

# IITA

Annual Report 2003



*Research to Nourish Africa*



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**IITA**  
**Annual Report**  
**2003**

**International Institute of Tropical Agriculture**  
Ibadan, Nigeria

## **Mission statement**

IITA, with its national partners, aims to enhance the food security, income, and well-being of resource-poor people in sub-Saharan Africa by conducting research and related activities to increase agricultural production, improve food systems, and sustainably manage natural resources.

## **Mission**

Ensemble avec ses partenaires nationaux, l'IITA s'efforce d'accroître la sécurité alimentaire et d'améliorer les revenus ainsi que le bien-être des populations démunies de l'Afrique subsaharienne, et ce grâce à la recherche et aux activités connexes visant à augmenter la production agricole, améliorer les systèmes alimentaires et gérer de façon durable les ressources naturelles.

# Contents

<b>First words: A tale of two women</b>	<b>1</b>
<b>Premiers mots: Récit de deux femmes</b>	<b>2</b>
<b>Research highlights</b>	<b>7</b>
<b>Repères de la recherche à l'IITA</b>	<b>8</b>
<b>Graduate research completed at IITA in 2003</b>	<b>25</b>
<b>Financial information</b>	<b>27</b>
<b>Publications</b>	<b>29</b>
<b>Governing board</b>	<b>44</b>
<b>Professional staff</b>	<b>45</b>
Abbreviations used in this report	48



# A tale of two women

In the village of Bungu, in the Rufiji district of Tanzania, members of community-based farmers' organizations are making progress that they could only dream about a few years ago. They have money—even their own bank accounts. And while they are not rich, they have advanced a considerable distance on their journey out of poverty.

One hundred and thirty kilometers to the north, in Tanzania's largest city, Dar es Salaam, modern supermarkets symbolize a new urban prosperity. On their shelves among packaged foods from Europe, the Americas, and South Africa, are packages from an upstart Tanzanian company. Power Foods makes products targeted to the health-conscious city dweller. You have to look closely at the labeling and packaging to tell that these are home grown.

Anna Temu is the force behind Power Foods, its founder and Managing Director. Shaika Masou is an inspiration for the Sululu group in Bungu. What binds them together is processed cassava and a dream that life can be better in both their communities. Power Foods and the farmers in Bungu are two anchors of a remarkable story of success in agricultural research for development that links farmers to markets in a real and sustainable way.

## Scene... night at the Sululu group center in Bungu

Sun has just set at the group's work area in Rufiji. Some of the farmers have gone home, but one woman stays to talk to us. Unseen in the dark, others work. In a storage area, a kerosene lamp and a candle are all the light there is to work by... it is too dark for shadows.

Shaika Masou, proud that she has learned some English, sits on a rickety, wooden bench, sharing tea with the visitors from IITA. She talks about how much things have changed since the community group started high quality cassava

processing. The talk is about the children, the business, and the future.

"I plan to improve our house with iron sheets for the roof," says Shaika, thinking about her options. "And also we will have to get our own vehicle to transport cassava to the factory."

In the midst of the conversation, a portable radio scratches the air. A member of the group is trying to find a program that broadcasts market prices and conditions for cassava and other crops.

For these farmers, getting the freshly processed cassava to the city as quickly as possible is imperative. They are working for quality because without quality, they will have no market. What might have been good enough for Bungu in the past is not good enough for Dar es Salaam tomorrow. So they work.

**Anna Temu, Managing Director, Power Foods –  
Anna Temu, Président-directeur-général,  
Power Foods**



# Récit de deux femmes

Dans le village de Bungu, district de Rufiji en Tanzanie, les membres des organisations paysannes communautaires accomplissent des progrès dont ils ne pouvaient rêver il y a quelques années. Ils ont de l'argent, et même leurs propres comptes en banque. Ils ne sont pas riches ; néanmoins, ils ont fait des pas de géant dans la lutte contre la pauvreté.

A cent trente kilomètres plus au nord, la plus grande ville tanzanienne, Dar es Salaam, symbolise la nouvelle prospérité urbaine par ses supermarchés modernes. Sur les rayons de ces derniers, des plats conditionnés d'une entreprise alimentaire naissante de la Tanzanie sont disposés au milieu de plats venant d'Europe, d'Amérique et d'Afrique du Sud. Power Foods confectionne des produits pour les citoyens qui s'intéressent à leur santé. Pour savoir qu'il s'agit de produits fait maison, il y a lieu de regarder l'étiquette et l'emballage de très près.

Anna Temu est la force tranquille derrière Power Foods, sa fondatrice et sa directrice générale. Shaika Masou est une source d'inspiration pour le groupe Sululu à Bungu. Ce qui les lie, c'est le manioc transformé, et le rêve selon lequel la vie peut être meilleure pour les deux communautés. Power Foods et les paysans de Bungu constituent les acteurs principaux d'un véritable succès de la recherche pour le développement qui établit un lien réel et durable entre l'agriculteur et le marché.

## Scène... Une nuit au centre du groupe Sululu à Bungu

La nuit vient de tomber sur le lieu de travail du groupe à Rufiji. Certains des paysans sont rentrés chez eux, mais une femme est restée pour nous parler. Dans l'obscurité, d'autres travaillent. Dans une aire d'entreposage, seules une bougie et une lampe à pétrole fournissent l'éclairage aux travailleurs dont les ombres étaient à peine perceptibles.

Shaika Masou, fière du peu d'anglais qu'elle a appris, s'assit sur un banc en bois branlant pour partager un thé avec ses visiteurs de l'IITA. Elle parle de comment les choses ont changé depuis que le groupe

communautaire a embrassé la transformation du manioc de haute qualité. La causerie portait sur les enfants, les affaires et l'avenir.

« J'ai l'intention de refaire le toit de notre maison avec des tôles » dit Shaika, en pensant à toutes les possibilités qu'elle avait. « Et aussi, il nous faut notre propre véhicule pour transporter le manioc à l'usine ».

Au milieu de la conversation, un poste de radio portatif se mit à grincer. Un membre du groupe tentait de capter une émission sur les prix et les conditions de vente du manioc et d'autres cultures.

Ces agriculteurs veulent à tout prix pouvoir transporter, le plus rapidement possible, le produit de manioc frais en ville. Leur objectif, c'est la qualité car sans elle, il n'y aura pas de marché. Ce qui aurait suffi pour Bungu dans le passé, ne sera pas assez pour Dar es Salaam demain. Ainsi, ils travaillent sans relâche.

Erodées par une vie de dur labeur, les mains habiles de deux des plus vieux membres du groupe manipulent des lames bien aiguisées à piler des racines de manioc récoltées plus tôt l'après-midi. Le manioc commence à fermenter aussitôt sorti de terre ; ainsi donc, le couple—dont les visages mal éclairés affichent cinquante ans d'histoire de dures épreuves—travaille. Leur labeur de ce soir se convertira en argent liquide demain lorsque le camion, qu'il partage sous contrat avec trois autres groupes de la zone, viendra enlever leur produit. Dans le passé, ces paysans étaient livrés aux caprices de quelques commerçants de manioc frais qui ne leur offraient jamais de bons prix à cause du mauvais état des routes et des longues distances à parcourir. Ils devaient s'estimer heureux s'ils obtenaient un peu plus du dixième du prix pratiqué sur le marché de manioc frais.

## Scène... Power Foods processing plant, Anna Temu, energizer

Anna Temu est une véritable bombe quand il s'agit de promouvoir les affaires. Vêtue d'un blouson rouge éclatant et armée d'une énergie sans cesse renouvelée, elle supervise une entreprise qui, peu à peu, remporte un grand succès en Tanzanie. La partie visible de son



Weathered from a life of toil, the skilled hands of two of the group's older members manipulate sharp blades to peel cassava roots that were harvested earlier in the afternoon. Cassava begins to ferment almost as soon as it is out of the ground, so the couple—on whose dimly lit faces are written the story of 50 years of hardship—work. Toil tonight will mean cash tomorrow when the truck they contract with three other groups in the area comes to fetch their product. In the past, these farmers were at the whim of the few traders in fresh cassava. The poor roads and long distances meant that the traders never paid a good price. They were lucky if they saw more than a tenth of what their product fetched in the fresh cassava market.

**Scene... Power Foods processing plant, Anna Temu, energizer**

Anna Temu is a fireball when it comes to promoting her business. Dressed in a power-red jacket and armed with unending energy, she oversees what is turning into a major success story in Tanzania. The foyer of her factory in Dar es Salaam is a storefront for her products and people drop in to buy. But the

real action is at the back. It takes a large number of people to make the factory hum but the biggest noise comes from the machine.

“Before IITA and Foodnet support, you would hardly see packed cassava flour on the market,” says Temu. “IITA first of all introduced me to the cassava chipper and presser whereby we could process cassava in a better quality manner.”

A milling machine, imported from China, takes the fresh cassava chips that have been delivered from the four groups in Rufiji and turns them into fine, clean, white flour. Anna Temu saw how well the machines worked when she took a fact-finding trip to Vietnam sponsored by IITA–Foodnet.

The milling machines also turn out soy flour. The combination of these flours with traditional maize is the foundation of many Power Foods recipes. Anna Temu targets these porridge-type flours to pregnant women and mothers with young children.

Once the cassava is milled, a human assembly line takes over. The availability of high quality cassava chips that can be made into flour is vital to Anna Temu's business.

**Shaika Massou, hope for a brighter future –  
Shaika Massou, l'espoir d'un avenir plus brillant**





### **Grating cassava for the Dar es Salaam market – Râpage de manioc pour le marché de Dar es Salaam**

usine à Dar es Salaam est la devanture où les produits sont exposés pour la vente, mais l'action même se déroule dans les coulisses. Pour faire vrombir l'usine, il faut beaucoup de personnes, mais le plus grand bruit est produit par la machine.

« Avant le soutien de l' IITA et de Foodnet, la farine de manioc conditionnée était une denrée rare sur le marché », dit Temu. « Au départ, l'IITA nous a fait découvrir la trancheuse et la presse de manioc afin de nous aider à obtenir des produits à base de manioc de meilleure qualité ».

Un moulin importé de la Chine reçoit les cossettes de manioc frais livrées par les quatre groupes de Rufiji et les réduit en farine fine et propre, de couleur blanche. Anna Temu put témoigner du bon fonctionnement de cet appareil à l'occasion d'une mission d'inspection qu'elle entreprit au Vietnam grâce au financement de l'IITA-Foodnet.

Les moulins transforment aussi le soja en farine. Ensemble avec la farine de maïs traditionnelle, ces farines constituent la base de bon nombre de recettes Power Foods. Anna Temu destine ces types de farine à bouillie aux femmes enceintes et aux nourrices.

Une fois le manioc moulu, une chaîne humaine prend la relève. La disponibilité de cossettes de manioc de qualité supérieure, transformables en farine, est d'importance capitale pour l'entreprise de Anna Temu.

« Lorsque vous mélangez le *ugali*—du maïs—avec le manioc, vous obtenez un produit de très bonne qualité », déclare-t-elle. « Si nous exploitons ce créneau, nous vendrons beaucoup. Nous pouvons ajouter 10% ou 20% de farine de manioc à la farine de maïs. Il s'agit là d'une très large consommation de manioc qui peut être facilement satisfaite ici en Tanzanie ».

### **Scène... Lever du jour à Bungu**

Le lever du soleil sur Bungu est un véritable spectacle... un ciel rose vif annonce une longue journée de travail pour les membres du groupe Sululu. Les villageois mus par le soleil déjeunent au thé chaud doux, accompagné de pain, puis se mettent au travail. Ils épluchent et lavent une partie du manioc de la veille, mais l'activité principale se déroule au niveau des machines, car c'est elles qui font toute la différence. Les trancheuses, acquises grâce à l'IITA et au Foodnet, produisent des cossettes de qualité supérieure qui peuvent être séchées

“When you mix *ugali*—which is maize—with cassava, you get a very good quality product,” she says. “If we can tap that opportunity, we really can sell a lot. We can add up to 10 or 20% of cassava flour to maize meal. That is a very big percentage of cassava consumption, which is very easy to market here in Tanzania.”

### Scene... Bungu sunrise

Sunrise is dramatic in Bungu...a vibrant pink sky is the harbinger of a long day ahead for members of the Sululu group. People in the village stir with the sun, share a breakfast of hot, sweet tea and bread, and start to work. Some of the cassava left from the night before is being peeled and washed, but the main activity is at the machines, because it is the machines that make all the difference. Chippers, purchased with help from IITA and Foodnet, produce high quality chips that can be dried and will store well for shipment to Dar es Salaam. In fact, as soon as thin chips fill a collection basket, they are moved to drying racks and spread out to make the most of the day's sunlight.

“Cassava which is processed with this technology dries very fast,” says Shaika Massou, quickly adding: “And we get money from processing the cassava.”

That money makes a real difference. In the past, villagers kept what cash they managed to save close to hand in their homes. They felt very vulnerable. Now members of the community group have their own bank accounts.

“We have escaped from thieves and hooligans,” says Shaika. And they have found strength in numbers. The four small processing groups in

Bungu have formed an association that can negotiate micro-credit loans and other advantages for their members.

### Scene... the packages on the shelf

The Shoprite supermarket chain has opened several stores in Dar es Salaam. Proudly displayed on their shelves are the products of Power Foods, made with cassava from Bungu.

“I was aiming at a market for people who are both health and quality conscious,” says Temu. “I just went straight to the big supermarket where I could position my product. From there it was received as a quality product.”

The link between Power Foods and the Bungu community represents the beginning of a powerful development model. Other groups are also selling to Power Foods as its demand continues to grow and Temu says that there is room in Tanzania for more companies like hers. Eventually she even sees an export market for the products. The Sululu group and their partners in Rufiji are winners too. By cutting out the middlemen and organizing collectively to chip and ship processed cassava, they nearly tripled the price they receive for their produce—from US\$300/ha to US\$800/ha.

IITA and the Government of Tanzania have learned a great deal from this pilot project. They are now working with nongovernmental organizations (NGOs) and other farmers' groups to scale up and expand the concept to other parts of the country.

The two women, Anna Temu and Shaika Massou, have learned too. They now know that even when the night is too dark for shadows, it is never too dark to dream.



et bien conservées pour expédition à Dar es Salaam. En effet, dès que les cossettes fines remplissent le panier de collecte, elles sont passées aux séchoirs et sont étalées pour tirer le meilleur parti du soleil du jour.

« Le manioc transformé grâce à cette technologie sèche très rapidement », déclare Shaika Massou, qui ajoute aussitôt : « et la transformation du manioc est une activité rentable ».

