Research to Nourish Africa

IITA

Annual Report 2004

IITA
Annual Report 2004

International Institute of Tropical Agriculture Ibadan, Nigeria

Mission statement

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

Mission

L'IITA aspire à augmenter la sécurité alimentaire, les revenus et le bien-être des populations pauvres, d'Afrique subsaharienne grâce à la recherche et activités connexes en vue d'accroître la production agricole, d'améliorer les systèmes de production alimentaire et de gérer de manière durable les ressources naturelles, en collaboration avec les parties prenantes au niveau national et international.

Contents

Improved cowpea, better living	3
Nouveau niébé : vie meilleure	4
Cassava silage feeds dairy cattle in Malawi	9
Ensilage à base de manioc pour le bétail au Malawi	10
Research highlights	13
Repères de la recherche à l'IITA	14
Graduate research completed at IITA in 2004	27
Financial information	29
Publications	31
Governing board	49
Professional staff	50
Abbreviations used in this report	54

Foreword

The International Institute of Tropical Agriculture (IITA) is more than a collection of research stations and scientific initiatives. IITA consists of dedicated people who provide technical skills and original ideas to improve the lives of people in sub-Saharan Africa. IITA works in close partnership with a wide range of expert collaborators, including farmers, research and extension staff of national programs, governments, regional organizations, agri-business, private foundations, nongovernmental organizations, advanced research institutions, and a host of others both within and outside Africa.

Our cooperative efforts result in the development of innovations which contribute to food security. Such novel technologies include development of integrated pest management options, ways for farmers to access crucial market information, increased nutritional value of food crops, ensuring the economic and environmental sustainability of varied cropping systems or the supply of key information to policy makers. IITA is optimistic that the agricultural sector can go beyond provision of food security to serve as an engine for economic development by creating wealth for farm families, villages, districts, countries, and regions in sub-Saharan Africa.

Africa is a continent rich in natural and human resources. Furthermore, many IITA technologies have contributed to increasing the quantity and quality of agricultural produce across the continent. However, since 1990, while the food available per person has increased in Latin America (+30%) and Asia (+20%), Africa has experienced a 3% decline (InterAcademy Council, 2004). Notwithstanding such alarming statistics, IITA has observed the potential provided by entrepreneurs who are using agricultural commodities to drive a chain resulting in increased profits for men and women from the farm to the consumer.

Now is a critical time for sub-Saharan Africa. The New Partnership for Africa's Development (NEPAD) has shown the commitment of Africa's leaders to "business unusual" across the continent. IITA is both honored and excited by the role that it has been asked to play in NEPAD's pan-African cassava initiative. IITA has also been invited to work with NEPAD on the African Union's Comprehensive African Agricultural Development Programme, as well as contribute to the important activities of other subregional trade and research organizations. IITA and its collaborators are committed to the UN's Millennium Development Goals, and the significant benefit to poor people which will result.

The experience and capacity of IITA permit us to play a determinant role in Africa's ongoing emphasis on agriculture as a driver of economic development. The Research for Development Council is a leadership group (composed of elected scientists and Directors) which aims to ensure that IITA's strategic capability is harmonized to the challenges and opportunities on the horizon.

IITA will play an active role to maximize the continent's remarkable agricultural potential in order to catalyze economic development.

Research for Development Council

Avant propos

L'institut international d'agriculture tropicale, l'IITA est plus qu'un rassemblement de stations de recherches et d'initiatives scientifiques. L'IITA se compose de personnes dédiées qui fournissent les compétences techniques et les idées originales pour améliorer le niveau de vie des gens en Afrique sub-saharienne. L'IITA travaille en partenariat avec une grande gamme de collaborateurs experts y compris des cultivateurs, des chercheurs et le personnel de vulgarisation de programmes nationaux, des gouvernements, des agro-entrepreneures, des organisations non-gouvernementales, des institutions à recherches avancées et bien d'autres en Afrique et ailleurs.

Nos efforts de coopération se traduisent dans le développement des innovations qui contribuent à la sécurité alimentaire. De telles nouvelles technologies incluent le développement des options intégrées pour le contrôle des pestes, les moyens par lesquels les cultivateurs peuvent avoir les renseignements cruciaux à propos du marché, l'amélioration de valeur nutritive des cultures, la durabilité économique et de l'environnement de divers systèmes culturaux, ou la provision des informations clés aux décideurs de politiques. L'IITA est optimiste que le secteur agricole peut non seulement assurer la provision des aliments mais aussi servir comme moteur pour le développement économique à travers la création de richesses pour les familles de cultivateurs, les villages, les arrondissements, les pays et les régions en Afrique sub-saharienne.

L'Afrique est un continent riche en ressources naturelles et humaines. De plus, beaucoup de technologies de l'IITA ont contribué à la croissance de la quantité et la qualité des produits agricoles à travers le continent. Pourtant, depuis 1990, alors que la nourriture disponible par personne a augmenté en Amérique latine (+30%) et en Asie (+20%), l'Afrique a connu un déclin de 3% (InterAcademy council, 2004). Malgré ces statistiques alarmantes, l'IITA a remarqué le potentiel de création par les entrepreneurs qui se servent de produits agricoles pour générer une filière qui résulte en profits croissants pour les hommes et les femmes, du producteur au consommateur.

Nous traversons une période critique pour l'Afrique sub-saharienne. Le Nouveau partenariat pour le développement de l'Afrique (NEPAD) a montré l'engagement des dirigeants africains à une 'affaire inhabituelle' à travers le continent. L'IITA est non seulement honoré mais aussi excité par le rôle qui lui a été demandé de jouer dans l'initiative pan-Africaine du manioc du NEPAD.

L'IITA a été aussi invité pour travailler avec le NEPAD en ce qui concerne le Programme détaillé pour le développement de l'agriculture africaine de l'Union africaine, ainsi qu'à contribuer aux activités importantes d'autres organisations sous-régionales de commerce et de recherche. L'IITA et ses collaborateurs sont dévoués aux buts de développement des Nations-Unies pour le millenium, et les bénéfices importants qui en sortiront pour les gens pauvres.

L'expérience et la capacité de l'IITA nous permettent de jouer un rôle déterminant dans l'accent que l'Afrique mets actuellement sur l'agriculture en tant que stimulant du développement économique. Le Conseil de la recherche pour le développement est un groupe de direction (composé de scientifiques et administrateurs) qui a comme objectif de s'assurer de la capacité stratégique de l'IITA à s'harmoniser avec les défis et les opportunités qui se pointent à l'horizon.

L'IITA continuera de jouer un rôle actif pour maximiser le potentiel agricole remarquable du continent en vue de stimuler le développement économique.

Conseil de la recherche pour le développement

Improved cowpea, better living

Cowpea is a popular crop in West Africa. It is a source of cash when sold, either raw or processed. As women do the processing, it plays a critical role in their empowerment. Cowpea fodder is a much higher protein source for animal feed than cereals, is easily stored and sold during dry season for additional cash. Healthy livestock, in turn, produce more milk, meat, traction, and manure for the sustainability of crop production.

However, despite the multiple roles cowpea plays in the farming system and livelihoods, the productivity level in farmers' fields remains low.

IITA has developed a package of technologies that include improved dual-purpose (grain and fodder) high yielding varieties, new crop spacing arrangements, and a minimum use of inputs. A study in Kano and Kaduna States, northern Nigeria, assessed the rate of adoption and intra-household impact of the improved varieties using a gender approach.

Higher yields, more income

Many farmers (68%) adopted the new technology. Higher yields were found among adopters (1200 kg/ha versus 500 kg/ha for nonadopters) and incomes increased by 134%. Adoption of the improved cowpea package as a whole, rather than only in part, had a significant positive impact on household income. The wives of adopters agreed that they had access to more income, first from the household head who sold more grain and fodder, and then from their own processing of the improved cowpea. Increased income among wives is important to start petty trading and for the contribution to household nutrition, education, and health care.

Cowpea, a source of cash, raw or processed

In Kera village, a woman said that she was able to buy three goats. This may not sound like much but it meant a lot to her. She was able to fatten them with more fodder and resell them just before the *Sallah* festival.

The family needs and social norms generally molded the use of this additional income. Men controlled income from sales of grain and fodder. Wives and other family members controlled income from the petty trading of processed bean cakes, etc. Women generally have the right to dispose of the product and income from their own economic activities and from cash handouts from the husband. However, they are often constrained

Nouveau niébé : vie meilleure

Le niébé est une culture très répandue en Afrique de l'ouest. Ses avantages pour les communautés rurales sont multiples. Vendu cru ou transformé, il est une importante source de revenus liquides pour les cultivateurs. Sa transformation étant essentiellement réservée aux femmes, il occupe une place importante dans le processus de leur responsabilisation. Les fanes de niébé destinées à l'alimentation animale renferment plus de protéines que les céréales et se prêtent bien au stockage et à la vente pendant la saison sèche, d'où les suppléments de revenus qui lui sont associés. Les animaux nourris aux fanes de niébé jouissent d'une bonne santé, produisent plus de lait, de viande, d'effort de traction et de fumier et, ce faisant, garantissent la pérennité de la production agricole.

Cependant, malgré les multiples rôles joués par le niébé dans le système de culture et comme moyen d'existence, son niveau de productivité demeure bas dans les exploitations paysannes. L'IITA a élaboré un paquet de technologies comprenant des variétés de niébé à haut rendement et à usage double (graines et fourrage), de nouveaux dispositifs spatiaux et une utilisation minimale d'intrants.

Une étude basée sur le genre, conduite dans les Etats de Kano et de Kaduna dans le nord du Nigéria, a permis d'évaluer le taux d'adoption ainsi que l'impact à l'intérieur du ménage des variétés améliorées.

Des beignets d'haricots

Hausse de rendements, hausse de revenus

Beaucoup de cultivateurs (68%) ont adopté la nouvelle technologie. Ceux ayant adopté cette technologie ont obtenu les meilleurs rendements (1200 kg/ha, contre 500 kg/ha pour ceux qui ne l'ont pas adoptée) et une hausse de leurs revenus de 134%. L'adoption des technologies endogènes, l'adoption intégrale, plutôt que partielle, du paquet de niébé amélioré a un impact significativement positif sur le revenu du ménage. Les femmes des paysans ayant adopté la technologie ont reconnu avoir enregistré une augmentation des revenus, d'abord au niveau du chef du ménage qui a vendu plus de graines et de fourrage, et ensuite grâce à leurs propres activités de transformation du niébé amélioré. Une hausse de revenus obtenue par les femmes est importante, car elles pourront ainsi démarrer leurs petits commerces et contribuer à la nutrition, l'éducation et la santé de la famille.

by the prevailing male-enforced norms to meet some of their needs. Despite this constraint, a large majority of women felt less dependent on their husbands and hence there was less stress within the family.

More savings, more investment

Apart from investing in food security and human capital investment (the education of children and health care), women reported that they did not spend all their earnings instantly. As their savings increased, they used them for consumption, investment in petty trading, or in purchase of other assets such as livestock. They also contributed to their husband's purchase of farm inputs.

The most notable aspect was that increased income and its subsequent use in setting up petty trading meant that women formed little "merry-go-round" credit groups with other women. This built up social networks to which they could revert in times of hardship within the family. Saratu Maalim from Bichi village sums this up.

"We are now able to have a little money which we contribute to a common pool among the women. This money is then used either for community activities or is handed over to member per member per month. You know our culture only allows women to be within the village and we are now working together."

