pests distributed to NARS.
- At least four IITA-derived clones of *D. rotundata* included in nationally-coordinated clonal trials in Nigeria aimed at formal release of new varieties.

- Five hybrids with resistance to stem borer and with at least 8% better grain yield than Oba Super 2 available to the NARS through international trials.
- New high yielding soybean varieties with greater capacity to stimulate *S. hermorrhagica* germination and 15% higher NDFA than TGx 1448-2E deployed to NARS for multilocation evaluation.
- Elite soybean lines with enhanced quality traits (high content of protein/oil/micronutrients) identified and distributed to NARS collaborators in Africa.

2005

- In vitro genebank of yams, cassava, and *Musa* increased to at least 3500 accessions.
- The core collection of yams validated and its diversity established.
- Diagnostics of viruses of all IITA mandate crops available and protocols documented.
- At least 10 new genotypes each of yam and cassava certified for international distribution and 4000 plantlets of each crop as well as 5000 yam minitubers distributed.
- Effect of seed borne pathogens on cowpea seed longevity elucidated.
- Transgenic Bt cowpea used in crosses and improved populations developed.
- At least one improved *Musa* hybrid adopted by farmers and officially released in Ghana.
- At least two IITA-derived varieties of *D. rotundata* formally released in Nigeria.
- New maize inbred lines with more than 30% reduced parasitism in comparison with 1368STR and 9030STR developed.
- Phenotypic characteristics of cassava, that are most appropriate for the dominant production and utilization systems elucidated and utilized in breeding.
- Bases for adaptation of cassava to abiotic and biotic stresses elucidated and applied in breeding.
- At least 5 new cassava genotypes recommended for release in at least 4 countries.
- Resistance to *Phakospora pachyrhizi* incorporated into elite soybean lines.
- Soybean lines with tolerance to low soil P or enhanced P-use efficiency developed.
- “Super nodulation” genes incorporated in elite promiscuous soybean lines.
- At least 50 improved cowpea breeding lines distributed to NARS.

Users

Plant scientists and breeders throughout the world gain from increased knowledge of genetic variation and inheritance of economically important traits of IITA mandate crops, and from source germplasm developed at IITA. The world community and

future generations benefit from the free availability of conserved genetic resources, especially in Africa. NARES benefit from the facilitated, safe exchange of improved germplasm and through their improved capacity to manage genetic resources.

Collaborators

IARCs—CIAT, CIMMYT, CIP, ICRAF, ICRISAT, ILRI, IPGRI, WARDA

Systemwide projects—SGRP, PRGA.

Networks—CORAF-Maize, EARRNET, PRONAF, SARRNET, WECAMAN, GRE-NEWECA, MUSACO, BARNESA, WASNET.

Regional organizations—ASARECA, CORAF, SACCAR, SADC-PGRC; Bean/Cowpea CRSP; SAFGRAD; WASDU; CSRS.

NARS—Several NARS in West Africa engaged in research on the priority food crops, Africa-wide national plant genetic resources programs or centers, FHIA in Honduras.

AROs—CIRAD, IRD, France; KULeuven, Belgium; University of Birmingham, UK; University of Reading, John Innes Centre, UK; NRI, UK; JIRCAS, Japan; ETH, Switzerland; Beltsville Human Nutrition Research Centre, USDA, Cornell University, Univ. of California, Davis, Univ. of Virginia, USA, Purdue Univ., Tuskegee Univ., Donald Danforth Plant Science Center/ILTAB, USA.

System linkages

Link to CGIAR logframe outputs Germplasm Improvement (55%), Germplasm Collection (15%), Sustainable Production (10%), Policy (5%), and Enhancing NARS (15%).

Project B. Developing biologically-based pest, disease, and weed management options, and conserving biodiversity for sustainable agriculture

Goal

Improved food security and well-being of rural and urban populations, through enhanced ecological stability and agricultural productivity by developing sustainable pest management options.

Purpose

Develop effective and ecologically sound options to manage major pest problems and sustain biodiversity in the humid forest, savanna, and midaltitude agroecological zones of sub-Saharan Africa.

Outputs

1. Knowledge base on distribution and biology of pests and their natural enemies, improved, and agrobiodiversity characterized.
2. New knowledge on the interactions between pests, host plants, natural enemies and the environment generated.
3. Efficient biological control options against important pests in farming and aquatic systems developed.
4. Effective host-plant resistance against pests identified and developed.
5. Effective habitat management options against pests developed.
6. Crop protection products based on entomopathogens, botanicals, semiochemicals and elicitors developed towards commercialization.
7. Information and diagnostics support for plant protection provided; reference collections and colonies of pests and natural enemies maintained.
8. NARES capacity to develop and apply biologically-based pest management components enhanced.

Priority activities

- Assess the importance of new problems (e.g., exotic invaders) by monitoring dispersal of pests and antagonists.
- Characterize important arthropod pests, nematodes and pathogens.
- Assess crop losses attributable to different pests.
- Study the ecology of arthropods and epidemiology of pathogens in the context of the environment (biodiversity) including multitrophic interactions and behavioral studies.
- Through foreign exploration, find candidate natural enemies for importation, screen them for adaptation, and rear and test them through experimental releases.

- Develop prototype mass rearing of promising natural enemies.
- Study establishment, spread, and impact of released natural enemies in the context of the larger environment.
- Identify and characterize mechanisms of resistance in mandated crops.
- Assess the use of cover, trap and nonhost crops and mulching as pest management options.
- Identify, screen, and assess impact of new biopesticides (ecotox studies).
- Develop formulations and application methodologies for biopesticides.
- Conduct ex-ante socioeconomic studies of efficient biopesticides.
- Produce most promising biopesticides in a prototype facility.
- Collect and identify arthropods, pathogens, nematodes, and weeds in order to develop and provide diagnostic services and tools.
- Provide germplasm health/quarantine services.
- Maintain insectaries and live microbial collections.
- Conduct formal training for national scientists.
- Develop and disseminate training materials.
- Collaborate with commodity and disciplinary based networks.
- Provide technical backstopping to NARES, NGOs, etc.

Gains (Impact)

- Greater food security and reduced poverty through the reduction of yield losses, increased labor productivity and on- and off-farm incomes per household and at aggregate level, as well as increased food quality.
- Improved public health and reduced environmental degradation through the reduction of pesticide use and expenditures, the related reduction in pesticide-induced health problems, and the maintenance of biodiversity and environmental quality.
- Improved equity and gender balance through better access to pest management technologies by poor farmers and women, and increased on- and off-farm incomes for women (farmers, food processors, traders).
- Improved NARES and NGOs capability building through formal training, farmer field fora, and various planning and skill improvement workshops.

Duration

10 years.

Milestones

2002

- Data on regional spread of cassava mosaic geminiviruses (CMGs) in East and Central Africa published.
- Development of distribution maps for monitoring virulent CMGs in Kenya and Tanzania available.

- Cassava whitefly parasitoid populations in Uganda characterized.
- Efficiency of cassava whitefly parasitoids assessed in cage experiments.
- Improved knowledge on the distribution of nematode pests of *Musa* in Nigeria established.
- Pathogen surveys in host plants of *Plutella xylostella* and/or *Helicoverpa armigera* completed.
- African root and tuber scale (ARTS) distribution in Cameroon and Democratic Republic of Congo determined.
- Exotic and indigenous isolates of *Neozygites tanajoae* characterized.
- Identity and prevalence of cassava green mite (CGM) pathogens in Ghana, Kenya, and Tanzania determined.
- Dispersal of exotic phytoseiid predators modeled with GIS techniques; GIS models for target releases of mite pathogens in cassava developed and tested.
- Nematode vector studies on banana die-back badnavirus (BDBV) completed
- Molecular characterization of BDBV completed.
- Pathogen surveys of water hyacinth in Benin, Burkina Faso, Ghana, Mali, Niger, and Nigeria completed.
- Survey for natural enemies of banana weevils in Indonesia completed.
- Studies on effect of cassava plant morphology on CGM predator preference completed and published.
- Dynamics of *N. tanajoae*–CGM interactions across agroecologies characterized.
- Ecological model of growth of water hyacinth developed.
- Host specificity of water hyacinth pathogens determined.
- One survey on weevil pest status in coffee-banana systems at 2 sites completed.
- One survey of ants as predators of banana weevil in banana fields completed.
- Fungal endophyte community of 2 banana cultivars determined.
- Impact of *Maruca vitrata* Cypovirus (MvCPV) on *M. vitrata* in Benin and northern Nigeria evaluated.
- Efficacy of *Metarhizium anisopliae* on cowpea flower thrips determined in the field.
- Serological diagnostics for *P. xylosella* cypovirus (PxCPV) developed.
- Distribution of PxCPV in *P. xylostella* populations in peri-urban zones of Benin and Ghana evaluated.
- Microbial basis on *Striga* spp. suppressive soils determined.
- Role of indigenous phytoseiid predators in whitefly control on cassava quantified and published.
- Brazilian strains of *N. tanajoae* released in eastern and southern Africa.
- Persistence studies of exotic phytoseiid predators across agroecologies completed and published.
- Performance of 2 strains of *Beauveria bassiana* against banana weevil tested in 4 farming systems.
- Germplasm and advanced breeding lines with resistance to soybean rust screened under natural inoculation at hot spots.

- Influence of at least 5 factors on resistance expression to banana weevil attack determined.
- Vegetation management strategies for ARTS based on removal of reservoir host plants in fallows tested in Cameroon.
- Effect of crop residue management on banana weevil population dynamics completed.
- Socioeconomic studies of biopesticide (against peri-urban pests) constraints completed.
- Lab and green house ecological studies on PxGV completed.
- Sustainable mass production system for at least one virus of a peri-urban pest developed, PxGV released in Benin.
- Biopesticide regulatory framework survey for Africa completed and published.
- Socioeconomic household surveys to evaluate CGM biocontrol conducted in Malawi, Tanzania, and Mozambique.
- Improved diagnostic tools are applied to increase the safe exchange of disease tested seeds and vegetative propagules.
- Reference arthropod and plant pathogen collection, and related identification capacity maintained and enhanced.

2003

- Epidemiology of cassava mosaic disease (CMD) in Congo Republic and DRC described.
- Distribution maps for monitoring virulent CMGs in Congo Republic and DRC developed.
- Effects of CMGs and CMG mixtures on cassava yield quantified and published.
- Molecular diagnostics for cassava brown streak disease (CBSD) established at Plant Quarantine Station, Kenya.
- Surveys on main nematode pests on cassava in DRC and on both cassava and yams in Zanzibar completed.
- Cast structure and distribution of ants associated with ARTS completed and published.
- Practical diagnostic tool for *N. tanajoae* developed and tested.
- GIS models of phytoseiid predators published; distribution of ARTS in Central Africa modeled and tested.
- Natural enemies of *M. vitrata* have been imported into South Africa and quarantine established in collaboration with PPRI in Pretoria.
- Survey of BDBV occurrence completed in Ghana, Nigeria and Cameroon.
- Nematode population in banana/plantain producing areas in southern Cameroon known.
- Importance of nematode species on *Musa* in relation to *Radopholus similis* established for mother crops.

- Appropriateness of 2 semiochemical based trapping systems for banana weevil determined.
- Improved knowledge on the development of nematode communities on *Musa* and the importance of different species within the communities gained.
- Field and greenhouse trials to assess yield loss caused by *Striga gesnerioides* in cowpea completed in Kano.
- Role of ants in ARTS biology determined.
- Nontarget ecological effects of CGM biocontrol studied and published.
- Mechanistic studies on phytoseiid predators-CGM-plant interactions completed and published.
- Control potential of 5 ant species against banana weevil evaluated.
- Fungal endophyte community of 1 banana cultivar characterized (AFLP, RFLP).
- Mechanisms of endophyte mediated pest and disease control of at least 5 isolates on 1 *Musa* clone determined.
- Molecular diagnostics of *N. tanajoae* based on AFLP and RAPD in collaboration with Cornell University developed and tested.
- Serological diagnostics for MvCPV developed and tested.
- Distribution of MvCPV assessed in Benin and northern Nigeria.
- Potential of entomopathogenic fungi for control of pod sucking heteropteran on cowpea assessed.
- Experimental releases of *Ceraninus femoratus* against cowpea flower thrips in Benin assessed.
- Influence of different host plant kairomones on the searching behaviour of *C. femoratus* determined.
- Potential of PxCPV in controlling *P. xylosella* assessed in the laboratory.
- Fungi from diseased *Striga* and *Alectra* isolated from several locations.
- Exotic isolates of *N. tanajoae* released in Ghana, Kenya, and Tanzania, and their persistence and impact on CGM populations monitored.
- Population dynamics, spread and impact studies of CGM populations on cassava in West Africa completed and published.
- Five substrates for mass production and 3 delivery systems for *Beauveria bassiana* against banana weevil tested.
- Six isolates of endophytic fungi for banana weevil, nematode, and *Fusarium* wilt control screened in pots experiments.
- Forty strains of *Paecilomyces lilacinus* for nematode control isolated and 20 strains screened.
- Rapid screening methodology for nematode resistance in yam established.
- Screening methodology for root-knot nematode resistance in cassava established.
- Screening techniques for resistance against cowpea bacterial blight under field conditions on-station evaluated.

- Cowpea varieties with varying levels of putative resistance to CoBB across locations/environments evaluated.
- Hot spots for soybean rust identified and evaluated.
- Preliminary vector studies of BSV on transgenic *Musa* completed.
- Plant defense mechanisms to banana weevil attack for at least 5 clones determined.
- Comparative efficiencies of mulching quantity of *Tithonia* for nematode management in *Musa* established for mother crops.
- Vegetation management strategies based on removal of reservoir host plants for ARTS in fallows tested in DRC.
- Effects of neem on banana weevils studied at 2 on-farm sites.
- Farmer and private sector participatory trials of PxGV completed.
- Strategies for commercialization of PxGV established.
- Effect of neem products on biology and control of *S. hermonthica* in cereals studied.
- Botanicals for the control of anthracnose, brown blotch, and web blight in cowpea studied in laboratory experiments.
- Comparative efficiencies of botanical insecticides (neem, papaya, *Hyptis suaveolens*) against key insect pests of cowpea established.
- Studies on conservation of botanical insecticides against key pests of cowpea completed.
- At least 300 isolates of *Musa* endophytes conserved.
- Socioeconomic benefits of CGM biocontrol in eastern and southern Africa quantified and published.
- Improved diagnostic tools applied to increase the safe exchange of disease tested seeds and vegetative propagules.
- Reference arthropod and plant pathogen collection, and related identification capacity maintained and enhanced.

2004

- Tanzanian CMGs characterized and interactions described.
- Presence/absence of a putative CMD epidemic associated *B. tabaci* genotype in Uganda determined.
- CBSD spread rates into SARRNET cassava germplasm quantified.
- Results on biocontrol of whiteflies published.
- Key mechanisms of resistance to CBSD established.
- Decision tree for phytosanitation management of CMD developed.
- Molecular markers identified and in use for separating distinct whitefly genotypes.
- Genetic and pathogenic conformity of the yam nematode *Scutellonema bradys* from West Africa established.
- Diet breadth of ants associated with ARTS assessed and published.
- Diagnostic tools for *N. tanajoae* widely implemented.

- GIS models of ARTS distribution and abundance published.
- Nematode population in banana/plantain producing areas in northern Cameroon are known.
- Importance of nematode species on *Musa* in relation to *Radopholus similis* established for ratoon crops.
- Yield losses caused by *S. hermonthica* in maize established.
- Mechanisms of endophyte mediated pest and disease control of at least 1 isolate on 3 *Musa* clones determined.
- Impact of PxCPV on *P. xylostella* populations evaluated.
- Bacteria associated with *Striga* spp. soil suppressiveness identified.
- Specific pathogenicity of pathogens of *Striga* and *Alectra* established.
- Recommendations for enhancing indigenous phytoseiid populations in whitefly control on cassava developed and disseminated.
- Impact of *N. tanajoae* on CGM populations in eastern and southern Africa determined.
- CGM biocontrol with exotic phytoseiid predators in central, eastern and southern Africa completed and published.
- Forty new isolates of endophytic fungi for banana weevil, nematode and *Fusarium* wilt control screened.
- Screening of *Musa* hybrids for resistance to *R. similis* completed and published.
- Screening of *Musa* hybrids and cultivars for resistance to *Helicotylenchus multicinctus* and *Pratylenchus* spp. completed and published.
- Screening of yam cultivars for resistance to nematode pests completed.
- Screening of cassava cultivars for resistance to nematode pests completed.
- Reliable methods for screening cowpea germplasm/advanced breeding lines for reaction to bacterial blight evaluated at 3 different locations.
- Genetic and environmental mechanisms of resistance to ARTS determined.
- Comparative efficiencies of mulching quantity of *Tithonia* for nematode management in *Musa* established for ratoon crops.
- Role of vegetation management in ARTS control completed and published.
- Botanicals for the control of anthracnose, brown blotch, and web blight in cowpea studied in greenhouse and field experiments.
- Effect of *Khaya* spp., *Hyptis* spp., and papaya extracts on natural enemies of cowpea pests evaluated in the field.
- Efficacy of mass-reared *Trichogrammatoidaea ?eldanae* on its host *M. vitrata* assessed through experimental releases.
- Monoclonal cell lines rejuvenated and antibody stocks maintained. New antibodies prepared and screened, diagnostics validated.
- Requested tests done on tissue culture plantlets of yam, *Musa*, and cassava to ensure freedom from viruses.
- At least 600 isolates of *Musa* endophytes conserved.
- Improved diagnostic tools are applied to increase the safe exchange of disease tested seeds and vegetative propagules.