L'argent fait une grande différence. Dans le passé, les villageois gardaient chez eux l'argent qu'ils arrivaient à économiser. Ils se sentaient très vulnérables. De nos jours, les membres du groupe communautaire possèdent leurs propres comptes en banque.

« Nous avons échappé aux voleurs et aux vandales », dit Shaika. Et ils sont devenus plus nombreux. Les quatre petits groupes de transformation de Bungu ont formé une association pour négocier des micro-crédits et d'autres avantages pour leurs membres.

### **Scène... Les produits en rayons**

La chaîne Shoprite Supermarket a ouvert plusieurs magasins à Dar es Salaam. Des produits Power Foods faits avec du manioc de Bungu y sont fièrement exposés.

« Je voulais un marché pour des gens pour qui la santé et la qualité ont une importance », affirme Temu. « Je me suis directement rendu dans un grand supermarché où j'ai pu positionner mon produit. C'est ainsi qu'il fut lancé comme produit de qualité ».

Le lien entre Power Foods et la communauté de Bungu constitue le début d'un puissant modèle de développement. D'autres groupes vendent aussi à Power Foods à mesure que la demande augmente et, d'après Temu, il y a de la place pour d'autres sociétés comme la sienne en Tanzanie. A terme, elle vise un marché d'exportation pour ses produits. Le groupe Sululu et leurs partenaires à Rufiji sont aussi des gagnants. En écartant les intermédiaires et en s'organisant collectivement pour produire et expédier des cossettes de manioc, ils ont pratiquement triplé leurs recettes, passant de 300\$EU/ha à 800\$EU/ha.

L'IITA et le gouvernement tanzanien ont tiré beaucoup d'enseignements de ce projet pilote. Ils travaillent présentement avec des organisations non-gouvernementales (ONG) et d'autres groupes pour étendre le concept à d'autres régions du pays.

Les deux femmes, Anna Temu et Shaika Massou, ont aussi appris. Elles savent maintenant que même si la nuit est trop noire pour les ombres, elle n'est jamais trop noire pour rêver.

# Research highlights

## Project A

### Preserving and Enhancing Germplasm and Agrobiodiversity

- The year saw the first ever report of production of yam microtubers from single nodal cuttings of greenhouse-grown plants for *Dioscorea rotundata*; the frequency of microtuberization from greenhouse-grown material was considerably higher when compared to microtuberization from plantlets grown in vitro (over 30% versus less than 5%), offering new perspectives for the distribution of yam propagules.
- Eighteen improved cassava varieties were analyzed for their amino acid profile in the leaves to determine protein quality. On average, the amino acids glutamic acid and leucine were highest, with values above 4 g/100 g protein, followed by aspartic acid, arginine, and alanine, with values above 3 g/100 g protein. The sulphur amino acids cysteine and methionine had the lowest values, of less than 0.5 g/100 g protein. Among the varieties, TME279 had the highest concentration of the essential amino acid lysine (3.7 g/100 g).
- The iron bio-availability of 20 elite and adapted late-maturing maize varieties was assessed using the Caco-2 cell model. Significant differences in bio-available iron were observed among varieties. Mean bio-available iron ranged from 14% below to 43% above the reference variety, TZB-SR.
- Transgenic shoots of plantain have been generated that contain a resistance gene derived from *Banana Streak Virus* (BSV) for further testing of BSV resistance and production of BSV-resistant plantains.
- An efficient and reproducible shoot regeneration system was established for cowpea (*Vigna unguiculata* L Walp.) using embryonic axes as explants. Conditions for genetic transformation with *Agrobacterium tumefaciens* and selection using the kanamycin resistance gene have been optimized.
- Molecular diversity studies were conducted on wild cowpea (48 accessions of ssp. *dekindtiana*, *ovata*, *momensis*, *rhomboidea*, *grandiflora*, *congolensis*, *protracta* and *pubescens*); water yam (53 accessions of *Dioscorea alata* L. from West Africa and Puerto Rico); cassava (96 cultivars from Sierra Leone); and cocoa (over 500 accessions from Nigeria) using single sequence reaction (SSR) and/or amplified fragment length polymorphism (AFLP) markers.
- Heterotic groups of the new midaltitude maize inbred lines were established using yield-based combining ability and molecular markers. Considering the diversity of the genetic backgrounds of the inbred lines, the marker-based grouping may serve as the basis for designing and carrying out combining ability studies in the field to establish clearly defined heterotic groups with greater genetic similarity within groups.
- A diagnostic survey was conducted in southern Nigeria to monitor changes in and spread of cassava mosaic disease (CMD). This study revealed that the Ugandan strain of *East African cassava mosaic virus* (EACMV), i.e., the causative agent of the CMD epidemic in Uganda, is not yet present in Nigeria. However, mixed infections of *African cassava mosaic virus* (ACMV) and EACMV, which gave rise to the recombinant Ugandan strain, are now widespread in southern Nigeria and virulent strains of ACMV and EACMV inducing very severe symptoms are already present in the survey area.

# Repères de la recherche à l'IITA

## Projet A

### Conservation et valorisation du matériel végétal et de l'agro-biodiversité

- Cette année on a obtenu le premier rapport sur la production de microtubercules d'igname à partir de boutures à un nœud de plants de *Dioscorea rotundata* élevés sous abri grillagé; la fréquence de la microtubérisation à partir du matériel élevé sous abri grillagé était beaucoup plus prononcée que celle notée pour la microtubérisation impliquant des plantules issues de culture in vitro (plus de 30% contre moins de 5%), ce qui ouvre de nouvelles perspectives pour la distribution de propagules d'igname.
- Le profile en aminoacides des feuilles a été analysé chez 18 variétés améliorées de manioc pour la détermination de la qualité protéique. La teneur moyenne en acide glutamique et en leucine était la plus élevée avec des valeurs dépassant 4g/100g de protéines, suivie de celle en acide aspartique, en arginine et en alanine dont les valeurs étaient supérieures à 3g/100g de protéines. Les aminoacides soufrés, notamment la cystéine et la méthionine, ont présenté les plus faibles valeurs, soit moins de 0,5g/100g de protéines. La plus forte concentration de la lysine, un aminoacide essentiel, a été enregistrée chez la variété TME279 (3,7g/100g).
- La bio-assimilabilité du fer a été évaluée chez 20 variétés d'élite et tardives adaptées de maïs à l'aide du modèle cellulaire Caco-2. Des différences significatives ont été enregistrées parmi les variétés. La bio-assimilabilité moyenne du fer variait entre 14% en dessous et 43% au-dessus de la moyenne enregistrée pour la variété de référence, TZB-SR.
- Des pousses transgéniques de la banane-plantain dotées d'un gène de résistance issu du virus de la striure du bananier (BSV) ont été générées pour des tests approfondis de résistance au BSV, et la production d'une variété de banane-plantain résistante au BSV.
- Un système efficace et reproductible de régénération de pousses a été créé pour le niébé (*Vigna unguiculata* L Walp.) en utilisant des axes de l'embryon comme explants. Les conditions requises pour la transformation génétique à l'aide de l'*Agrobacterium tumefaciens* et la sélection au moyen du gène de résistance à la kanamycine ont été optimisées.
- Des études effectuées avec des marqueurs SSR et/ou AFLP ont porté sur la diversité moléculaire du niébé sauvage (48 obtentions de ssp. *dekindtiana*, *ovata*, *mensensis*, *rhomboidea*, *grandiflora*, *congolensis*, *protracta* et *pubescens*); d'igname aqueuse (53 obtentions de *Dioscorea alata* L. de l'Afrique de l'Ouest et de Porto Rico); du manioc (96 cultivars de la Sierra Leone); et du cacao (plus de 500 obtentions du Nigeria).
- Des groupes hétérotiques des nouvelles lignées endogames de maïs de moyenne altitude ont été établis sur la base de l'aptitude à la combinaison du rendement et des marqueurs moléculaires. Vu la diversité du patrimoine génétique des lignées endogames, le regroupement à l'aide de marqueurs peut être utilisé comme base pour concevoir et réaliser des études en plein champ sur l'aptitude à la combinaison en vue de l'établissement de groupes hétérotiques clairement définis et génétiquement plus proches les uns des autres.
- Une enquête exploratoire a été conduite dans le sud-est du Nigeria afin d'apprécier les mutations ainsi que la propagation de la mosaïque du manioc (CMD). L'étude a révélé que la souche ougandaise de l'EACMV, l'agent causal de l'épidémie de la CMD en Ouganda, n'a pas encore atteint le Nigeria. Toutefois, des infections combinées de l'ACMV et de l'EACMV à l'origine de la souche recombinante ougandaise, sont maintenant très répandues dans le sud du Nigeria où des souches virulentes de l'ACMV et de l'EACMV, responsables de symptômes très sévères, sont rencontrées dans la zone d'étude.

- Over 20 000 in vitro plantlets of 10 improved and multiple pest- and disease-resistant cassava clones have been produced for further introduction into the Democratic Republic of Congo. About 1500 in vitro plantlets have been distributed to DR Congo to combat the CMD epidemic. Also, the tissue culture laboratory at the Mvuazi Research Station in DR Congo is being upgraded, with the introduction of a capacity to produce 2000 pathogen-tested in vitro plantlets per month.
- Upgrading of the IITA genebank was initiated with information on available germplasm being made available on the intranet; rejuvenation of the Bambara groundnut collection (1400 accessions) was completed.
- Three *Striga*-resistant and high yielding maize varieties have been identified in the regional early *Striga* variety trial and recommended to the West and Central Africa Maize Network (WECAMAN) member countries for on-farm evaluation.
- A herbicide resistance gene (imizapur resistance gene) that inhibits acetolactate synthase activity and growth of *Striga* was introgressed into tropical maize adapted to the savannas to allow effective control of *Striga* by treatment of maize seed with low doses of imizapur.
- With backstopping from IITA, a *Musa* breeding program was established at the Centre National de Recherche Agronomique of Côte d'Ivoire—the first NARS in West and Central Africa to initiate a plantain breeding program.
- Genetically segregating populations of bananas were produced by selfing of *Musa balbisiana*, and by interspecific crossing of *M. balbisiana* and *M. acuminata*, which will allow the genetic analysis of genes contributing to nematode resistance, earliness, plant height, and water use efficiency in diploid banana.
- The first scientifically verified apomixis (i.e., the production of seed in the absence of fertilization), has been genetically and phenotypically characterized in banana, paving the way for counterselection against this trait in breeding programs.
- A dwarf and early-maturing secondary triploid plantain hybrid was produced with resistance to black Sigatoka and derived from high yielding PITA17 and nematode-resistant *Moron princesa*.

## Project B

### Developing Biologically Based Pest, Disease, and Weed Management Options, and Conserving Biodiversity for Sustainable Agriculture

- The transmission efficiency of *Cucumber Mosaic Virus* (CMV) by a single aphid was found to be between 19 and 27%, indicating that low vector populations are capable of high rates of spread. The virus can be transmitted from *Musa* sp. to *V. unguiculata*. The probability for spread within a mixed farming system is high, especially as CMV also occurs in weed species. Losses due to CMV can be high where there is super-infection by other viruses (and BSV is endemic) or where there is poor management. Since the virus can, to a large extent, be identified visually, roguing of infected plants becomes an important control option for reducing inoculum pressure.
- The mango mealybug was for the first time observed in Burkina Faso during a survey conducted in October 2002. The presence of the parasitoids *Gyranusoidea tebygi* and *Anagyrus mangicola* was confirmed, with results showing that both are beginning to have an impact on mango mealybug populations.
- In West Africa, the two parasitoids *Encarsia haitiensis* and *E. guadeloupae* have always followed their host, the spiralling whitefly, since its accidental introduction in 1992. In Cape Verde, they had been

- Plus de 20.000 vitroplants de 10 clones de manioc améliorés, incorporant une résistance multiple aux maladies et ravageurs, ont été créés en vue de nouvelles introductions en République Démocratique du Congo. Environ 1.500 vitroplants ont été distribués en RDC pour combattre l'épidémie de la CMD. En outre, la capacité du laboratoire de culture des tissus, à la station de recherche de Mvuzi, est en train d'être renforcée pour atteindre une production mensuelle de 2.000 plantules résistantes aux pathogènes.
- Le processus d'amélioration de la banque de gènes de l'IITA a commencé avec la mise sur Internet des renseignements relatifs au matériel conservé; la revitalisation de la collection de voandzou (1.400 obtentions) a été achevée.
- Trois variétés de maïs à haut rendement, résistantes au *Striga*, ont été identifiées dans le cadre de l'essai variétal régional sur le maïs précoce résistant au *Striga*; elles ont été proposées au pays membres de Réseau de recherche collaboratif sur le maïs en Afrique de l'ouest et du centre (WECAMAN) pour évaluation en milieu réel.
- Un gène de résistance à l'herbicide (gène de résistance à l'imizapur), qui inhibe l'activité de synthèse de l'acétolactate et la croissance du *Striga*, a été introgressé dans du maïs tropical adapté aux zones savanicoles en vue d'une meilleure maîtrise du *Striga* par application de doses réduites d'imizapur au maïs.
- Grâce au soutien de l'IITA, un programme d'amélioration de *Musa* a été mis en place au Centre National de Recherche Agronomique de Côte d'Ivoire—le tout premier SNRA dans la région d'Afrique occidentale et centrale à avoir lancé un programme de sélection sur la banane-plantain.
- Des populations de bananes en disjonction génétique ont été produites par auto-croisement de *Musa balbisiana*, et par croisement interspécifique de *Musa balbisiana* et *Musa acuminata*, ce qui permettra l'analyse des gènes qui contribuent à la résistance aux nématodes, la précocité, la hauteur de la plante et l'utilisation efficiente de l'eau chez la banane diploïde.
- Le premier cas d'apomixie (production de semences en l'absence de fécondation) vérifié au plan scientifique, a fait l'objet d'une caractérisation génétique et phénotypique chez la banane, ce qui ouvre la voie à la contre-sélection pour l'apomixie dans les programmes de sélection.
- Le croisement de la variété à haut rendement de banane-plantain, PITA17, avec *Moron princesa*, une variété résistante aux nématodes, a permis de générer une variété hybride, précoce et naine de plantain triploïde secondaire incorporant la résistance à la cercosporiose noire.