Distribution of benefits

Accrued benefits filtered through the community as the larger family could be assisted in times of hardship. Also, increased participation in social events raised the family status. This was seen as the most important aspect. Status has a great deal of meaning in terms of influencing collective decision-making. The household benefited from the nutritional values of cowpea and also from the purchase of different types of food and better food availability throughout the year. During the group meetings, Rahima of Gawalde village reported:

"…previously, we had to eat pap (porridge). Now we can afford rice and occasionally meat and milk. Now during the dry period (crisis period) we may go without fish or meat but not without some rice or vegetables."

...happy, healthy, active

Good health

During the focus group discussions, the women considered indicators such as happy, active, and plump children as the most striking features in improved health care from the adoption of improved cowpea. As a protein-rich food and source of cash, increased production of cowpea grain improves the nutrition conditions of a household directly through consumption and indirectly though increased income used to buy other food items.

Better gender relations

During the focus group discussions, not much had changed in terms of the roles played by the men or women. What however had changed was that there was less conflict in the

Dans le village de Kera, une femme a dit qu'elle a pu acheter trois chèvres. C'est peut-être rien, mais pour elle, trois chèvres, c'est beaucoup. Elle a pu les engraisser avec plus de fourrage et les revendre à la veille de la tabaski.

C'est les besoins de la famille et les normes sociales qui, généralement, dictent l'utilisation de ces revenus supplémentaires. Les hommes contrôlent les revenus générés par la vente des graines et du fourrage. En revanche, les femmes et les autres membres de la famille contrôlent les revenus obtenus grâce au petit commerce de beignets d'haricot et autres. Les femmes ont généralement le droit de disposer du produit et des revenus générés par leurs propres activités économiques ainsi que des aides monétaires que leur apportent leurs maris. Toutefois, en satisfaisant leurs besoins, elles se heurtent souvent aux normes sociales dominées par les hommes. Nonobstant cette difficulté, une grande majorité des femmes se sent moins dépendante de leurs maris, d'où une vie moins stressante au sein de la famille.

Plus d'épargne, plus d'investissement

Outre les investissements dans la sécurité alimentaire et le capital humain (éducation des enfants et soins de santé), les femmes ont indiqué qu'elles ne dépensaient pas tous leurs revenus immédiatement. Comme le niveau de leur épargne a augmenté, elles l'ont affecté à des dépenses de consommation ou investi dans le petit commerce, ou dans l'achat d'autres biens tels que le cheptel. Elles ont également contribué aux achats d'intrants agricoles effectués par leurs maris.

L'aspect le plus remarquable est que le gain de revenus, et son utilisation subséquente pour le lancement du petit commerce, a fait que les femmes ont formé de petits groupes de tontine avec d'autres femmes. Elles ont pu ainsi mettre en place des réseaux sociaux auxquels elles pouvaient recourir pour sortir la famille des difficultés. Saratu Maalim du village de Bichi résume la situation en ces termes :

Les femmes forment de petits groupes de tontine

« Nous sommes à présent capables d'avoir un peu d'argent que nous cotisons dans une caisse commune réservée aux femmes. Cet argent est par la suite utilisé pour les activités communautaires ou passe d'un membre à un autre membre chaque mois. Vous savez que notre culture ne permet pas que les femmes sortent du village. Donc, nous nous mettons ensemble pour travailler. »

Partage des bénéfices

Les bénéfices accumulés parvenaient à tous les membres de la communauté. Ainsi, les plus grandes familles pouvaient bénéficier d'une aide en période de difficulté. Par ailleurs, une participation accrue aux événements sociaux apporta plus de prestige à la famille. Cet aspect fut considéré comme le plus important. Un rang social élevé a beaucoup de sens car il influence la prise de décision collective. Le ménage a profité des valeurs nutritionnelles du niébé, de l'achat de types variés d'aliments, et d'une meilleure disponibilité de vivres tout au long de l'année. Au cours des rencontres de groupes, Rahima du village de Gawalde s'exprima en ces termes:

household over limited resources and how these were allocated. This was important for the women. They felt they had more independence and there was more stability with fewer incidences of conflict.

Binta Shaibu from Santa Rago village commented:

"Now my husband and I can even sit down and decide what to do together, what to contribute to a community activity. In the past he controlled all the resources because he was not confident that I could make a decision on so little money."

Amina Sunusi from a household that did not grow improved cowpea in Gwagwaranda village had this to say.

"We see these women with new wrappers all the time and they look happy. They seem to go along well with their husbands…what else can a woman ask for in these times than a happy home? Everything follows."

«…auparavant, il nous fallait consommer de la bouillie. A présent, nous pouvons acheter du riz et, de temps en temps, de la viande et du lait. Pendant la période des vaches maigres, nous pouvons nous passer du poisson ou de la viande mais pas du riz ou des légumes. »

Bonne santé

Lors des discussions en groupes, les femmes ont estimé que des enfants heureux, actifs et potelés sont les témoignages les plus vivants d'une meilleure santé chez les enfants dont les parents ont adopté le niébé amélioré. Comme le niébé est un aliment riche en protéine et source de revenus liquides, une production accrue de graines de niébé améliore directement les conditions nutritionnelles du ménage grâce à la consommation, et indirectement, grâce à l'augmentation des revenus affecté à l'achat d'autres denrées alimentaires.

Meilleures relations entre l'homme et la femme

Lors des discussions en groupes, peu de changement a été observé quant aux rôles joués par les hommes ou les femmes. Cependant, les conflits touchant aux ressources limitées et leur affectation au sein du ménage se sont atténués. Ce fut un changement très important pour les femmes. Elles ont estimé qu'elles étaient plus autonomes et qu'il y avait plus de stabilité dans le ménage, l'incidence des conflits ayant diminué. Binta Shaibu du village de Santa Rago a fait remarquer:

« A présent, je peux même m'asseoir avec mon mari pour décider avec lui de ce qu'il faut faire, et de notre contribution à l'activité communautaire. Dans le passé, il avait la main mise sur toutes les ressources parce qu'il n'était pas confiant que j'étais capable de prendre une décision concernant si peu d'argent. »

Amina Sunusi, venant d'un ménage qui n'a pas cultivé le niébé amélioré dans le village de Gwagwaranda, a déclaré.

« Nous voyons ces femmes avec de nouveaux pagnes tout le temps et elles paraissent heureuses. Elles semblent bien s'entendre avec leurs maris…quoi d'autre peut vouloir une femme pendant ces durs moments en dehors d'un foyer heureux? Tout le reste suit. »

Cassava silage feeds dairy cattle in Malawi

The Chitsanzo bulking group in Dedza district of Malawi, located about 60 km south of Lilongwe city comprises 62 smallholder dairy farmer members. The animal holding size ranges from 1 to 6 per farm family. Land o' Lakes (an NGO) supports this group by providing in-calf Holstein breed cows on loan, and a cooling center with a capacity of 1500 liters where farmers bring their milk on daily basis for collective storage and marketing.

Mrs E. Khoya from Malawi has one dairy cow that came from the Land o' Lakes NGO in 2003. She used to milk this cow twice a day, getting altogether between 12 and 14 liters. One day she attended a demonstration on making silage for animal feed from cassava. Intrigued by the possibilities, she made her own silage and fed it to the cow. The results amazed her. Milk yield increased from 14 to 23 liters/day and milking had to be done three times instead of twice. As well as quantity, quality also increased, with butter fat content raised from 3.2 to 3.6%.

"I am planting more cassava this year (2004/5)" she said, "so I can make more silage. I hope to get 25 liters of milk each day."

For Mrs Khoya, as for other small-scale dairy farmers, cassava silage technology is the key to expanding her business.

Shortage of protein limits human and animal development in sub-Saharan Africa. Dairy cattle farming can generate income and improve rural livelihoods in southern Africa but the industry is underdeveloped. Feed scarcity is a serious problem especially during the dry season in Malawi. Grass dries up; maize and legumes are in demand for human food. Research was needed to find alternative ways of getting cheap and non-conventional sources of protein and energy. Cassava satisfies this need and produces plentiful leaf and root biomass.

Small-scale farmers chopping cassava leaves for silage

Making cassava silage

The technology was introduced into southern Africa through collaboration between IITA-SARRNET and CIAT/CAYUKA. Young cassava plants are detopped or ratooned (cut at about 20–30 cm from the rootstock at 3–4 months after planting and thereafter every 2–4 months). The shoot tips with the leaves are cut into small pieces manually or

Ensilage à base de manioc pour le bétail au Malawi

Le groupe d'assemblage de Chitsanzo dans le district de Dedza au Malawi, situé à environ 60 km au sud de la ville de Lilongwe, regroupe 62 petits éleveurs laitiers. L'exploitation animale comprend 1 à 6 têtes de bétail par famille. Land o' Lakes (une ONG) soutient ce groupe en lui fournissant à credit des vaches in-calf de la race Holstein et un centre de réfrigération d'une capacité de 1500 litres où les éleveurs apportent chaque jour leur lait pour stockage et vente collectifs.

Mme E. Khoya au Malawi possède une vache laitière obtenue de l'ONG Land o' Lakes en 2003. Elle avait l'habitude de la traire deux fois par jour, obtenant au total 12 et 14 litres. Un jour elle participa à l'ensilage pour l'alimentation des animaux à partir du manioc. Intriguée par toutes les possibilités qu'elle avait, elle produit son propre ensilage et le donna à la vache. Elle fut étonnée par les résultats. Sa production laitière a augmenté de 14 à 23 litres/jour et la traite doit se faire désormais trois fois au lieu de deux fois par jour. Elle produit désormais plus de lait de meilleure qualité et la teneur en graisse de beurre est passée de 3,2 à 3,6%.

« Je cultive plus de manioc cette année (2004/5) » déclare-t-elle, « pour que je puisse produire plus de fourrage. »

Pour Mme Khoya, comme pour d'autres petits exploitants laitiers, la technologie d'ensilage de manioc est la clef de l'expansion de ses activités.

Les feuillies sont mélangées avec les tubercules frais

Le déficit protéique est un obstacle au développement humain et animal en Afrique subsaharienne. L'industrie laitière peut générer des revenus et améliorer les moyens d'existence en Afrique subsaharienne mais elle est sous développée. La pénurie de fourrage constitue un problème grave, surtout pendant la saison sèche au Malawi. Les herbes s'assèchent ; la demande du maïs et des légumineuses est forte. Il était nécessaire de mener des travaux de recherche afin de trouver d'autres sources non conventionnelles d'énergie et de protéines bon marché. Le manioc répond à ce besoin et produit beaucoup de biomasse foliaire et racinaire.

Ensilage à base de manioc

La technologie fut introduite en Afrique australe grâce à la collaboration entre l'IITA/SARRNET et CIAT/CAYUKA. De jeunes plants de manioc sont décimés ou rejetonnés (coupes à environ 20 à 30 cm de la base racinaire à l'âge de 3–4 mois après bouturage puis par la suite chaque 2-mois). Les pousses apicales et les feuillies sont découpées en petits morceaux à la main ou dans une machine

in motorized or tractor-driven choppers and mixed with chopped fresh roots in the proportion 80% leaves to 20% roots. The mixture is ensiled in plastic bags or pits up to 1.5 m deep, lined at the bottom and sides with plastic sheeting and covered. The mixture has to be thoroughly compacted to allow aerobic fermentation.

Is it safe to use cassava in this form?