- Reference arthropod and plant pathogen collection, and related identification capacity maintained and enhanced.

2005

- Detailed characterization of CMGs in Congo Republic and DR Congo completed.
- CBSD epidemiology data published.
- Data on mechanisms of resistance to CBSD published.
- Results on use of phytosanitation for CMD control in cassava and SPVD control in sweetpotato published.
- CBSD molecular diagnostics in use in Kenya, Tanzania, and Mozambique.
- Invertebrate fauna associated with ARTS published.
- Olfactory responses by main natural enemies to semiochemicals from *M. vitrata* elucidated.
- Heritability studies of predator-preferred plant morphology published and incorporated into cassava improvement programs.
- Yield losses caused by *S. hermonthica* in maize and sorghum completed and published.
- Yield losses caused by *S. gesnerioides* in cowpea completed.
- Yield losses caused by *Alectra vogelii* in cowpea and groundnut completed.
- Studies on *N. tanajoa*-CGM interactions, and predator-pathogen-CGM interactions completed and published.
- Isolates with specific pathogenicity to *S. gesnerioides* and *A. vogelii* evaluated
- Data on cassava resistance to ARTS published.
- Comparative screening of most efficacious crop varieties against *Striga* spp. populations from representative AEZ sites established.
- Isolation and elucidation of chemical structure of active compounds from *Hyptis* spp. and *Papaya* spp. completed.
- Improved diagnostic tools applied to increase the safe exchange of disease-tested seeds and vegetative propagules.
- Reference arthropod and plant pathogen collection, and related identification capacity maintained and enhanced.

Users

This project delivers a wide range of pest management options, from stand-alone classical biological control agents which require little or no inputs, to biopesticides, which might be developed and disseminated through private-public enterprises. Ultimate targets are farmers in all agroecological regions of SSA. Intermediate users are plant protectionists assembling, testing and fine-tuning the different pest management components into IPM baskets in the three IITA systems projects, as well as collaborators in NARES, NGOs, and extension services.

Collaborators

NARES and NGOs in West and Central Africa, and some from East and southern Africa, the Inter-African Phytosanitary Council, CIMMYT, ICRISAT, ICIPE, CABI, CIRAD, IRD, GTZ, NRI, ICIPE, IBCD, USDA, FAO; commercial biopesticide producers, and arthropod collections in Europe and Africa.

System linkages

Link to CGIAR logframe outputs Germplasm Improvement (10%), Germplasm Collection (0%), Sustainable Production (60%), Policy (10%), and Enhancing NARS (20%).

Project C. Assessing impact, formulating policy options, and systems analysis

Goal

Contribute to improved rural livelihoods and sustainable developments in sub-Saharan Africa through the generation and application of knowledge on food and marketing systems, policy options, the benefits and disbenefits of technological change and relevant socioeconomic processes, in partnership with agro-entrepreneurs, consumers, policy makers, NARES, NGOs, and other stakeholders.

Purpose

In partnership with stakeholders including policymakers, agro-entrepreneurs, consumers, NARES, NGOs, ARIs, and international scientists, bring direct benefits to people in key research sites through the development of methodologies and strategies that result in needed technologies and through their subsequent promulgation and adoption for the overall development of sub-Saharan Africa.

Outputs

1. Methodologies/strategies for priority setting of IITA research developed, available, and implemented.
2. Policy and market opportunities developed and used for technical change and commercialization.
3. Strategies developed for enhancing livelihoods related to nutrition, health and gender.
4. Strategies available for enhanced commercialisation of agro-enterprises and support services.
5. Extrapolation of IITA research findings through the development and application of geo-spatial and systems models.
6. Impact of agricultural research enhanced and documented.
7. NARES capabilities strengthened for maintaining policy, impact, and systems analysis.

Priority activities

- Develop strategies for the development of a market-driven agriculture.
- Make recommendations, in collaboration with other stakeholders, to improve commodity based supply chain efficiency and effectiveness.
- Develop and establish new strategies for the dissemination of market information systems.
- Evaluate future food needs in urban and rural areas.
- Identify constraints in policy concerning the supply and distribution system, and use of basic input commodities (seed, fertilizer, machinery), and engender healthy and competitive markets for agricultural commodities.

- Determine the effects of institutional arrangements (e.g., land tenure) and infrastructure on commercialization and intensification of African agriculture.
- Identify opportunities and understand farmers' strategies for change and their ways of interacting with new technologies in order to improve their livelihoods.
- Examine strategies to mitigate the negative effects of emerging and pandemic diseases (AIDS/HIV and malaria) and negative effects of agriculture on human health.
- Formulate strategies permitting efficient scaling-up of research results from selected villages to the entire benchmarks and beyond their boundaries through the assessment of scale relationships in biophysical and socioeconomic contexts.
- Develop and apply research methods and procedures for IITA to set research priorities.
- Enhance the impact of technological interventions.
- Monitor and evaluate adoption processes for feedback into the research and development cycle, leading to the development of appropriate strategies for scaling-up agricultural innovations.
- Strengthen NARES capacity for impact, policy, and systems analysis.

Gains (Impact)

- NARES, NGOs, IARCs, and ARIs working together, in partnership with farmers, in key research sites in the humid forest, savannas of West and Central Africa, and middle altitude of eastern and southern Africa.
- Policy decision-makers from West, Central, eastern, and southern Africa sensitized to, and supportive of relevant policies that facilitate the development of a market-oriented agricultural sector.
- Rural poor farmers adopt improved food systems that result in increased agricultural productivity, higher income, and environment protection.
- Impact pathways identified and returns to research demonstrated.
- Donors convinced to increase investment in agricultural research in sub-Saharan Africa.
- IITA efficiently allocates resources to priority regions, programs, and activities.
- Holistic, participatory, and market-driven research programs operational in the key research sites.

Duration

10 years.

Milestones

2002–2003

- Development of GIS market indicators for the savanna research site.

2002–2004

- Surveys on marketing systems for agricultural outputs in West, Central, and East Africa.

- Modelling impacts of policy interventions on sustainable management of landscapes in the forest margins.
- Gender impacts of the commercialization of smallholder agriculture in Nigeria.
- Modelling changes in the agricultural practices in the derived-savanna of Nigeria.
- Testing pilot networks of farmer-private sector linkages for market-driven technology transfer in Nigeria.
- Commercialization of cassava and sweetpotato utilization in the SARRNET region.
- Characterization of landscape units in the humid forest margins of Nigeria.

2002–2005

- Yearly production of extension material (such as market information systems) in collaboration with NARS institutions.
- Assessment of the impact of malaria and HIV/AIDS on agriculture in West Africa.
- Economic analysis of aflatoxin on human health in Benin Republic.
- Financial and economic analyses of improved technologies.
- Developing systems for improving market support services in eastern and West Africa.
- Establishing new market information systems.
- Production of a GIS of sociological, economic, physical and biological data for the extrapolation of the IITA research findings benchmark.

2003

- Development of methods and procedures for priority setting.

2003–2004

- Food surveys in rural areas of the savannas and forest ecologies in Nigeria.
- Surveys on marketing systems of seed inputs in Nigeria.
- Development of database required to setting research priorities.

2003–2005

- Compilation and ongoing monitoring of agricultural policies and their impact on agriculture in benchmark areas.
- Set research priorities for IITA programs and ecoregions.
- Development of the FOODNET website.
- Preliminary output on GIS information incorporating environmental biological and socio-economic variables analyzed to define technology specific recommendation domains with annual refinement to 2010.
- Adoption and impact generation studies to guide ongoing research and the development of new and improved research and extension methods (Continuing process, as specific data become available from other projects up to 2010).

- Social, environmental, and economic ex-post impact studies of win-win IITA developed technologies.
- Production of at least 1 special impact report per year.
- Research planning and execution takes place with principal stakeholders with at least one annual meeting in West, Central, eastern, and southern Africa.
- Demand-driven group training for impact, policy, and socioeconomic studies.
- On-the-job annual training of partners in surveys, socioeconomic, and GIS techniques from late 2002 until 2005.
- Postgraduate training of at least one MSc or PhD student every year up to 2010.
- Short-term training (≤ 1 year) of students on industrial attachment in Nigeria.
- Institutional capacity building of the national research systems.

Users

Researchers and policymakers will have access to ad hoc information on socioeconomic and biophysical data, allowing for better research planning and policies that encourage farmers to adopt technologies that could contribute to the improvement of rural livelihoods and sustainable development in SSA. Private sector that will have ad hoc information on market opportunities for inputs and outputs. Donors sensitized to the usefulness of continuous support for agricultural research for SSA.

Collaborators

NARS, policymakers, the private sector of West, Central, eastern, and southern Africa, as well as other CG centers such as ICLARM, ICRAF, IFPRI, ILRI, CIAT, CIFOR, and non CG centers such as IFDC, CIRAD, and WINROCK. Joint research will be carried out with the University of Hohenheim, KUL Leuven, Kyoto University, other ARIs, and selected NGOs.

System linkages

Link to CGIAR logframe outputs Sustainable Production (17%), Policy (58%), and Enhancing NARS (25%).

Project C. Assessing impact, formulating policy options, and systems analysis

Goal

Contribute to improved rural livelihoods and sustainable developments in sub-Saharan Africa through the generation and application of knowledge on food and marketing systems, policy options, the benefits and disbenefits of technological change and relevant socioeconomic processes, in partnership with agro-entrepreneurs, consumers, policy makers, NARES, NGOs, and other stakeholders.

Purpose

In partnership with stakeholders including policymakers, agro-entrepreneurs, consumers, NARES, NGOs, ARIs, and international scientists, bring direct benefits to people in key research sites through the development of methodologies and strategies that result in needed technologies and through their subsequent promulgation and adoption for the overall development of sub-Saharan Africa.

Outputs

1. Methodologies/strategies for priority setting of IITA research developed, available, and implemented.
2. Policy and market opportunities developed and used for technical change and commercialization.
3. Strategies developed for enhancing livelihoods related to nutrition, health and gender.
4. Strategies available for enhanced commercialisation of agro-enterprises and support services.
5. Extrapolation of IITA research findings through the development and application of geo-spatial and systems models.
6. Impact of agricultural research enhanced and documented.
7. NARES capabilities strengthened for maintaining policy, impact, and systems analysis.

Priority activities

- Develop strategies for the development of a market-driven agriculture.
- Make recommendations, in collaboration with other stakeholders, to improve commodity based supply chain efficiency and effectiveness.
- Develop and establish new strategies for the dissemination of market information systems.

- Evaluate future food needs in urban and rural areas.
- Identify constraints in policy concerning the supply and distribution system, and use of basic input commodities (seed, fertilizer, machinery), and engender healthy and competitive markets for agricultural commodities.
- Determine the effects of institutional arrangements (e.g., land tenure) and infrastructure on commercialization and intensification of African agriculture.
- Identify opportunities and understand farmers' strategies for change and their ways of interacting with new technologies in order to improve their livelihoods.
- Examine strategies to mitigate the negative effects of emerging and pandemic diseases (AIDS/HIV and malaria) and negative effects of agriculture on human health.
- Formulate strategies permitting efficient scaling-up of research results from selected villages to the entire benchmarks and beyond their boundaries through the assessment of scale relationships in biophysical and socioeconomic contexts.
- Develop and apply research methods and procedures for IITA to set research priorities.
- Enhance the impact of technological interventions.
- Monitor and evaluate adoption processes for feedback into the research and development cycle, leading to the development of appropriate strategies for scaling-up agricultural innovations.
- Strengthen NARES capacity for impact, policy, and systems analysis.

Gains (Impact)

- NARES, NGOs, IARCs, and ARIs working together, in partnership with farmers, in key research sites in the humid forest, savannas of West and Central Africa, and middle altitude of eastern and southern Africa.
- Policy decision-makers from West, Central, eastern, and southern Africa sensitized to, and supportive of relevant policies that facilitate the development of a market-oriented agricultural sector.
- Rural poor farmers adopt improved food systems that result in increased agricultural productivity, higher income, and environment protection.
- Impact pathways identified and returns to research demonstrated.
- Donors convinced to increase investment in agricultural research in sub-Saharan Africa.
- IITA efficiently allocates resources to priority regions, programs, and activities.
- Holistic, participatory, and market-driven research programs operational in the key research sites.

Duration

10 years.

Milestones

2002–2003

- Development of GIS market indicators for the savanna research site.

2002–2004

- Surveys on marketing systems for agricultural outputs in West, Central, and East Africa.
- Modelling impacts of policy interventions on sustainable management of landscapes in the forest margins.
- Gender impacts of the commercialization of smallholder agriculture in Nigeria.
- Modelling changes in the agricultural practices in the derived-savanna of Nigeria.
- Testing pilot networks of farmer-private sector linkages for market-driven technology transfer in Nigeria.
- Commercialization of cassava and sweetpotato utilization in the SARRNET region.
- Characterization of landscape units in the humid forest margins of Nigeria.

2002–2005

- Yearly production of extension material (such as market information systems) in collaboration with NARS institutions.
- Assessment of the impact of malaria and HIV/AIDS on agriculture in West Africa.
- Economic analysis of aflatoxin on human health in Benin Republic.
- Financial and economic analyses of improved technologies.
- Developing systems for improving market support services in eastern and West Africa.
- Establishing new market information systems.
- Production of a GIS of sociological, economic, physical and biological data for the extrapolation of the IITA research findings benchmark.

2003

- Development of methods and procedures for priority setting.

2003–2004

- Food surveys in rural areas of the savannas and forest ecologies in Nigeria.
- Surveys on marketing systems of seed inputs in Nigeria.
- Development of database required to setting research priorities.

2003–2005

- Compilation and ongoing monitoring of agricultural policies and their impact on agriculture in benchmark areas.
- Set research priorities for IITA programs and ecoregions.
- Development of the FOODNET website.
- Preliminary output on GIS information incorporating environmental biological and socioeconomic variables analyzed to define technology specific recommendation domains with annual refinement to 2010.
- Adoption and impact generation studies to guide ongoing research and the development of new and improved research and extension methods (Continuing process, as specific data become available from other projects up to 2010).
- Social, environmental, and economic ex-post impact studies of win-win IITA developed technologies.
- Production of at least 1 special impact report per year.
- Research planning and execution takes place with principal stakeholders with at least one annual meeting in West, Central, eastern, and southern Africa.
- Demand-driven group training for impact, policy, and socioeconomic studies.
- On-the-job annual training of partners in surveys, socioeconomic, and GIS techniques from late 2002 until 2005.
- Postgraduate training of at least one MSc or PhD student every year up to 2010.
- Short-term training (≤ 1 year) of students on industrial attachment in Nigeria.
- Institutional capacity building of the national research systems.

Users

Researchers and policymakers will have access to ad hoc information on socioeconomic and biophysical data, allowing for better research planning and policies that encourage farmers to adopt technologies that could contribute to the improvement of rural livelihoods and sustainable development in SSA. Private sector that will have ad hoc information on market opportunities for inputs and outputs. Donors sensitized to the usefulness of continuous support for agricultural research for SSA.

Collaborators

NARS, policymakers, the private sector of West, Central, eastern, and southern Africa, as well as other CG centers such as ICLARM, ICRAF, IFPRI, ILRI, CIAT, CIFOR, and non CG centers such as IFDC, CIRAD, and WINROCK. Joint research will be carried out with the University of Hohenheim, KUL Leuven, Kyoto University, other ARIs, and selected NGOs.

System linkages

Link to CGIAR logframe outputs Sustainable Production (17%), Policy (58%), and Enhancing NARS (25%).

Project D. Promoting food security and income generation through sustainable production and commercialization of starchy and grain staples in eastern and southern Africa

Goal

Enhanced food security, improved livelihoods, and socioeconomic development in eastern and southern Africa.

Purpose

Develop and promote, in collaboration with public and private sector stakeholders, the adoption of improved technologies and market support services for sustainable increases in production, utilization and commercialization of starchy and grain staples.

Outputs

1. Market opportunities identified for setting R for D agenda and formulating policy options.
2. Commercially viable small- and medium-scale agroenterprises that expand trade of starchy and grain staples enhanced.
3. Broad-based and special trait genotypes and populations targeting the major production systems and market opportunities developed and disseminated.
4. Environmentally safe integrated plant protection technologies that reduce pre- and postharvest losses due to pests and diseases developed and applied.
5. Crop and natural resource management practices for sustainable, competitive, and commercially based production systems developed and disseminated.
6. Public and private sector partnerships that promote information and technology exchange with emphasis on scaling up strategies for increased trade developed and/or strengthened.
7. Capacities of NARS and other stakeholders to generate, evaluate and disseminate appropriate knowledge and intervention technologies for target subsectors enhanced.

Priority activities

- Characterization of agrifood systems and markets to identify opportunities and constraints to expansion of utilization in the food, feed, and industrial sectors.
- Increased knowledge base for effective prioritization, planning, implementation, monitoring, and impact assessment of R for D activities.
- Development, evaluation, and promotion of improved postharvest technologies for expanded utilization in viable commercial enterprises.
- Evaluate value adding opportunities within selected market chains to strengthen agroenterprise linkages between producers, processors, and emerging markets to expand commercial options.

- Development, evaluation, and promotion of improved and adapted germplasm for the different production systems and market opportunities with emphasis on food, feed, and industrial characteristics.
- Maintenance and improvement of broad-based and special trait populations, and delivery of seed populations and in vitro plantlets of elite germplasm to national programs and other stakeholders.
- Integration and application of environmentally safe plant protection technologies to reduce pre- and postharvest losses caused by pests and diseases.
- Development of natural resource management practices to ensure sustainable commercially competitive production systems.
- Fostering broader interaction with the public and private sectors to promote information and technology exchange and their application towards increased national and regional trade.