## Projet B

### Elaboration d'options biologiques de lutte contre les ravageurs, maladies et adventices et conservation de la biodiversité pour une agriculture durable

- Une étude a révélé que l'efficacité de transmission du virus de la mosaïque du concombre (CMV), par un seul puceron, variait entre 19 et 27%. En d'autres termes, de faibles populations du vecteur peuvent être à l'origine de forts taux de propagation. Le virus peut être transmis de *Musa* sp. à *V. unguiculata*. Il existe une forte probabilité de diffusion rapide en systèmes de culture mixte, d'autant que le CMV s'attaque également aux adventices. Les pertes dues au CMV peuvent être élevées en situation de super-infection par d'autres virus (et d'endémie du BSV), ou de recours aux méthodes de contrôle inadéquates. Puisque que le virus peut être, dans une large mesure, repéré visuellement, l'arrachage des plants infectés constitue un précieux moyen pour réduire la pression de l'inoculum.
- La cochenille du manguier a été pour la première fois observée au Burkina Faso lors d'une enquête en octobre 2002. La présence des deux parasitoïdes *Gyranoidea tebygi* et *Anagyrus mangicola* a été confirmée. Les résultats ont montré que les deux parasitoïdes commencent à avoir un impact sur les populations de la cochenille du manguier.
- En Afrique de l'Ouest, les deux parasitoïdes *Encarsia haitiensis* et *E. guadeloupae* ont toujours évolué avec leur hôte, la mouche blanche en spirale, depuis son introduction accidentelle en 1992. Au Cap Vert, ils n'ont pas été découverts jusqu'au moment où ils ont été ramenés d'un laboratoire à Cotonou et lâchés en plein champ en 2002. Il s'agit donc du premier cas de lâchers et d'établissements délibérés de ces deux parasitoïdes.
- L'indice de couverture des surfaces d'eau (sur une échelle de 1 à 20) par la hyacinthe d'eau au Bénin, a chuté d'une moyenne de 12,75 en 1991/2 à 3,29 en 2002 (la dernière année où des données complètes ont été enregistrées), ce qui



- absent until they were taken from the IITA laboratory in Cotonou and released in the field in 2002. This is therefore the first record of deliberate release and establishment of these two parasitoids.
- The surface coverage index (1 to 20 scale) for water hyacinth in Bénin has declined from a mean of 12.75 in 1991/2 to 3.29 in 2002 (the last year with complete data), indicating a substantial general reduction in eight of the nine sites monitored. However, seasonal fluctuations can still be observed.
  - Children who were fully weaned on maize-based porridge had higher aflatoxin blood levels than those still partially breastfed. The highest quartile of aflatoxin blood levels was associated with a mean 1.67 cm reduction in growth over 8 months compared to the lowest quartile.
  - Banana weevils may be attracted to pheromone lures where they may be infected by *Beauveria bassiana*. The weevils remain longer at such lures than at conventional pseudostem traps, thereby facilitating adherence of *B. bassiana* spores to the insects. Infected banana weevils remain active in the field and can infect other weevils. Laboratory studies on antibiosis against banana weevil showed that larvae had longer development periods on resistant clones, but that survival and pupal weight could not be related to the level of banana susceptibility to this pest. This means that, under current rearing methods, laboratory studies cannot replace field evaluations in screening germplasm. Larval developmental rate, survival, and size were all lower on pseudostems than on corms.
  - In collaboration with Cornell University, USA, an isolate-specific molecular diagnostic tool was developed for distinguishing African and Brazilian isolates of *Neozygites tanajoa*, a fungal pathogen of cassava green mite (CGM). Brazilian strains of the fungus are under evaluation as microbial control agents of CGM to complement biocontrol of this pest with predatory mites.
  - A biochemical tool was developed for monitoring maize pollen consumption by phytoseiid predatory mites. Maize pollen plays a very important role in the biology of phytoseiid predators: it enhances their persistence and abundance and hence their ability to suppress pest mite densities.
  - Six studies on the agronomic impact of CGM biocontrol with the neotropical phytoseiid predatory mite *Typhlodromalus aripo* in eastern and southern Africa were concluded in 2003. Cassava root yield gain from CGM biocontrol depended on agroecology and variety. Protected plants produced 20% to 84% higher yields than plants lacking the predators.
  - ELISA was used to test over 1400 *Maruca vitrata* samples collected from *Vigna unguiculata*, *Pterocarpus* sp. and *Pueraria* sp. from both Nigeria and the Republic of Bénin. Incidence of infection of *M. vitrata* *cypovirus* (MvCPV) in different batches ranged from < 10% to 100%, while about 6% of the *M. vitrata* larvae were very severely infected with a very high level of antigen detected in the larvae. Ultimately, the aim is to understand the role of MvCPV in wild populations in order to evaluate the likely impact of redistributing the virus to areas of low incidence.
  - Plantation longevity of plantain cv. Agbagba was increased, crop yield improved, and nematode damage suppressed when organic mulch from wooden chips was applied during the first cycle. Similarly, early vegetative growth was improved with *Tithonia diversifolia* mulch: as little as 2 t/ha mulch doubled plantain fresh weight over a 6-month period in drums infested with nematodes.
  - Inoculation studies in Uganda confirmed for the first time that yam tuber cracking, retarded root growth, and reduced tuber yield are caused by lesion nematodes (*Pratylenchus sudanensis*). Differences in the susceptibility of yam cultivars to these nematodes were evident in both local landraces (*Dioscorea cayenensis*) and improved IITA cultivars (*Dioscorea rotundata*).
  - Maize growth in the presence of lesion nematodes (*Pratylenchus* spp.) and soybean growth in the presence of root-knot nematodes (*Meloidogyne* spp.) were both substantially improved by the application of microbial antagonists or root symbionts (mycorrhizae). Damage to cassava by root-

indique une baisse générale substantielle sur huit des neuf sites étudiés. Toutefois, des variations saisonnières peuvent encore être observées.

- Des enfants sevrés uniquement à la bouillie de maïs ont présenté des niveaux plus élevés d'aflatoxine sanguine que ceux partiellement sevrés au lait maternel. Le plus fort quartile de niveaux d'aflatoxine sanguine corrélait avec une baisse moyenne de croissance de 1,67 cm sur une période de 8 mois par rapport au plus faible quartile.
- Les charançons du bananier peuvent être attirés autour ou proche d'appâts à phéromone pour infection éventuelle par *Beauveria bassiana*. Le séjour des charançons à ces pièges est plus long qu'aux pièges conventionnels à pseudo-troncs, ce qui facilite l'adhérence des spores de *B. bassiana* aux insectes. Les charançons du bananier infectés demeurent actifs au champ et peuvent contaminer d'autres charançons. Des études d'antibiose menées en laboratoire contre le charançon du bananier ont révélé que les stades larvaires durent plus longtemps sur les clones résistants. En revanche, leur survie et le poids des pupes n'ont pu être mis en relation avec le niveau de sensibilité du bananier à ce ravageur. En d'autres termes, avec les méthodes d'élevage actuelles, les études en laboratoire ne sauraient être substituées aux pratiques d'évaluation du matériel végétal en plein champ. L'évolution, la survie et la taille des larves étaient toutes plus réduites sur les pseudo-troncs que sur les bulbes.
- En collaboration avec l'Université Cornell (USA), un outil de diagnostic moléculaire spécifique aux isolats a été élaboré pour différencier les isolats d'origine africaine et brésilienne de *Neozygites tanajoa*, un pathogène cryptogamique de l'acarien vert du manioc (CGM). Les souches brésiennes du champignon sont en train d'être évaluées comme agents de lutte microbienne contre le CGM afin de compléter les méthodes de lutte biologique avec des acariens prédateurs.
- Un outil biochimique a été élaboré pour suivre la consommation du pollen de maïs par des acariens prédateurs phytoséiides. Le pollen de maïs tient une place très importante dans la biologie des prédateurs phytoséiides—il augmente leur persistance et abondance, ainsi que leur aptitude à contrôler les densités d'acariens nuisibles.
- Six études effectuées en Afrique orientale et australe sur l'impact agronomique de la lutte biologique contre l'acarien vert du manioc (CGM), à l'aide de l'acarien prédateur phytoséiide néotropical *Typhlodromalus aripo*, ont été conclues en 2003. Le gain en rendement racinaire de manioc favorisé par la lutte biologique contre le CGM était fonction de la zone agro-écologique et de la variété. Les plantes protégées ont enregistré une hausse de rendement de 20 à 84% par rapport aux plantes non exposées aux prédateurs.
- La technique à base d'ELISA a été utilisée pour tester plus de 1400 spécimens de *Maruca vitrata* récoltés sur *Vigna unguiculata*, *Pterocarpus* sp. et *Pueraria* sp. au Nigeria et en République du Bénin. L'incidence de l'infection de *M. vitrata* cytopvirus (MvCPV) dans différents lots variait entre < 10% et 100%, alors qu'environ 6% des larves de *M. vitrata* étaient très sévèrement infectées, un niveau très élevé d'antigènes ayant été détecté au sein des larves. L'objectif final est d'appréhender l'effet du MvCPV sur les populations sauvages afin d'apprécier l'impact probable de la redistribution du virus vers les zones à faible incidence.
- L'application au cours du premier cycle végétal de paillis organique de copeaux de bois a prolongé la longévité de la plantation de plantain cv. Agbagba, augmenté sa productivité et supprimé les dégâts causés par les nématodes. De même, la croissance végétative initiale s'est améliorée avec le paillis de *Tithonia diversifolia*: seulement 2 t/ha de paillis ont doublé le poids frais du plantain, sur une période de 6 mois, dans des fûts infestés de nématodes.
- Des études d'inoculation effectuées en Ouganda ont, pour la première fois, confirmé que la craquelure du tubercule d'igname, le retardement de la croissance racinaire et la baisse du rendement en tubercule sont causés par les nématodes à lésion *Pratylenchus sudanensis*. Les différences en ce qui concerne la sensibilité des cultivars d'igname au nématode se sont nettement affichées aussi bien sur les variétés locales (*Dioscorea cayenensis*) que sur les cultivars améliorés de l'IITA (*Dioscorea rotundata*).
- Le développement du maïs en présence des nématodes à lésion (*Pratylenchus* spp.), et celui du soja en présence des nématodes à galles (*Meloidogyne* spp.), ont connu une amélioration sensible grâce à l'application d'antagonistes microbiens ou de symbionts racinaires (mycorrhizae). Les dégâts causés au manioc par les nématodes à galles (*Meloidogyne* spp.) et par le champignon de la pourriture des racines (*Botryodiplodia theobromae*), 4 mois après plantation, ont considérablement augmenté en présence combinée des nématodes et du champignon.

knot nematodes (*Meloidogyne* spp.) and root rot fungus (*Botryodiplodia theobromae*) 4 months after planting was greatly increased when both nematodes and the fungus were present.

- More than 400 plant protection officers, village brigade members, and farmers were trained in integrated grasshopper control in Burkina Faso, Cape Verde, Niger, and Senegal.
- About 4500 accessions of the IITA mandate crops (excluding 7000 rice varieties from WARDA) were field inspected and seed health tested and certified for international distribution.

## Project C

### Assessing Impact, Formulating Policy Options, and Systems Analysis

- A constraint assessment and farmer evaluation of herbaceous legume options for crop–livestock integration in the moist savanna of southern Benin and the dry northern Guinea savanna (NGS) zones of Nigeria were completed in eight villages characterized by differing levels of land endowment and market access.
- The efficiency of resource use among farmers in two communities located in the forest and savanna zones of southwest Nigeria was evaluated using a stochastic production function approach. The mean technical efficiency was 75.5% in the forest and 77% in the savanna. Therefore, there are opportunities for improvement by rearranging input combinations in the current system even before any technical change is introduced.
- Data on household income and expenditure were collected over two weeks in each quarter of the year and analyzed using the Almost ideal demand system (AIDS) model. Farm production was the main source of household income (> 60% in both ecologies), which was below the World Bank poverty line. Food expenditures accounted for 21.5% of total household expenditure for the forest and 15.5% for the savanna zones, despite a major share of harvest being used for home consumption.
- A transect walk characterization method allowed the estimation of the area planted to IITA cowpea, maize, and soybean in a survey area of more than 40 000 km<sup>2</sup> for a survey cost of US\$5000. In addition to adoption studies, the transect walk characterization approach is also useful for benchmarking areas prior to development interventions.
- An evaluation found that the participatory research and extension (PR&E) approach successfully led to improved farmer knowledge of *Striga* control options, changes in farmer perceptions, adoption, and adaptation of aspects of the integrated *Striga hermonthica* control (ISC) options, and farmer-to-farmer diffusion. Adoption of an average of 3.5 ISC options jumped from 19 farmers in 3 villages to 271 farmers in 16 villages and hamlets in three seasons. Farmer field school (FSS) type training played a crucial role in the adoption and diffusion of management practices, while improved germplasm gave the rapid benefits necessary to maintain farmer interest and participation.
- In the northern Guinea savanna, the economic performance of three improved maize-based cropping systems was evaluated. The first system is maize + high fertilizer rate, the second is maize + reduced fertilizer rate + animal manure, and the third is a soybean, maize + fertilizer rotation. Analysis indicated clearly the importance of the manure cost to profitability. Because there is no clear-cut choice for any of the improved systems, it is suggested that they should be promoted as a basket of best-bet options whose use depends on the farmer's resources and market prices.
- Five hundred and fifty-nine farm households from the Sudan savanna (SS) and NGS agroecological zones were studied to examine the factors affecting production efficiency. Estimation of stochastic frontier production functions indicated the importance of including ecological and socioeconomic

- Plus de 400 personnes, dont des responsables de la protection des végétaux, des membres des brigades villageoises et des paysans ont été formés à la lutte intégrée contre les criquets au Burkina Faso, au Cap Vert, au Niger et au Sénégal.
- Environ 4.500 obtentions de cultures faisant l'objet de recherches à l'IITA, à l'exception des 7.000 variétés de riz de l'ADRAO, ont été inspectées au champ et ont vu leurs semences testées et certifiées pour distribution à l'échelle internationale.