Farmers know that bitter varieties of cassava are less likely to be damaged by monkeys and other animals or stolen. However, such varieties need correct processing before they can be safely consumed as food or feed. In cassava silage, the cyanogenic glucosides are reduced to levels far below the safety limit for animal feeds. The process is given 21 days to allow the silage to mature before being fed to animals.

Dairy animals feeding on cassava silage

What do farmers think of this?

Meetings were held with Land o'Lakes staff, Ministry of Agriculture extension workers and lead/innovative farmers and followed by demonstrations of the technology. Exciting results followed. Animals fed on cassava silage produced more milk than those fed on the usual maize/grass silage with mineral premixes. In the first year, IITA/SARRNET provided farmers with planting materials of *Maunjili* (TMS 91934) and. *Silira* (TMS 601426) both bred at IITA and introduced in Malawi in tissue culture form, and *Mbundumali* (a local landrace). These varieties can produce 40–50 t/biomass/ha over four harvests/yr with ± 21% of crude protein content in the leaves.

In the second year, farmers shared planting materials from the communal nursery for individual field production. Some used locally available cassava and leaves of the rubber cassava.

Impact: milk production and farmers' livelihoods

Commercial farms have recorded milk increases of around 40%. The gains in milk yield and quality translate into huge gains in cash income to farmers. For every US$1 that a farmer invests in cassava silage, he gets back US$49, compared to the US$13 he would get from investment in maize silage. Malawi also benefits as a nation by reducing the foreign exchange spent on importing dairy feeds.

IITA/SARRNET are now promoting silage making as a business in Malawi and Tanzania. Cassava farmers will make extra income from the leaves that are often left to dry in the fields. Individuals or groups can process silage in 20–50 kg polyethylene bags for sale to dairy farmers.

Scaling out

Within Malawi, twelve additional bulking groups (10 under MDFA [Mzuzu Dairy Farmers' Association] and 2 under Blantyre Shire Highlands) have started planting cassava for silage making. A total of 215 additional farmers have planted cassava for silage making in the 2004/2005 season. The technology has been spread through networking among the SARRNET countries; Tanzania has adopted it. Zambia is engaged in validation. The gross margin analysis and cost–benefit ratio show that producing and using cassava silage is a viable venture, especially when the ongoing prices for milk products in the SADC region are considered.

à couper motorisée ou tractée. Elles sont ensuite mélangées à des tranches de racines fraîches à raison de 80% de feuilles contre 20% de racines. Le mélange est ensilé dans des sacs en plastique ou des fosses de 1,5m de profondeur tapissées au fond et sur les côtés de feuilles de plastique, puis recouvert. Le mélange doit être complètement compacté afin de permettre une fermentation aérobie.

Peut-on sans risque utiliser le manioc sous cette forme ?

Les paysans savent que les variétés amères de manioc sont moins exposées aux dégâts des singes et d'autres animaux, et au vol. Ces variétés doivent toutefois subir un traitement adéquat pour ne poser aucun danger aussi bien pour la consommation humaine que la consommation animale. Dans l'ensilage de manioc les glucosides cyanogènes sont rabaissés à des niveaux nettement en dessous du niveau de sûreté fixé pour la consommation animale. On étale le procédé sur 21 jours pour que le fourrage soit suffisamment mûr pour être donné aux animaux.

Qu'en pensent les paysans ?

Des reunions ont été tenues avec le personnel de Land o'Lakes, des agents de vulgarisation du ministère de l'agriculture et des paysans chef de file/novateurs. Ces rencontres ont été suivies de séances de démonstrations de cette technologie. Des résultats remarquables ont été obtenus. Les animaux nourris au fourrage à base de manioc ont produit plus de lait que ceux nourris au fourrage habituel maïs/herbe + minéraux. Au cours de la première année, IITA/SARRNET a fournit aux paysans du matériel de plantation de *Maunjili* (TMS 91934) et *Silira* (TMS 601426), deux variétés sélectionnées à l'IITA et introduites au Malawi sous forme de culture de tissus, et *Mbundumali* (une variété locale). Ces variétés peuvent produire 40 à 50 tonnes de biomasse/ha sur quatre récoltes/an, avec ± 21% de teneur en protéine brute des feuilles.

Au cours de la deuxième année, les paysans ont partagé le matériel de plantation issu de la pépinière communautaire pour la mise en culture de leurs champs. Certains d'entre eux se sont servis du manioc et des feuilles du manioc sauvage disponibles localement.

Les grandes exploitations ont enregistré une hausse du lait avoisinant 40%

Impact: production laitière et moyens d'existence des paysans

Les exploitations commerciales ont enregistré une hausse de la production de lait avoisinant 40%. Les gains de productivité et de qualité du lait se sont traduits en d'énormes revenus liquides pour les paysans. Pour chaque dollar des Etats-Unis investi par le paysan dans l'ensilage, il obtient en retour 49$ EU, contre les 13$EU qu'il obtiendrait pour son investissement dans l'ensilage à base du maïs. Tout le pays aussi en profite grâce aux économies en devises réalisées sur les importations de produits laitiers destinés à l'alimentation du bétail au Malawi.

L'IITA/SARRNET se sont mis à promouvoir la création d'entreprises d'ensilage au Malawi et en Tanzanie. Les cultivateurs de manioc tirent des revenus supplémentaires des feuilles de manioc qui sont souvent laissées sécher au champ. Des individus ou des groupes peuvent ensiler le manioc dans des sacs en polyéthylène de 20–50 kg pour vendre aux producteurs de lait.

Expansion du procédé

Au Malawi, douze groupes supplémentaires d'assemblage de lait (10 formés sous l'appellation MDFA [Association des producteurs de lait de Mzuzu], et 2 sous Blantyre Shire Highlands) ont commencé à cultiver le manioc pour la fabrication du fourrage ensilé. En tout, 215 autres paysans ont cultivé le manioc pour l'ensilage pendant la campagne 2004/2005. La technologie s'est vite répandue grâce aux activités menées en réseau par les pays du SARRNET. La Tanzanie l'a adoptée. La Zambie a lancé le processus de validation. Le calcul de la marge brute et du ratio coût-bénéfice a révélé, compte tenu surtout des prix actuels des produits laitiers, que l'ensilage du manioc et son utilisation, constituent une entreprise viable.

Research highlights

Project A: Preserving and enhancing germplasm and agrobiodiversity

Project A produces deliverables for the other agroecological projects of IITA. The main activities are collecting, characterizing, and disseminating germplasm, developing cultivars with broad-based and special quality traits, using biotechnology as a tool for germplasm conservation and crop improvement, training national researchers, and supporting NARS activities in sub-Saharan Africa.

Highlights

- The inventory of seed, field, and in-vitro stores of the IITA Genebank was completed.
  A new Germplasm Health Unit was established. The virus indexing facility for virus testing was commissioned.
- The genetic diversity of a random subset of 500 accessions of cassava from the germplasm collection at CIAT, IITA, and EMBRAPA (Brazil) was assessed with SSR markers.
- The genetic diversity of 13 strains of *Xanthomonas axonopodis* pv. *manihotis* and two reference strains was assessed with AFLP and RAPD markers.
- IITA's cassava breeding genepool was enhanced by acquiring clones from CIAT and South Africa for high starch content and good eating quality, to target whitefly resistance, and for adaptation to the lowland, humid savanna, and midaltitude agroecologies.
- Local cassava landraces in Tanzania are being evaluated for resistance to cassava brown streak disease (CBSD). Mikocheni Agricultural Research Institute in Tanzania is undertaking a diversity assessment of CBSD-resistant germplasm
- One potential approach to the control of *Striga* is seed treatment with low doses of herbicides. Since herbicides that inhibit acetolactate synthase activity are phytotoxic to both *Striga* and the host, we have introduced an Imazapur resistance gene into *Striga*-resistant maize lines adapted to the savannas.
- A kernel screening assay identified promising lines of maize with significantly less aflatoxin than the recurrent parent.
- Genetically controlled embryo lethality has been identified as a constraint to cross-hybridization in plantain germplasm.
- The construct pC-BB4 was used to transform *Musa* accessions for resistance to *Banana streak virus*.
- A nationwide food consumption and nutrition survey was conducted in Nigeria between 2001 and 2003 to assess deficiencies in vitamin A and E and micronutrients (zinc and iron) and to obtain information on

Repères de la recherche à l'IITA

Projet A: Conservation et valorisation du matériel végétal et de l'agrobiodiversité

Le Projet A alimente les autres projets à vocation agroécologique de l'IITA. Il porte essentiellement sur la collecte, la caractérisation et la diffusion du matériel végétal, la création de cultivars à base large et à caractères qualitatifs spéciaux. Il se sert de la biotechnologie pour la conservation et l'amélioration des cultures, la formation des chercheurs nationaux, et le soutien aux activités des SNRA en Afrique subsaharienne.

Points de la recherche

- L'inventaire de la banque de gènes de l'IITA comprenant du matériel conservé sous forme de semences, en plein champ et *in-vitro*, a été réalisé.
  Une nouvelle unité de matériel végétal a été crée. L'équipement d'indexage viral a été inauguré.
  La diversité génétique d'un sous-ensemble aléatoire de 500 obtentions de manioc issues de la collection du CIAT, de l'IITA et de l'EMBRAPA (Brésil) a été évaluée à l'aide de marqueurs SSR.
  La diversité génétique de 13 souches de *Xanthomonas axonopodis* pv. *manihotis* et de deux souches de référence a été appréciée au moyen de marqueurs AFLP et RAPD.
- Le patrimoine génétique de manioc de l'IITA a été enrichi par des clones obtenus du CIAT et de l'Afrique du Sud pour la création de variétés à forte teneur d'amidon, à bonne qualité gustative, résistantes à la mouche blanche et adaptées aux agroécologies de bas-fonds, de savane humide et de moyenne altitude.
  Des variétés locales de manioc sont en cours d'évaluation en Tanzanie pour la résistance à la striure brune du manioc (CBSD). L'Institut de recherche agricole de Mikocheni en Tanzanie entreprend une évaluation de la diversité du matériel végétal résistant à la CBSD.
- Une méthode potentielle de lutte contre le *Striga* consiste au traitement des semences à l'aide de doses réduites d'herbicides. Les herbicides qui inhibent l'activité de synthèse de l'acétolactate étant phytotoxiques aussi bien pour le *Striga* que pour son hôte, nous avons introduit un gène de résistance à l'Imazapur dans des lignées de maïs résistantes au *Striga* et adaptées aux zones de savane.
  Dans le cadre d'un essai d'évaluation de graines, des lignées prometteuses de maïs ont été identifiées avec beaucoup moins d'aflatoxine que leurs parents récurrents.
- La létalité de l'embryon, sous contrôle génétique, a été identifiée comme une contrainte au métissage du matériel végétal de plantain.
  Le produit de synthèse pC-BB4 a été utilisé pour transformer des obtentions de *Musa* en vue de la résistance au *Virus de la striure du bananier*.
- Une enquête Consommation des aliments et nutrition couvrant l'ensemble du territoire nigérian a été effectuée entre 2001 et 2003 afin d'apprécier les carences en vitamine A et E et en oligo-éléments (zinc et fer) et de collecter des informations sur la nutrition et le régime alimentaire, surtout auprès des ménages ayant des enfants de moins de cinq ans. Les résultats ont été publiés en 2004 dans le rapport intitulé « Nigéria Food Consumption and Nutrition Survey » (Enquête consommation des aliments et nutrition au Nigéria).
  Les caractéristiques de la qualité alimentaire ont été évaluées chez le maïs, l'igname et le niébé. 108 lignées pures à endosperme jaune ont été expérimentées pour la teneur en caroténoïde; 19 génotypes

nutrition and diets, particularly in households with children under 5 years of age. Results were published in 2004 in the ''Nigeria Food Consumption and Nutrition Survey''.
Food quality traits were assessed in maize, yam, and cowpea; 108 yellow endosperm maize inbred lines were assayed for carotenoid content; 19 genotypes of *Dioscorea alata* and 30 of *D. rotundata* were screened for iron and zinc content in the tubers. Seventy-three accessions of *D. cayenensis* were screened for beta-carotene content. Fifty advanced cowpea breeding lines and selected local varieties were screened for iron, zinc, calcium, and lutein contents.