Gains (Impacts)

- Diverse and multiple disease and pest resistant cultivars with superior and stable yield performance and acceptable food, feed, and industrial quality characteristics increasingly available and utilized by NARS and other stakeholders by 2004 onwards. Potentially adoptable technologies for improved and sustained production systems demonstrated in long-term, on-station trials and in benchmark sites available. Increased value addition to improved germplasm within the food, feed, and agro-industrial sectors for expanded commercialization and trade. These achievements combined with effective delivery by NARS and broader public and private partnerships, which promote information and technology exchange, will lead to widespread and successful deployment of improved technologies tailored to meet farmer, processor, and consumer requirements that will enhance increased production, utilization, commercialization and national and regional trade.
- Resource-poor farmers using these technologies will significantly improve and sustain their production systems with less dependence on pesticide and chemical inputs. Increased productivity with genetic traits that enhance utilization in the food, feed, and industrial sector would provide additional source of cash income for those households, especially women, who produce and/or process these commodities. In addition, there will be an increased low cost carbohydrate staple for low-income urban and rural consumers, and food security in vulnerable areas. Collaborating NARS and other stakeholders will benefit from enhanced human resource development and capacity to undertake research and development activities towards increased productivity, utilization, commercialization, and national and regional trade.

Duration

10 years.

Milestones

2002

- Cassava subsector and market characteristics described in at least 5 countries and approaches to strengthen links between producers and end-users developed, regional study on banana markets and products completed and opportunities identified to target R&D activities.
- Sources of resistance to cassava brown streak virus, mosaic, bacterial blight, and green mite, and lines with improved nutritional quality and specific functional characteristics targeting different end uses identified and incorporated into breeding populations for screening.
- Studies on genetic diversity, molecular mapping, resistance mechanisms, and yield loss due to pests and diseases initiated.
- Expanded genetic base for selection programs and improved capacity of NARS and other stakeholders to increasingly undertake collaborative research and development activities on the starchy and grain staples.
- Regional exchange of germplasm facilitated among collaborating countries as seeds or tissue cultured material and through open quarantine facilities.
- Clean foundation seed and planting material of promising genotypes multiplied and made available for farmer participatory on-farm testing, multiplication, and distribution.
- Major areas for commercial cassava and banana production identified, target areas for soil rejuvenation studies characterized in terms of cropping systems and soil fertility status/constraints.
- Past natural resource management research in Uganda reviewed, probable soil constraints to production identified on a regional basis, and target domains for future research identified.
- Genetic diversity and relationships among East African highland bananas established, new sources of resistant to black Sigatoka, *R. similis*, and weevils identified, male and female fertility of germplasm from Papua New Guinea evaluated, and germplasm with desirable agronomic and quality traits selected for propagation or used in developing improved populations.
- Human capabilities improved through initiation of 3 PhD programs on microbial control, weevil, nematode resistance/mechanisms of banana, 1 PhD program on nematode resistance in yam, 2 PhD programs on cassava mosaic virus and whitefly characterization, 6 MSc programs on microbial control and genetic diversity of EAHB, 2 MSc programs on pest and disease management in cassava through phytosanitation and biocontrol of whiteflies in sweetpotato, and completion of 3 MSc studies on evaluation of transfer of clean banana planting material, biocontrol of whiteflies in cassava and cassava mosaic virus interactions, and organization of a national course on statistical analysis using SAS program.
- Information and technologies diffused through radio/TV broadcasts and print media; attendance, promotion and participation in network steering committee meetings and initiatives; support for NARS scientists as requested, exchange

visits, completion of the market study reports and attendance in the cassava sub-sector workshop; stakeholder meetings; participation in the establishment of farmer field schools; and completion of one manual on banana IPM.

- Diagnostic pest and disease surveys conducted in Uganda, DR Congo, Angola, Madagascar, Malawi, Tanzania and Rwanda, on-farm and on station studies on crop sanitation initiated on factors affecting weevil response to semiochemicals and economic mass production and delivery systems for the fungal entomopathogen *Beauveria bassiana* developed.

2003

- At least 20 improved cassava genotypes with superior yield, stable performance, and acceptable quality targeting different end uses recommended for farmer participatory testing, multiplication, and distribution in at least 5 countries in ESA.
- New cassava-based value-added food products and income generating processing techniques disseminated through NARS and other stakeholders to operate at least 5 pilot rural microenterprises by farmers/women groups in at least 3 countries.
- Bases for adaptation to abiotic and biotic stresses and phenotypic characteristics most appropriate for various production and utilization systems elucidated and utilized in breeding programs.
- Medium- and long-term sustainability trials initiated to positively identify soil constraints to production in degraded systems and test effects of soil amendments and natural resource management strategies.
- Soil and plant analysis laboratory capacity and quality improved, equipment upgraded, monitoring procedures implemented, and analytical training program established.
- Feasibility studies and cost-benefit analysis for tissue cultured planting material established, and impact of clean planting material assessed.
- Secondary triploids with Sigatoka resistance, good bunch weight, and agronomic traits selected for further on-station evaluation.
- Information and technologies diffused through radio/TV broadcasts and print media, attendance, promotion and participation in network steering committee meetings and initiatives, support for NARS scientists as requested, exchange visits, participation in the ISTRC symposium (Tanzania), stakeholder meetings, participation in farmer field schools, and publication of one manual on banana IPM.
- Completion of 2 PhD studies on natural enemies and effects of crop sanitation for control of banana weevil and organization of a national course on statistical analysis using SAS.
- In vitro collection of all EAHB established, genetic relationships of highland bananas and *M. acuminata* subsp. *banksii* established, drum and bucket trials to identify cultivars resistant to *Fusarium* wilt completed, genetic analysis of resistance to nematodes and resistance mechanisms completed in at least 10 genotypes.
- Pathogenicity testing and genetic/molecular characterization of isolates/biotypes of *Fusarium* wilt, *R. similis* completed and weevils responses to two *B. bassiana* isolates completed and delivery systems established.

- Regional exchange of germplasm facilitated among collaborating countries as seeds or tissue cultured material and through open quarantine, and establishment of primary, secondary, and tertiary multiplication fields, 3 high-yielding “matooke” landraces multiplied and distributed to NARS in Rwanda.
- Cassava G × E interaction and site characterization completed and results used for regional evaluation of improved germplasm by NARS.

2004

- At least 100 NARS personnel and other stakeholders trained in production and utilization techniques and microenterprise development.
- Nutrient management for high yielding cassava in sustainable production systems documented.
- Commodity based public–private sector consortium with network partners operational in at least one country.
- Knowledge-base significantly strengthened for effective prioritization, planning, implementation, monitoring, and impact assessment of R&D activities.
- Appropriateness for semiochemicals and *B. bassiana* determined and their costs–benefit analysis established, on-farm testing of banana IPM components in Kenya, Uganda, and Tanzania.
- Components of cassava whitefly and whitefly-borne virus IPM developed and assembled into a package for on-farm testing.
- Clones with high breeding values identified and used in back-up population development. In vitro regional core collection of local and improved cassava genotypes with accessible information maintained at the regional in-vitro germplasm bank at PQS, Muguga, Kenya, in vitro and in situ conservation of national core collection maintained in at least 5 ESA countries, at least 30 TC materials introduced to NARS for testing and establishment of multiplication fields.
- Sources of *Fusarium* wilt resistance identified and used in *Musa* breeding program, sources for resistance to *Pratylenchus goodeyi* assessed, durability for nematode resistance established, sources of resistance to nematodes in yam assessed.
- Effects of banana-coffee intercropping on weevil and nematode incidence determined and factors affecting performance of endophytes and *B. bassiana* on weevil, nematode, and wilt control ascertained.
- Information and technologies diffused through radio/TV broadcasts and print media; attendance, promotion, and participation in network steering committee meetings and initiatives; support for NARS scientists as requested; exchange visits; participation in the ISTRC—AB symposium (Kenya); stakeholder meetings, participation in farmer field schools, completion of 3 PhD studies on the potential of semiochemicals for banana weevil control, whitefly characterization, and cassava mosaic virus characterization; and completion

of two MSc studies on phytosanitation for pest/disease management and biocontrol of whiteflies in sweetpotato.

- Policy studies undertaken with at least 1 government agency in the region with clear recommendations and pathways for change identified and discussed with policymakers.

2005

- Options and strategies for long-term sustainability for small-, medium-, and large-scale production to processing systems developed.
- At least 2 adoptable technologies for improved, sustained commercially viable production system in use by farmers.
- At least 15 cassava genotypes recommended for release in at least 5 countries.
- Impact analysis of pilot phase commercial agroenterprises completed.
- Soil and natural resource management strategies leading to higher yield and improved soil quality in high-yielding commercial based systems identified.
- Soil fertility constraints to production in marginal systems and adaptable resource management strategies to overcome said constraints identified.
- At least 3 improved cultivars with Sigatoka resistance, nematode resistance, and good bunch weights recommended for testing in farmers' fields.
- Regular meetings with NARS scientists and other stakeholders for exchange of ideas, joint planning, and collaborative activities.

Users

NARS and other stakeholders (farmers, processors and consumers) in ESA are the primary users of the outputs of this project through existing or new delivery systems. Impact at the farm level will continue to increase and contribute to improved incomes and food supply for resource poor people. Processors will be able to sell a range of improved, new value-added products with lower production costs due to improved storage and processing efficiencies. New partnerships with other stakeholders will evolve with expanded utilization, increasing commercialization, and national and regional trade.

Collaborators

IARCs—CIAT, CIMMYT, CIP, ICRAF, ICRISAT, ILRI, IPGRI, ICIPE

Networks—EARRNET, SARRNET, FOODNET, BARNESA, BIONET International.

Regional organizations—ASARECA, SACCAR, ISTRC—AB, NGOs and CBOs, Farmers Associations, Entrepreneurs.

AROs—Vegetable and Ornamental Plant Institute ARC, South Africa; CIRAD, France; FAO, Rome, ILTAB, USA, NRI, UK, KU Leuven, Belgium, FABI University Pretoria, South Africa, University Bonn, Germany, Makerere University, Uganda, TSBF, Kenya, Institute of Experimental Botany, Czech Republic, NARO, Uganda; KARI, Kenya; KEPHIS, Kenya; ISAR, Rwanda; ISABU, Burundi; INERA, DR Congo; University of Arizona, USA.

System linkages

The project has direct contributions to outputs Germplasm Improvement (17%), Germplasm Collection (2%), Sustainable Production (31%), Policy (9%), and Enhancing NARS (41%).

Project E. A future through farming: enhancing livelihoods, improving the resource base and protecting the environment through starchy staple, peri-urban and tree crop systems of the humid and subhumid zones of West and Central Africa

Goal

Productivity and profitability of diverse agricultural systems increased and environmental services and sustainable management of natural resources improved, leading to enhanced livelihoods in the humid and subhumid zones of West and Central Africa.

Purpose

Productive plantain and banana systems, intensified cassava systems, sustainable yam systems, multi-product tree crop systems, and market-oriented peri-urban crop and livestock systems developed in partnership with farmers, NGOs, NARES, and advanced research institutions are adopted and adapted by farmers and agribusiness in a conducive policy environment leading to widespread uptake of innovations in production, commercialization, and management.

Outputs

- 1. Productive plantain systems:** Integrated pest management strategies, improved cultivars, sustainable resource and crop management practices, and improved product use options developed for productive plantain and cooking banana systems, including associated crops, in partnership with farmers, NGOs, NARES, and advanced research institutions are adopted and adapted in major production areas supplying urban markets such that farmer to farmer diffusion follows leading to widespread uptake.
- 2. Intensified cassava systems:** Integrated pest management strategies, improved cultivars, sustainable resource and crop management practices, and improved product use options developed for intensified cassava systems, including associated crops, in partnership with farmers, NGOs, NARES, and advanced research institutions are adopted and adapted in major production areas supplying urban markets such that farmer to farmer diffusion follows leading to widespread uptake.
- 3. Sustainable yam systems:** Integrated pest management strategies, improved cultivars, sustainable resource and crop management practices, and improved product use options developed for sustainable yam systems, including associated crops, in partnership with farmers, NGOs, NARES, and advanced research institutions are adopted and adapted in major production areas supplying urban markets such that farmer to farmer diffusion follows leading to widespread uptake.
- 4. Multiproduct tree crop systems:** Integrated pest management strategies, improved cultivars, sustainable resource and crop management practices developed for multi-product tree crop systems in partnership with farmers, NGOs, NARES, and advanced research institutions are adopted and adapted such that farmer to farmer diffusion follows leading to widespread uptake.

5. **Market-oriented peri-urban crop and livestock systems:** Integrated pest management strategies, improved cultivars, sustainable resource and crop management practices and improved product utilization options developed for market-oriented peri-urban crop and livestock systems in partnership with farmers, NGOs, NARES, and advanced research institutions are adopted and adapted such that farmer to farmer diffusion follows leading to widespread uptake. (Note: Livestock include ruminants, monogastrics, and fish.)
6. **Integrated farm and landscape management options:** In partnership with farmers, NGOs, NARES, and advanced research institutions, appropriate farm, community and landscape management strategies and policy options developed to facilitate the widespread adoption and adaptation of innovations by farmers.
7. **Strengthening institutions and outreach:** In partnership with innovative farmers, NGOs, NARES, and advanced research institutions, information modules are developed and disseminated and the capability of stakeholders is enhanced to facilitate the widespread adoption and adaptation of innovations by farmers.

Priority activities

Productive plantain systems

- Develop plantain systems that are productive in deforested lands through integrated resource management, pest and disease management, and crop improvement strategies.
- Address soil fertility constraints through a combined use of organic and inorganic amendments.
- Address nematode and weevil control through improved clean planting material and agronomic measures adapted to farmer circumstances.
- Develop germplasm adapted to key pest and disease constraints, while preserving market preferences.
- Identify new product use options to enhance marketing opportunities.

Intensified cassava systems

- Develop intensified market-oriented cassava systems through integrated resource management; pest, disease, and weed management; and crop improvement strategies.
- Analyze cassava postharvest system and markets to identify needs, constraints, and opportunities, and to develop market and information systems efficiently linking producers to users.
- Develop soil fertility management strategies through a combined use of organic and inorganic amendments in commercial-oriented systems.
- Develop integrated management systems adapted to farmer circumstances to address particularly African root and tuber scale, root rots, and new cassava mosaic disease virus strains in Central Africa.
- Test and distribute germplasm adapted to the encountered key pest and disease constraints, while preserving market preferences.

Sustainable yam systems

- In general, develop intensified and sustainable yam systems that are productive in short fallow and continuously cropped lands through strategies integrating resource management, labor-saving measures, pest and disease management, and crop improvement.
- Establish nutrient deficiency symptoms in yam and address soil fertility constraints through efficient use of organic and inorganic amendments.
- Address pests and diseases, particularly nematodes, through improved and clean planting material and agronomic measures adapted to farmer circumstances.
- Develop germplasm adapted to key pest and disease constraints, while preserving market preferences and improving storability.
- Develop improved storage and processing methods and identify new marketing opportunities.

Multiproduct tree crop systems

- Test different approaches to create capacity and motivation of farmer associations and farmer-owned support services to assist smallholder cocoa and oil palm producers.
- Create and strengthen regional market and information systems, which enhance the efficiency of the tree crop sector, i.e., primarily cocoa and associated crops.
- Identify and promote the use of policy and strategy options that increase the efficiency and sustainability of the cocoa sector, address undesirable labor practices, and remunerate farmers for environmental services.
- Elucidate the ecological functioning, environmental services, and costs of newly established cocoa trees and maintain mature cocoa agroforests and other tree crop systems to identify factors of system sustainability and link to the global environmental debates/opportunities on carbon trading and biodiversity.
- Identify sustainable management practices, increase availability, and use of environmentally friendly production and postharvest technologies, while raising profitability and productivity of smallholder cocoa and oil palm systems.
- Establish multi-product cocoa and oil palm systems that are productive in deforested lands through strategies integrating resource management, pest and disease management, and crop and varietal choice.
- Identify cultural methods in combination with limited chemical use to reduce yield loss due to black pod disease in shaded multi-strata cocoa agroforest systems.

Market-oriented peri-urban crop and livestock systems

- Develop market-oriented peri-urban cropping systems and integrated crop–livestock systems in the humid and subhumid zones that exploit market opportunities, while making more economical and environmentally sound use of external and internal inputs adapted to different cropping sequences and management practices.

- Commercial fresh cassava systems: design and test intensive and sustainable crop rotations for fresh cassava, in order to generate income notably for resource-poor women. (Linked closely to Output 2 on cassava systems.)
- Commercial maize-grain legume systems: develop sustainable intensive crop rotations of maize and grain legumes in order to exploit niche markets for new products, e.g., new foods and animal feed. (Linked closely to the Savanna Systems Project.)
- Improving integration between crop and livestock: develop, test, and integrate into farming systems crop–livestock management strategies integrating crop selection, nutrient management, and livestock options in an environmentally sound manner while protecting the health of animals and humans. Target systems include aquaculture, pig, and poultry systems, and peri-urban dairy production, which add value to crops and recycle nutrients.

Integrated farm and landscape management options

- Assess agroecosystems at the household, community, and landscape levels through dynamic systems analysis, and determine farmers' management strategies and stakeholder roles in targeted study areas of the humid and subhumid zone, e.g., benchmark areas.
- Develop, test, and integrate into rural livelihood systems strategies for the improvement of farming systems productivity and sustainable use of the resource base at the household, community, and regional levels in the targeted study areas.
- Generate and disseminate among local and national policymakers policy and institutional options to improve farming systems productivity and sustainable use of the resource base at the household, community, and regional levels.
- Characterize and delineate appropriate recommendation domains for targeting experimentation and dissemination permitting efficient extrapolation of research results from selected research sites/villages to the entire benchmark areas and beyond their boundaries into larger ecologies the benchmark areas represent. Identify stakeholder networks to validate innovations beyond initial study areas and groups.