## Projet C

### Etude d'impact, formulation des options de politique, et analyse des systèmes

- Les contraintes ont été identifiées et les options à base de légumineuses herbacées évaluées par les paysans pour une intégration culture-élevage dans la zone de savane humide du sud du Bénin et dans la savane nord-guinéenne (SNG) aride au Nigeria. Ces actions se sont déroulées dans huit villages caractérisés par différents niveaux de ressources foncières et d'accès au marché.
- L'efficacité d'utilisation des ressources par les paysans de deux communautés installées en zone forestière et en zone de savane dans le sud-ouest du Nigeria a été évaluée selon une fonction de production stochastique. L'efficacité technique moyenne s'élevait à 75,5% en zone de forêt et à 77% en zone de savane. Des possibilités d'amélioration peuvent donc s'offrir si les combinaisons d'intrants dans le système actuel sont réarrangées avant tout changement technique.
- Des données relatives aux revenus et aux dépenses familiaux ont été collectées pendant deux semaines en chaque trimestre, puis analysées selon le modèle AIDS (Almost Ideal Demand System Analysis). La production agricole, la principale source de revenus pour les ménages (>60% dans les deux écologies), était en dessous du seuil de pauvreté fixé par la Banque Mondiale. Les dépenses alimentaires représentaient 21,5% du total des dépenses familiales en zone de forêt et 15,5% en zone de savane, malgré que le gros de la récolte soit destiné à l'autoconsommation.
- Une méthode de caractérisation par marche en transect a permis d'estimer la superficie consacrée par l'IITA au niébé, au maïs et au soja sur un domaine expérimental de plus de 40.000 km<sup>2</sup>, pour un coût de 5.000\$EU. Outre les études d'adoption, la méthode de caractérisation par transect s'est avérée aussi utile pour le zonage de référence préalable à toute action de développement.
- Les résultats d'une évaluation ont montré que la méthode de *Recherche et de vulgarisation participatives* (RVP) a conduit au renforcement des connaissances paysannes sur les options de lutte contre le *Striga*, à des changements de perceptions chez les paysans, à l'adoption et à l'adaptation de certains aspects de la lutte intégrée contre *Striga hermonthica*, et à la diffusion de paysan à paysan. Le taux moyen d'adoption de ces options, soit 3,5%, est monté en flèche passant de 19 paysans dans trois villages à 271 paysans dans 16 villages et hameaux au bout de trois campagnes. La formation de type champs-école (FSS) a joué un rôle déterminant dans l'adoption et la diffusion des pratiques de gestion. Pour sa part, le matériel végétal amélioré a offert les avantages rapides nécessaires pour maintenir l'intérêt et la participation des paysans.
- La performance économique de trois systèmes améliorés à dominante maïs a été évaluée dans la zone de savane nord-guinéenne. Il s'agissait de: maïs + forte dose d'engrais, maïs + dose réduite d'engrais + fumier, et soja en rotation avec maïs + engrais. L'analyse a clairement révélé l'importance du coût du fumier par rapport à la rentabilité. Etant donné que le choix n'a nettement porté sur aucun des systèmes améliorés, il a été proposé qu'ils soient tous les trois promus sous forme de panier des meilleures options dont l'utilisation dépend des moyens possédés par les agriculteurs ainsi que des prix pratiqués sur le marché.
- Cinq-cent cinquante-neuf ménages agricoles ont été enquêtés en zone de savane soudanienne (SS) et en savane nord-guinéenne (SNG) dans le cadre d'une étude des facteurs qui affectent l'efficacité de la production. Une estimation des fonctions de production stochastique a révélé l'importance de la prise en compte de variables écologiques et socio-économiques dans le modèle. L'efficacité moyenne générale était de 76% : 68% en SS et 86% en SNG.

variables in the model. The overall average efficiency was 76%: 68% in the SS and 86% in the NGS zones.

- Results from a survey of 208 households in the humid forest zone of southern Cameroon indicate that the average expenditure on agrochemicals by horticultural producers using intensive monocrop production systems was US\$190/ha. A logit model of intensive monocrop adoption suggests that policymakers interested in intensifying agriculture should promote horticultural development in areas of higher population density while increasing investment in rural roads. Cocoa producers were more likely to have adopted intensive horticulture, suggesting that export crop promotion indirectly facilitated diversification. Women's participation was limited to traditional leafy vegetables (TLVs) and efforts to promote their greater involvement are recommended.
- African leafy vegetables such as *Solanum scabrum*, *Amaranthus* spp., and *Corchorus olitorius* were found to be vitally important to the rural, urban, and periurban poor in Central Africa both as a commercial crop and more importantly as a low-cost affordable source of micronutrients in the diet. Consumption studies indicate that policymakers interested in increasing nutritional outcomes for the poor would do well to promote the greater consumption of TLVs.
- A symposium on strategies for increasing agricultural trade, food security, and rural income through improved access to local, regional, and global markets was hosted by Project C at the 25th triennial meeting of the International Association of Agricultural Economists in Durban, South Africa.

## Project D

### Promoting Food Security and Income Generation through Sustainable Production and Commercialization of Starchy and Grain Staples in Eastern and Southern Africa

- A rapid rural appraisal was carried out to determine possible interactions between banana and coffee production and the potentials and constraints of this system. Results show that marketing imposes a constraint to farmers' revenues in both banana and coffee production. The lack of financial and other resources impedes management of the two crops.
- Market opportunities for southern Sudan were evaluated. Results show that the most severe constraint to marketing is the high transport costs that arise from insecurity and poor infrastructure. Once this constraint is removed, southern Sudan will have comparative advantages in trade for timber, livestock, groundnut, sesame, and gum Arabic.
- The need for rapid dewatering is the second major problem in the production of high quality unfermented cassava flour (HQCF). A cassava processing equipment manufacturer (Intermech Engineering Ltd) is being provided with technical backstopping to enable production of a combined grater-press that will perform grating and dewatering operations in a single, rapid, and continuous operation. This will lead to reduced labor and energy costs for HQCF production. The output of the improved process will contain less moisture than products made by manual pressing, thereby giving additional advantages in terms of reduction in drying time and total production cost.
- An open quarantine facility (OQF) has been established at the Agricultural Research Institute (ARI) Kibaha, Tanzania, into which 430 genotypes with a high potential tolerance to cassava brown streak disease (CBSD) were introduced from Kenya Agricultural Research Institute (KARI) Mtwapa. In a similar unit established at Nampula, Mozambique, 125 genotypes were introduced. Preliminary observation indicates that more than 75% show tolerance to the high CBSD pressure in the two locations.

- Une enquête couvrant 208 ménages en zone de forêt humide dans le sud du Cameroun a montré que les horticulteurs qui pratiquent la monoculture intensive dépensent en moyenne 190 \$EU/ha pour l'achat de produits agrochimiques. Un modèle logit d'adoption de la monoculture intensive suggère que les décideurs qui s'intéressent à l'agriculture intensive doivent encourager le développement horticole dans les zones densément peuplées, tout en investissant davantage dans la construction des pistes rurales. Les producteurs de cacao étaient plus à même d'adopter l'horticulture intensive, ce qui suggère que la promotion des cultures de rente a indirectement facilité la diversification. La participation des femmes était limitée à la culture des légumes à feuilles traditionnels. Les efforts visant à accroître leur participation sont encouragés.
- Des études ont montré que les légumes à feuilles africains tels que *Solanum scabrum*, *Amaranthus* spp., et *Corchorus olitorius* jouent un rôle déterminant dans la vie des populations démunies des zones rurales, urbaines et péri-urbaines de l'Afrique centrale en tant que cultures commerciales et, qui plus est, en tant que source bon marché d'oligo-éléments nutritifs. Des études sur la consommation indiquent que les décideurs qui s'intéressent à l'amélioration du bien-être nutritionnel des pauvres devraient activement les encourager à consommer plus de légumes à feuilles traditionnels.
- Un symposium sur les stratégies requises pour accroître les échanges agricoles, la sécurité alimentaire et les revenus ruraux, grâce à un meilleur accès aux marchés locaux, régionaux et internationaux, a été organisé par le Projet C en marge de la 25<sup>e</sup> session triennale de l'Association internationale des agro-économistes tenue à Durban en Afrique du Sud.

## Projet D

### Promotion de la sécurité alimentaire et génération de revenus grâce à la production et la commercialisation durables de féculents et de céréales de base en Afrique orientale et australe

- La méthode active de recherche et de planification participatives (MARP) a été utilisée pour déterminer les interactions possibles entre la production de la banane et celle du café, de même que les potentialités et contraintes du système. Les résultats ont montré que les obstacles à la commercialisation ont un impact sur les revenus agricoles aussi bien dans les systèmes de production de banane que dans les exploitations de café. L'insuffisance de ressources financières et d'autres ressources constitue une contrainte à la gestion des deux cultures.
- Des opportunités de marché dans le sud du Soudan ont été évaluées. Les résultats ont montré que la plus sérieuse entrave à la commercialisation réside dans le coût élevé du transport dû à l'insécurité et au mauvais état des infrastructures. Une fois cette contrainte levée, le sud du Soudan aura des avantages comparatifs dans le commerce du bois, du bétail, de l'arachide, du sésame et de la gomme arabique.
- La nécessité d'une déshydratation rapide est la deuxième difficulté majeure dans la production de farine de manioc non fermentée de haute qualité. Un fabricant de matériel de transformation de manioc (Intermech Engineering Ltd) bénéficie d'un appui technique pour la fabrication d'une presse-râpeuse. Ainsi, le râpage et la déshydratation se dérouleront en une seule opération rapide et continue, d'où une réduction de la main-d'œuvre, du temps, de l'énergie homme-heure et des tâches de manutention dans la production de farine de manioc non fermentée de haute qualité. Le produit ainsi obtenu aura une teneur en eau inférieure à celle des produits générés par pressage manuel, d'où des avantages supplémentaires en termes de réduction de la durée de séchage et du coût de production total.
- Un dispositif de quarantaine à ciel ouvert a été mise en place à l'Institut de recherche agricole de Kibaha, en Tanzanie. 430 génotypes potentiellement très tolérants à la striure brune du manioc (CBSD) y ont été introduits à partir du KARI à Mtwapa. Dans une unité semblable installée à Nampula, Mozambique, 125 génotypes ont été introduits. Une observation préliminaire a montré que plus de 75% a présenté une tolérance à une forte pression de la CBSD dans les deux localités.
- Vingt-cinq clones sélectionnés par le programme d'amélioration végétale IITA/KARI/EARRNET à Mtwapa (Kenya) sont en cours d'évaluation en milieu réel dans les bas-fonds côtiers du Kenya infectés par la CBSD. Les mêmes clones

- Twenty-five improved clones selected by the IITA/KARI/EARRNET breeding program at Mtwapa, Kenya, are being evaluated on-farm in the CBSD-affected coastal lowlands of Kenya. The same clones are undergoing multiplication in Tanzania (25) and Mozambique (18) for rapid on-farm farmer participatory evaluation. In addition, more than 500 highly promising new genotypes selected at ARI Kibaha are undergoing evaluation at three sites in Tanzania. Crossing blocks have been established at ARI Kibaha and ARI Nampula, in order to generate new genotypes that combine resistance/tolerance to CBSD with farmer- or consumer-preferred traits, and in order to study the genetics of CBSD resistance.
- One hundred yellow-fleshed cassava genotypes that combine disease resistance, good agronomic characteristics, and good cooking qualities are being characterized for micronutrient qualities in collaboration with the Jomo Kenyatta University of Agricultural Technology in Kenya.
- The augmented design is increasingly being applied in participatory research and on-farm evaluation of improved cassava germplasm by many national collaborators in the region. A total of 14, 12, and 8 improved clones have been selected for release in 2004 by the Kenya, Uganda, and Rwanda national programs respectively. In the Republic of Congo, 97 out of a total of 117 genotypes introduced were selected and cloned at Odziba research station for further evaluation. Genotypes 92/277, 92/167, and 92/269 were ranked as good performers in a multilocal trial.
- Eleven secondary triploids with good bunch characteristics and black sigatoka resistance are being multiplied for testing in farmers' fields. Six genotypes, namely Pisang lilin, SH3217, SH3142, SH3362, Yangambi Km5, and Kikundi, are demonstrating field resistance to *Fusarium*. Morphological and cytological characterization of new germplasm from Papua New Guinea has been completed.
- Banana weevils may be attracted to or near pheromone lures where they may be infected by *Beauveria bassiana*. The weevils remain longer at such lures than at conventional pseudostem traps, thereby facilitating adherence of *B. bassiana* spores to the insects. Infected banana weevils remain active in the field and can infect other weevils.
- Studies conducted on reproductive fitness and pathogenicity on *Musa* germplasm of four *Radopholus similis* populations from four locations (Namulonge, Mbarara, Ikulwe, and Mukono) in Uganda showed that the population from Mbarara had a higher reproductive and pathogenic potential than the other populations. This population also managed to break the resistance of Pisang Jari Buaya, known worldwide to be resistant to *R. similis*. The IITA hybrid, TMB2x 9128-3, showed resistance to all four populations. Two secondary triploids derived from East African highland banana have been identified with resistance to *Radopholus similis* using the individual root inoculation method. Histochemical experiments designed to study mechanisms of resistance to nematodes in *Musa* showed resistant cultivars had an increased number of phenolic cells after nematode inoculation.
- A diagnostic survey conducted in February 2003 provided a comprehensive and detailed assessment of the status of cassava mosaic disease (CMD) in the Republic of Congo. CMD incidence was generally high, averaging 86.2% compared to 80.3% for 2002. The greatest disease severity was observed in Niari Region in the south and Cuvette Ouest Region in the north. EACMV-UG2 was shown to occur virtually throughout the country, commonly in dual infections with ACMV. The high incidence of plants infected as cuttings (81.7%), the relatively low incidence of whitefly-borne infection and the wide distribution of EACMV-UgV or ACMV alone or in combination suggest that the CMD pandemic affected the country some years back, and that the areas sampled are currently in a stable post-epidemic phase.
- National stakeholders' meetings were held in each of the five countries (Madagascar, Mozambique, Tanzania, Uganda and Zambia) participating in the Committee on Commodity Problems (CFC)-funded project on small-scale cassava processing and vertical integration of the cassava subsector in southern and eastern Africa.

sont en cours de multiplication en Tanzanie (25) et au Mozambique (18) en vue d'évaluations participatives rapides en milieu paysan. En outre, plus de 500 nouveaux génotypes hautement prometteurs sélectionnés à l'ARI Kibaha, sont en évaluation sur trois sites en Tanzanie. Des blocs de croisement ont été établis à l'ARI Kibaha (Tanzanie) et l'ARI Nampula (Mozambique) afin de produire de nouveaux génotypes alliant la résistance/tolérance à la CBSD aux caractéristiques préférées par les paysans/consommateurs et de décoder la génétique de la résistance à la CBSD.