- Various partners received 6551 yam, 2149 cassava, and 990 banana/plantain accessions. Twenty-two maize inbred lines with better resistance to gray leaf spot and highland leaf blight and 17 *Striga*-resistant lines were distributed to 13 countries in West and Central Africa. Over 50 cowpea lines with multiple resistance to diseases and pests as well as drought and heat tolerance were distributed to over 100 collaborators in 25 countries. The National Agricultural Research Organization released two IITA-bred cowpea varieties as CP-2 and CP-3 for general cultivation in Uganda.
- IITA hosted the following training workshops: West and Central Africa Maize Network (WECAMAN) held a regional laboratory training workshop on tryptophan analysis in Ibadan, October 2004, jointly with CIMMYT. Genetic Resources Network for West and Central Africa (GRENEWECA) had a workshop on Plant Genetic Resources in West and Central Africa in April 2004. Under the auspices of the Sustainable Tree Crops Program, IITA held a regional workshop on Cocoa breeding and multiplication in July 2004 in Ibadan, and initiated and cohosted the first Cassava Biotechnology Consortium of Biosciences Eastern and Central Africa (BECA) from 29 September to 31 October 2004.
- An "Inventory of Agricultural Biotechnology for Southern Africa" has been compiled and published.
- Tissue culture laboratories were established in Mozambique and Malawi to provide clean planting material of IITA's mandate crops.

Project B: Developing plant health management options

This project aims to improve the food security and well-being of rural and urban Africans by providing farmers with environmentally sound options for pest, disease, and weed management. Its guiding principles are ecological stability and agricultural productivity. It develops and delivers plant health management options, primarily in the area of host-plant resistance, biological control including biopesticides, and habitat management.

Highlights

- Two tephritid fruit fly species (*Dacus punctatifrons* and *D. bivittatus*) were found in Cameroon and *D. punctatifrons* in Bioko in Equatorial Guinea, causing widespread infestations and substantial crop losses in tomato. Three species, *Dacus bivittatus* and *D. ciliatus* (both native to Africa) and the highly destructive Asian species *Bactrocera cucurbitae,* were found infesting cucurbit crops in Bénin.
- The entomopathogenic fungi *Metarhizium anisopliae* and *Beauveria bassiana* were isolated from the African root and tuber scale (ARTS) in Cameroon, with infections ranging from 0.8% to 9.4%. This is the first record of *M. anisopliae* on a subterranean scale insect.
- The IITA insect reference collection has now over 210 000 preserved specimens. Responding to recent research focus at IITA-Bénin, a new capacity in fruit fly pest and scale insect identification was created.
- In Kaduna State, Nigeria, the mean concentration of the mycotoxin fumonisin B1 was 0.4 mg/kg (range: 0 to 3.7 mg/kg) in samples of good quality maize and 31.5 mg/kg (range: 0 to 112 mg/kg) in poor quality maize. The extent of fumonisin contamination cannot be judged from the visual appearance of grain.
- Several cotton lines/varieties induced, in vitro, 70–85% germination of the parasitic weed *Striga hermonthica* seeds from three populations (Mokwa, Zaria, and Kano), compared to the best lines/varieties of cowpea, soybean, groundnut, sesame, and pigeon pea.

de *Dioscorea alata* et 30 de *D. rotundata* ont été évalués pour la teneur en fer et en zinc des tubercules. Soixante-treize obtentions de *D. cayenensis* ont été évaluées pour la teneur en bêta-carotène. Cinquante lignées avancées de niébé et quelques variétés locales ont été évaluées pour leur teneur en fer, zinc, calcium et lutéine.

- Divers partenaires ont reçu 6551 obtentions d'igname, 2149 obtentions de manioc et 990 obtentions de banane/plantain. Vingt-deux lignées endogames dotées d'une meilleure résistance à la tache foliaire grise et à la brûlure foliaire des hautes terres (highland leaf blight) et 17 lignées résistantes au *Striga* ont été distribuées dans 13 pays en Afrique occidentale et centrale. Plus de 50 lignées de niébé incorporant la résistance multiple aux maladies et aux ravageurs et la tolérance à la sécheresse et à la chaleur ont été distribuées à plus de 100 collaborateurs dans 25 pays.
  L'organisme national de recherche agricole a vulgarisé, sous les noms de CP-2 et CP-3, deux variétés de niébé créées à l'IITA, pour culture généralisée en Ouganda.
- L'IITA a abrité des ateliers de formation: le Réseau de recherche sur le maïs de l'Afrique occidentale et centrale (WECAMAN), conjointement avec le CIMMYT, y a organisé un atelier régional de formation en laboratoire sur le dosage du tryptophan, en octobre 2004 à Ibadan. En avril 2004, le Réseau des ressources génétiques pour l'Afrique occidentale et centrale (GRENEWECA) y a organisé un atelier sur les ressources phytogénétiques. Sous les auspices du «Sustainable Tree Crops Program» (Programme sur les cultures arborées durables), l'IITA a tenu, en juillet 2004 à Ibadan, un atelier régional sur la sélection et la multiplication du cacaoyer. En outre, il a initié et co-organisé le premier Consortium sur la biotechnologie du manioc de Biosciences Eastern and Central Africa (BECA), du 29 septembre au 31 octobre 2004.
- Un inventaire de la biotechnologie agricole pour l'Afrique australe a été compilé et publié.
- Des laboratoires de culture des tissus ont été établis au Mozambique et au Malawi afin de fournir du matériel de plantation indemne des cultures faisant l'objet de recherche à l'IITA.

Projet B: Mise au point d'options de gestion de la santé végétale

Ce projet vise à renforcer la sécurité alimentaire et accroître le bien-être des habitants des villes et campagnes africaines en dotant les agriculteurs d'options respectueuses de l'environnement pour la lutte contre les ravageurs, maladies et adventices. Il s'inspire de deux principes clefs: stabilité écologique et productivité agricole. Il constitue un cadre pour l'élaboration et la mise à disposition d'alternatives de gestion de la santé végétale, notamment la résistance de la plante hôte, la lutte biologique, y compris les biopesticides et la gestion de l'habitat.

Points de la recherche

- Deux espèces de mouches de fruits tephritidés (*Dacus punctatifrons* et *D. bivittatus*) découvertes au Cameroun et une autre espèce, *D. punctatifrons*, trouvée à Bioko en Guinée Equatoriale seraient à l'origine d'infestations et de pertes considérables chez la tomate. Deux espèces, *Dacus bivittatus* et *D. ciliatus*, originaires de l'Afrique, et l'espèce asiatique très destructive, *Bactrocera cucurbitae*, ont été rencontrées sur des cucurbitacées au Bénin.
  Les champignons entomopathogènes *Metarhizium anisopliae* et *Beauveria bassiana* ont été isolés de la cochenille africaine des plantes à racines et tubercules (ARTS) au Cameroun, avec des taux d'infection allant de 0,8% à 9,4%. C'est la première fois que *M. anisopliae* fut noté sur une cochenille souterraine. La collection d'insectes de référence de l'IITA renferme à présent plus de 210 000 spécimens. Suite au regain d'attention pour la recherche à la station de l'IITA-Bénin, une nouvelle capacité a été mise en place en vue d'identifier les insectes nuisibles et la cochenille de la mouche des fruits.
  Dans l'Etat de Kaduna (Nigeria), la concentration moyenne de fumonisine de la mycotoxine B1 s'élevait à 0,4 mg/kg (0 à 3,7 mg/kg) dans des échantillons de maïs de bonne qualité et 31,5 mg/kg (0 à 112 mg/kg) dans du maïs de mauvaise qualité. La relation entre la décoloration de la graine et la teneur en fumonisine

- In Uganda, the most prevalent nematode species occurring on yam is *Pratylenchus sudanensis,* followed by *Meloidogyne* spp. Galled tubers lost more weight during storage than tubers without galls. *Dioscorea rotundata* was more susceptible to *Meloidogyne* spp. than *D. alata* or *D. cayenensis.*
- Lettuce and the leafy vegetable *Solanum* sp.(*gboma*) were artificially infested with 3000 juvenile root-knot nematodes (*Meloidogyne* spp.) per pot in previously sterilized soil. The application of airdried cassava and orange peels (each at 50 g and 15 g per pot) and the fungal pathogen *Peacilomyces lilacinus* (at 0.5 g and 1 g per pot) substantially reduced the severity of damage to roots.
- A trial with the biopesticide Green Muscle® in Niger assessed whether a further reduction in dose to 12.5 g/ha was possible. A trial in Senegal investigated the effect of mixing a low dose of pyrethroid with Green Muscle®. The present upsurge of locusts in West Africa has created a lot of interest in Green Muscle® and may possibly lead to financial support to solve the last outstanding problems concerning its market uptake.
- Polyclonal antisera against the isolates of CMV from *Dioscorea* sp., *Musa* sp., and pepper have been produced using purified virus preparations. Two new high titer polyclonal antisera against ACMV have also been produced. A polyclonal antiserum against *Nosema locustae* has been developed and standardized. The molecular diagnostic protocols for diagnosis of yam viruses were successfully established and validated.
- A laboratory manual for plant virus diagnostics has been completed.
- Seventy-three officers and inspectors of national plant protection organizations were trained to reinforce capacities and structures in phytosanitary measures, inspection protocols, and seed health testing procedures and methods in Nigeria and Gabon. Plant virus diagnostics were demonstrated to 28 officers of the Nigerian Plant Quarantine Service, to two collaborators (from Nigeria and Senegal) and to four trainees from Mozambique.

Project C: Supporting innovation processes

IITA is committed to creating new knowledge and technologies that are widely applied and directly relevant to the needs and livelihoods of rural Africans. Researchers need first to understand the social, economic, and policy context in which innovations are adopted or rejected, succeed or fail. Within IITA, the project is also responsible for developing and applying methods for setting research priorities, and for assessing the impact of the Institute's research.

Beyond IITA, the project works with national agricultural research and extension systems to strengthen their capacity for impact, policy, and systems analysis.

Highlights

- An assessment of the prices of fresh yam tubers in West Africa revealed differences across species and varieties due to end-use qualities and food value attributes. The study identifies opportunities for farmers to use cultivar selection, planting, harvesting, and marketing decisions to increase their farm revenues.
- Aflatoxin in maize imposes serious threats to public health and is subject to trade restrictions that impede African exports. Poor storage conditions and insect attacks are correlated with the incidence of aflatoxin in maize. The adoption of the synthetic insecticide Sofagrain to treat stored maize in central and northern Bénin was assessed. Farmers with more commercialized production were more likely to use Sofagrain.
- A gender study in the agricultural systems of the Niger Delta has revealed a less rigid division between male and female roles for traditional crops, such as yams (in the past, male responsibilities) and cassava (female responsibilities), where men and women are now cultivating both crops. This societal change is increasing economic opportunities for women. Labor demands and access to resources still limit women's participation in commercialized farming.
- A detailed food consumption and nutrition survey of 6000 Nigerian households was conducted. An index of food insecurity at the household level was defined and used in a Tobit regression model that

était insignifiante. On en déduit que l'ampleur de la contamination par la fumonisine ne peut être appréciée sur la base de l'apparence visuelle de la graine.