Strengthening institutions and outreach

- Promulgation of best options: make innovations actively available to the target communities for self-promulgation through stakeholder networks and assess the extent of and constraints to the up-take of innovations.
- Information dissemination: test and disseminate information resources (written, audio, visual) through stakeholder networks.
- Capacity building: enhance capacity of stakeholders to develop, test, and implement innovations through formal and informal, group and individual, and information sharing and experiential learning techniques.

Gains (Impact)

Productive plantain systems

- Plantain is an important subsistence and cash crop in the humid zones of West and Central Africa. Local and subregional markets already exist and it is a preferred starchy staple in many urban communities. This project will enhance income-generating opportunities for the farmer and the rural community.
- Traditionally, plantain has been planted into cleared forest fields. However, with less forest or long fallow land available, plantain production has been displaced into land with shorter fallows. These production systems experience declines in yield due to reduced soil fertility and greater pest and disease pressures. This project will develop sustainable systems for already deforested land and contribute to reducing pressure on forests.

Intensified cassava systems

- Besides being the major subsistence starchy crop in the humid and subhumid region, cassava is an important food crop of the growing urban centers. In addition, there are developing market opportunities in the starch and livestock feed industry. This project will develop opportunities that will increase income for producers and transformers, as well as provide for the increasing demand of the urban population.
- Significant progress is being made on improving the germplasm for greater yield and disease resistance. Greater yield, however, can lead to soil degradation, if not accompanied by nutrient and soil management strategies. This project will develop systems that will prevent decline in the natural resource base.
- Biological control approaches have led and are leading to the control of key cassava pests, though important challenges still remain. This project will contribute to the development of economically and environmentally sustainable systems.
- Small-scale postharvest equipment have been developed and are being integrated into farming systems through development organizations. This project will test innovative approaches to link the producers with the processors and end-users towards developing efficient and profitable market chains.

Sustainable yam systems

- Yam is a traditional African crop and increasing in importance. Urban consumption studies in the humid and subhumid zones of several West and Central African countries have indicated that as incomes rise, yam (and plantain) is preferentially consumed compared to other starchy staples. This project will develop systems that allow producers to exploit these opportunities.
- Yam requires relatively fertile soils to produce well, especially for high quality yam. As pressure on land increases and fallows shorten or disappear, yam productivity has declined due to lower soil fertility and greater pest and disease pressure (particularly, nematodes, anthracnose, and viruses). This project will develop systems that allow the intensification of yam production in a sustainable way, providing income as well as protecting the resource base.

- Storage loss and options for transformation are key factors limiting marketability of this crop. This project will identify opportunities to reduce losses and increase marketability.

Multiproduct tree crop systems

- Tree crops play a strategic role in smallholder agriculture, account for a large share of agricultural trade, are an area of strength and comparative advantage for the region, and can contribute substantially to sustaining biodiversity and carbon stocks and to the sound management of natural resources. This project will build on the strengths to develop options to further the income of smallholder farmers while improving on the efficiency of the marketing chain and enhancing the environmental services of tree crops.
- Nevertheless, tree crops systems in West and Central Africa encounter varying levels of development-related constraints: soil fertility, pest and germplasm limitations; low farmgate prices for products; limited availability of and access to technology for production, postharvest, and processing; unresponsive and expensive input supply systems; low organizational and management skills of farmer associations and groups; controversial labor practices; inefficient marketing channels; inadequate access to information; poor infrastructure to support trade and investment; lack of a policy or incentive environment to encourage competition and investment. This project will develop an integrated producer-to-user approach across the commodity chain to improve the opportunities of the smallholder tree crop farmer.
- Traditionally, tree crops have been planted into fully or partially cleared forest fields. However, with less forestland available, existing tree crop systems need to be rehabilitated and new systems established on already deforested land. This project will develop such management options and systems for fallow land.

Market-oriented peri-urban crop and livestock systems

- Urban populations in the region are increasing at several times the rate of national averages. This results in increasing and diverse urban market opportunities for agricultural products, i.e. crop, livestock and fish. The farming communities in the vicinity of these peri-urban areas are in a prime position to respond to these opportunities due to greater access to inputs, markets, and availability of labor. This project will help identify these opportunities and develop them together with the necessary stakeholders to generate income for the peri-urban farmers while supplying the urban demand.
- Farmers are already adopting intensive short fallow or continuously cropped and simplified field systems for primarily commercial purposes. Examples include high-value horticultural, green maize, and cassava monocrops, which are frequently integrated into cropping rotations with staple food crops. This project will initially focus on the development of sustainable and profitable management practices for fresh cassava systems and maize-grain legume systems. Additionally, it will seek the partnerships necessary for the development of the indigenous leafy green vegetable sector.
- The crops in the peri-urban systems are often the only ones where fertilizers and pesticides are applied. However, uninformed use of these inputs, often in combination with continuous cropping, has led to significant concerns regarding

resource use efficiency, environmental impact, and health risks. This project will test integrated soil fertility and crop protection measures to reduce this risk.

- One the one hand, limited use is being made of the synergies inherent in the integration of crop and livestock production systems. And on the other, uncontrolled growth of livestock enterprises can result in environmental pollution and illness to animals and humans. This project will initially focus on developing integrated aquaculture-agricultural systems for the forest margins together with ICLARM.

Integrated farm and landscape management options

- The targeted cropping and land use systems in this project generally only make up part of the portfolio of farming activities of rural households in the humid and subhumid zone of West and Central Africa. Willingness of farmers to take up innovations will also depend on the relative allocation of resources to these other activities. This project will evaluate opportunities and innovations based on the overall conditions encountered by the farmers.
- Particularly in the humid zone, agriculture and forest management/conservation interface. This can lead to conflicts between different stakeholders. Furthermore, land with specific characteristics is often allocated preferentially to specific cropping systems. This requires a spatial understanding of household and community decisions on resource use. This project will interface across disciplines and institutions to identify alternative land use opportunities also at a spatial level.
- Integration of innovations by farming households is a social process. Technology development alone is not adequate to ensure adoption beyond the test sites. This project will endeavor to include the social component as an integral part of its approach.
- The policy and institutional environment (e.g., related to markets, credits, and input supply) can influence the uptake of innovations by farmers and rural communities. At the same time, feedback needs to be provided to policymakers on options. This project will take these factors into consideration as it develops strategies and will also relay its findings to policymakers at different levels.

Strengthening institutions and outreach

- IITA can only work together with its partners in defined locations. To ensure sustainability of the research effort, translation of this into real change on the ground, and reaching beyond the original research locations, it is necessary to develop information resources and strengthen local and regional institutions. This project will actively promulgate its innovations to its partners and stakeholders in the region.

Duration

Initially 10 years, and to be reviewed periodically.

Milestones

2002

Productive plantain systems

- Six pilot multiplication centers established in Nigeria to facilitate distribution of improved plantain and banana hybrids to farmers.
- Three pilot multiplication centers established in Ghana to facilitate distribution of improved plantain and banana hybrids to farmers.
- At least 500 farmers trained in rapid plant multiplication techniques and pre- and postharvest management of plantain in Nigeria.
- At least 10 improved plantain and banana hybrids distributed to at least 50 farming communities in Nigeria.
- Germplasm with resistance to *Radopholus similis* identified.
- Trials for assessment of organic amendments for nematode management initiated.
- Interaction between mechanical and thermal cleaning methods against nematodes and weevils established.
- Plant parasitic nematode populations in forest and bush fallow soil determined.
- *Radopholus similis* populations in conventional planting material before and after boiling water treatment determined.

Intensified cassava systems

- Distribution maps of major cassava pests and diseases produced for the Republic of Congo and Democratic Republic of Congo to aid in targeting control efforts.
- More than 100 elite multiple pest and disease resistant cassava clones introduced from IITA to Republic of Congo.
- CMD resistant cassava multiplication activities established in at least three sites in the Republic of Congo as part of the emergency CMD mitigation effort.
- Development of strategy for the five-year period starting in 2003 for research into the agronomic management of intensified cassava and yam systems.
- Economic impact of improved cassava processing systems assessed.
- Evaluation and delivery of multiple pest and disease resistant germplasm in West and Central Africa continued.
- Participatory evaluation and distribution of elite germplasm in the humid and subhumid zones continued.

Sustainable yam systems

- Database on geographic information, manpower resources, projects, and improved technologies relevant to yam research and development in Africa disseminated.

- Manual on pests and diseases of yams published.
- At least 50 improved clones of *D. rotundata* delivered to, and evaluated by, NARS collaborators in five countries in West Africa.
- At least two IITA-derived varieties of *D. rotundata* nominated for release by at least one country in West Africa following collaborative testing.
- At least 20 improved clones of *D. alata* delivered to, and evaluated by, NARS collaborators in two countries in West Africa.
- Economic benefits of chemical treatment of seed yam against nematodes and other pests established in one country.
- Producers' preferences for agronomic characteristics and food quality attributes of *D. rotundata* and *D. alata* documented in at least three countries in West Africa.
- Critical nutrient requirements and nutrient deficiency symptoms in *D. alata* and *D. rotundata* established.
- National systems in 5 West African countries collect geo-referenced data that will form a (GIS-inclusive) information system containing geographic information, manpower resources, projects, and improved technologies relevant to yam research and development in Africa.

Multiproduct tree crop systems

- Growth rates of fruit and timber trees as a function of shade and fertilizer regime, established.
- Survival rates of Cameroonian cocoa hybrids established.
- Three years of data on initial establishment of mixed tree crop systems on short fallow land collected, recommendations of best species combinations made and manuscripts on component responses written.
- Information gathered on ecological consequences and food safety issues of fungicide, the major input on cocoa farms understood, documented and manuscripts written and recommendations made regarding consequences for certifying production.
- Productivity of key indigenous fruit tree species in fallow land documented.
- Action plan developed for an integrated approach to the development of sustainable tree crops systems in West and Central Africa together with cocoa and cashew sector stakeholders.
- Use of child labor in cocoa production systems of West Africa determined.
- Credit scheme developed for cocoa farmers in southern Cameroon.
- Manual developed summarizing farmers' experiences in the establishment of oil palm systems on degraded land in southern Cameroon.
- Community oil palm nurseries developed for southern Cameroon.

Market-oriented peri-urban crop and livestock systems

- Long-term (6 years) effects of *Pueraria* and *Mucuna* relay cropping with maize established on-station.
- Mid-term (4 years) effects of *Mucuna* relay cropping with maize established on-farm.
- SIUPA (system-wide program) established and functioning for the Yaoundé site.

Integrated farm and landscape management options

- Prototype CamFlores model running and tested to improve understanding of interactions between farmers and land, and to evaluate the effects on productivity, livelihoods and landscape sustainability of interventions in farming systems; modified and expanded to simulate one real Forest Margin Benchmark village.
- Humid Forest Margins Benchmark GIS completed.
- Farmer participatory evaluation of targeted herbaceous legume options in southern Benin completed.
- Survey, constraint assessment, and baseline data collection from households in selected villages in southern Benin as an approach to identification of target options for herbaceous legumes evaluated.
- Pilot systems in southern Benin for the multiplication and dissemination of selected best-bet herbaceous legume germplasm established.
- Effect of subsoil conditions on cover crops growth, nutrient uptake efficiency and subsequent effect on crop growth determined in the Nigerian middle-belt.
- Cover crops seed and information exchange with NARS in the region established.
- LEXSYS database, which allows the identification of potential legumes for integration into specific cropping systems updated.
- Problems, including water hyacinth, within aquatic systems identified.
- Food demand structure for urban consumers in Cameroon and moist Savanna of Nigeria evaluated and opportunities for farming communities identified.
- Publicity video on an integrated farming systems approach to solving problems in forest margins agriculture completed and disseminated.

2003

Productive plantain systems

- At least 5 improved plantain and banana hybrids distributed to 10 farming communities in Ghana.
- Germplasm with resistance to other nematode species identified.
- Use of paring for nematode management adopted by target farmers.
- Bunch yield levels in different age fallow (forest versus bush) established.

- Relationship between soil chemical properties and plantain bunch yields investigated.
- Relationship between nematode infestation and bunch yield investigated.
- Yield performance and productive life time of cooking bananas versus local plantains established.

Intensified cassava systems

- More than 10 elite pest and disease resistant cassava clones evaluated in CMD hotspots in the Republic of Congo.
- At least 3 improved cassava varieties distributed to at least 50 farming communities in Cameroon.
- Nutrient budgets by crop for cassava intercropping systems established.
- Limiting nutrients for cassava on non-degraded terre de barre soils determined in southern Benin using a missing nutrient arrangement of N, P, and K amendments.
- Determination of litter component of nutrient and carbon cycling in intensified cassava systems on non-degraded terre de barre soils in southern Benin and Nigeria.
- Cassava postharvest system in southern Cameroon reviewed to identify constraints and opportunities and to prioritize research domains for improved postharvest and marketing systems.
- Opportunities to use cassava as a livestock feed and associated need for postharvest machinery identified.
- Biophysical factors affecting the distribution and abundance of the cassava root scale identified.
- Cassava productivity trends 10 years after COSCA evaluated to ascertain sustainability issues in various ecoregions.
- Cassava varietal suitability to predators of the cassava green mite integrated into cassava screening program.

Sustainable yam systems

- Influences of varietal provenance, tuber storage environment, and planting site on the period of tuber dormancy and flowering behavior in *D. rotundata* documented.
- Differential series of *D. alata* genotypes established for studies on yam anthracnose disease.
- At least 4 IITA-derived clones of *D. rotundata* included in nationally-coordinated clonal trials in Nigeria aimed at formal release of varieties.
- Research on yams of 6 African postgraduate students supervised and 2 PhD theses completed.

- Extent of yield loss in *D. rotundata* due to infection by yam mosaic virus, genus *Potyvirus*, established.
- Evaluation of the profitability, constraints, and opportunities in the seed yam subsector and the roles of stakeholders are completed in at least three countries in West Africa.
- Assessment of the profitability and farmers' perceptions on using planted legume fallows in yam cultivation completed in one country.
- Economic benefit of pre-planting treatment of seed yam against pests and diseases established in two countries in West Africa.
- Characteristics and attributes that determine the commercial value of yams documented in at least one country in West Africa and information available to breeders to use in genetic selection.
- Consumers' preferences and quality criteria in the choice of yams established in two countries in West Africa and information available for varietal improvement.
- Protocols for diagnosis of nutrient deficiency in yams established.
- Feasibility of double cropping systems assessed through on-farm trials in the inland valleys of Nigeria.
- Yam plant nutrition and soil management with inorganic fertilizer and legume rotations assessed with NARES of Benin, Togo, Ghana, Côte d'Ivoire.
- Preliminary yam critical tissue levels of N, P, and K determined for support of fertilizer recommendations based on fertilizer trials conducted in Benin, Togo, Ghana, Côte d'Ivoire, and Nigeria.
- Yam productivity as a function of land use intensification and other factors determined.

Multiproduct tree crop systems

- Best performing cocoa hybrids from Côte d'Ivoire identified.
- Carbon sequestration potential of selected tree crop systems assessed.
- Processes underlying biomass conversion in different cocoa agroforests of southern Cameroon elucidated.
- Differential management and subsequent impact on yield of cocoa agroforests in southern Cameroon ascertained.
- Agronomic and economic benefits of *Acacia auriculiformis* woodlots determined, including effect on maize yield and nutrient management.
- Baseline for cocoa and cashew production systems for West and Central Africa established.
- Incidence of child labor in the cocoa supply chain and non-cocoa agricultural sector determined.

- Information system tracking cocoa production practices of farmer associations tested.
- Farmers testing options for the successful establishment of oil palm systems on fallow lands.

Market-oriented peri-urban crop and livestock systems

- Nutrient budgets of *Pueraria* and *Mucuna* relay cropping with maize established.
- *Pueraria* and *Mucuna* relay cropping with horticultural crops evaluated on-farm.
- Organic/inorganic fertilizer use on horticultural crops tested on-farm.
- Botanical pesticides tested against major cowpea pests (aphids, thrips, maruca, pod bugs, pod weevil) and related natural enemies in forest margins.
- Livelihood strategies, cropping systems, and agriculture-aquaculture integration opportunities identified for southern Cameroon.
- Participatory germplasm testing and deployment for maize carried out.
- Dual-purpose grain legume germplasm tested in southern Cameroon.

Integrated farm and landscape management options

- CamFlores modified and expanded for two additional benchmark villages.
- Results of modelling extrapolated to humid forest margins benchmark.
- Congo Basin GIS completed.
- Influences of genotype and environment on *Mucuna* seed L-Dopa content evaluated.
- Resources management systems at the community level identified and their spatial dimensions referenced in the forest margin benchmark of southern Cameroon.
- Policy implications of property rights on the uptake of improved fallow cropping systems for Cameroon determined.
- Impact of fallow vegetation on the incidence and development of the variegated grasshopper.
- Impact of *Chromolaena* on fallow species composition and the subsequent weed community ascertained.

2004

Productive plantain systems

- At least 2 improved *Musa* hybrids adopted by farmers and officially released in Nigeria.

- Two pilot multiplication centers established in Côte d'Ivoire and 2 plantain hybrids distributed to farmers.
- Suitability of certain organic amendments for nematode management established.
- Performance of plantain hybrids compared to local cultivars determined.
- Profitability of different planting materials and cleaning methods against nematodes and weevils evaluated.
- Profitability of fertilizer use in different age fallows investigated.
- Clean planting material production methods and thermal cleaning methods for conventional suckers introduced in at least 5 villages in southern Cameroon.