- Cent génotypes de manioc à chair jaune dotés d'une résistance aux maladies et de bonnes caractéristiques agronomiques et culinaires sont en train d'être caractérisés en collaboration avec l'Université de technologie agricole Jomo Kenyatta pour la qualité des oligo-éléments qu'ils renferment.
- Le dispositif augmenté est de plus en plus appliqué dans la recherche participative et l'évaluation en milieu réel du matériel amélioré de manioc par un grand nombre de collaborateurs nationaux dans la région. Au total, 14, 12, et 8 clones améliorés de manioc ont été sélectionnés, pour distribution en 2004, respectivement par les programmes nationaux du Kenya, de l'Ouganda et du Rwanda. En République du Congo, 97 sur 117 génotypes introduits ont été choisis et clonés à la station de recherche d'Odziba pour une évaluation plus poussée. Les génotypes 92/277, 92/167, et 92/269 ont été classés parmi le matériel ayant présenté un bon comportement dans un essai multilocal.
- Onze triploïdes secondaires possédant de bonnes caractéristiques au niveau du régime et une résistance à la cercosporiose noire sont en multiplication pour des essais auprès des paysans. Six génotypes dont Pisang lilin, SH3217, SH3142, SH3362, Yangambi Km5 et Kikundi présentent des signes de résistance à la fusariose au champ. La caractérisation morphologique et cytologique du nouveau matériel végétal obtenu de la Papouasie Nouvelle-Guinée a été achevée.
- Les charançons du bananier peuvent être attirés autour ou proche de pièges à phéromone pour être infectés par *Beauveria bassiana*. Les charançons séjournent plus longtemps à ces pièges qu'aux pièges conventionnels faits de pseudo-troncs, ce qui facilite l'adhérence des spores de *B. bassiana* aux insectes. Les charançons du bananier infectés demeurent actifs au champ et peuvent infecter d'autres charançons.
- Des études conduites sur l'aptitude à la reproduction et la pathogénicité du germoplasme *Musa* de quatre populations de *Radopholus similis* issues de quatre localités (Namulonge, Mbarara, Ikuwe et Mukono), en Ouganda, ont révélé que le potentiel reproductif et pathogénique de la population de Mbarara est plus élevé que celui des autres populations. Cette population a pu également briser la résistance de Pisang Jari Buaya, une variété connue de par le monde comme résistante à *R. similis*. L'hybride de l'IITA, TMB2x 9128-3, a présenté une résistance aux quatre populations. La technique d'inoculation individuelle des racines a permis d'observer que les deux triploïdes secondaires, dérivés de la banane des hauts plateaux de l'Afrique de l'Est, incorporaient la résistance à *Radopholus similis*. Des expérimentations histochimiques conduites sur les mécanismes de résistance aux nématodes chez les espèces *Musa* ont conclu que les cultivars résistants présentaient un nombre plus élevé de cellules phénoliques après inoculation de nématodes.
- Une enquête exploratoire effectuée en février 2003 a permis une évaluation complète et détaillée de la situation du virus de la mosaïque du manioc (CMD) en République du Congo. L'incidence de la CMD était généralement élevée, en moyenne 86,2%, contre 80,3% en 2002. Le niveau de sévérité le plus élevé a été observé dans la région du Niari dans le sud, et dans la région de la Cuvette Ouest dans le nord. L'EACMV-UG2 a été détecté pratiquement sur l'ensemble du territoire, souvent en doubles infections avec l'ACMV. La forte incidence de la coupe de plants infectés (81,7%), l'incidence relativement faible de l'infection par la mouche blanche, et la large distribution de l'EACMV-UgV ou d'ACMV, séparée ou combinée, suggèrent que la pandémie de la CMD a atteint le pays il y a quelques années, et que les zones échantillonnées sont actuellement dans une phase post-épidémique stable.
- Dans chacun des cinq pays (Madagascar, Mozambique, Tanzanie, Ouganda et Zambie) membres du projet sur la transformation du manioc à petite échelle et l'intégration verticale de la filière du manioc, financé en Afrique australe et orientale par le CFC, des rencontres ont été organisées à l'intention des intervenants nationaux.
- Quatre chercheurs de la République du Congo ont été formés aux techniques de monitoring, d'échantillonnage et de détection des virus à l'ESARC. Un cours de formation national sur la production des plantes à racines et tubercules et la lutte contre la CMD a été organisé à Brazzaville à l'intention de 30 techniciens, alors que 500 paysans ont été formés



- Four scientists from the Republic of Congo were trained in monitoring, sampling techniques, and virus diagnostics at ESARC. An in-country training course on root crop production and CMD management was organized in Brazzaville for 30 technicians, while 500 farmers were trained in CMD management in four regions. An SAS/GIS course for 25 participants was organized at IITA/ESARC.
- The project on accelerated multiplication and distribution of healthy planting materials of the best high yielding varieties of cassava and sweetpotato in Mozambique has assembled 124 partners. The project aims to mitigate the adverse effects of floods and drought on food crop production. It has established 51 ha of sweetpotato and 253 ha of cassava, and has distributed planting material to about 434 000 families. The project has promoted the utilization and processing of both crops using improved tools and machines. Several training workshops have been conducted on production, processing, and the development of public–private partnerships.

## Project E

### **A Future through Farming: Enhancing Livelihoods, Improving the Resource Base and Protecting the Environment through Starchy Staples, Peri-Urban and Tree Crop Systems of the Humid and Subhumid Zones of West and Central Africa**

- Boiling water treatment of planting materials and fertilizer application jointly reduce nematode infestation, hasten plant growth, and improve the yield of plantain in Cameroon. The boiling water treatment combined with fertilizer produced nearly three times more yield than the fertilizer option without the boiling water treatment.
- Leguminous cover crops reduce nematode population densities in the soil. Planting *Pueraria phaseoloides* or *Flemingia macrophylla* reduced nematode population densities in the soil within one year after planting compared to a hot pepper crop and a control left to natural regrowth. This suggests that leguminous species can provide a sustainable means of controlling nematodes in farmers' fields.
- Improved banana hybrids raise farmers' incomes and boost the yield of landraces in varietal mixtures in Nigeria. Higher harvest frequency and bunch yields for the hybrids (18.0 kg) relative to the landraces (7.4 kg) were recorded, with corresponding cash income of ₦10 000 for hybrids and ₦7000 for landraces. The average bunch weight of landraces increased from 6.1 kg when planted sole to 8.4 kg when planted in a mixture with hybrids. Adoption prospects for the new varieties appear very high, as the yields of contact farmers increased by an average of 50% on land cropped with hybrids and each farmer distributed suckers to 18 new farmers.
- IITA launched several integrated projects to preempt virulent forms of the cassava mosaic virus while fostering cassava-based agroenterprise development in West and Central Africa. An unusually severe CMD outbreak, caused by a recombinant hybrid of the *East African cassava mosaic virus* (EACMV) and *African cassava mosaic virus* (ACMV), designated as the Ugandan variant (EACMV-Ug), has been spreading from Uganda, through eastern Africa and westwards into Central Africa.
- Ethephone breaks dormancy and induces germination of yam tubers, opening up the possibility of off-season yam cultivation. Ethephone was applied to induce the sprouting of dormant tubers of white Guinea yam (*D. rotundata* var TDr 93-31) and water yam (*D. alata* var TDa 95/00328). Tubers of both varieties obtained in January 2003 were planted in farmers' fields (at Bida, in Niger State, Nigeria), producing new mature tubers that were harvested in early September 2003. This provides opportunities for developing off-season yam production systems.

à la lutte contre la CMD dans quatre régions. Un stage de formation sur le SAS/SIG a réuni 25 participants à l'IITA/ESARC, du 15 septembre au 1<sup>er</sup> octobre 2003.

- Le projet sur la multiplication accélérée et la distribution de matériel de plantation sain des meilleures variétés à haut rendement de manioc et de patate douce, implanté au Mozambique, a rassemblé 124 partenaires pour des échanges d'idées sur les mesures à prendre en vue d'atténuer les effets néfastes des inondations et de la sécheresse sur la production des cultures vivrières. Le projet a mis en place 51 ha de patate douce et 253 ha de manioc, et distribué du matériel de plantation à environ 434. 000 familles. Il a promu l'utilisation et la transformation des deux cultures à l'aide d'outils et d'appareils modernes. Plusieurs ateliers de formation ont été organisés sur la production, la transformation et le développement de la coopération avec les agences publiques et privées.

## Projet E

### **L'avenir par l'agriculture: de meilleurs moyens d'existence, une base de ressources consolidée, et un environnement protégé grâce aux féculents de base, aux systèmes péri-urbains et d'espèces ligneuses installés en zones humides et subhumides de l'Afrique occidentale et centrale**

- Le traitement à l'eau bouillante de matériel de plantain et l'application d'engrais ont ensemble réduit l'attaque des nématodes, accéléré la croissance végétale et amélioré le rendement du plantain au Cameroun. Ainsi, le traitement combiné eau bouillante + engrais a presque triplé le rendement par rapport à l'option engrais sans traitement à l'eau bouillante.
- Des espèces légumineuses de couverture ont réduit les densités des populations de nématodes dans le sol. *Pueraria phaseoloides* ou *Flemingia macrophylla* ont réduit les populations de nématodes dans le sol en l'espace d'un an après semis, par rapport à une culture de piment et un témoin abandonné à la repousse naturelle. En d'autres termes, les espèces légumineuses peuvent être un moyen durable de lutte contre les nématodes dans les exploitations paysannes.
- Des variétés hybrides améliorées de banane ont augmenté les revenus des agriculteurs et fait monter la productivité des variétés locales dans des mélanges variétaux au Nigeria. Une fréquence de récolte plus élevée et des gains de rendements en régimes ont été obtenus pour les hybrides (18,0 kg) par rapport aux variétés locales (7,4 kg), pour des revenus équivalents de 10.000 ₦ pour les hybrides et 7.000 ₦ pour les variétés locales. Le poids régime moyen chez les variétés locales est monté de 6,1 kg en culture pure à 8,4 kg en mélange avec les hybrides. Les chances d'adoption des nouvelles variétés sont très fortes. En effet, les rendements chez les paysans de contact ont augmenté en moyenne de 50% dans les parcelles où les hybrides ont été plantés, et chaque paysan a distribué des rejets à 18 nouveaux paysans.
- L'IITA met en route plusieurs projets intégrés afin d'anticiper des formes virulentes du virus de la mosaïque du manioc, tout en promouvant le développement des entreprises de manioc en Afrique occidentale et centrale. Une épidémie exceptionnellement sévère de la CMD, causée par un hybride recombinant du virus est-africain de la mosaïque du manioc (EACMV) et du virus africain de la mosaïque du manioc (ACMV), nommé variant ougandais (EACMV-Ug), se propage à partir de l'Ouganda dans toute l'Afrique de l'Est, puis vers l'ouest en direction de l'Afrique centrale.
- L'éthephone rompt la dormance et induit la germination des tubercules d'igname, offrant ainsi des perspectives pour la culture d'igname hors saison. L'éthephone a été appliqué pour induire la germination de tubercules dormants de l'igname blanche (*D. rotundata* var TDr 93-31) et de l'igname aqueuse (*D. alata* var TDa 95/00328). Des tubercules sortis de dormance des deux variétés, obtenus en janvier 2003, ont été plantés dans des champs appartenant aux paysans (Bida, Etat du Niger, Nigeria). Des tubercules matures ont été récoltés au début du mois de septembre 2003, favorisant ainsi le développement des systèmes de production hors saison.
- Dans une agroforêt à strates multiples établie sur jachère courte, *Dacryodes edulis*, *Ricinodendron heudelotii* et *Terminalia ivorensis* atteignent l'optimum de croissance dans des combinaisons intégrant le plantain et utilisant le « traitement de la moindre ombre ». Pour le maintien de la productivité cacaoyère, le recours à des pratiques d'assainissement peut ne pas s'avérer un substitut valable à l'utilisation de fongicide contre la maladie de la gousse noire. De janvier

- In a multistrata agroforest established on short-fallow land, *Dacryodes edulis*, *Ricinodendron heudelotii*, and *Terminalia ivorensis* grow best in combination with plantain, using the 'least-shade treatment'. Sanitation may not be an adequate substitute for fungicide application against blackpod disease to sustain cocoa yields. From January to September 2003, blackpod disease was shown to reduce dry bean mass by 189 kg/ha in untreated plots, 71 kg/ha in plots subjected to low fungicide application, and 37 kg/ha in plots with high fungicide application. Indeed, without spraying, yield losses to blackpod disease approach 100%, even with stringent phytosanitary harvests and complete removal of infected material from the cocoa field.
- African traditional leafy vegetables (TLVs) provide essential nutrients and cash income for the urban and peri-urban poor in Cameroon. Field and market surveys estimated that over 32 000 households were engaged in producing and marketing TLVs under readily accessible entry conditions. Successful in situ conservation will require research to improve the productivity of TLV cropping systems and media efforts to promote their use.
- Leguminous species integrated into intensive periurban maize and cassava systems can provide additional food and cash and substitute in part for N-fertilizer, but do not enhance soil conservation. Grain legumes have far lower potential for soil conservation and fertilizer substitution, but they may offer better adoption prospects for farmers, with experimental land equivalent ratios of 1.1 : 1.3 when intercropped with maize. With the exception of *Flemingia macrophylla* when alley-cropped with cassava, most leguminous species failed to have a positive impact on cassava root yields.
- Participatory research and extension approaches were implemented in the humid savanna to promote improved *Imperata* management technologies and increase their adoption by small-scale farmers. Sixty extension agents were trained in general agronomy, *Imperata* biology and management, sprayer calibration and safe herbicide application, and participatory extension methods. About 1000 farmers whose crops were affected by speargrass in yam, cassava, and maize production systems were also mobilized. Labor was identified as the major constraint to improving farmers' production systems in speargrass-dominated sites, since tripled labor costs reduced treatment benefits by 38% in contrast to a benefit reduction of only 3% associated with tripling the price of glyphosate.
- Côte d'Ivoire has started its own *Musa* breeding program with backstopping from IITA. The Centre National de Recherche Agronomique (CNRA) of Côte d'Ivoire became the first NARS in West and Central Africa to initiate a plantain breeding program. The first hybrid *Musa* plants derived from crosses involving parental lines from IITA were regenerated using a seed germination protocol developed by IITA and were established in the field at Abbe (Azaguié) station in Côte d'Ivoire. Ghana established a delivery system for healthy improved *Musa* germplasm with field tolerance to *Banana Streak Virus* and resistance to black Sigatoka disease. Monthly farmer field schools are now routinely held with farmer groups near secondary nurseries. Thus, 500 farmers have been exposed to new technologies for rapid multiplication and effective management of banana and plantain while 300 farmers are now testing newly introduced *Musa* hybrids.
- Nigeria released four improved yam varieties from IITA while Ghana moved to the final stages of release of three other varieties. The Nigerian varieties were released for cultivation following tests conducted in partnership with the National Root Crops Research Institute (NCRI). The released varieties are TDr 89/01213, TDr 89/02665, TDr 89/01438, and TDr 95/01924. Meanwhile, the Crops Research Institute (CRI) in Ghana has planted three IITA-derived clones (TDr 89/02665, TDr 89/02660, and TDr 98/02977) for inspection by the National Varietal Release Committee.
- The Sustainable Tree Crops Program (STCP) Action Plan, which is based on a long-term private-public partnership to ensure sustainable production and stable supply of quality tree crop products, moved into full implementation of its 3-year program, focusing initially on cocoa and cashew

au mois de septembre 2003, la maladie de la gousse noire a, selon les études, réduit la masse sèche de la fève de 189 kg/ha dans les parcelles non traitées, 71kg/ha dans les parcelles soumises à de faibles doses de fongicide et 37kg/ha dans les parcelles ayant reçu de fortes doses de fongicide. En effet, sans pulvérisation, les pertes de rendement dues à la maladie de la gousse noire avoisinent 100% en dépit de l'observation rigoureuse des normes phytosanitaires au moment de la récolte, et de l'élimination complète du matériel infecté de la plantation cacaoyère.