Plusieurs lignées/variétés de coton ont provoqué en culture *in vitro*, 70 à 85% de germination sur des graines du phanérogame parasite *Striga hermonthica* prélevées sur trois populations (Mokwa, Zaria, et Kano), par rapport aux meilleures lignées/variétés de niébé, de soja, d'arachide, de sésame et de pois d'Angol.

- L'espèce de nématode la plus couramment rencontrée sur l'igname en Ouganda est *Pratylenchus sudanensis*, suivie de *Meloidogyne* spp.

  Les tubercules atteints de galles ont aussi perdu plus de poids que les tubercules exempts de galles. *Dioscorea rotundata* s'est montrée plus sensible au *Meloidogyne* spp. que *D. alata* ou *D. cayenensis*.

  La laitue et le légume à feuille *Solanum* sp.(*gboma*) ont été artificiellement infestés à raison de 3000 nématodes à galles juvéniles (*Meloidogyne* spp.) par pot dans un sol préalablement stérilisé. L'application de peaux de manioc et d'orange séchées à l'air (soit respectivement 50 g et 15 g par pot), et du pathogène cryptogame *Peacilomyces lilacinus* (0,5g et 1g par pot) a considérablement atténué la gravité des dégâts aux racines.
- Un essai conduit au Niger sur le biopesticide Green Muscle® a tenté de déterminer si une réduction accrue de la dose à 12,5 g/ha était possible. Dans le cadre d'un autre essai mené au Sénégal, l'effet du mélange d'une faible dose de pyréthrinoïde avec le Green Muscle® a été étudié. Le péril actuel du criquet pèlerin en Afrique de l'Ouest a suscité un vif intérêt face au Green Muscle®, ce qui pourrait générer un appui financier en faveur des solutions aux problèmes qui empêchent encore son succès commercial.
- Des antisérums polyclonaux contre des isolats de CMV prélevés sur *Dioscorea* sp., *Musa* sp. et le piment ont été produits à l'aide de préparations virales purifiées. Deux nouveaux antisérums polyclonaux de titre élevé ont été également produits contre l'ACMV. Un antisérum polyclonal contre *Nosema locustae* a été élaboré et normalisé. Les protocoles de diagnostic moléculaire des virus de l'igname ont été établis avec succès et validés.

  Un manuel de laboratoire sur la détection des virus végétaux a été réalisé. Afin de renforcer les capacités et structures, soixante-treize responsables et inspecteurs d'organismes nationaux de protection des végétaux ont été formés au Nigéria et au Gabon dans divers domaines : mesures phytosanitaires, protocoles de contrôle, et procédures et méthodes pour apprécier l'état des graines. Des séances de démonstration ont été organisées sur le diagnostic des virus végétaux à l'intention de 28 responsables du Service de la quarantaine phytosanitaire du Nigéria, de deux collaborateurs (du Nigéria et du Sénégal) et de quatre stagiaires mozambicains.

Projet C: Appui aux processus novateurs

L'IITA s'engage à créer de nouvelles connaissances et technologies applicables à grande échelle et directement adaptées aux besoins et aux moyens d'existence des habitants des campagnes africaines. Les chercheurs devront d'abord comprendre le contexte politique et socio-économique dans lequel ces innovations sont adoptées ou rejetées, réussissent ou échouent. Le projet est aussi chargé de doter l'IITA de méthodes pour l'établissement des priorités et la mesure de l'impact de la recherche effectuée par l'institut. En dehors de l'IITA, le projet travaille avec les systèmes nationaux de recherche et de vulgarisation agricoles pour renforcer leurs capacités en matière d'étude d'impact, de politique et de systèmes d'analyse.

Points de la recherche

- Une enquête sur les prix des tubercules frais en Afrique de l'Ouest a mis en exergue des différences entre les espèces et les variétés à cause de la qualité à l'utilisation finale et des caractéristiques de la valeur alimentaire. L'étude identifie les possibilités dont disposent les paysans pour des prises de décisions relatives au choix des cultivars, à la plantation et à la commercialisation afin d'accroître leurs revenus agricoles compte tenu de ces attributs.
- L'Aflatoxine sur le maïs porte gravement atteinte à la santé publique et est soumise à des restrictions commerciales qui entravent les exportations africaines. Les mauvaises conditions de stockage et les attaques d'insectes présentent une corrélation avec l'incidence de l'aflatoxine sur le maïs. L'adoption

explains food insecurity. Rural households were relatively more food insecure than those in urban areas. Households in the moist savanna agricultural zone were more food insecure than in the dry savanna and humid forest zones. Households headed by men show more food insecurity than those headed by women.

- A series of evaluations of the technical and allocative efficiency of farming households has been conducted in the various agroecological zones of Nigeria. Findings from the northern Guinea savanna, moist savanna, and humid forest zones all suggest that more effective extension services are needed to improve farm management and close the technical efficiency gaps between the more efficient producers and the less efficient.
- A study of the impact of eliminating OECD wheat and rice subsidies estimated short-run annual foreign exchange savings for Mali (US$1.5 million) Bénin (US$ 2.7 million), Nigeria (US$80 million), and Senegal (US$81 million).

Project D: Eastern and Southern Africa agricultural food systems

Project D has an immense ecozone and geographical spread. Our activities represent all scientific disciplines and IITA mandate commodities. Special projects predominate in Project D with about 80% of scientists' time being devoted to their implementation. Some projects have primarily a developmental focus; others tend more to research. Project D depends heavily on partnerships to achieve its objectives.

Highlights

- Some 960 improved cassava clones were field maintained under germplasm conservation at Serere and 700 at Namulonge (Uganda). Biotic data were collected. One hundred and forty half sib crosses with 3000 plants were evaluated for biotic stresses and cloned for further evaluation; 490 and 269 clones under performance I and II trials were evaluated and advanced; 48 genotypes were introduced to Ethiopia as tissue forms (580 plantlets); 196 clones were introduced to Burundi through the open quarantine system. Improved resistant varieties produce twice the yield of local varieties.
- Pilot centers for production of high quality unfermented cassava flour for the bread and biscuit baking industry were established with national partners in Tanzania and Madagascar. The potential uses of cassava were publicized in daily newspaper articles in Tanzania and Madagascar, and also in one-on-one meetings with Special Advisers to the President, the Minister of Agriculture, and the Prime Minister of Tanzania. IITA backstopped the Tanzania Bureau of Standards on drafting cassava flour and starch standards.
- IITA/SARRNET conducted demonstration trials with various industries on use of cassava flour and starch. Farmers have been mobilized into groups for collective processing and marketing as the demand for flour in Malawi alone at 20% substitution at present is 6700 t/year. Two starch processing plants and several pilot processing sites for cassava flour have been established in Malawi and Tanzania. The cassava silage technology increases milk yield by over 60%. Use has spread from Malawi to Tanzania and Zambia.
- Through the cassava project organized by Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance (ACDI/VOCA), 1245 beneficiary farmers from northern and western Uganda planted 300 ha of improved cassava varieties for multiplication purposes.
- The burrowing nematode, *Radopholus similis*, is the most destructive species on East African highland bananas in Uganda. Host plant resistance appears an effective way to reduce yield losses at low cost for farmers. The *Musa* breeding program aims at developing improved genotypes with resistance to nematodes. To date, five secondary triploids with resistance and seven with partial resistance to *R. similis* have been identified.
- FoodNet (the marketing and postharvest network) conducted 24 trainings in six districts with the National Agricultural Advisory Services of Uganda. FoodNet with national and international development partners developed and launched a manual on collective marketing for small-scale farmers.

de l'insecticide synthétique Sofagrain pour le traitement du maïs entreposé dans le centre et le nord du Bénin a été évaluée. Les plus gros exploitants agricoles sont plus enclins à utiliser le Sofagrain.

- Une étude sexospécifique portant sur les systèmes agraires du delta du Niger a révélé une division moins tranchée entre les hommes et les femmes quant à leurs rôles dans la culture de spéculations traditionnelles telles que l'igname (autrefois culture masculine) et le manioc (culture féminine). Les deux sont actuellement cultivées aussi bien par les hommes que par les femmes. Cette transformation sociale offre plus d'opportunités économiques aux femmes. Les demandes de main-d'oeuvre et l'accès aux ressources limitent encore la participation des femmes à l'agriculture commerciale.
- Une enquête sur la consommation des aliments et la nutrition couvrant 6000 ménages a été effectuée au Nigéria. L'indice de l'insécurité alimentaire dans le ménage a été calculé et employé dans un modèle de régression Tobit qui explique l'insécurité alimentaire. Les ménages ruraux étaient relativement plus touchés par l'insécurité alimentaire que les ménages urbains, et que les ménages en zone agricole de savane humide souffraient davantage d'insécurité alimentaire que les ménages établis en savane sèche et dans les zones de forêt humide. Les ménages dirigés par des hommes étaient caractérisés par une plus grande insécurité alimentaire que ceux dirigés par des femmes.
- Une série d'évaluations de l'efficacité technique et distributive des ménages agricoles a été entreprise dans les diverses zones agro-écologiques du Nigéria. Les résultats obtenus en savane nord-guinéenne, en savane humide et en zones de forêt humide indiquent tous que des services de vulgarisation plus efficaces sont requis afin d'améliorer la gestion des périmètres agricoles et de combler le fossé d'efficacité technique entre les producteurs les plus efficaces et les moins efficaces.
- Une étude portant sur l'effet de la suppression des subventions accordées au blé et au riz dans l'espace OCDE a permis d'estimer les économies annuelles en devises réalisables à court terme par le Mali (1,5 million $US), le Bénin (2,7 millions $US), le Nigéria (80 millions $US), et le Sénégal (81 millions $US).

Projet D: Systèmes agro-alimentaires de l'Afrique orientale et australe, couvre une vaste écozone et surface géographique

Nos activités y sont dictées par les disciplines scientifiques et les produits agricoles relevant du mandat de l'IITA. Le Projet D est dominé par des projets spéciaux auxquels les chercheurs consacrent environ 80% de leur temps. Certains projets s'occupent essentiellement des questions de développement. D'autres, en revanche, sont plutôt axés sur la recherche.