Intensified cassava systems

- IPM components tested for sustainable management of cassava pests and diseases in DR Congo.
- Importance of nematodes as a pest in intensifying cassava production systems in West Africa determined.
- Improved postharvest technologies tested and disseminated in southern Cameroon to generate feedback for further development and/or adoption.
- Cassava drying system developed and tested to enhance the adoption of the chipping technology for flour production and other associated products, which necessitate the development of efficient drying systems to ensure a high quality product.
- Weed management systems options in cassava systems tested in the derived savanna of Nigeria.
- Soil and vegetation management practices to reduce African root and tuber scale problems in Central Africa identified.

Sustainable yam systems

- The value of varietal mixtures in stabilizing performance of *D. alata* varieties in hot spots of anthracnose disease demonstrated on-farm in Nigeria.
- Superior performance of new varieties of *D. alata* in anthracnose resistance, tuber yield and food quality demonstrated on-farm in relation to popular local cultivars in at least two countries in West Africa.
- Superior performance of new varieties of *D. rotundata* in virus resistance and tuber yield demonstrated on-farm in relation to popular cultivars in at least four countries in West Africa.
- At least 5 new *D. alata* varieties selected by farmers for cultivation in Nigeria and Côte d'Ivoire through farmer-participatory evaluation.
- At least 4 IITA-derived clones of *D. rotundata* included in nationally coordinated clonal trials in Nigeria aimed at formal release of new varieties.

- Strategies for sustainable and intensive yam cultivation tested in the moist savanna and forest zones in Nigeria.
- Suitable tuber disinfestation technologies developed.

Multiproduct tree crop systems

- Best performing cocoa hybrids from Cameroon identified.
- Standards of sustainability for tree crop systems proposed and feasibility tested.

Market-oriented peri-urban crop and livestock systems

- Integrated agriculture-aquaculture systems tested in southern Cameroon.
- Nutrient management practices for legumes determined in southern Cameroon.

Integrated farm and landscape management options

- CamFlores modified and expanded by postgraduate student for one additional village.
- Results of modelling in benchmark extrapolated to Central and West African humid forest ecozone.
- Baseline data for insects associated with cover-crop legumes in West and Central Africa collected and recommendations made in the humid forest zone.
- Impact of rural credit market constraints on productivity, intensification, and diversification quantified.

2005

Productive plantain systems

- At least one improved hybrid adopted by farmers and officially released in Ghana.
- Use of organic amendments adopted by farmers.
- Paring for nematode management adopted in main plantain growing areas.
- Differential importance of different nematode species identified.
- Effect of cropping system on mat survival and ratooning established.
- Economic viability of soil fertility maintenance measures evaluated.

Intensified cassava systems

- Cassava IPM packages being used in at least 20 on-farm sites in DR Congo.
- Performance of cassava varieties, better than cv. 8017 verified in intercropping systems in southern Cameroon.
- Alternative tillage systems (no till vs conventional tillage) in the derived savanna ecozone of Nigeria tested and possible interactions between tillage and residue management practices determined.

Sustainable yam systems

- At least 50 improved clones of *D. rotundata* and 30 of *D. alata* are delivered to, and evaluated by, NARS collaborators in at least two countries in West Africa.
- At least 2 IITA-derived clones of *D. rotundata* included in nationally coordinated clonal trials in Nigeria aimed at formal release of varieties.
- Research on yams of 4 African postgraduate students supervised and 2 PhD theses completed
- Broad acceptance in Nigeria of new varieties of *D. alata* with high anthracnose resistance and good culinary characteristics confirmed.
- Strategies for double cropping system tested in the in-land valley and delta zones in Nigeria.
- Combined improved soil fertility and pest/disease management options identified.

Multiproduct tree crop systems

- Growth rates of fruit and timber trees and commencement of fruit production as a function of shade and fertilizer regime established.
- Options for an economical establishment of oil palm systems on degraded land identified.

Market-oriented peri-urban crop and livestock systems

- Options for the integration of grain legumes into the current cropping systems developed in southern Cameroon.

Users

Productive plantain systems: NARS and small- to medium-scale farmers will be offered higher-yielding banana and plantain with resistance to black Sigatoka and other diseases and pests, new options for pest and disease management, recommendations for farming practices to ensure sustainable production on already deforested land, and new commercialization opportunities.

Intensified cassava systems: NARS and NGOs in West and Central Africa are the primary users of outcomes, and onwards to farmers, processors, and consumers through existing or new delivery systems. The target systems are those in cassava-producing agroecologies in West and Central Africa. Impact at the farm level will continue to increase and contribute to improved incomes and food supply for poorer people. Processors (mainly women) will be able to sell a range of improved, new, and value-added products with lower production costs due to improved storage and processing efficiencies. The crop will continue to have a role in food security in vulnerable areas, also for the urban poor. New partnerships with other stakeholders will evolve with cassava's expanded utilization, increasing commercialization, and national and regional trade.

Sustainable yam systems: Yam growers, processors, and traders will obtain increased incomes through the improved production technologies for this high-value crop. Also, the production increases would make this preferred crop affordable for a longer period in the year for lower-income earners. Improved choice of starch staples

would impact on human welfare through more balanced nutrition and more routine availability of calorie rich foods. The increased opportunity for crop diversification would improve food security and enhance income generation, through reducing over-dependence on a few major crops. Breeding and selection programs will benefit from improved protocols for screening for desirable attributes and enhanced flexibility in manipulation of propagules leading to more improved varieties for farmers, processors, and consumers.

Multiproduct tree crop systems: The intended beneficiaries are smallholders in the humid and subhumid ecoregions of Ghana, Côte d'Ivoire, Guinea, Nigeria, and Cameroon. Households currently participating in the project are in general resource limited, practice mixed farming with gendered responsibilities across cropping systems and field management practices. The initial focus is on diversified cocoa and oil palm systems. The process knowledge generated is expected to be applicable to a wide range of land use systems. The landscape niche is exclusively deforested/degraded land, so as to increase local and global environmental services. Intermediate users of the knowledge generated are expected to include NGOs, NARES, and most importantly platforms of farmer organizations.

Market-oriented peri-urban crop and livestock systems: NARES, NGOs, and CBOs will have access to improved technologies for intensive peri-urban systems management. Farmers are the ultimate clients and will increasingly use innovative technologies (such as the use of improved germplasm, integrated nutrient management, better crop protection, and exploitation of the advantages of association with livestock) resulting in more sustainable and profitable production systems.

Integrated farm and landscape management options: The direct beneficiaries are national and international researchers, NGOs, CBOs, and national and local policymakers in the humid and subhumid zone of West and Central Africa who will have access to information and tools allowing for targeted decision-making to improve the well-being of farmers and their communities while maintaining a healthy resource base.

Strengthening institutions and outreach: NARES, NGOs, and CBOs will have access to innovations for target land use systems in the humid and subhumid zone of West and Central Africa. Policymakers will be informed of policy and institutional options that will promote the adoption of innovations by farmers and communities in a sustainable manner. Farmers and their communities are the ultimate clients and will increasingly use innovative technologies, processes, and institutional arrangements resulting in more sustainable and profitable production systems and thus greater well-being.

Collaborators

Productive plantain systems: Networks (MUSACO) and NARS in West and Central Africa, particularly Nigeria, Ghana, and Cameroon; INIBAP/IPGRI; ICIPE; CARBAP Cameroon; FHIA Honduras; NRI; CABI; IEB; CIRAD; universities in Africa, Europe, and North America.

Intensified cassava systems: IARCs such as CIAT; networks as CORAF-cassava; NARS particularly in Nigeria, Ghana, Cameroon, Sierra Leone, and Democratic Republic of Congo, besides a majority of other NARS root crops programs in West and Central Africa; various agriculture extension projects in Nigeria; regional

organizations such as CORAF, ISTRC—AB; NGOs CBOs, and entrepreneurs in several countries in West and Central Africa; ARIs such as ICIPE in Kenya, CIRAD in France; FAO in Rome, and NRI in UK.

Sustainable yam systems: NARS in Nigeria, Ghana, Guinea, Sierra Leone, Benin, Côte d'Ivoire, The Gambia, Central African Republic, and Cameroon; ARIs such as University of Reading, CABI, Institute for Food Research (IFR) and NRI in the UK, CIRAD/IRD in France; Centre Suisse de Recherches Scientifiques in Côte d'Ivoire (CSRS); NGOs such as World Vision International in Liberia; GTZ in Ghana; NAOC-Agip in Nigeria.

Multiproduct tree crop systems: IARCs such as IPGRI/CFC and ICRAF; ARIs such as University of Wales/Bangor, Purdue University, Yale University, USGS/South Dakota, University of Wageningen and CIRAD; NARES, NGOs, CBOs, and private industry in Ghana, Côte d'Ivoire, Guinea, Nigeria, and Cameroon through the framework of the Sustainable Tree Crops Program and the Alternatives to Slash-and-Burn system-wide program.

Market-oriented peri-urban crop and livestock systems: IARCs such as ICLARM and ILRI; ARIs such as University of Hannover, NRI, and ICIPE; a number of NARES and NGOs particularly in Cameroon.

Integrated farm and landscape management options: IARCs such as ICRAF and CIFOR; ARIs such as University of Edinburgh, University of Wales/Bangor, Yale University, USGS/South Dakota; NARES in Cameroon; local partners within the framework of ASB system-wide program.

Strengthening institutions and outreach: IARCs, ARIs, NARES, NGOs, and CBOs active in West and Central Africa as defined by the target land use systems.

System linkages

Link to CGIAR logframe outputs Germplasm Improvement (8%), Sustainable Production (43%), Policy (16%), and Enhancing NARS (33%).

Project F. Improving and intensifying cereal–legume systems in the moist and dry savannas of West and Central Africa

Goal

Food security and livelihoods enhanced, poverty reduced, and human nutrition improved in West and Central Africa.

Purpose

To improve and intensify cereal–legume and crop–livestock systems and promote adoption in partnership with multiple stakeholders (including crop and livestock farmers, consumers, the commercial sector, NGOs, NARES, and advanced research institutes) in West and Central Africa.

Outputs

1. Identification of key drivers of intensification to formulate, target, and prioritize researchable issues to respond to stakeholders' needs.
2. Understanding of soil and weed processes to develop management practices for the optimization and stabilization of intensified production systems.
3. Maize hybrids and open pollinated varieties to address system and end-user constraints and opportunities evaluated.
4. High yielding dual-purpose soybean breeding lines to address system and end-user constraints and opportunities evaluated.
5. Identification and selection of improved cowpea breeding lines to address system and end-user constraints and opportunities.
6. Develop and validate intensified farmer-acceptable cereal–legume systems through improved resource management and IPM strategies.
7. Develop and validate intensified farmer-acceptable crop–livestock systems through increased grain and fodder production, IPM strategies, and improved livestock and resource management.
8. Wide range of client-oriented production equipment and postharvest technologies to reduce drudgery, and diversify food products developed
9. NARES and other stakeholders' capacity to generate and transfer technologies enhanced.

Priority activities

- Characterize the dry savanna benchmark areas and existing IITA experimental breeding sites in the savanna.
- Land use intensification characterized in geospatially quantifiable parameters and correlated to key drivers in the fields of demography, marketing, and agro-ecological conditions at a benchmark level.
- Assess implications of alternate management options leading to improved nutrient use efficiencies in crop systems and in order to enhance farmers' return on purchased external inputs and to reduce environmental degradation.

- Determine factors governing weed seed and biomass as it relates to the kind and level of inputs and design technologies that reduce crop losses and labor requirements and increase profitability.
- Maize varieties for enhanced nitrogen use efficiency and tolerance to drought.
- Maize hybrids and OPV varieties developed with resistance to pests, diseases, and parasitic weeds.
- Dual-purpose soybean breeding lines with enhanced N fixation and P use efficiency.
- Dual-purpose soybean breeding lines with enhanced capacity to stimulate suicidal germination of *Striga*.
- Screening of selected cowpea breeding lines for resistance to viruses, bacterial blight, *Striga*, *Alectra*, *Septoria* leafspot, and scab.
- Screening of selected cowpea breeding lines for resistance to aphid, thrips, bruchid, *Maruca*, and pod bugs.
- Screening of selected dual-purpose cowpea varieties for fodder quality.
- Cereal–legumes systems, including best bet combinations developed, tested, and adapted to farmer circumstances and generic recommendations disseminated within the savanna ecozone.
- Improved crop/livestock integration through stover or forage crops as feed improvement to maximize synergistic qualities of mixed enterprises.
- Evaluation of the economic and environmental implications of the above farming systems.
- Postharvest machinery (shelling, threshing, processing, drying, storage) designed to improve labor use efficiency and add value to productivity and reduce storage and handling losses in maize, cowpea, soybean, and associated grain crops.
- Food quality improvement and IPM activities, awareness program to enhance nutritional status.
- NARES capability for maintaining continuity of research effort unaided post 2012 strengthened through transfer of elite germplasm and appropriate management practices from IITA.
- NARES capability for maintaining continuity of research effort unaided post 2012 strengthened by promoting sustainable seed production and distribution via the private sector, NGOs, CBOs, and farmer organizations.
- NARES capability for maintaining continuity of research effort unaided post 2012 strengthened by improving research-extension-NGO-Private sector-farmer linkages

Gains (Impact)

- NARES, NGOs, IARCs, ARIs, and private sector working together, in partnership with farmers, in key research sites in the savannas of West and Central Africa.
- By 2012, at least 20% of the targeted land threatened by unsustainable farming practices in at least 3 benchmark areas are converted to improved sustainable land use systems that result in increased farm productivity and enhanced livelihoods for all sections of the rural community.

- By 2012, farmer-to-farmer diffusion of new knowledge of improved crop and crop/livestock systems takes place in two benchmark areas resulting in sustainable per-hectare productivity increases of 75% for adopting farmers.
- Rural poor farmers adopt improved food systems that result in increased agricultural productivity, higher income, and environment protection.

Duration

10 years.

Milestones

2003–2005

- New germplasm emanating from output of crop improvement projects suitable to meet specific needs of intense production systems are available annually.

2003–2007

- Machine prototypes under test by 2003, farmer validation and amendment by 2005, local manufacturing of key products under way by 2007.

2005

- Intense systems characterized in the moist and dry savanna benchmark areas and diagnosis of principal constraints completed.

2007

- New knowledge generated and incorporated into the design of improved crop and livestock systems being tested in two benchmark areas.
- Technological recommendations for maximizing reciprocal crop–livestock benefits in moist and dry savanna benchmark areas are available and tested on farm in collaboration with NARES partners in at least 2 benchmark areas.
- Best bet technological options for sustainably improving productivity of selected intense farming systems developed and are available and tested on farm in collaboration with NARES partners in moist and dry savanna benchmark areas.

Post-2012

- NARES capability for maintaining continuity of research effort unaided and strengthened by improving research-extension-NGO-Private sector-farmer linkages.

Users

NARES (National Agricultural Research and Extension Services), NGOs and private sector will have access to improved technologies for intensified crop/livestock system management. Farmers are the ultimate clients and will increasingly use innovative technologies (such as the use of improved germplasm, more efficient weed control, balanced nutrient management, better tillage practices and exploitation of the advantages of association with livestock.) resulting in more sustainable production systems.

Collaborators

IAR, UI, NAPRI (Nigeria), INRAB, RAMR (Benin), IRAT (Cameroon), ITRA (Togo), SARI, Univ. of Ghana (Ghana) ILRI, IFDC, ICRISAT, CIRAD, KULeuven, IAEA, DIAS, CARPE, Sasakawa Global 2000, Soils CRSP.

System linkages

Link to CGIAR logframe outputs Germplasm Improvement (20%), Germplasm Collection (5%), Sustainable Production (60%), Policy (0%) and Enhancing NARS (15%).

Annex 3
Financial tables

Table 1. IITA—Research Agenda Requirements, by CGIAR Output^{1/}, 2003

(expenditure in US\$ million)

Center Projects	Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS	PROJECT TOTALS
A. Preserving and Enhancing Germplasm and Agrobiodiversity	4.247	1.158	0.772	0.386	1.158	7.721
B. Developing Biological Control Options	0.671		4.024	0.671	1.341	6.707
C. Impact, Policy and Systems Analysis			0.468	1.597	0.689	2.754
D. Starchy and Grain Staples in Eastern and Southern Africa	1.051	0.185	1.917	0.433	2.597	6.183
E. Starchy Staples, Peri-Urban and Tree Crop Systems of the Humid and Subhumid Zone of West and Central Africa	0.374	0.054	2.301	0.856	1.765	5.350
F. Cereal-Legume Systems in the Moist and Dry Savannas of West and Central Africa	1.276		3.827	0.638	0.638	6.379
Systemwide Program for Integrated Pest Management			0.094	0.156	0.063	0.313
Ecoregional Program for the Humid and Subhumid Tropics of sub-Saharan Africa			0.152	0.017	0.169	0.338
OUTPUT TOTALS	7.619	1.397	13.555	4.754	8.420	35.745

^{1/} Please refer to Table 2 for the crosswalk between CGIAR Activities and the new CGIAR Outputs.