- Les légumes à feuilles traditionnels fournissent les éléments nutritifs essentiels et des revenus liquides aux populations démunies des zones urbaines et péri-urbaines du Cameroun. Selon des enquêtes effectuées au champ et sur les places de marché, plus de 32.000 ménages seraient engagés dans la production et la commercialisation des légumes à feuilles traditionnels dans des conditions de facilité d'accès. Pour réussir la conservation *in situ*, la recherche devra accroître la productivité des systèmes de culture à base de légumes à feuilles traditionnels. Cette action devra s'accompagner d'efforts visant à promouvoir leur utilisation à travers les médias.
- Des espèces légumineuses incorporées dans des systèmes intensifs péri-urbains à base de manioc et de maïs, peuvent apporter un complément alimentaire et monétaire, et remplacer une partie de l'azote apporté. Néanmoins, elles n'améliorent pas la conservation du sol. Les légumineuses à graines sont dotées d'un potentiel nettement plus faible en matière de conservation du sol et de substitution de l'engrais, mais elles sont plus susceptibles d'être adoptées, en association avec le maïs, par les paysans dont les ratios équivalent-terre expérimentaux sont dans l'ordre de 1,1 :1,3. En dehors de *Flemingia macrophylla* en culture en couloirs avec le manioc, la plupart des légumineuses n'ont pu avoir un impact positif sur les rendements en racines de manioc.
- Des approches de recherche et de vulgarisation participatives ont été adoptées en zone de savane humide afin de promouvoir des technologies modernes de lutte contre *Imperata* et d'accroître les chances d'adoption par les petits cultivateurs. Soixante agents de vulgarisation ont été formés dans divers domaines: agronomie générale, biologie et gestion de l'*Imperata*, calibrage des pulvérisateurs et application sans danger des herbicides, et méthodes participatives de vulgarisation. Près de 1000 paysans dont les systèmes de production d'igname, de manioc et de maïs sont infestés par le chiendent ont été également mobilisés. La main-d'œuvre a été identifiée comme la contrainte majeure à l'amélioration des systèmes de production paysans dans les zones dominées par le chiendent. En effet, le triplement du coût de la main-d'œuvre réduit les avantages du traitement de 38% contrairement à seulement 3% de réduction de bénéfice lorsque le prix du glyphosate triple.
- La Côte d'Ivoire démarre son propre programme de sélection de *Musa* grâce au soutien de l'IITA. Le Centre National de Recherche Agronomique (CNRA) de Côte d'Ivoire est le premier SNRA en Afrique occidentale et centrale à avoir lancé un programme de sélection sur la banane-plantain. Les premiers hybrides de *Musa* issus de croisements impliquant des lignées parentales de l'IITA, ont été régénérés sur la base d'un protocole de germination de semences élaboré par l'IITA et établi au champ à la station d'Abbe (Azaguié) en Côte d'Ivoire. Le Ghana met en place un système de livraison de matériel amélioré sain de *Musa* doté de tolérance au champ au virus de la striure du bananier, et de résistance à la cercosporiose noire. Des champs-écoles sont systématiquement organisés tous les mois avec les groupements paysans établis autour des pépinières secondaires. Ainsi, 500 agriculteurs ont été exposés aux nouvelles technologies de multiplication rapide et de gestion efficace des bananes/plantains alors que 300 agriculteurs cultivent actuellement les hybrides de *Musa* nouvellement introduits.
- Le Nigeria a diffusé quatre variétés améliorées d'igname provenant de l'IITA, tandis que le Ghana passe aux étapes finales des préparatifs pour la diffusion de trois autres variétés. Quatre variétés améliorées d'igname ont été diffusées pour être mises en culture au Nigeria suite au succès des essais menés en partenariat avec l'Institut national de recherche sur les plantes à racines et tubercules (NCRI). Au nombre des variétés diffusées, on trouve TDr 89/01213, TDr 89/02665, TDr 89/01438, et TDr 95/01924. Entre temps, l'Institut de recherche sur les plantes cultivées au Ghana a planté trois clones mis au point à l'IITA (TDr 89/02665, TDr 89/02660, et TDr 98/02977) pour inspection par la Commission nationale chargée de la diffusion des variétés.
- Le plan d'action STCP, fondé sur un partenariat public-privé à long terme pour une production durable et un apport stable de produits ligneux de bonne qualité, passe à la phase la plus active d'un échéancier de trois ans. Au départ, l'accent y est mis sur les systèmes à base de cacao et d'anacarde. Des projets pilotes sont en cours d'exécution dans cinq pays (Cameroun, Côte d'Ivoire, Ghana, Guinée, Nigeria). Dans le cadre dudit projet, les paysans sont formés

systems. Pilot projects have now been launched in five countries (Cameroon, Côte d'Ivoire, Ghana, Guinea, and Nigeria) in which farmers are being trained in improved production technologies, farmer organizations are being strengthened to provide efficient services to their members, marketing and information systems are being tested for their ability to increase farmer income, and rural communities are being sensitized on important social issues such as the use of child labor, HIV/AIDS, and farm safety. A farmer field school curriculum on cocoa (FFS-CC) has been developed, including integrated pest management (IPM) strategies, rehabilitation of old cocoa farms, and postharvest quality management, as well as the child labor issues that may be associated with cocoa production. About 90 facilitators selected from farmer organizations and 40 from public extension services have been trained in four countries to implement the FFS-CC. Over 160 schools have been established through which more than 4000 farmers are being trained.

## Project F

### Improving and Intensifying Cereal–Legume Systems in the Moist and Dry Savannas of West and Central Africa

- Project scientists are developing a deeper understanding of soil, nutrients, and weed processes; developing improved component technologies involving cereals, legumes, and livestock; packaging them into best-bet options; and testing and validating them in relevant agroecologies. A great deal of progress was made during the year although not all the results are in yet.
- Several experiments on the parasitic weed *Striga* and on balanced nutrient management strategies were conducted. Improved high yielding N-efficient maize varieties, and P-efficient cowpea and soybean varieties with high biological N-fixation, were developed with grain yields over 20% higher and fodder yields over 15% higher than the local varieties. Beneficial effects of cereal–legume rotation and relay cropping were established and quantified. Best-bet options involving “cereal–legumes” and “cereal–legumes–livestock” and “cotton–cowpea” combined with integrated pest management were developed and tested on farmers’ fields. These options shared higher benefit : cost ratio than farmers’ practices. The success of these best-bet options has attracted several donor agencies including USAID, DFID, DANIDA, The Gatsby Charitable Foundation, IFAD, CIDA Belgium, Japan, etc., which are funding about 15 special projects to test, validate, and disseminate them.
- In the 2003 cropping season, over 900 farmers participated in the on-farm evaluation of best-bet options involving sorghum–cowpea in the Sudan savanna and maize–dual-purpose cowpea in the northern Guinea savanna. Farmers obtained 100 to 300% increases in yields.
- The farmer-to-farmer diffusion of an improved cowpea variety reached over 27 000 farmers in Kano State of Nigeria. This appeared to be a powerful model for technology dissemination.
- A systematic transect survey revealed high rates of adoption of IITA's improved maize, cowpea, and soybean varieties in northern Nigeria. National capacity to generate and transfer technologies, including postharvest technologies, was enhanced through degree and non-degree related training, technical backstopping, monitoring tours, workshops, field days, extension materials, and networks such as WASNET, PRONAF, and WECAMAN.
- A center-commissioned external review (CCER) of this project was conducted and the project scientists were congratulated for their teamwork and for the good progress made in developing a well integrated project with a high potential for impact.

aux techniques modernes de production, les organisations paysannes sont renforcées pour leur permettre d'offrir efficacement certains services clés à leurs membres, des systèmes d'information et de commercialisation sont testés pour leur aptitude à accroître les revenus agricoles, et les communautés rurales sont sensibilisées sur d'importants problèmes sociaux tels que le travail des enfants, le VIH/SIDA, et la sécurité des exploitations agricoles. Un programme d'enseignement sur le cacao (FFS-CC) destiné aux champs-écoles a été élaboré. Il couvre des sujets tels que les techniques de lutte intégrée contre les ravageurs, la réhabilitation de vieilles plantations cacaoyères, la gestion de la qualité post-récolte ainsi que les problèmes liés au travail des enfants susceptibles d'être engendrés par la production cacaoyère. Environ 90 animateurs choisis au sein des organisations paysannes, et 40 des services de vulgarisation publics, ont été formés dans quatre pays pour la conduite de la FFS-CC. Plus de 160 écoles ont été créées. Grâce à ces dernières, plus de 4.000 agriculteurs reçoivent une formation.

## Projet F

### Amélioration et intensification des systèmes à base de céréales-légumineuses dans les savanes humides et arides de l'Afrique occidentale et centrale

- Les chercheurs du projet s'emploient à mieux appréhender les détails des processus qui régissent le sol, les éléments nutritifs et les adventices, à mettre au point des composantes technologiques améliorées sur les légumineuses et le cheptel, et à les conditionner sous forme d'options « meilleur pari » pour les essais et la validation dans des agro-écologies appropriées. Un progrès considérable a été enregistré au cours de l'année, même si tous les résultats ne sont pas encore obtenus.
- Plusieurs essais ont porté sur le *Striga* et les stratégies de gestion équilibrée des éléments nutritifs. Des variétés améliorées de maïs à haut rendement et économiques en termes d'utilisation d'azote, ainsi que des variétés de niébé et de soja, efficaces en P et en fixation biologique de l'azote, ont été mises au point avec des gains de rendements de plus de 20% en grains et de plus de 15% en fourrage par rapport aux rendements en grains et en fourrages des variétés locales. Les effets bénéfiques de la rotation céréale-légumineuse et de la culture en relais ont été établis et quantifiés. Des options « meilleur pari » céréales-légumineuses, céréales-légumineuses-élevage et coton-niébé, incluant la lutte intégrée contre les ravageurs, ont été élaborées et testées dans des exploitations paysannes, avec une supériorité significative et des ratios bénéfiques: coûts plus élevés que ceux des pratiques paysannes. Le succès remporté par ces options a séduit plusieurs bailleurs de fonds dont l'USAID, DFID, DANIDA, le Gatsby Charitable Foundation, FIDA, ACIDI, la Belgique, le Japon etc. Ces derniers financent près de 15 projets spéciaux dans le cadre desquels ces options sont testées, validées et disséminées.
- Au cours de la campagne 2003, plus de 900 paysans ont participé à l'évaluation en milieu réel des meilleures options sorgho-niébé en savane soudanienne et maïs-niébé à double usage en savane nord-guinéenne, et ont obtenu 100 à 300% d'augmentation de productivité.
- La diffusion de paysan à paysan d'une variété améliorée de niébé a permis d'atteindre plus de 27.000 paysans dans l'Etat de Kano au Nigeria. Ce mode de diffusion des technologies paraît extrêmement efficace.
- Une enquête par transect systématique a révélé de forts taux d'adoption des variétés améliorées de maïs, de niébé et de soja de l'IITA dans le nord du Nigeria. La capacité nationale à créer et à transférer les technologies, y compris les technologies post-récolte, a été renforcée grâce à des formations diplômantes et non diplômantes, l'appui technique, les visites de suivi, les ateliers, les journées agricoles, les matériels de vulgarisation, et des réseaux comme WASNET, PRONAF et WECAMAN.
- Le projet a été soumis à une revue externe et ses chercheurs ont été félicités pour le progrès accompli et l'esprit d'équipe dont ils ont fait montre dans l'élaboration d'un projet aussi bien intégré et fonctionnel.