Points de la recherche

- Environ 960 clones améliorés de manioc ont été conservés en plein champ à Serere et 700 à Namulonge (Ouganda). Des données biotiques ont été collectées. Cent quarante hybrides demi-sœurs et 3000 plants ont été évalués pour le stress biotique et clonés pour une évaluation plus poussée. 490 et 269 clones sous essais de comportement I et II ont été évalués et avancés. 48 génotypes ont été introduits en Ethiopie sous forme de tissus (580 plantules). 196 clones ont été introduits au Burundi par voie de quarantaine ouverte. Les variétés améliorées résistantes ont produit le double du rendement des variétés locales.
- Des centres pilotes de production de farine de manioc non fermentée de qualité supérieure, destinée aux boulangeries et biscuiteries, ont été créés ensemble avec des partenaires nationaux en Tanzanie et à Madagascar. Les utilisations potentielles ont fait l'objet d'articles publiés dans les quotidiens en Tanzanie et à Madagascar, et d'entretiens avec les conseillers spéciaux du Président, du Ministre de l'Agriculture, et du Premier Ministre de la Tanzanie. En outre, l'IITA a aidé le Bureau de normalisation de la Tanzanie à élaborer des normes pour la farine et l'amidon de manioc.
- L'IITA/SARRNET a mené des essais de démonstration avec différentes industries sur l'utilisation de la farine et de l'amidon de manioc. Des paysans ont été mobilisés en groupes pour la conduite collective d'activités de transformation et de commercialisation. En effet, la demande de farine seulement au Malawi, pour une substitution de 20%, s'élève actuellement à 6700 t/an. Deux usines de fabrication d'amidon et plusieurs

- The Southern Africa Rural Livelihoods project employed a market-led enterprise development strategy to encourage diversified rural economy, enable trade and policy reforms, enhance regional commodity and income flows, strengthen food security, exploit new market options, and improve access to information and innovation services. Pilot production and processing sites for high quality cassava flour and chips were established. Partnership between the Donald Danforth Plant Science Center (DDPSC) and Malawi NARS led to a draft application for introducing transgenic cassava to test the biosafety regulatory system in Malawi.
- In collaboration with 125 partners in 98 districts of Mozambique, IITA-led inititatives established 103.5 ha of sweetpotato and 267 ha of cassava, distributed planting materials to 355 971 families, and established and harvested 61 research trials, including 18 on-farm. Two hundred technicians were trained in product development, multiplication, and breeding. Eight students completed their thesis work. The project collected yield data in 1200 fields in six provinces and carried out an impact study involving 1269 farmers.

Project E: Enhancing livelihoods in the humid and subhumid zones of West and Central Africa through profitable and sustainable intensification of diverse agricultural systems

The landscape in the humid and subhumid zones of West and Central Africa is a mosaic of agricultural land use and forest fragments. Agriculture is dominated by traditional mixed cropping patterns. The main features are starchy crops (plantain, cassava, yam) and tree crops (cocoa, oil-palm). Nearer to urban settlements, vegetable crops and livestock become important. Project E aims to maintain and optimize the ecological and socioeconomic functions of this mosaic.

Highlights

- Fallow age definitely influences plantain yields but it is unclear how yield responses relate to soil chemical properties. Nutrient exports in cassava, maize, and groundnut intercropping systems and some non-traditional leguminous crops are minor for calcium and magnesium and greater for phosphorus, nitrogen, and potassium in southern Cameroon.
- Varietal mixtures enhanced the performance of plantain varieties in hot spots of black sigatoka disease, on-farm in Nigeria. Intercropping maize with legumes or cassava reduces stem borer infestations and increases maize yield in southern Cameroon.
- Five IITA-derived clones of yam (*Dioscorea alata*) were tested in variety release trials in Nigeria; five other lines were certified for international distribution. Six improved cassava clones resistant to the cassava mosaic disease have been recommended for release to farmers in DRC. The rehabilitated tissue culture laboratory at Mvuazi, DRC, provided over 7000 plantlets of five improved varieties in addition to the 13 750 plantlets introduced from IITA-Ibadan for expanded on-farm trials.
- Integrating food legumes into maize systems in southern Cameroon maintained maize yields and provided additional benefits through food legume grain yields. Collaborative trials with NARES in Bénin, Togo, and Ghana demonstrated that inorganic fertilizers and legume rotations suppress nematodes and improve yam yields but may increase postharvest storage losses.
- Surveys in Nigeria assessed private sector opportunities and constraints and mapped marketing channels for cassava products to support the development of the cassava industry. Inventories of processing technologies and standards for cassava products were completed. Training was provided in novel processing technologies in collaboration with Nigerian partner NARS. The production and use of high quality unfermented cassava flour is promoted in DRC.
- In Côte d'Ivoire, seven cooperatives were included in an MIS initiative linking them to world markets and quality control systems, resulting in increases in sale prices of between 10 and 15%. In Ghana, efforts commenced to set up a geographic information system (GIS) referenced cocoa production database system.

sites pilotes de fabrication de farine ont été établis au Malawi et en Tanzanie. La technologie d'ensilage du manioc a augmenté la production de lait de plus de 60%. L'utilisation s'est répandue du Malawi jusqu'en Tanzanie et en Zambie.

- Grâce au projet Manioc-ACDI/VOCA (Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance), 1245 agriculteurs du nord et de l'ouest de l'Ouganda ont planté 300 ha de variétés améliorées de manioc aux fins de la multiplication.
- Le nématode *Radopholus similis*, est l'espèce la plus dévastatrice des bananes des hauts plateaux de l'Afrique de l'Est en Ouganda. La résistance de la plante hôte apparaît comme un moyen efficace pour réduire les pertes de rendement à moindre coût pour les paysans. Le programme de sélection de *Musa* vise à développer des génotypes améliorés incorporant la résistance aux nématodes.
- FoodNet (le réseau de commercialisation et des systèmes post-récolte) a organisé 24 cours de formation dans six districts en collaboration avec le National Agricultural Advisory Services (Services nationaux de conseil agricole) de l'Ouganda. FoodNet, ensemble avec les partenaires au développement nationaux et internationaux, a élaboré et lancé un manuel sur la commercialisation collective à l'intention des petits exploitants agricoles.
- Le Projet sur les moyens d'existence en zone rurale de l'Afrique australe a utilisé une stratégie de développement des entreprises axée sur le marché pour encourager la diversification de l'économie rurale, favoriser des reformes politiques et commerciales, accroître le flux des produits et des revenus à l'échelle régionale, renforcer la sécurité alimentaire, explorer de nouveaux débouchés et améliorer l'accès aux services d'information et aux innovations. Des sites pilotes de production et de transformation de farine et de cossettes de manioc de qualité supérieure ont été établis. Grâce au partenariat entre le Donald Danforth Plant Science Center (DDPSC) et le SNRA du Malawi, un projet de demande a été élaboré pour l'introduction du manioc transgénique dans le but de tester le système de réglementation de la biosécurité au Malawi.
- En collaboration avec 125 partenaires dans 98 districts au Mozambique, des initiatives dirigées par l'IITA ont permis d'établir 103,5 ha de patate douce et 267 ha de manioc, puis distribuer du matériel de plantation à 355 971 familles. 61 parcelles expérimentales, dont 18 essais en milieu paysan, ont été établies et récoltées. Deux cent techniciens ont été formés en élaboration des produits, en multiplication et en sélection. Huit étudiants ont achevé leur thèse de recherche. Le projet a collecté des données sur le rendement dans 1200 champs, dans six provinces, et a réalisé une étude d'impact impliquant 1269 cultivateurs.

Projet E: Améliorer les moyens d'existence dans les zones humides et subhumides de l'Afrique occidentale et centrale grâce à l'intensification rentable et pérenne de divers systèmes agraires

Le paysage offert par les zones humides et subhumides de l'Afrique occidentale et centrale est une mosaïque de modes d'utilisation des terres et de fragments forestiers. L'agriculture y est dominée par les mélanges culturels traditionnels. On y trouve principalement des féculents (plantain, manioc, igname) et des ligneux (cacao, palmier à huile). Près des établissements urbains, la culture maraîchère et l'élevage occupent une place importante dans les systèmes de production. Le Projet E vise à maintenir et à optimaliser les fonctions écologiques et socio-économiques d'une telle mosaïque.

Points de la recherche

- La durée de la jachère a une influence certaine sur les rendements du plantain mais un lien clair n'est pas établi entre le rendement et les propriétés chimiques du sol. Les exportations d'éléments nutritifs dans les systèmes de cultures associées du manioc, du maïs et d'arachide et sur certaines cultures légumineuses non traditionnelles sont insignifiantes pour le calcium et le magnésium et plus élevées pour le phosphore, l'azote et le potassium dans le sud du Cameroun.
- Des mélanges variétaux ont amélioré le comportement des variétés de plantain dans des points chauds de la cercosporiose noire en milieu réel au Nigéria. Le maïs, cultivé en association avec les légumineuses ou le manioc, réduit les attaques de foreuses de tiges et augmente le rendement du maïs dans le sud du Cameroun.

The organizational capacity and marketing power of cocoa farmer cooperatives was strengthened in Ondo State in Nigeria. A union of cooperatives was created in Côte d'Ivoire, increasing sales by 2–10%. In Nigeria 33 cooperatives with 3050 members formed a union registered with the Ondo State Department of Cooperatives. Farmers' Field Schools (FFS), designed to improve the performance of cocoa farmers, reached nearly 4000 farmers in Ghana, Nigeria, Guinea, and Côte d'Ivoire.

- Training in efficient plantain and banana plant propagation methods was provided to about 125 farmers in Cameroon and more than 740 farmers in Nigeria, to deliver improved hybrids and promote healthy production methods.
- Degree-oriented training continued in 2004 with the completion of at least five student theses.

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

The savannas of West and Central Africa have a high potential for crop and livestock production. Yields, however, are limited by constraints such as soil erosion, poor soil fertility, low soil organic matter, insect pests and diseases, weed infestation, drought, overgrazing, lack of livestock feed, lack of better production and postharvest techniques, poor markets, unfriendly policies, and low adoption of improved technologies. In partnership with multiple stakeholders (farmers, consumers, the commercial sector, NGOs, NARES, and advanced research institutes) Project F is helping to solve these problems.

Highlights

- A diffusion, adoption, and impact study of new extra-early maize varieties in the Sudan savanna of Nigeria was completed on a sample of 220 farm households and their 363 children aged 5 years and below. Children from adopters' households were nutritionally better off than those from households that did not adopt. Other benefits were the acquisition of material items and assets, improved household food supply, and higher cash income. However, the adoption rate was found to be low (14%). Scarcity of seed, lack or high cost of fertilizer, and little farmer-to-farmer seed exchange were among factors constraining the spread of the technology. More involvement by men in growing the new varieties, more contact with extension services, earliness of the varieties, and low labor : land ratios could all stimulate adoption.
- Two herbicides (Scepter® and Stomp®) for weed control in cowpea reduced spore populations of vesicular-arbuscular mycorrhiza (VAM) and suppressed VAM colonization. Scepter® had the greater effect. This has implications for P uptake. The percentage of nitrogen derived from biological nitrogen fixation ranged from 59 to 81% and was similar across all herbicide rates.
- A diversity analysis of 41 *Striga*-resistant maize inbred lines from four source populations using AFLP and SSR markers revealed considerable levels of genetic diversity among the lines. Lines selected from two germplasm sources were evaluated in hybrid combinations under *Striga* infestation at two locations in Nigeria. Results showed that most of the crosses with two resistant parental lines produced hybrids that combined desirable plant and ear characters and higher grain yields with less *Striga* damage and fewer emerged *Striga* plants than most susceptible × resistant crosses. Also, open-pollinated varieties and synthetics of varying maturity formed from *Striga*-resistant maize inbred lines or families derived from improved cycles of selections of the diverse source populations supported reduced numbers of emerged *Striga* plants and produced higher yields.
- Fifty cowpea lines were screened for iron, zinc, calcium, and lutein. A diversity analysis of 41 *Striga*-resistant maize inbred lines from four source populations using AFLP and SSR markers revealed considerable level of genetic diversity among the lines. The values ranged between 545 and 1300 ppm for calcium, from 48 to 79 ppm for iron, from 23 to 48 ppm for zinc, and from 0 to 69 ppm for lutein. Two soybean lines, UG 5 and TGx 1805-31F, were found resistant to soybean rust. The F2 population between them has given transgressive segregation for higher levels of resistance.