Table 2. IITA Research Agenda—Allocation of Resources, 2001–2005
(expenditure in US\$ million)

Allocation of Resources by Outputs
Logical Framework Format

Outputs:	2001 (actual)	2002 (est)	2003 (proposal)	2004 (plan)	2005 (plan)
Germplasm Improvement <i>(Activity: Germplasm Enhancement & Breeding, plus Networks, as appropriate)</i>	10.404	7.316	7.619	7.792	7.857
Germplasm Collection <i>(Activity: Saving Biodiversity, plus networks, as appropriate)</i>	1.229	1.349	1.397	1.430	1.457
Sustainable Production <i>(Activity: Production Systems Dev & Mgmt, Protecting the Environment and Networks, as appropriate)</i>	14.945	12.895	13.555	13.859	13.768
Policy <i>(Activity: Improving Policies, plus Networks, as appropriate)</i>	3.207	4.532	4.754	4.878	5.059
Enhancing NARS <i>(Activity: Strengthening NARS - the three sub-activities, plus Networks, as appropriate)</i>	8.033	7.938	8.420	8.610	8.615
TOTAL	37.818	34.030	35.745	36.569	36.756

Allocation of Resources by CGIAR Activity

	2001 (actual)	2002 (est)	2003 (proposal)	2004 (plan)	2005 (plan)
Increasing Productivity	19.072	14.795	15.481	15.830	15.842
<i>of which:</i>					
Germplasm Enhancement & Breeding (01)	10.404	7.316	7.619	7.792	7.857
Production Systems Development & Management (03)	8.668	7.479	7.862	8.038	7.985
Protecting the Environment (03)	6.277	5.416	5.693	5.821	5.783
Saving Biodiversity (02)	1.229	1.349	1.397	1.430	1.457
Improving Policies (04)	3.207	4.532	4.754	4.878	5.059
Strengthening NARS	8.033	7.938	8.420	8.610	8.615
TOTAL	37.818	34.030	35.745	36.569	36.756

Illustrative Allocation of Resources by Outputs
Logical Framework Format

Outputs

(01) Germplasm Improvement

Germplasm and germplasm improvement techniques for priority crops, livestock, trees and fish are enhanced and made accessible to NARS and other partners.

(02) Germplasm Collection

Germplasm of selected species and their wild relatives for priority crops, livestock, trees and fish are collected and managed, and procedures for germplasm conservation are developed and made accessible to NARS and other partners.

(03) Sustainable Production (System/Natural Resources)

Management practices and research methodologies for sustainable production systems and for natural resource conservation and use are accessible to NARS and other partners.

(04) Policy

Improved policy analyses and techniques for policy formulation and public management are accessible to NARS, policy makers and the development community.

(05) Enhancing NARS

Knowledge and expertise for enhancing the performance of research and related institutions are accessible to relevant users.

Table 3. IITA Research Agenda Projects & Output Cost summary, 2001–2005

(in US\$ million)

	2001 *	2002	2003	2004	2005
	(actual)	(est)	(proposal)	(plan)	(plan)
A. Preserving and Enhancing Germplasm and Agrobiodiversity		7.511	7.721	7.907	8.069
B. Developing Biological Control Options		6.404	6.707	6.860	6.812
C. Impact, Policy and Systems Analysis		2.482	2.754	2.842	2.963
D. Starchy and Grain Staples in Eastern and Southern Africa		5.684	6.183	6.298	6.378
E. Starchy Staples, Peri-Urban and Tree Crop Systems of the Humid and Subhumid Zone of West and Central Africa		5.167	5.350	5.485	5.520
F. Cereal-Legume Systems in the Moist and Dry Savannas of West and Central Africa		6.073	6.379	6.513	6.334
Systemwide Program for Integrated Pest Management		0.464	0.313	0.322	0.574
Ecoregional Program for the Humid and Subhumid Tropics of SSA		0.245	0.338	0.342	0.106
Total	37.818	34.030	35.745	36.569	36.756

Summary by Output:

	2001	2002	2003	2004	2005
	(actual)	(est)	(proposal)	(plan)	(plan)
Germplasm Improvement	10.404	7.316	7.619	7.792	7.857
Germplasm Collection	1.229	1.349	1.397	1.430	1.457
Sustainable Production	14.945	12.895	13.555	13.859	13.768
Policy	3.207	4.532	4.754	4.878	5.059
Enhancing NARS	8.033	7.938	8.420	8.610	8.615
Total	37.818	34.030	35.745	36.569	36.756

Institutional Cost Components:

	2001	2002	2003	2004	2005
	(actual)	(est)	(proposal)	(plan)	(plan)
Direct Project Costs	25.550	23.546	25.480	25.918	25.599
Direct Project Support Costs	3.598	3.269	2.821	2.952	3.109
Indirect Project Costs (Overhead)	8.670	7.215	7.444	7.699	8.048
Total	37.818	34.030	35.745	36.569	36.756

* New project portfolio commenced in 2002.

Table 4. IITA Allocation of Project Costs to CGIAR Activities, 2001 - 2005

		(in US\$ millions)				
Project	Activity	2001 * actual	2002 estimate	2003 proposal	2004 plan	2005 plan
A. Preserving and Enhancing Germplasm and Agrobiodiversity	Enhancement and Breeding		4.131	4.247	4.349	4.438
	Production Systems		0.436	0.448	0.459	0.468
	Protecting the Environment		0.315	0.324	0.332	0.339
	Saving Biodiversity		1.127	1.158	1.186	1.211
	Improving Policies		0.376	0.386	0.395	0.403
	Strengthening NARS		1.126	1.158	1.186	1.210
	Total Project Cost		7.511	7.721	7.907	8.069
B. Developing Biological Control Options	Enhancement and Breeding		0.642	0.671	0.686	0.682
	Production Systems		2.234	2.334	2.387	2.370
	Protecting the Environment		1.617	1.690	1.728	1.717
	Improving Policies		0.642	0.671	0.687	0.681
	Strengthening NARS		1.269	1.341	1.372	1.362
		Total Project Cost		6.404	6.707	6.860
C. Impact, Policy and Systems Analysis	Production Systems		0.245	0.271	0.280	0.292
	Protecting the Environment		0.177	0.197	0.203	0.211
	Improving Policies		1.439	1.597	1.648	1.719
	Strengthening NARS		0.621	0.689	0.711	0.741
	Total Project Cost		2.482	2.754	2.842	2.963
D. Starchy and Grain Staples in Eastern and Southern Africa	Enhancement and Breeding		0.966	1.051	1.071	1.084
	Production Systems		1.022	1.112	1.132	1.147
	Protecting the Environment		0.740	0.805	0.820	0.830
	Saving Biodiversity		0.171	0.185	0.189	0.191
	Improving Policies		0.398	0.433	0.441	0.447
	Strengthening NARS		2.387	2.597	2.645	2.679
	Total Project Cost		5.684	6.183	6.298	6.378
E. Starchy Staples, Peri-Urban and Tree Crop of the Humid and Subhumid Zone of West and Central Africa	Enhancement and Breeding		0.362	0.374	0.383	0.386
	Production Systems		1.289	1.335	1.368	1.377
	Protecting the Environment		0.933	0.966	0.991	0.997
	Saving Biodiversity		0.051	0.054	0.055	0.055
	Improving Policies		0.827	0.856	0.878	0.883
	Strengthening NARS		1.705	1.765	1.810	1.822
	Total Project Cost		5.167	5.350	5.485	5.520
F. Cereal-Legume Systems in the Moist and Dry Savannas of West and Central Africa	Enhancement and Breeding		1.215	1.276	1.303	1.267
	Production Systems		2.114	2.220	2.267	2.204
	Protecting the Environment		1.530	1.607	1.641	1.596
	Improving Policies		0.607	0.638	0.651	0.634
	Strengthening NARS		0.607	0.638	0.651	0.633
		Total Project Cost		6.073	6.379	6.513
Systemwide Program for Integrated Pest Management	Production Systems		0.081	0.055	0.056	0.100
	Protecting the Environment		0.058	0.039	0.041	0.072
	Improving Policies		0.232	0.156	0.161	0.287
	Strengthening NARS		0.093	0.063	0.064	0.115
	Total Project Cost		0.464	0.313	0.322	0.574
Ecoregional Program for Humid and Subhumid Tropics of SSA	Production Systems		0.060	0.088	0.089	0.028
	Protecting the Environment		0.044	0.064	0.065	0.020
	Improving Policies		0.011	0.017	0.017	0.005
	Strengthening NARS		0.130	0.169	0.171	0.053
	Total Project Cost		0.245	0.338	0.342	0.106

Summary by Undertaking:

	2001 actual	2002 estimate	2003 proposal	2004 plan	2005 plan
Increasing Productivity	19.072	14.795	15.481	15.830	15.942
Protecting the Environment	6.277	5.416	5.693	5.821	5.783
Saving Biodiversity	1.229	1.349	1.397	1.430	1.457
Improving Policies	3.207	4.532	4.754	4.878	5.059
Strengthening NARS	8.033	7.938	8.420	8.610	8.615
Total:	37.818	34.030	35.745	36.569	36.756

* New project portfolio commenced in 2002.

Table 5. IITA Research Agenda, 2001-2005

Investments by Sector, Commodity and Region (in US\$ million)

PRODUCTION SECTORS & COMMODITIES	2001 (actual)	2002 (est)	2003 (proposal)	2004 (plan)	2005 (plan)
1/ <i>Germplasm Improvement</i>					
Crops	9.936	6.987	7.276	7.441	7.503
Banana/plantain	2.081	1.463	1.523	1.559	1.571
Cassava	2.081	1.464	1.524	1.558	1.571
Cowpea	1.353	0.951	0.990	1.013	1.021
Soybean	0.884	0.622	0.648	0.662	0.668
Maize	1.873	1.317	1.371	1.403	1.414
Yam	0.832	0.585	0.610	0.623	0.629
Other	0.832	0.585	0.610	0.623	0.629
Livestock	0.052	0.037	0.038	0.039	0.039
Trees	0.312	0.219	0.229	0.234	0.236
Fish	0.104	0.073	0.076	0.078	0.079
TOTAL	10.404	7.316	7.619	7.792	7.857
1/ <i>Sustainable Production</i>					
Crops	14.273	12.315	12.944	13.235	13.148
Banana/plantain	2.989	2.579	2.711	2.771	2.754
Cassava	2.989	2.579	2.711	2.772	2.754
Cowpea	1.943	1.676	1.762	1.802	1.790
Soybean	1.270	1.096	1.152	1.178	1.170
Maize	2.690	2.321	2.440	2.495	2.478
Yam	1.196	1.032	1.084	1.108	1.101
Other	1.196	1.032	1.084	1.109	1.101
Livestock	0.075	0.064	0.068	0.069	0.069
Trees	0.448	0.387	0.407	0.416	0.413
Fish	0.149	0.129	0.136	0.139	0.138
TOTAL	14.945	12.895	13.555	13.859	13.768
2/ <i>Total Research Agenda</i>					
Crops	36.116	32.499	34.137	34.923	35.101
Banana/plantain	7.564	6.806	7.149	7.313	7.352
Cassava	7.564	6.807	7.149	7.314	7.351
Cowpea	4.916	4.424	4.647	4.754	4.778
Soybean	3.215	2.893	3.038	3.108	3.124
Maize	6.807	6.125	6.434	6.582	6.616
Yam	3.025	2.722	2.860	2.926	2.940
Other	3.025	2.722	2.860	2.926	2.940
Livestock	0.189	0.170	0.179	0.183	0.184
Trees	1.135	1.021	1.072	1.097	1.103
Fish	0.378	0.340	0.357	0.366	0.368
TOTAL	37.818	34.030	35.745	36.569	36.756
REGION	2001 (actual)	2002 (est)	2003 (proposal)	2004 (plan)	2005 (plan)
Sub-Saharan Africa (SSA)	37.477	33.724	35.423	36.240	36.426
West/Central Africa (WCA)	26.094	23.481	24.664	25.233	25.362
East/Southern Africa (ESA)	11.383	10.243	10.759	11.007	11.064
Asia	0.114	0.102	0.107	0.110	0.110
Latin American and the Caribbean (LAC)	0.113	0.102	0.108	0.109	0.110
Central/West Asia and North Africa (CWANA)	0.114	0.102	0.107	0.110	0.110
TOTAL	37.818	34.030	35.745	36.569	36.756

1/ Includes overheads, and must add up to the sum of the individual sectors/commodities from the project portfolio.

2/ Equals the sum of sectors/commodities in Increasing Productivity, scaled up to total investments for the Research Agenda.

Table 6. IITA Research Agenda, 2001-2005
Expenditure by Functional Category, and Capital Investments (in US\$ million)

OBJECT OF EXPENDITURE	2001 (actual)	2002 (est)	2003 (proposal)	2004 (plan)	2005 (plan)
Personnel	17.768	15.410	17.349	17.852	18.256
Supplies and Services	15.969	15.120	14.948	15.231	14.974
Operational Travel	2.066	1.500	1.448	1.486	1.526
Depreciation	2.015	2.000	2.000	2.000	2.000
TOTAL	37.818	34.030	35.745	36.569	36.756
CAPITAL INVESTMENTS	2001 (actual)	2002 (est)	2003 (proposal)	2004 (plan)	2005 (plan)
<i>Physical Facilities</i>					
Research					
Training					
Administration					
Housing					
Auxiliary Units					
sub-total	0.000	0.000	0.000	0.000	0.000
<i>Infrastructure & Leasehold</i>					
<i>Furnishing & Equipment</i>					
Farming		0.100	0.100	0.100	0.100
Laboratory & Scientific	0.950	1.600	0.800	0.800	0.800
Office		0.250			
Housing		0.428			
Auxiliary Units		1.000			
Computers	0.712	0.300	0.350	0.350	0.350
Vehicles	0.737	0.750	0.750	0.750	0.750
Aircraft					
sub-total	2.399	4.428	2.000	2.000	2.000
TOTAL	2.399	4.428	2.000	2.000	2.000
CAPITAL FUND RECONCILIATION	2001 (actual)	2002 (est)	2003 (proposal)	2004 (plan)	2005 (plan)
<i>Balance, January 1</i>	5.920	5.561	3.133	3.133	3.133
plus: annual depreciation charge	2.015	2.000	2.000	2.000	2.000
plus / minus: disposal gains/(losses)	0.025	0.000	0.000	0.000	0.000
plus / minus: other					
minus: asset acquisition costs	(2.399)	(4.428)	(2.000)	(2.000)	(2.000)
<i>equals: Balance, December 31</i>	5.561	3.133	3.133	3.133	3.133

Table 7. IITA Research Agenda Financing & Summary Statement of Activity, 2001-2003

(in US\$ million)

Member	2001 (audited actual)		2002 (current estimate 02/02)		2003 (current proposal 05/02)	
	(US \$)	(nat. currency)	(US \$)	(nat. currency)	(US \$)	(nat. currency)
	Unrestricted Contributions					
AUSTRIA	0.150	\$	0.000	-	0.000	-
BELGIUM	* 0.038	Euro0.087m	0.076	Euro0.087m	0.076	Euro0.087m
CANADA	0.679	CAD\$1.050m	0.670	CAD\$1.050m	1.340	CAD\$2.100m
DENMARK	0.830	DKr7.0m	0.720	DKr6.0m	0.720	DKr6.0m
FRANCE	0.081	FF0.6m	0.082	FF0.6m	0.082	FF0.6m
GERMANY	0.140	DM0.3m	0.213	DM0.450m	0.213	DM0.450m
ITALY	0.113	\$	0.078	Euro0.085m	0.078	Euro0.085m
JAPAN	2.073	¥271.540m	1.094	¥140.032m	1.094	¥140.032m
KOREA	0.050	\$	0.050	\$	0.050	\$
NETHERLANDS	0.609	NLG1.5m	0.610	Euro0.687m	0.610	Euro0.687m
NIGERIA	0.000	-	0.000	-	0.000	-
NORWAY	0.549	Nok5.0m	0.569	Nok5.6m	0.569	Nok5.0m
SOUTH AFRICA	0.050	\$	0.050	\$	0.050	\$
SWEDEN	0.349	Sk3.5m	0.350	Sk3.5m	0.350	Sk3.5m
USA	2.944	\$	2.944	\$	2.944	\$
WORLD BANK 1/	3.627	\$	2.595	\$	2.000	\$
subtotal	12.282		10.101		10.176	

Targeted Contributions	2001 (audited actual)		2002 (current estimate 02/02)		2003 (current proposal 05/02)	
	(US \$)	(nat. currency)	(US \$)	(nat. currency)	(US \$)	(nat. currency)
AUSTRIA	0.382	\$	0.000	-	0.000	-
BELGIUM	0.497	Euro	0.404	Euro	0.554	Euro
CANADA	0.015	CAD\$	0.000	-	0.000	-
CG/AEG	0.017	\$	0.000	-	0.000	-
CGIAR - Finance Committee **	0.088	\$	0.000	-	0.000	-
DENMARK	0.960	DKr	0.733	DKr	0.733	DKr
EU 2/	1.170	Euro	1.922	Euro	2.435	Euro
EMBRAPA/BRAZIL	0.000	-	0.020	\$	0.000	-
FAO	(0.001)	\$	0.000	-	0.000	-
FRANCE	0.380	FF\$	0.346	FF\$	0.366	Euro
GATSBY CHARITABLE FDN	0.339	£	0.459	£	0.459	£
GERMANY	0.844	DM	0.626	Euro	0.926	Euro
IDRC	0.012	\$	0.000	-	0.000	-
IFAD	1.166	\$	1.750	\$	1.750	\$
INT. INST. OF BIOLOGICAL CONTROL (IIBC)	0.277	£	0.200	£	0.200	£
ITALY	0.271	\$	0.268	Euro	0.268	Euro
JAPAN	1.000	¥130.960m	0.656	¥80.500m	0.656	¥80.500m
MISCELLANEOUS	0.730	\$	0.579	\$	1.389	\$
NETHERLANDS	0.098	NLG0.25m	0.102	Euro0.113m	0.102	Euro0.113m
NIGERIA	0.000	\$	0.000	-	0.000	-
NORWAY 2/	0.226	Nok2.0m	0.116	Nok1.0m	0.116	Nok1.0m
NRU	0.123	\$	0.077	\$	0.077	\$
ROCKEFELLER FOUNDATION	0.955	\$	0.705	\$	0.922	\$
SASAKAWA AFRICA ASSOCIATION	0.139	\$	0.100	\$	0.100	\$
SWEDEN	0.070	Sk	0.067	Sk	0.067	Sk
SWITZERLAND	0.758	SFr	0.709	SFr	0.709	SFr
UNDP	0.315	\$	0.071	\$	0.071	\$
UNITED KINGDOM (DFID)	0.972	£	0.971	£	1.046	£
USA	7.744	\$	7.437	\$	7.535	\$
subtotal	19.547		18.318		20.481	

TOTAL CONTRIBUTIONS

	2001 (actual)	2002 (estimate)	2003 (proposal)
Summary Statement of Activity	31.829	28.419	30.657
Member Contributions	31.829	28.419	30.657
+ Center Income	4.503	3.075	3.266
= Total Financing	36.332	31.494	33.923
- Total Research Agenda	37.818	34.030	35.745
= Deficit	(1.486)	(2.536)	(1.822)

* Adjusted for prior-year uncollectible.