# Graduate research

completed at IITA in 2003

Name	M/F	Country of Nationality	University	Research location	Sponsor	Research topic
<b>MSc Fellows</b>						
Adeoti, R.	M	Benin	University of Benin	Benin	IITA	Profitability and competitiveness of cowpea production in West Africa: A comparative analysis between coastal and landlocked Sahelian countries
Adumila, C.O.	F	Nigeria	University of Ibadan	Ibadan	Self	Effects of various modified strains of <i>Agrobacterium tumefaciens</i> on efficiency of genetic transformation of banana ( <i>Musa</i> species)
Atta, H.	F	Nigeria	University of Agriculture, Abeokuta	Ibadan	DFID, UK	Genetics of resistance of maize ( <i>Zea mays</i> L.) to acetolactate synthase inhibiting herbicides used for the control of <i>Striga hermonthica</i> (L.Benth)
Benesi, I.	M	Malawi	University of Orange Free State	South Africa	IITA	Native starch evaluation and genetic distance analysis using AFLP for elite cassava ( <i>Manihot esculenta</i> Crantz) genotypes from Malawi
Clymans, E.	F	Belgium	Katholieke Universiteit Leuven	Ibadan	BNMS	Achieving development impact and environmental enhancement through adoption of BNMS II
Gbati, O.	M	Benin	University of Benin	Benin	DANIDA	Contribution on study of ecology and biological control of <i>Sitotroga cerealella</i> (Olivier) (Lepidoptera: Gelechiidae) in northern Guinea savanna of Benin
Maboudou Alidou, G.	M	Benin	National University	Benin	DANIDA	Socioeconomic determinants of maize postharvest systems in the Guinea savanna
N'Kpenu, E.K.	M	Togo	Université de Lomé	Togo	IFAD	Evaluation des caractéristiques agronomiques et organoleptiques de clones améliorés d'igname ( <i>Dioscorea cayenensis-rotundata</i> ) dans deux zones agroécologiques
Olukolu, B.	M	Nigeria	University of Ibadan	Ibadan	Self	Phenotypic diversity in accessions of bambara groundnut ( <i>Vigna subterranea</i> (L.) verdc.)
Osei Akraasi, K.	M	Ghana	Kwame Nkrumah University	Ghana	IFAD/IITA/WECARD	Studies on the anti-microbial properties of yam rhizosphere microorganisms (Mos) for the control of rots of seed and food yams
Twizeyimana, M.	M	Rwanda	University of Ibadan	Ibadan	Self	Screening plantain and banana cultivars for resistance to black sigatoka disease caused by <i>Mycosphaerella fijiensis</i>
Van Loon, L.	F	Belgium	Katholieke Universiteit Leuven	Ibadan	BNMS	Achieving development impact and environmental enhancement through adoption of BNMS II

Name	M/F	Country of Nationality	University	Research location	Sponsor	Research topic
<b>PhD Fellows</b>						
Achidi, A.	F	Nigeria	University of Ibadan	Ibadan	IITA	Nutritional evaluation of cassava ( <i>Manihot esculenta</i> Crantz) leaves and effect of processing on nutrient composition and utilization
Hankoua, B.B.	M	Cameroon	University of Ibadan	Ibadan	SDC	Regeneration and transformation of cassava ( <i>Manihot esculenta</i> Crantz) germplasm
Horna, D.	F	Peru	University of Hohenheim	Ibadan	Self	Reinforcing the agricultural research and extension system in West Africa: rice case
Olaitan, J.	F	Nigeria	University of Ibadan	Ibadan	Self	Biological control of <i>Striga gesnerioides</i> using isolated bacteria and fungi from suppressive soil
Olojede, A.	M	Nigeria	University of Nigeria	Ibadan	Self	Evaluation of new genotypes of cassava ( <i>Manihot esculenta</i> Crantz) for intercropping in cassava-based systems of southeastern Nigeria
Omo-Ikerodah, E.E.	F	Nigeria	University of Ibadan	Ibadan	IITA	Inheritance of resistance to flower thrips and identification of DNA markers associated with the resistance loci in cowpea
Oselebe, H.	F	Nigeria	University of Nigeria	Onne	USAID	Ploidy and genome effect on combining ability and heterosis in <i>Musa</i> populations
Rotimi, M.O.	F	Nigeria	Katholieke Universiteit Leuven	Onne	BMZ-West	Incidence of plant-parasitic nematodes in Nigeria and their effect on root health, plant growth and yield in <i>Musa</i> spp. (AAB group)
Tabi, F.O.	M	Cameroon	University of Ibadan	Ibadan	IITA	Development of a land information system for agrotechnology transfer
Tchienkoua, M.	M	Cameroon	University of Yaoundé	Cameroon	RF	Improving soil phosphorus availability in maize-based cropping systems using P-efficient legumes
Zannou, D.I.	M	Benin	Ecole Nationale Supérieur Agronomique de Montpellier	Benin	IITA	Taxonomic study of the family Phytoseiidae in America and Africa with the impact of <i>Typhlodromalus aripo</i> local species population composition
Zeller, H.	M	Germany	University of Hohenheim	Ibadan	Self	GIS characterization of rainfed rice-based production systems in southern Nigeria



# Financial information

## Funding overview

Funding for 2003 was US\$37.306 million, of which 96.6% came from CGIAR investors and 3.4% from other sources. Expenditure was US\$37.147 million, of which 88% was used for program expenses and 12% for management and general expenses.

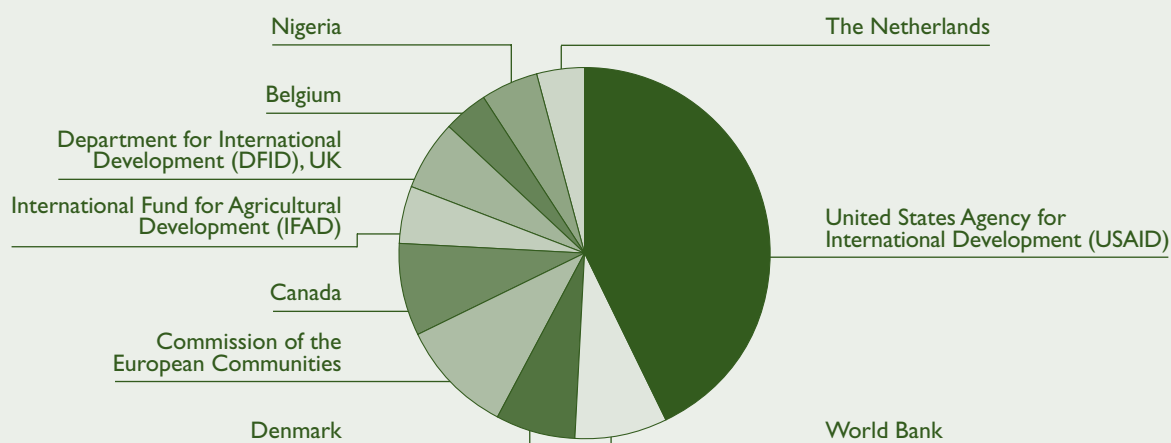
The governments and agencies that provided the largest share of our funding in 2002 and 2003 are shown in Figure 1 (top 10 donors). IITA's allocation to five research outputs of the CGIAR is shown in Figure 2.

## Bref aperçu de l'état des finances

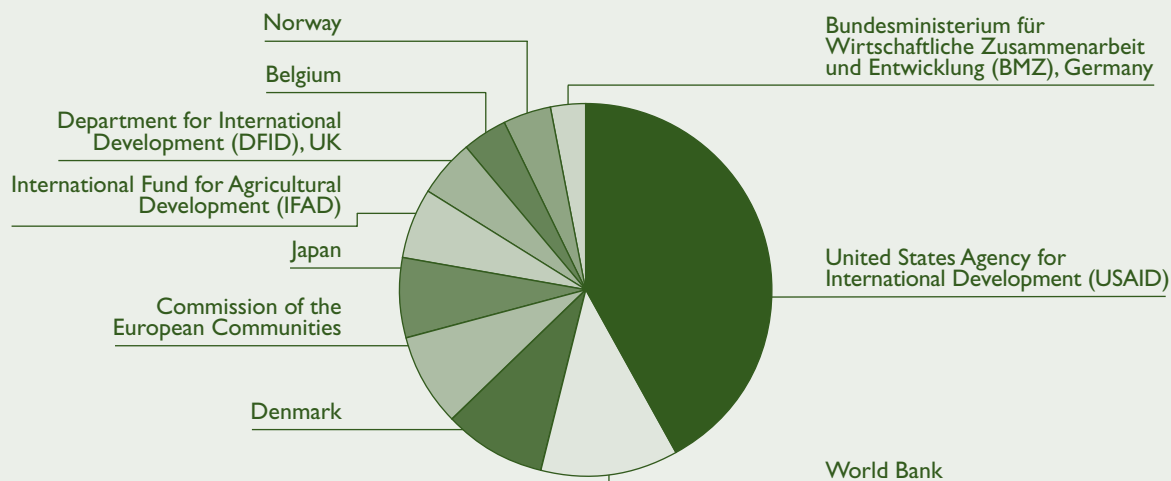
L'enveloppe financière de l'IITA au titre de 2003 s'élevait à 37,306 millions de \$EU, soit 96,6% fournis par les investisseurs du GCRAI et 3,4% provenant de sources diverses. Les dépenses montaient à 37,147 millions de \$EU, dont 88% ont été consacrées au programme et 12% aux frais administratifs et généraux.

Les Etats et agences (les dix premiers) ayant le plus contribué à notre budget de fonctionnement en 2002 et 2003 sont présentés à la figure 1. La figure 2 montre les ressources allouées à cinq volets de recherche du GCRAI.

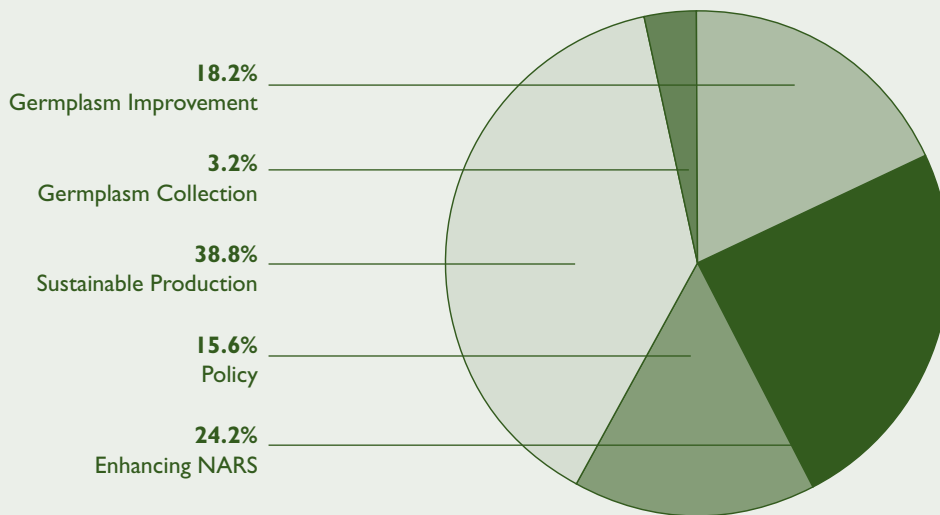
**Figure 1** Funding: top 10 donors, 2003



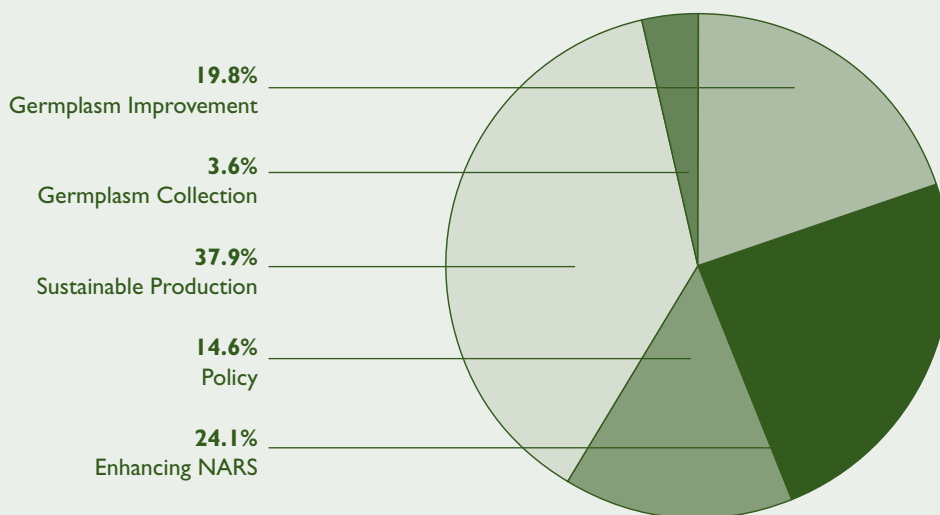
Funding: top 10 donors, 2002



**Figure 2** Core research expenditure by CGIAR output, 2003



Core research expenditure by CGIAR output, 2002



# Publications

Contributions by IITA staff to scientific literature that became available during 2003, including journal articles, books and book chapters, papers in monographs or conference proceedings, published abstracts, research notes, and disease reports. Also included are publications based on work done by IITA staff prior to their joining IITA, especially where the work reported is of interest to IITA, and publications by staff who have left IITA, which are based on work done while they were at the Institute.

## Journal articles

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C.A. Fatokun, Nigerian biotechnology program coordinator, *Ibadan*  
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I. Ingelbrecht, head, biotechnology lab, *Ibadan*  
M. Kolesnikova-Allen, cocoa geneticist, *Ibadan*  
B. Maziya-Dixon, maize food technologist, *Ibadan*  
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G. Goergen, entomologist, *Cotonou*  
R. Hanna, acarologist, *Cotonou*  
K. Hell, postharvest biologist, *Cotonou*  
C. Herron, plant pathologist, *Ibadan*  
J.d'A. Hughes, virologist, *Ibadan*  
B.D. James, entomologist, *Cotonou*  
J. Langewald, insect pathologist, *Cotonou*\*  
P. Le Gall, entomologist (IRD), *Cotonou*  
P. Neuenschwander, principal scientist, *Cotonou*\*  
M. Tamò, legume entomologist, *Cotonou*  
F. Beed, weed pathologist, *Cotonou*

## Postdoctoral Fellows

T. Dubois, entomologist, *Kampala*  
B. Niere, nematologist, *Kampala*\*  
F. Mwangi, plant pathologist, *Ibadan*

## Visiting Scientists

S. Offei, virologist, *Ibadan*  
F. Ogbe, virologist, *Ibadan*  
M. Toko, acarologist, *Cotonou*

## Associate expert

K. Agboka, insect ecologist, *Cotonou*

## Project C – Impact, Policy, and System Analysis Scientists

J. Gockowski, agricultural economist, *Yaoundé*  
P. Kormawa, agricultural economist, *Ibadan*  
C. Legg, geospatial laboratory manager, *Ibadan*  
V. Manyong, agricultural economist, *Ibadan*  
J. Helsen, PROSAB manager, *Maiduguri*

## Postdoctoral Fellows

K.N. Amegbeto, yam economist, *Ibadan*  
A. Alene, impact assessment economist, *Ibadan*

## Associate Experts

V. Robiglio, GIS specialist, *Yaoundé*  
A. Tipilda, anthropologist, *Ibadan*

## Visiting Scientist

P. Amaza, agricultural economist, *Maiduguri*

## Consultants

N. de Haan, rural sociologist, *Ibadan*  
S. Egal, geographer, *Cotonou*  
C. Ezedinma, agricultural economist, *Ibadan*  
K. Makinde, marketing economist, *Ibadan*  
A.O. Onabolu, technology transfer specialist, *Ibadan*

## Project D – Starch and Grain Staples in Eastern and Southern Africa Scientists

A. Abass, coordinator, SSCPP, *Dar-es-Salaam*  
M. Andrade, agronomist, *Maputo*

S. Ferris, enterprise development specialist, *Kampala*  
 C.S. Gold, entomologist, *Kampala*  
 B.W. Khizzah, agronomist, *Kampala*  
 S. Koliijn, postharvest specialist, *Dar-es-Salaam*  
 K. Lema, coordinator, DR Congo cassava project, *Kinshasa*  
 J.P. Legg, virologist (joint appointment with NRI), *Kampala*  
 N-M. Mahungu, agronomist/coordinator, SARRNET, *Lilongwe*  
 J. Wendt, soil chemist, *Kampala*  
 J.B.A. Whyte, breeder/coordinator EARRNET, *Kampala*