- Cinq clones d'igname obtenus de l'IITA (*Dioscorea alata*) ont été testés dans le cadre d'essais variétaux au Nigéria ; cinq autres lignées ont été certifiées pour distribution à l'échelle internationale. Six clones de manioc améliorés résistants à la mosaïque du manioc ont été proposés pour vulgarisation auprès des paysans de la RDC. Le laboratoire de culture des tissus réhabilité de Mvuazi en RDC, a fournit plus de 7000 plantules de cinq variétés améliorées en plus des 13.750 plantules introduites à partir de l'IITA-Ibadan pour des essais élargis en milieu réel.
- L'intégration des légumineuses alimentaires dans des systèmes à base de maïs du sud du Cameroun a permis de maintenir les rendements maïsicoles et de générer des avantages supplémentaires sous forme de rendements en graines de légumineuses vivrières. Des essais menés en collaboration avec les SNRVA du Bénin, du Togo et du Ghana ont démontré que les engrais inorganiques et les rotations de légumineuses éliminent les nématodes et améliorent les rendements d'igname, mais peuvent aussi accroître les pertes de stockage post-récolte.
- Des enquêtes effectuées au Nigéria ont permis d'évaluer les contraintes et opportunités au niveau du secteur privé, et de dégager des circuits de commercialisation pour les dérivés de manioc, afin de promouvoir le développement de l'industrie du manioc. Des inventaires des technologies et normes de transformation des produits de manioc ont été réalisés. Une formation sur les nouvelles technologies de transformation a été organisée en collaboration avec les SNRA partenaires du Nigéria. La production et l'utilisation de la farine de manioc non fermentée de qualité supérieure sont promues en RDC.
- En Côte d'Ivoire, sept coopératives ont été intégrées dans une initiative MIS pour être reliées aux marchés mondiaux et aux systèmes de contrôle de la qualité, ce qui leur a permis d'obtenir des prix de vente plus élevés de 10 à 15%. Au Ghana, des efforts ont été engagés pour la mise en place d'un système d'information géographique (SIG) axé sur la base de données de la production cacaoyère.
  La capacité organisationnelle et le pouvoir marchand des coopératives de producteurs de cacao ont été renforcés dans l'Etat d'Ondo au Nigéria.
  Les champs-écoles (FFS), conçus pour améliorer la performance des producteurs de cacao, ont atteint près de 4000 paysans au Ghana, au Nigéria, en Guinée et en Côte d'Ivoire.
- Une formation sur des méthodes efficaces de multiplication du plant de plantain et de bananier a été organisée à l'intention de 125 paysans au Cameroun et plus de 740 paysans au Nigéria, afin de livrer des hybrides améliorés et de promouvoir des méthodes de production saines.
- La formation de 3è cycle s'est poursuivie en 2004 et au moins cinq étudiants ont achevé leurs thèses.

Projet F : Amélioration et intensification des systèmes associant céréales, légumineuses et élevage dans les zones de savane humide et de savane sèche de l'Afrique occidentale et centrale

En Afrique occidentale et centrale, les zones de savane regorgent d'énormes potentialités dans les domaines de l'agriculture et de l'élevage. Les rendements sont toutefois limités par des contraintes comme l'érosion, la pauvreté et la faible teneur en matière organique des sols, les insectes et les maladies, l'enherbement, la sécheresse, le surpâturage, le manque de fourrage, l'absence de meilleures techniques de production et de technologies post-récolte, des marchés mal structurés, des politiques hostiles et un bas niveau d'adoption des technologies améliorées. En partenariat avec de nombreux acteurs, (agriculteurs, consommateurs, secteur commercial, ONG, SNRVA et instituts de recherche avancés), le Projet s'emploie à lever ces contraintes. Il promeut l'utilisation de variétés culturales résistantes, de pratiques de gestion équilibrée des éléments nutritifs et de lutte intégrée contre les ravageurs, ainsi que de technologies de production et post-récolte améliorées. Il relie les agriculteurs aux meilleurs marchés et facilite le transfert des technologies à l'aide de méthodes participatives.

Points de la recherche

- Une étude portant sur la diffusion, l'adoption et l'impact de nouvelles variétés extra précoces dans la zone de savane soudanienne au Nigéria a porté sur 220 ménages agricoles et leurs 363 enfants

- The market sector survey on micronutrient enhancement in maize revealed a wide disparity between white and yellow maize varieties in utilization and consumption patterns. Over 50% of processors were aware that yellow maize was more nutritious than white maize. However, they indicated that yellow maize was less available and had a low market value, while there was a high demand for white maize because it yielded more flour than yellow maize and was easier to process.
- Crop–livestock integration (based on a grain legume–maize rotation) allowed farmers to return up to 45 kg N/ha through manure to the subsequent cereal. A yearly application of animal manure combined with fertilizer to continuous maize became more productive and profitable than an application of sole fertilizer from the third year onwards. A partial budget analysis indicated that the soybean–maize rotation dominates all improved maize systems in terms of profitability.
- The upgrading of the streak resistance level in the quality protein maize (QPM) varieties, *Obatanpa* from Ghana, *Susuma* and DMRE-SR-W from Mozambique, was completed. About 154 kg of seed of the upgraded versions of the varieties were provided to NARS for on-farm testing and community-based seed production in 10 member countries of West and Central Africa Maize Network (WECAMAN). In addition, adequate seed of the extra-early QPM variety, EV 99 QPM, was produced and made available for on-farm testing in WECAMAN member countries.

âgés de cinq ans et moins. Les résultats de mesures anthropométriques ont révélé que les enfants dans les ménages ayant adopté cette technologie jouissaient d'une meilleure santé nutritionnelle que ceux des ménages qui ne l'ont pas adoptée. Les autres avantages englobent l'acquisition de biens et des réalisations d'ordre matériel, un meilleur approvisionnement des ménages en vivres, et des revenus monétaires plus importants. Toutefois, le taux d'adoption était faible (14%). La pénurie de semences, le manque ou la cherté des engrais, et la faiblesse des échanges de semences entre paysans figuraient au nombre des facteurs qui limitent la propagation de cette technologie. L'adoption pourrait être stimulée par une plus forte implication des hommes dans la production de ces nouvelles variétés, un contact plus rapproché avec les services de vulgarisation, la précocité des variétés et un faible ratio main-d'œuvre/terre.

- Deux herbicides (Scepter® et Stomp®) du niébé ont réduit les populations de spores de mycorrhizes arbusculaires (VAM) et éliminé la colonisation de ces mycorrhizes. Scepter® a enregistré l'effet le plus remarquable, d'où des implications pour le prélèvement de P. Le pourcentage d'azote dérivé de la fixation biologique de l'azote était dans l'ordre de 59 à 81%. Ce taux n'a pas varié quelque soit la dose d'herbicide appliquée.
- Une analyse à l'aide des marqueurs AFLP et SSR de la diversité de 41 lignées pures de maïs résistantes à *Striga* et provenant de quatre populations sources a révélé des niveaux considérables de diversité génétique entre les lignées. Des lignées sélectionnées de deux sources de matériel végétal ont été évaluées sous forme de combinaisons hybrides et sous infestation du *Striga* dans deux localités au Nigéria. Selon les résultats obtenus, la plupart des croisements impliquant deux lignées parentales résistantes ont produit des hybrides combinant des caractéristiques de plant et d'épi désirables ainsi que des rendements en grains élevés avec moins de dégâts de *Striga* et de plants de *Striga* émergés que la plupart des croisements entre lignées sensibles et lignées résistantes. En outre, des variétés-populations et des variétés synthétiques de cycles divers créées à partir de lignées pures ou de familles issues de cycles améliorés de sélections des diverses populations sources ont supporté des nombres réduits de plants de *Striga* émergés et ont généré des rendements plus élevés.
- Cinquante lignées de niébé, ont été évaluées pour le fer, le zinc, le calcium et la lutéine. Les valeurs obtenues se situaient entre 545 et 1300 ppm pour le calcium, 48 et 79 ppm pour le fer, 23 et 48 ppm pour le zinc, et 0 et 69 ppm pour la lutéine. Deux lignées de soja, UG 5 et TGx 1805-31F, se sont avérées résistantes à la rouille du soja. La population F2, entre elles, a généré une ségrégation transgressive pour des niveaux de résistance plus élevés.
- L'enquête de marché portant sur la valorisation des oligo-éléments chez le maïs a révélé une forte disparité entre le maïs blanc et le maïs jaune en ce qui concerne les modes d'utilisation et de consommation. Plus de 50% des transformateurs savaient que le maïs jaune était plus nutritif que le maïs blanc. Ils ont toutefois indiqué que le maïs jaune était moins disponible et possédait une faible valeur marchande, tandis que la demande de maïs blanc était plus élevée parce qu'il était plus farineux et plus facile à transformer.
- L'intégration culture-élevage (fondée sur la rotation légumineuse à graines-maïs) a permis aux agriculteurs de retourner jusqu'à 45kg de N/ha à la culture céréalière subséquente grâce au fumier. L'application combinée de fumier et d'engrais chaque année, à la culture continue de maïs, est devenue plus productive et plus rentable que l'application de l'engrais uniquement à partir de la troisième année. Une analyse de budget partiel a révélé que l'assolement soja-maïs domine dans tous les systèmes améliorés de maïs quant à la rentabilité.
- L'augmentation du niveau de résistance à la striure dans la variété de maïs à protéine de qualité (QPM), *Obatanpa* du Ghana, *Susuma* et DMRE-SR-W du Mozambique, a été réalisée. Environ 154 kg de semences des créations améliorées de ces variétés ont été fournis aux SNRA pour des essais en milieu réel et pour la production de semences communautaires dans 10 pays membres du Réseau de recherche sur le maïs de l'Afrique occidentale et centrale (WECAMAN). En outre, des quantités suffisantes de semences de la variété extra précoce QPM, EV 99 QPM, ont été produites et mises à la disposition des pays membres de WECAMAN pour des essais en milieu réel.