** Systemwide Integrated Pest Management.

1/ World Bank matching funds are calculated at 12% (for 2001) and 10% (for 2002) of non-World Bank funding; and a fixed contribution of US\$2 million in 2003.

2001 figure includes \$243,000 deferral in prior year.

2/ This Plan includes EU funding which may be forthcoming for 2003 in the amount of about Euro 2.2 million (or US\$ 2.035 million).

3/ Year 2002 figure includes NOK 1.0 million received in 2001 spent in 2002.

Table 8a. IITA Allocation of 2001 Member Financing to Projects by Logframe format
(in US\$ million)

Project	Member	Total	Outputs				
			G/plasm Improvem't	G/plasm Collect'n	Sust'ble Production	Policy	Enhancing NARS
001. Conservation & Use of Plant Biodiversity	Belgium	0.086	0.030	0.030	0.013	0.004	0.009
	Gatsby	0.067	0.024	0.023	0.010	0.003	0.007
	Italy	0.041	0.014	0.014	0.006	0.002	0.005
	Japan	0.250	0.087	0.088	0.038	0.013	0.024
	Misc.	0.023	0.008	0.008	0.003	0.002	0.002
	USA	0.013	0.005	0.005	0.002	0.000	0.001
	unrestricted + center income	1.261	0.441	0.442	0.189	0.063	0.126
	Total Project Cost	1.741	0.609	0.610	0.261	0.087	0.174
002. Improving Plantain & Banana-Based Systems	Belgium	0.344	0.138	0.010	0.103	0.007	0.086
	Gatsby	0.146	0.058	0.004	0.044	0.003	0.037
	Germany	0.141	0.056	0.004	0.042	0.003	0.036
	IDRC	0.005	0.002	0.000	0.002	0.000	0.001
	NRI	0.021	0.009	0.001	0.006	0.000	0.003
	Rockefeller Fdn.	0.422	0.168	0.013	0.127	0.008	0.106
	USA	0.258	0.103	0.008	0.077	0.005	0.065
	Misc.	0.001	0.001	0.000	0.000	0.000	0.000
	unrestricted + center income	1.866	0.746	0.056	0.560	0.037	0.467
	Total Project Cost	3.204	1.281	0.096	0.961	0.063	0.803
003. Improving Cowpea- Cereal Systems in Dry Savannas	Canada	0.015	0.007	0.001	0.005		0.002
	Denmark	0.145	0.072	0.007	0.044		0.022
	Gatsby	0.004	0.002	0.000	0.001		0.001
	Germany	0.007	0.004	0.000	0.002		0.001
	IFAD	0.475	0.238	0.024	0.143		0.070
	Italy	0.041	0.021	0.002	0.012		0.006
	Japan	0.250	0.124	0.013	0.075		0.038
	USA	0.051	0.026	0.003	0.014		0.008
	unrestricted + center income	1.439	0.719	0.072	0.432		0.216
	Total Project Cost	2.427	1.213	0.122	0.728	0.000	0.364
004. Improving Maize-Grain Legume Systems in WCA	Germany	0.007	0.003		0.002		0.002
	IDRC	0.007	0.004		0.002		0.001
	IFAD	0.079	0.035		0.027		0.017
	Rockefeller Fdn.	0.220	0.099		0.075		0.046
	SAA	0.028	0.013		0.010		0.005
	UNDP	0.315	0.142		0.107		0.066
	USA	0.875	0.393		0.298		0.184
	unrestricted + center income	1.612	0.725		0.548		0.339
Total Project Cost	3.143	1.414	0.000	1.069	0.000	0.660	
005. Improving Yam-Based Systems	France	0.065	0.033		0.023		0.009
	Gatsby	0.104	0.053		0.036		0.015
	Germany	0.007	0.004		0.002		0.001
	IFAD	0.331	0.169		0.116		0.046
	Japan	0.250	0.128		0.088		0.034
	Misc.	0.023	0.011		0.007		0.003
	United Kingdom	0.256	0.130		0.090		0.036
	USA	0.820	0.418		0.287		0.115
	unrestricted + center income	0.664	0.339		0.232		0.093
	Total Project Cost	2.510	1.285	0.000	0.881	0.000	0.352
006. Improving Cassava-Based Systems	Gatsby	0.018	0.008		0.005	0.001	0.004
	Germany	0.008	0.004		0.002	0.000	0.002
	Misc.	0.013	0.005		0.004	0.001	0.003
	NRI	0.024	0.011		0.007	0.001	0.005
	Rockefeller Fdn.	0.102	0.047		0.030	0.004	0.021
	SAA	0.111	0.052		0.032	0.004	0.023
	Switzerland	0.025	0.012		0.007	0.001	0.005
	USA	3.647	1.678		1.058	0.146	0.765
	unrestricted + center income	2.433	1.119		0.706	0.097	0.511
	Total Project Cost	6.381	2.936	0.000	1.851	0.255	1.339
007. Biological Control and Functional Biodiversity	Austria	0.382		0.038	0.191	0.019	0.134
	CAB International	0.008		0.001	0.004	0.000	0.003
	Denmark	0.171		0.017	0.086	0.009	0.059
	Int. Inst. of Bio. Control	0.277		0.028	0.138	0.014	0.097
	Misc. (GBDI)	0.108		0.011	0.054	0.005	0.038
	Switzerland	0.201		0.020	0.101	0.010	0.070
	United Kingdom	0.117		0.011	0.059	0.006	0.041
	unrestricted + center income	0.977		0.098	0.489	0.048	0.342
	Total Project Cost	2.241	0.000	0.224	1.122	0.112	0.784

Table 8a. (continued)

(in US\$ million)

Project	Member	Total	Outputs				
			G/plasm Improvem't	G/plasm Collect'n	Sust'ble Production	Policy	Enhancing NARS
008. Integrated Management of Legume Pests	Italy	0.041	0.004		0.018	0.006	0.013
	Misc.	0.002	0.000		0.001	0.000	0.001
	NRI	0.058	0.006		0.026	0.009	0.017
	Switzerland	0.419	0.041		0.185	0.062	0.122
	unrestricted + center income	1.211	0.121		0.545	0.182	0.363
	Total Project Cost	1.722	0.172	0.000	0.775	0.259	0.516
009. Integrated Management of Maize Pests	Germany	0.494	0.099	0.010	0.207	0.040	0.138
	IFAD	0.001	0.000	0.000	0.001	0.000	0.000
	Japan	0.250	0.050	0.005	0.105	0.020	0.070
	Rockefeller Fdn.	0.155	0.031	0.003	0.065	0.012	0.044
	Rotary International	0.148	0.030	0.003	0.062	0.012	0.041
	USA	0.097	0.019	0.002	0.041	0.008	0.027
	unrestricted + center income	0.984	0.197	0.020	0.412	0.079	0.276
	Total Project Cost	2.129	0.426	0.043	0.893	0.171	0.596
010. Integrated Management of Cassava Pests	Denmark	0.644	0.129	0.032	0.258	0.032	0.193
	France	0.064	0.013	0.003	0.026	0.003	0.019
	IFAD	0.289	0.056	0.014	0.112	0.014	0.084
	NRI	0.020	0.004	0.001	0.008	0.001	0.006
	USA	0.761	0.152	0.038	0.304	0.039	0.228
	unrestricted + center income	0.851	0.170	0.043	0.340	0.043	0.255
	Total Project Cost	2.620	0.524	0.131	1.048	0.132	0.785
011. Protection & Enhancem't of Vulnerable Cropping Syst.	EU	0.529	0.069		0.344	0.021	0.095
	USA	0.017	0.002		0.011	0.001	0.003
	unrestricted + center income	1.126	0.146		0.732	0.045	0.203
	Total Project Cost	1.672	0.217	0.000	1.087	0.067	0.301
012. Improvement of High Int. Food & Forage Crop Syst.	Belgium	0.054	0.005		0.032	0.006	0.011
	EU	0.449	0.045		0.269	0.045	0.090
	Germany	0.180	0.018		0.108	0.018	0.036
	Misc. (ACIAR)	0.035	0.004		0.020	0.004	0.007
	Misc. (Others)	0.023	0.002		0.014	0.002	0.005
	Rockefeller Fdn.	0.056	0.005		0.034	0.006	0.011
	United Kingdom	0.402	0.041		0.241	0.040	0.080
	USA	0.017	0.002		0.010	0.002	0.003
	unrestricted + center income	1.403	0.140		0.842	0.140	0.281
	Total Project Cost	2.619	0.262	0.000	1.570	0.263	0.524
013. Dev. of Integrated Annual & Perennial Cropping Syst.	Misc. (CMA/ACRI/STP)	0.100			0.120	0.024	0.016
	Sweden	0.070			0.053	0.011	0.006
	United Kingdom	0.197			0.147	0.030	0.020
	USA	0.614			0.461	0.092	0.061
	unrestricted + center income	0.592			0.444	0.089	0.059
Total Project Cost	1.633	0.000	0.000	1.225	0.246	0.162	
014. Impact, Policy and Systems Analysis	Belgium	0.013			0.005	0.006	0.002
	CG/IEAG	0.007			0.003	0.003	0.001
	Misc. (CTA)	0.040			0.016	0.018	0.006
	Misc. (Unicef)	0.085			0.035	0.038	0.012
	Misc. (Others)	0.050			0.021	0.022	0.007
	USA	0.574			0.235	0.259	0.080
	unrestricted + center income	1.672			0.686	0.752	0.234
Total Project Cost	2.441	0.000	0.000	1.001	1.098	0.342	

Table 8a. (continued)

(in US\$ million)

Project	Member	Total	Outputs				
			G/plasm Improvem't	G/plasm Collect'n	Sust'ble Production	Policy	Enhancing NARS
015. Systemwide program for IPM	CG/TEAG	0.010			0.003	0.006	0.001
	CG Finance Committee	0.088			0.026	0.053	0.009
	EU	0.192			0.058	0.115	0.019
	Italy	0.148			0.044	0.089	0.015
	Misc.	0.013			0.004	0.008	0.001
	Norway	0.226			0.068	0.135	0.023
	Switzerland	0.122			0.037	0.073	0.012
	unrestricted + center income	0.003			0.001	0.002	0.000
	Total Project Cost	0.802	0.000	0.000	0.241	0.481	0.080
016. Ecoregional program of SSA	FAO	-0.001			0.000	0.000	-0.001
	France	0.251			0.112	0.013	0.126
	Netherlands	0.098			0.044	0.005	0.049
	unrestricted + center income	0.072			0.032	0.004	0.036
	Total Project Cost	0.420	0.000	0.000	0.188	0.022	0.210

	CG/TEAG	EU	Italy	FAO	France	Netherlands
Total Targeted Funding	19.547	5.476	0.495	7.711	1.674	4.191
Total Unrestricted Funding	12.282	3.338	0.431	5.081	0.781	2.651
Total Center Income	4.503	1.189	0.222	1.543	0.634	0.915
Total Allocations/Financing (table 7)	36.332	10.003	1.148	14.335	3.089	7.757

Total Research Agenda (table 2)	37.818	10.404	1.229	14.945	3.207	8.033
Unfunded Shortfall	(1.486)	(0.401)	(0.081)	(0.610)	(0.118)	(0.276)

Table 8b. IITA Allocation of 2002 Member Financing to Projects by Logframe Format

(in US\$ million)

Project	Member	Total	Outputs				
			G/plasm Improvem't	G/plasm Collect's	Seed/ble Production	Policy	Enhancing NARS
A. Preserving and Enhancing Germplasm and Agrobiodiversity	Belgium	0.202	0.111	0.030	0.020	0.010	0.031
	EMBRAPA/Brazil	0.010	0.005	0.002	0.000	0.001	0.002
	EU	1.076	0.592	0.161	0.108	0.054	0.161
	France	0.103	0.057	0.016	0.010	0.005	0.015
	Gatsby	0.144	0.079	0.022	0.014	0.007	0.022
	IFAD	0.400	0.220	0.060	0.040	0.020	0.060
	Japan	0.328	0.181	0.049	0.033	0.016	0.049
	Misc.	0.015	0.008	0.002	0.002	0.001	0.002
	Rockefeller Fdn.	0.003	0.002	0.000	0.000	0.000	0.001
	United Kingdom	0.325	0.177	0.049	0.034	0.016	0.049
	UNDP	0.036	0.020	0.005	0.004	0.002	0.005
	USA	2.447	1.346	0.367	0.245	0.122	0.367
	unrestricted + center income	2.422	1.333	0.364	0.241	0.122	0.362
	Total Project Cost	7.511	4.131	1.127	0.751	0.376	1.126
B. Developing Biological Control Options	Denmark	0.551	0.055		0.331	0.055	0.110
	EU	0.646	0.065		0.388	0.065	0.128
	France	0.103	0.010		0.062	0.010	0.021
	Gatsby	0.315	0.032		0.189	0.032	0.062
	Germany	0.300	0.030		0.180	0.030	0.060
	IFAD	0.550	0.055		0.330	0.055	0.110
	Int. Inst. of Bio. Control	0.200	0.020		0.120	0.020	0.040
	Italy	0.003	0.000		0.002	0.000	0.001
	Misc. (Rotary Int.)	0.036	0.004		0.022	0.004	0.006
	NRI	0.042	0.004		0.025	0.004	0.009
	Rockefeller Fdn.	0.301	0.030		0.181	0.030	0.060
	Switzerland	0.372	0.038		0.223	0.037	0.074
	United Kingdom	0.100	0.010		0.060	0.010	0.020
	USA	0.111	0.011		0.067	0.011	0.022
	unrestricted + center income	2.774	0.278		1.671	0.279	0.546
	Total Project Cost	6.404	0.642	0.000	3.851	0.642	1.269
C. Impact, Policy and Systems Analysis	Italy	0.053			0.009	0.031	0.013
	Rockefeller Fdn.	0.031			0.005	0.018	0.008
	Misc. (Unicef)	0.000			0.014	0.046	0.020
	USA	0.220			0.037	0.128	0.055
	unrestricted + center income	2.098			0.357	1.216	0.525
Total Project Cost	2.481	0.000	0.000	0.422	1.439	0.621	
D. Starchy and Grain Staples in Eastern and Southern Africa	Germany	0.100	0.017	0.003	0.031	0.007	0.042
	Misc.	0.005	0.001	0.000	0.002	0.000	0.002
	NRI	0.035	0.006	0.001	0.011	0.002	0.015
	Rockefeller Fdn.	0.205	0.035	0.006	0.064	0.014	0.086
	USA	2.594	0.441	0.078	0.804	0.182	1.089
	unrestricted + center income	2.745	0.466	0.083	0.850	0.193	1.153
Total Project Cost	5.684	0.966	0.171	1.762	0.398	2.307	
E. Starchy Staples, Peri-Urban and Tree Crop of the Humid and Subhumid Zone of WCA	Belgium	0.202	0.014	0.002	0.087	0.032	0.067
	Denmark	0.007	0.007	0.001	0.043	0.016	0.032
	EU	0.200	0.014	0.002	0.086	0.032	0.066
	Italy	0.054	0.004	0.001	0.023	0.009	0.017
	Misc. (World Cocoa Fdn.)	0.110	0.008	0.001	0.047	0.018	0.036
	Misc. (Others)	0.020	0.001	0.000	0.009	0.003	0.007
	Rockefeller Fdn.	0.004	0.000	0.000	0.002	0.001	0.001
	SAA	0.050	0.004	0.001	0.021	0.008	0.016
	United Kingdom	0.321	0.022	0.003	0.139	0.051	0.106
	USA	1.264	0.088	0.013	0.544	0.202	0.417
	unrestricted + center income	2.043	0.200	0.027	1.221	0.455	0.940
	Total Project Cost	5.167	0.362	0.051	2.222	0.827	1.705

Table 8b. (continued)

(in US\$ million)

Project	Member	Total	Outputs				
			G/plasm Improvem't	G/plasm Collect'n	Sust'ble Production	Policy	Enhancing NARS
F. Cereal-Legume Systems in the Moist and Dry Savannas of WCA	EMBRAPA/Brazil	0.810	0.002		0.006	0.001	0.001
	Denmark	0.893	0.017		0.050	0.008	0.008
	Germany	0.226	0.045		0.136	0.023	0.022
	IFAD	0.800	0.160		0.480	0.080	0.080
	Japan	0.328	0.066		0.197	0.032	0.033
	Misc. (ACIAR)	0.223	0.045		0.134	0.022	0.022
	Misc. (Hirose)	0.075	0.015		0.044	0.008	0.008
	Misc. (Others)	0.015	0.003		0.010	0.001	0.001
	Rockefeller Fdn.	0.161	0.032		0.097	0.016	0.016
	SAA	0.050	0.010		0.030	0.005	0.005
	Sweden	0.067	0.013		0.040	0.007	0.007
	Switzerland	0.212	0.042		0.127	0.022	0.021
	United Kingdom	0.225	0.045		0.135	0.023	0.022
	UNDP	0.835	0.007		0.020	0.004	0.004
	USA	0.801	0.160		0.481	0.080	0.080
	unrestricted + center income	2.762	0.553		1.657	0.275	0.277
	Total Project Cost	6.073	1.215	0.000	3.644	0.607	0.607
Systemwide program for IPM	Italy	0.158			0.047	0.079	0.032
	Norway	0.116			0.035	0.058	0.023
	Switzerland	0.125			0.038	0.062	0.025
	unrestricted + center income	0.065			0.019	0.033	0.013
	Total Project Cost	0.464	0.000	0.000	0.139	0.232	0.093
Ecoregional program of SSA	France	0.140			0.057	0.006	0.077
	Netherlands	0.102			0.046	0.005	0.051
	unrestricted + center income	0.003			0.001	0.000	0.002
	Total Project Cost	0.245	0.000	0.000	0.104	0.011	0.130

Center Totals	Total	Outputs				
		G/plasm Improvem't	G/plasm Collect'n	Sust'ble Production	Policy	Enhancing NARS
Total Targeted Funding	18.318	4.486	0.875	6.878	1.959	4.120
Total Unrestricted Funding	10.101	1.383	0.210	4.017	1.923	2.568
Total Center Income	3.075	0.883	0.088	1.193	0.229	0.682
Total Allocations/Financing (table 7)	31.494	6.752	1.173	12.088	4.111	7.370

Total Research Agenda (table 2)	34.030	7.316	1.349	12.895	4.532	7.938
Unfunded Shortfall	(2.336)	(0.564)	(0.176)	(0.807)	(0.421)	(0.568)

Table 9. IITA Research Agenda Staff Composition, 2001-2005.