#### Postdoctoral Fellows

S. Abele, economist, *Kampala*  
 E.E. Kanju, cassava breeder/pathologist, *Mikocheni*

#### Associate Experts

C. Dochez, biologist, *Kampala*  
 A. Fermont, legume agronomist, *Kampala*  
 P. van Asten, banana agronomist, *Kampala*

#### Visiting Scientists

C. Nankinga, insect pathologist, *Kampala*  
 S.H.O. Okech, entomologist, *Kampala*  
 P. Ragama, statistician, *Kampala*  
 C. Muchopa, policy economist, *Harare*

#### Consultants

J.M. Mbwika, PESA co-developer, *Nairobi*  
 P.M. Ntawurhunga, agronomist, *Kampala*  
 T. Phillips, PESA Interim leader/developer, *Guelph*

### Project E – Diverse Agricultural Systems in the Humid Zone of West and Central Africa

#### Scientists

A.N. Attey, TARGET Musa coordinator West Africa  
 (Joint appointment with IPRGI), *Njombe*  
 S. David, STCP technology transfer specialist, *Yaoundé*  
 A.G.O. Dixon, cassava breeder, *Ibadan*  
 S. Hauser, soil physicist, *Yaoundé*  
 C. Nolte, soil fertility specialist, *Yaoundé*  
 H. Shiwachi, yam physiologist, *Ibadan*  
 A. Tenkouano, plantain/cassava breeder, *Yaoundé*  
 S. Weise, STCP manager, *Yaoundé*

#### Associate Expert

L. Wijnans, entomologist/ecologist, *Yaoundé*

#### Visiting Scientists

L. Norgrove, STCP/MARS scientist, *Yaoundé*  
 D. Cornet, yam agronomist (CIRAD), *Cotonou*

#### Consultants

J. Lemchi, economist/Musa technology exchange, *Onne*  
 G.B. Nkamleu, economist, *Yaoundé*  
 B. Tchiakam, modeler, *Yaoundé*  
 M. Tindo, entomologist, *Yaoundé*

#### STCP Pilot Sites

I. Gyamfi, Ghanaian NPP manager, *Accra*  
 M.V.A. Jonas, Cameroonian NPP manager, *Yaoundé*  
 C. Okafor, Nigerian NPP manager, *Akure*  
 A.R. Yapo, Cote d'Ivoire NPP manager, *Abidjan*

### Project F – Grain-based Systems in the West African Savanna

#### Scientists

B. Badu-Apraku, breeder/coordinator WECAMAN, *Bouaké*  
 W. Bertenbreiter, project coord. IITA/GTZ/CSIR seed project,  
*Accra*  
 D. Chikoye, weed scientist, *Ibadan*  
 J. Diels, modeler, *Ibadan*  
 A. Emechebe, plant pathologist, *Kano*  
 L. Halos-Kim, food and agricultural engineer, *Ibadan*  
 N. Maroya, WASNET coordinator, *Accra*  
 A. Menkir, maize breeder, *Ibadan*  
 S. Schulz, agronomist, *Ibadan\**

B.B. Singh, cowpea breeder, *Kano*  
 S. Tarawali, agronomist (joint appointment with ILRI), *Ibadan*  
 A.Y. Kamara, maize physiologist, *Ibadan*

#### Postdoctoral Fellows

T. Adati, entomologist, *Kano*  
 G. Dercon, soil fertility specialist, *Ibadan*  
 O. Fashola, soil scientist, *Ibadan*  
 F. Hakizimana, soybean breeder, *Ibadan*

#### Associate Experts

A.C. Franke, agronomist, *Ibadan*  
 O.K. Nielsen, weed scientist, *Ibadan*  
 K. Roing, soil scientist, *Ibadan*

#### Visiting Scientist

R. Abaidoo, soil microbiologist, *Ibadan*

#### Consultants

G. Tarawali, agronomist, *Ibadan*  
 J.A. Okogun, soil scientist, *Ibadan*

#### Research Farms Unit

F.O. Adunoye, farm superintendent, *Abuja*  
 J.J. Olobashola, assistant farm unit head, *Ibadan*

### Research and Administrative Support

A. Aboubakar, station administrator, *Cameroon, Yaoundé*  
 C.A. Soboyejo, station administrator, *Benin, Cotonou*  
 F. Onyango, station administrator, *Uganda, Kampala*  
 R. Adeleke, international trials manager, *Ibadan*  
 O.J. Adeniyi, laboratory manager, *Ibadan*  
 J.N. Agba, station administrative manager, *Onne*  
 A. Ajeigbe, assistant project manager, *Kano*  
 I.E. Ezeaku, assistant project manager, *Kano*  
 J.B. Akinwumi, engineer, *Cotonou*  
 P. Ilona, international trials manager, *Ibadan*  
 S. Korie, statistician, *Cotonou*  
 E. Ndindjock, finance officer, *Yaoundé*  
 S. Nyampong, executive assistant, *Cotonou*  
 E. Oyetunji, research database manager, *Ibadan*  
 E.O. Oyewole, research administrative manager, *Ibadan*  
 F. Tossé, chief accountant, *Cotonou*  
 M. Umaru, station administrative manager, *Kano*  
 J. Uponi, manager, analytical services laboratory, *Ibadan*  
 C. Yumga, station assistant, *Yaoundé*  
 R.W. Yusuf, multimedia specialist, *Cotonou*

#### Budget and Finance

E. Estoque, chief financial officer, *Ibadan\**  
 B.A. Adeola, senior accountant, *Ibadan*  
 J.E. Bolarinwa, payroll accountant, *Ibadan*  
 S.A. Ogunade, treasury manager, *Ibadan*  
 K.O. Olatifede, special projects accountant, *Ibadan*  
 O. Sholola, corporate budget and accounting manager,  
*Ibadan*

#### Communications and Information Services

D. Mowbray, head, *Ibadan*  
 Y.A. Adedigba, head, library and documentation, *Ibadan*  
 W. Adekunle, project coordinator, ICS, *Ibadan*  
 T. Babaleye, public affairs manager, *Ibadan*  
 E.O. Ezomo, principal librarian (collection and data), *Ibadan*  
 L. Abraham, communications writer, *Ibadan*  
 J. Ojuronbe, production manager, ICS, *Ibadan\**  
 Y. Olatunbosun, editor, *Ibadan*  
 A. Oyetunde, editor, *Ibadan*  
 P. Philpot, manager, multimedia unit, *Ibadan*

#### Corporate Services

O.I. Osotimehin, head, *Ibadan*  
 V. Waiyaki, human resources manager, *Ibadan*

#### Auxiliary Services

H. Cameron, manager, hotel and catering services, *Ibadan*  
 W. Ekpo, security manager, *Ibadan*

D. Errington, specialist science teacher, *Ibadan\**  
 D. Hurst, head, international school, *Ibadan\**  
 K. Hurst, teacher, international school, *Ibadan\**  
 C. Eykyn, deputy head, international school, *Ibadan*  
 C. Inniss-Palmer, head, international school, *Ibadan*  
 E. Piennar, teacher, international school, *Ibadan*  
 R. Ogundun, materials logistics manager, *Ibadan*  
 M.O. Olanrewaju, asst. manager, hotel and catering services, *Ibadan*

F. Oshikanlu, assistant head, travel services, *Ibadan*  
 D. Sewell, manager, aircraft operations, *Ibadan*

#### Computer Services

J. Scott, manager, *Ibadan*

#### Human Resources

O.O. Sikuade, head, IITA clinic, *Ibadan*  
 O. Babalola, senior pharmacist, *Ibadan*  
 F. Ajose, head, IITA clinic *Ibadan\**  
 O. Adebayo, physician, *Ibadan*  
 E.O. Lawani, physician, *Ibadan\**  
 O.O. Akinteye, employee relations manager, *Ibadan\**  
 S. Ayebameru, executive assistant, *Ibadan*  
 A. Ohanwusi, planning/training manager, *Ibadan*  
 P. Ojo, medical laboratory services officer, *Ibadan*  
 O. Babasanya, personnel manager, *Ibadan*

#### Internal Audit

R.A. Fagbenro, senior internal auditor, *Ibadan*

#### Management Information Systems

N.N. Eguzozie, manager, MIS, *Ibadan*  
 L.O. Afemikhe, senior technical analyst (computer), *Ibadan*  
 R. Cruickshank, software trainer, *Ibadan*  
 J. Ukpong, senior analyst, *Ibadan*

#### Physical Plant Services

W. Quader, head, *Ibadan*  
 F.M. Akeredolu, electronic services officer, *Ibadan*  
 E.O. Akintokun, research vehicle services officer, *Ibadan*  
 F.K. Alude, heavy equipment and fabrication services manager, *Ibadan*  
 R. Bishop, construction and site services officer, *Ibadan*  
 P.T. Lamuren, telecommunication services officer, *Ibadan*  
 M.A. Oyedeji, electrical services officer, *Ibadan*  
 M.A. Oyeleke, R and A services officer, *Ibadan*  
 O.O. Taiwo, buildings and grounds services officer, *Ibadan*

#### Training

E. Oyewole, research administrative manager, *Ibadan*

#### Cooperative special projects

##### Eastern Africa Root Crops Research Network (EARRNET)

B.W. Khizzah, regional agronomist  
 J.B.A. Whyte, breeder/coordinator – Project D

##### IITA/GTZ/CSIR Seed Project

W. Bertenbreiter, GTZ seed manager  
 N. Maroya, coordinator, WASNET

##### Postharvest and Marketing Research Network for Eastern and Central Africa (Foodnet)

S. Ferris, enterprise development specialist

##### Southern Africa Root Crops Research Network (SARRNET)

S. Koliijn, postharvest specialist

M-N. Mahungu, agronomist/coordinator

##### West and Central Africa Collaborative Maize Research Network (WECAMAN)

B. Badu-Apraku, breeder/coordinator, *Ibadan*

##### Sustainable Tree Crops Program (STCP)

S. David, STCP technology transfer specialist, *Yaoundé*  
 J. Gockowski, research and impact monitoring specialist, *Yaoundé*

I. Gyamfi, Ghanaian NPP manager, *Accra*

M.V.A. Jonas, Cameroonian NPP manager, *Ibadan*

M. Kolesnikova-Allen, cocoa geneticist, *Ibadan*

G.B. Nkamleu, economist, *Yaoundé*

L. Norgrove, agroecologist, *Yaoundé*

C. Okafor, Nigerian NPP manager, *Akure*

A.R. Yapo, Côte d'Ivoire NPP manager, *Abidjan*

S. Weise, manager, *Yaoundé*

##### Collaborative programs with IARCs and other institutes

##### ASP II (Cornell Univ.-led) (Accra)

W. Alhassan

##### CIFOR (Yaoundé)

O. Ndoye

##### CIRAD (Cotonou, Yaoundé)

D. Cornet

##### HSPH/APIN (Ibadan, Abuja)

M. Aina

W. Odutolu

##### ICLARM (Yaoundé)

R. Brummett

##### ICRISAT (Kano, Nairobi)

J.J. Adu-Gyamfi

M.E. Ferguson

##### IFDC (Ibadan)

O. Obademi

##### ILRI (Ibadan)

A. Larbi\*

J. Niezen\*

T.O. Williams\*

F. Sonaiya

##### ISNAR (Ibadan)

F. Idachaba\*

##### IRAD (Cotonou)

B. Nguimgo

##### IRD (Cotonou)

P. LeGall

##### NRI (Cotonou, Kampala)

A. Cherry\* (joint appointment)

J.P. Legg (joint appointment)

##### IPGRI (Nyombe)

A.N. Attey (joint appointment)

##### WARDA (Ibadan)

A. Munyemana\*

O. Osiname

M-G. Saethre

##### VVOB (Kampala)

C. Dochez

##### Winrock International

Ezedinma, C.

\* Left during the year

#### Statistics

New appointments	34
Resignations/terminations	22
Country citizenships	40
Female/male ratio	ca. 1 : 3

# Abbreviations used in this report

ACMV	<i>African cassava mosaic virus</i>
AFLP	amplified fragment length polymorphism
AIDS	Almost Ideal Demand System
ARI	Agricultural Research Institute
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BSV	<i>Banana streak virus</i>
CBO	community-based organization
CBSD	cassava brown streak disease
CCER	center commissioned external review
CFC	Committee on Commodity Problems
CGM	cassava green mite
CIDA	Canadian International Development Agency
CMD	cassava mosaic disease
CNRA	Centre National de Recherche Agronomique, Côte d'Ivoire
CRI	Crops Research Institute, Ghana
DANIDA	Danish International Development Agency
DFID	Department for International Development, UK
DNA	deoxyribonucleic acid
EACMV-Ug	<i>East African cassava mosaic virus</i> –Uganda variant
EAHB	East African highland banana
EARNET	East African Root Crops Research Network
ELISA	enzyme-linked immunosorbent assay
ESARC	Eastern and Southern Africa Regional Center
FSS	farmer field school
FAO	Food and Agriculture Organization of the United Nations
Foodnet	Marketing and Postharvest Research Network for Eastern and Central Africa
GATSBY	Gatsby Charitable Foundation, UK
GIS	geographical information system
GTZ	Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)
HQCF	high-quality unfermented cassava flour
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
IIBC	International Institute of Biological Control
ILRI	International Livestock Research Institute
ISC	integrated <i>Striga hermonthica</i> control
KARI	Kenya Agriculture Research Institute
MARP	Méthode active de recherche et de planification participatives
NARO	National Agricultural Research Organization, Uganda
NARS	national agricultural research system
NCRI	National Root Crops Research Institute, Nigeria
NGO	nongovernmental organizations
NGS	northern Guinea savanna
NRI	Natural Resources Institute (UK)
OQF	open quarantine facility
PR&E	participatory research and extension
PRONAF	Projet niébé pour l'Afrique
RAPD	random amplified polymorphic DNA
RUSEP	Rural Sector Enhancement Project
SP-IPM	Systemwide Program on Integrated Pest Management
SS	Sudan savanna
SSR	single sequencing reaction
TLVs	traditional leafy vegetables
STCP	Sustainable Tree Crops Program
USAID	United States Agency for International Development
WARDA	West Africa Rice Development Association
WASNET	West Africa Seed Network
WECAMAN	West and Central Africa Maize Network