	2001 (act)		2002 (est)		2003 (proposal)		2004 (plan)		2005 (plan)	
	Hired by:		Hired by:		Hired by:		Hired by:		Hired by:	
	center	other	center	other	center	other	center	other	center	other
Internationally-Recruited Staff (IRS)										
Research and Research Support										
<i>of which:</i>										
<i>Post-doctoral Fellows</i>	98.5	7.5	88.2	10.5	101.8	10.5	94.2	10.5	91.2	10.5
<i>Visiting Scientists</i>	10.75		8.5		11.5		11.5		10.5	
<i>Associate Professionals</i>	11		8		11.3		8		8	
			14.6		15.6		14.6		14.6	
Training / Communications										
<i>of which:</i>										
<i>Post-doctoral Fellows</i>	3		2		2		2		2	
<i>Associate Professionals</i>										
Research Management										
<i>of which:</i>										
<i>Post-doctoral Fellows</i>	15.5		11.1		11.1		11.1		11.1	
<i>Associate Professionals</i>										
	3		3		3		3		3	
Total IRS	117.00	7.5	101.30	10.5	114.90	10.5	107.30	10.5	104.30	10.5
Support Staff	1,003.0	85.0	920.0	86.0	951.0	86.0	934.0	86.0	927.0	86.0
TOTAL STAFF	1,120.00	92.5	1,021.30	96.5	1,065.90	96.5	1,041.30	96.5	1,031.30	96.5

DEFINITIONS

Internationally-Recruited Staff (IRS)

This category includes staff who carry out highly technical/senior functions, as defined by the center, and they may include personnel hired in the local or regional labor market. Included in this group, but shown separately, are post-doctoral fellows and associate professionals (who may have other titles in different centers), and who often are staff provided by donors as part of a project or other institutional arrangement. Costs for consultants engaged for specific tasks are not personnel expenses and the individuals are not staff; their costs should be calculated in the "supplies and services" category.

Support Staff

This category includes the numerical majority, in many cases, of personnel at a center. These are usually, but not necessarily always, individuals hired in the local labor market. They carry out functions which require less demanding skills than for the IRS category. The support staff category does not include seasonal field labor or other individuals engaged on a purely contract basis, for example when a center contracts with an employment agency to provide security, janitorial, and other services. Such costs should be calculated in the "supplies and services" category.

Table 10. IITA Cash Requirement, Revenue Flow & Currency Shares, 2001–2003

(in US\$ million)

MONTHLY CASH USES AND SOURCES

<i>2001 actual</i>	Balance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cash Requirement		3.450	3.239	3.222	3.225	3.400	3.225	3.250	3.250	3.508	3.501	3.624	3.689
Member & Center Income		10.715	2.875	2.911	1.531	4.809	2.000	2.275	2.300	2.640	2.112	2.848	5.178
Net Monthly Position		7.265	(0.364)	(0.311)	(1.694)	1.409	(1.225)	(0.975)	(0.950)	(0.865)	(1.389)	(0.776)	1.489
Accumulated Position	17.258	24.523	24.159	23.848	22.154	23.563	22.338	21.363	20.413	19.545	18.156	17.380	18.869

<i>2002 estimate</i>	Balance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cash Requirement		3.650	3.239	3.222	3.225	3.400	3.225	3.250	3.250	3.250	3.300	3.300	3.445
Member & Center Income		6.703	1.875	0.844	1.500	2.456	2.000	2.875	2.800	3.000	2.555	3.775	4.384
Net Monthly Position		3.053	(1.364)	(2.378)	(1.725)	(0.944)	(1.225)	(0.375)	(0.450)	(0.250)	(0.745)	0.475	0.939
Accumulated Position	18.869	21.922	20.558	18.180	16.455	15.511	14.286	13.911	13.461	13.211	12.466	12.941	13.880

<i>2003 proposal</i>	Balance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cash Requirement		3.610	3.215	3.215	3.160	3.160	3.160	3.160	3.160	3.260	3.260	3.310	3.373
Member & Center Income		4.405	5.733	1.200	2.000	2.500	2.565	3.500	3.670	3.000	3.000	3.000	4.501
Net Monthly Position		0.795	2.518	(2.015)	(1.160)	(0.660)	(0.595)	0.340	0.510	(0.260)	(0.260)	(0.310)	1.128
Accumulated Position	13.880	14.675	17.193	15.178	14.018	13.358	12.763	13.103	13.613	13.353	13.093	12.783	13.911

CURRENCY STRUCTURE OF EXPENDITURES

Currency	2001 (actual)			2002 (estimate)			2003 (proposal)		
	Amount	\$ value	% share	Amount	\$ value	% share	Amount	\$ value	% share
US Dollar	18.153	18.153	48.0%	16.505	16.505	48.5%	17.336	17.336	48.5%
Naira	889.703	7.942	21.0%	831.080	7.146	21.0%	900.840	7.507	21.0%
Pound Sterling	2.068	2.949	7.8%	1.753	2.552	7.5%	1.730	2.681	7.5%
Euro/CFA/French Franc	9.292	8.320	22.0%	8.048	7.316	21.5%	7.876	7.792	21.8%
Others		0.454	1.2%		0.511	1.5%		0.429	1.2%
TOTAL		37.818	100%		34.030	100%		35.745	100%

Notes:

1/ All other currencies the sum of which accounts for less than 5% of total expenditure.

Table 11. IITA Statement of Financial Position, 2001–2005

(in US\$ million)

	2001 *(actual)	2002 (est)	2003 (proposal)	2004 (plan)	2005 (plan)
Assets					
Current Assets					
Cash & Cash Equivalents	18.869	13.880	13.911	11.367	10.236
Accounts Receivable					
Donors	2.238	3.500	2.202	2.100	2.100
Employees	0.340	0.250	0.250	0.250	0.250
Other	0.672	0.250	0.200	0.200	0.200
Inventories	0.918	2.758	2.123	2.123	2.123
Prepaid Expenses	0.199	0.100	0.100	0.100	0.100
Other Current Assets	0.081	0.100	0.080	0.080	0.080
Total Current Assets	23.317	20.838	18.866	16.229	15.089
Fixed Assets					
Property, Plant, & Equipment	28.283	32.711	34.711	36.711	38.711
Less: Accumulated Depreciation	21.482	23.482	25.482	27.482	29.482
Total Fixed Assets - Net	6.801	9.229	9.229	9.229	9.229
Total Assets	30.118	30.067	28.095	25.449	24.318
Liabilities and Net Assets					
Current Liabilities					
Bank Indebtedness	0.942	1.000	1.000	1.000	3.522
Accounts Payable					
Donors	3.118	5.000	5.000	5.000	5.000
Employees	6.552	6.750	6.800	6.900	6.900
Others	0.730	1.000	0.800	0.700	0.700
In-Trust Accounts					
Accruals and Provisions	1.723	1.800	1.800	1.800	1.800
Total Current Liabilities	13.065	15.550	15.400	15.400	17.922
Long-Term Liabilities					
Total Liabilities	13.065	15.550	15.400	15.400	17.922
Net Assets					
Unrestricted :					
Unappropriated (CIFA/OFA) 1/	11.492	11.384	9.562	6.916	3.263
Appropriated (CFA) 2/	5.561	3.133	3.133	3.133	3.133
Restricted (Temporary)	-	-	-	-	-
Total Net Assets	17.053	14.517	12.695	10.049	6.396
Total Liabilities & Net Assets	30.118	30.067	28.095	25.449	24.318

* This represents audited figures.

1/ This represents Capital Invested in Fixed Assets and Operating Fund balances. 2005 figure is made up of US\$9.229m on Capital Invested in Fixed Assets and US\$(5.966)m on Operating Fund.

2/ This represents Capital Fund balance.

Annex 4
Abbreviations and
acronyms used in text

Abbreviations and acronyms used in the text

ACIAR	Australian Center for International Agricultural Research
ADP	Agricultural Development Project (World Bank Supported)
ARI	Agricultural Research Institute, Tanzania
ARO	Advanced research organization
ASARECA	Association for the Strengthening of Agricultural Research in Eastern and Central Africa
AYN	African Yam Network
BARNESA	Banana Research Network for Eastern and Southern Africa
CABI	Commonwealth Agriculture Bureau International, UK
CBN	Cassava Biotechnology Network
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (Colombia)
CIFOR	Center for International Forestry Research
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo (Mexico)
CIP	Centro Internacional de la Papa (Peru)
CIP	International Potato Center
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CORAF	Conférence des Responsables de Recherche Agronomique Africains
COSCA	Collaborative Study of Cassava in Africa
CRBP	Centre de recherche sur bananes et plantains
CRI	Crops Research Institute (Ghana)
CRSP	Collaborative Research Support Program
DRA	Direction de la Recherche Agronomique, Benin
DRTA	Direction de la Recherche et de la Technologie Agricoles, Chad
EARNNET	East African Root and Tubers Research Network
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária, Brazil
EPHTA	Ecoregional Program for the Humid and Subhumid Tropics of Sub-Saharan Africa
ESA	East and Southern Africa
FHIA	Fundación Hondureña de Investigación Agraria
FOODNET	Post harvest and Market Research Network for Eastern and Central Africa
GIS	geographic information systems
GTZ	German Agency for Technical Cooperation
GRENEWCA	Genetic Resources Network for West and Central Africa
IAPSC	Inter Africa Phytosanitary Council
IAR	Institute of Agricultural Research, Samaru, Nigeria
IAR	Institute of Agricultural Research, Sierra Leone
IAR&T	Institute of Agricultural Research and Training, Ibadan, Nigeria
IARC	international agricultural research center
ICARDA	International Center for Agricultural Research in the Dry Areas
ICIPE	International Center of Insect Physiology and Ecology
ICRAF	International Center for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDESSA	Institut des Savannes, Côte d'Ivoire
IFDC	International Fertilizer Development Center
IIBC	International Institute of Biological Control, UK
IITA	International Institute of Tropical Agriculture

ILRI	International Livestock Research Institute
INCV	Institut National des Cultures Vivrieres
INERA	Institut National d'Etudes et de Recherches Agricoles, Burkina Faso
INIBAP	International Network for the Improvement of Bananas and Plantains
INRAB	Institut National des Recherches Agricoles du Benin
INRAN	Institut National de Recherche Agronomique du Niger
INSAH	Institut du Sahel, Mali
IPGRI	International Plant Genetic Resources Institute
IPM	integrated pest management
IRA	Institut de la Recherche Agronomique, Cameroon
IRAG	Institut de la Recherche Agronomique de Guinée, Conakry
IRRI	International Rice Research Institute, Philippines
ISTRC—AB	International Society for Tropical Root Crops—Africa Branch
KUL	Katholieke Universiteit, Leuven
LUBILOSA	Lutte biologique contre les locustes et sauteriaux
MTP	Medium-term Plan
MUSACO	<i>Musa</i> Research Network for Western and Central Africa
NAARI	Namulonge Agricultural and Animal Production Research Institute (Uganda)
NARI	National Agricultural Research Institute, Gambia
NARS	national agricultural research systems
NCRI	National Cereals Research Institute, Nigeria
NGOs	nongovernmental organizations
NIHORT	National Institute for Horticultural Research, Nigeria
NRCRI	National Root Crops Research Institute, Nigeria
NRI	Natural Resources Institute, UK
OAU/STRC	Organization of African Unity/Scientific Technical and Research Commission
ORSTOM	Institut Français de Recherche Scientifique pour le Développement en Coopération
PASCON	Pan African <i>Striga</i> Control Network
PEDUNE	Protection Ecologiquement Durable du Niebé
RENACO	West and Central Africa Cowpea Research Network
RRPMC	Regional Research Project for Maize and Cassava
SACCAR	Southern Africa Center for Cooperation in Agricultural Research
SADC	Southern Africa Development Community
SADC-PGRC	Regional Plant Genetic Resources Center of the SADC Member Countries
SARI	Savanna Agricultural Research Institute (Ghana)
SARRNET	Southern Africa Root Crops Research Network
SIUPA	Systemwide Initiative on Urban and Peri-Urban Agriculture
SPALNA	Soil and Plant Analytical Laboratories Network of Africa
SP-IPM	Systemwide Program on Integrated Pest Management
SPAAR	Special Program for African Agricultural Research
SRP	Strategic Review Panel
SSA	sub-Saharan Africa
SSY	senior staff year
STCP	Sustainable Tree Crops Program

SWI-HIV/AIDS	Systemwide Initiative on HIV/AIDS
TAC	Technical Advisory Committee
TSBF	Tropical Soil Biology and Fertility Program
USDA	United States Department of Agriculture
WARDA	West Africa Rice Development Association
WCA	West and Central Africa
WCASRN	West and Central African Systems Research Network
WECAMAN	West and Central Africa Maize Network

Annex 5
CGIAR *i*SC comments on the
IITA Medium-term Plan

CGIAR iSC comments on IITA MTP 2003–2005

(at <http://www.worldbank.org/html/cgiar/publications/agm2002/isccommentsmtps&fp.pdf>)

The new MTP reflects IITA's plan for implementation of its 2001–2010 Strategic Plan, with consolidation of work into six projects. IITA plans to increasingly address the problems of poverty and food security through a food systems approach, both on the production technology side and through policy and institutional capacity building. Emphasis will be given to developing suitable environmental health and poverty indicators against which improvement in rural livelihoods and progress towards CGIAR goals can be measured.

The new MTP responds to the need to strengthen the agroecological approach and to simplify project and management structures within the Centre. Its three agroecological zone projects are delineated both by climate and geography. The three “zonal” projects correspond to the mandate area of the three sub-regional organizations (SROs) that make up FARA. The iSC supports this ‘decentralized’ and ‘demand-driven’ approach with its emphasis on predominant cropping systems and selected food systems within the agroecological zones.

The three “disciplinary” projects likewise represent logical clusters with germplasm enhancement and preservation, biocontrol, and impact and policy analysis. The elevation of biocontrol/IPM to a major disciplinary project, integrating biodiversity in sustainable systems, is appropriate. The iSC is pleased to see this ongoing and enhanced effort in IPM with IITA as a leader for the Systemwide effort. The combination of policy and impact assessment is also logical. The Centre has also adopted a more streamlined research management structure to strengthen priority setting and strategy development to ensure scientific and programmatic quality across the Institute.

Consistent with the CGIAR's new vision and strategy, the new MTP places stronger emphasis on poverty reduction. The iSC supports the stronger focus on market analysis, policy research, institutional reform and business development as described in the new Plan but cautions the Centre against shifting too many resources away from other critical areas of research. Investment in policy research is targeted to grow by \$1.9 million between 2001 and 2005 (a 59% increase) principally through networks that aim to speed up the adoption of technologies and serve the needs of SROs. (Actual net investments in market and policy research *per se* increase by only \$0.5 m). At the same time, the iSC notes with concern that resources allocated to germplasm improvement and sustainable production will fall by \$2.6 and \$1.2 million, respectively, during the same period.

The major focus of IITA's research continues to be sustainable production and utilization increases in SSA, together with diversification and increased commercialization of farming and agro-industrial enterprises. The Centre expects to strengthen the linkages between agriculture, human nutrition and human health along a number of fronts. The iSC commends the Centre for seeking to strengthen these linkages by, among other things, its involvement in the new Challenge Programmes. The partnerships with sub-regional organizations are applauded, although absent is any explicit mention of FARA as a coordinating organization. IITA indicates in the Plan its intention to readily support any forthcoming CPs in Africa. A slight reduction in senior staff positions will be compensated for in 2003 with post-docs, visiting scientists and associate professionals, which appears to be a cost-effective solution.