Graduate research

completed at IITA in 2004

Name	Country	M/F	Research location	University	Sponsor	Research topic
PhD Fellows						
Adandonon, A.	Bénin	M	Pretoria	University of Pretoria, South Africa	IITA	Damping-off and stem rot of cowpea in the Republic of Bénin caused by *Sclerotium rolfsii*
Adejobi, A.	Nigeria	M	Ibadan	University of Ibadan, Nigeria	IITA	Rural poverty, food production and demand in Kebbi State, Nigeria
Aina, O.	Nigeria	M	Ibadan	University of Ibadan, Nigeria	Self	Variability in root and shoot characteristics of cassava genotypes as influenced by water stress conditions in different agroecological zones of Nigeria
Aliyu, B.	Nigeria	M	Kano	Bayero University, Kano, Nigeria	Self	Screening of cultivated crop species in the dry savannas for false host manifestation against *Striga hermonhica, S. gesnerioides* and *Alectra vogelii*
Assigbe, P.	Bénin	M	Benin	University of Cocody, Abidjan, Côte d'Ivoire	WARDA	Evaluation en milieu reel d'options de gestion de la matière organique pour l'amélioration de la fertilité des sols en riziculture pluviale de bas-fonds au centre du Bénin
Atungwu, J.	Nigeria	M	Ibadan	University of Agriculture, Abeokuta, Nigeria	Self	Mechanisms of resistance of soybean to *Meloidgyne incognita*
Baimey, K.	Bénin	M	Benin	University of Pretoria, South Africa	IITA	Biology and epidemiology of yam nematodes in Bénin
Banful, B.	Ghana	M	Cameroon	University of Ghana	IITA	Contribution of legume cover crops to growth and yield of plantain
Fagwalawa, L.D.	Nigeria	M	Kano	Bayero University, Kano, Nigeria	Self	Agro-physiological characterization of early, medium and late varieties of cowpea under sole and intercrop
Fatunbi, A.	Nigeria	M	Ibadan	University of Ibadan, Nigeria	Self	Evaluation of locally available vegetative materials as green manure in the Guinea savanna of Nigeria
Mustapha, Y.	Nigeria	M	Kano	Bayero University, Kano, Nigeria	Self	Inheritance of plant pigmentation and seed coat color in cowpea
Ndunguru, J.	Tanzania	M	University	University of Pretoria, South Africa	IITA	Molecular characterization and dynamics of cassava mosaic germiniviruses in Tanzania
Obamiro, E.	Nigeria	F	Ibadan	University of Ibadan, Nigeria	Self	Poverty, nutritional status, and the determinants of rural households' food demand in northern Nigeria
Odiyi, A.	Nigeria	M	Ibadan	Federal University of Technology	Self	Genetic variability in maize for combined resistance to the pink stem borer and the African sugarcane borer
Ojiako, I.	Nigeria	M	Ibadan	University of Ibadan, Nigeria	IITA	Impact assessment of improved soybean production and utilization in Nigeria
Olaoye, J.	Nigeria	M	Ibadan	University of Ilorin, Nigeria	Self	Performance modelling of a stationary multi-crop thresher
Olarinde, L.	Nigeria	M	Ibadan	Ladoke Akintola University of Technology, Ogbomoso, Nigeria	Self	Resource optimization strategies under differential risk attitudes among maize farmers in Kaduna State, Nigeria

Name	Country	M/F	Research location	University	Sponsor	Research topic
Otegbayo, B.	Nigeria	F	Ibadan	University of Ibadan, Nigeria	Self	Granule morphology, physico-chemical and rheological characteristics of yam species as indicators of textural quality in pounded yam
Owoeye, L.	Nigeria	M	Ibadan	University of Stellenbosch South Africa	IITA	Evaluation of selected legumes for sustainable weed ecology/soil fertility/livestock management interactions in crop–livestock systems of the moist savanna of sub-Saharan Africa
Paparu, P.	Uganda	F	Ibadan	Makerere University, Uganda	BMZ	Development delivery systems for effective field transmission of endophytes into banana plants
Pypers, P.	Belgian	M	Ibadan	Katholieke Universiteit Leuven, Belgium	BNMS	Soil research Phosphorus availability
Sonwa, D.	Cameroon	M	Cameroon	University of Yaoundé, Cameroon	IITA	Dynamics of diversification of cocoa multistrata agroforestry systems in Southern Cameroon
Sseruwagi, P.	Uganda	M	Uganda	University of Witwatersrand, SA	DFID	Whitefly molecular biology
Yusuf, S.	Nigeria	M	Kano	Abubakar Tafawa Balewa University, Nigeria	Self	Effects of cowpea varieties and cropping systems on the level of infestation by legume pod borer (*Maruca vitrata* Fab.) in Kano, Nigeria
MSc Fellows						
Alhassan, S.	Nigeria	M	Kano	Bayero University, Kano, Nigeria	Self	Studies in water imbibition, radicle emergence and early seedling vigour in photo-sensitive and photo-insensitive cowpea varieties
Aluko, O.	Nigeria	M	Ibadan	Federal University of Technology, Akure, Nigeria	DFID, UK	Evaluation of the suppressive genotypes of soybean on speargrass (*Imperata cylindrica* (L) Reauchel) growth and development
Butao, M.	Malawi	F	University	University of Pretoria, South Africa	IFAD/CGM	Local phytoselid, *Iphesieus degenerans* and its potential in the control of whitefly populations in cassava fields of Malawi
Darabidan, I.A.	Nigeria	F	Ibadan	University of Ibadan, Nigeria	Self	Effect of different agrobacteria strains on gus expression in cowpea (*Vigna unguiculata* [L] Walp.
Kilama, P.	Uganda	M	Uganda	Makerere University, Uganda	BMZ	*Paecilomyces lilacinus* and other soil fungi for the biological control of banana nematodes
Mukwaba, E.	Uganda	M	Uganda	Makerere University, Uganda	BMZ	Fungal endophytes for the biological control of banana nematodes
Nielsen, A.	Danish	F	Ibadan	The Royal Veterinary and Agricultural Univerity, Denmark	Self	Correlation between germination and content of sorgolactone in sorghum
Opoku, S.	Ghana	M	Ghana	University of Ghana	USAID	Molecular markers for resistance to CSSV and pod rot diseases in cocoa collections of Ghana
Oyederu, O.	Nigeria	F	Ibadan	Olabisi Onabanjo University, Ogun State, Nigeria	DFID, UK	Adoption of chemical control measures against *Imperata cylindrica* (Speargrass) in Ogoja
Ugbabe, O.	Nigeria	M	Ibadan	Ahmadu Bello University, Nigeria	BNMS	Economic analysis of the best bet balance nutrient management systems in northern Nigeria
Venansio, T.	Uganda	M	Uganda	Makerere University, Uganda	BMZ	*Beauveria bassiana* delivery systems with emphasis on semiochemicals
Yanguba, A.	Sierra Leone	M	Ibadan	University of Ibadan, Nigeria	Self	Diffusion, adoption and impact of extra-early maize varieties in the Sudan savanna ecological zone, northern Nigeria

Financial information

Funding overview

Funding for 2004 was US$44.854 million, of which 96.6% came from CGIAR investors and 3.4% from other sources. Expenditure was US$43.170 million (net of indirect costs recovery of US$4.001 million), of which 83.4% was used for program expenses and 16.6% for management and general expenses.

The governments and agencies that provided the largest share of our funding in 2003 and 2004 are shown in Figure 1 (top 10 donors).

IITA`s allocation to five research outputs of the CGIAR is shown in Figure 2.

Vue d'ensemble

Le financement pour 2004 était de 44,854 millions dont 96,6% contribués par les investisseurs du GCRAI et 3,4% par d'autres sources. Les dépenses s'élevaient à 43,170 millions $US (net des recouvrements indirects des coûts de 4,001 millions $US), dont 83,4% ont été consacrés aux dépenses du programme et 16,6% aux frais de gestion et aux dépenses générales.

La figure 1 présente les 10 premiers bailleurs de fonds (Gouvernements et agences) de l'IITA en 2003 et 2004. L'allocation de l' IITA à cinq rubriques de recherche du CGIAR est présentée à la Figure 2.

Figure 1. Funding: top 10 donors, 2003 and 2004

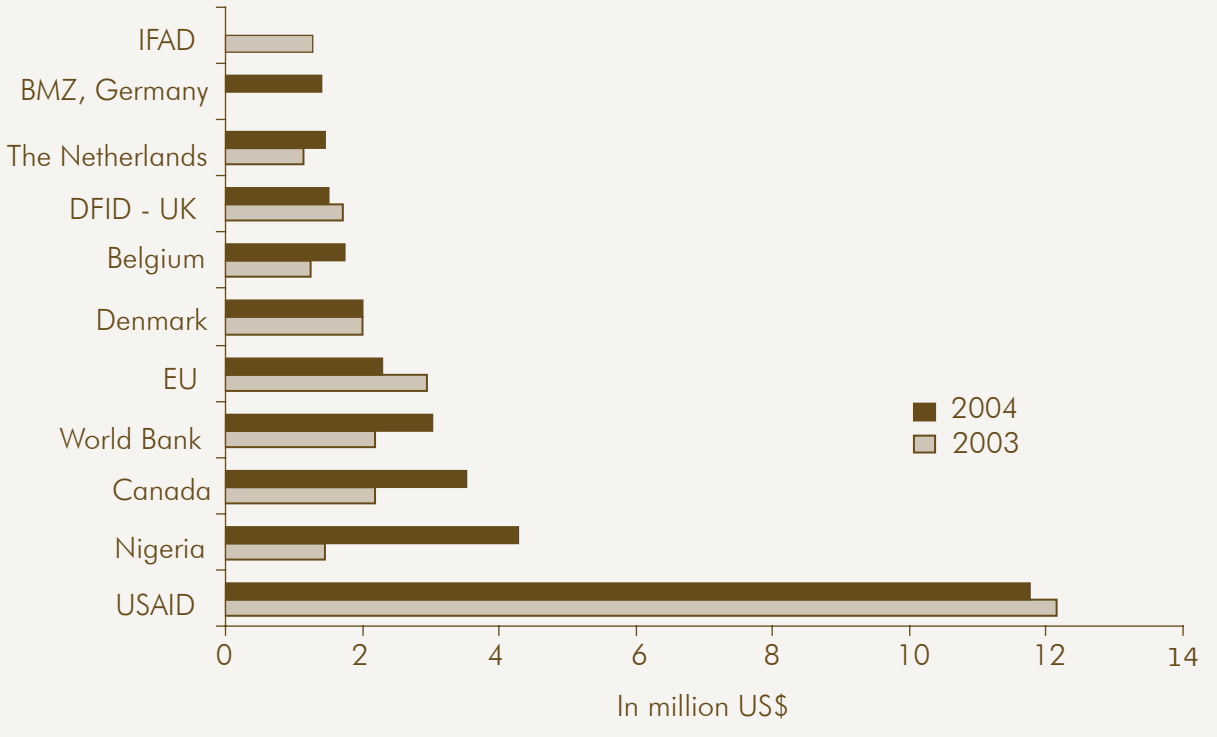
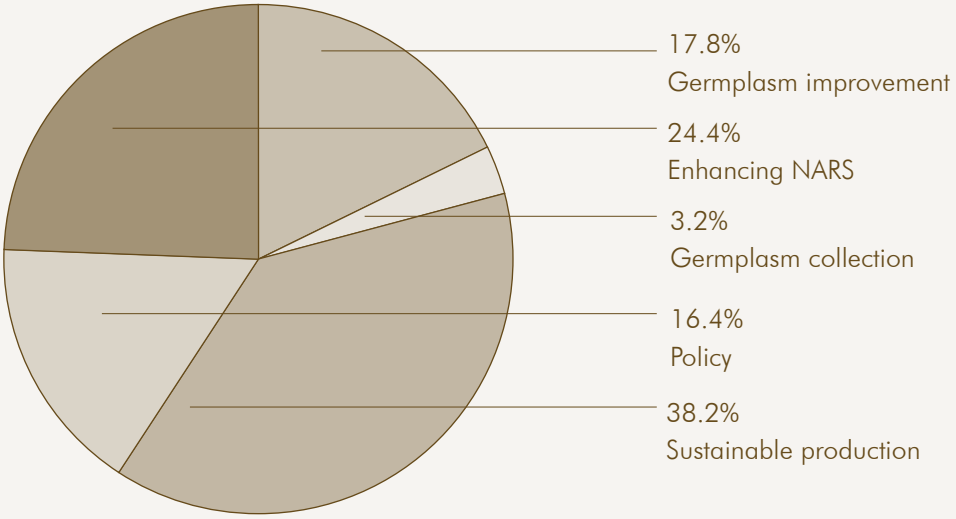
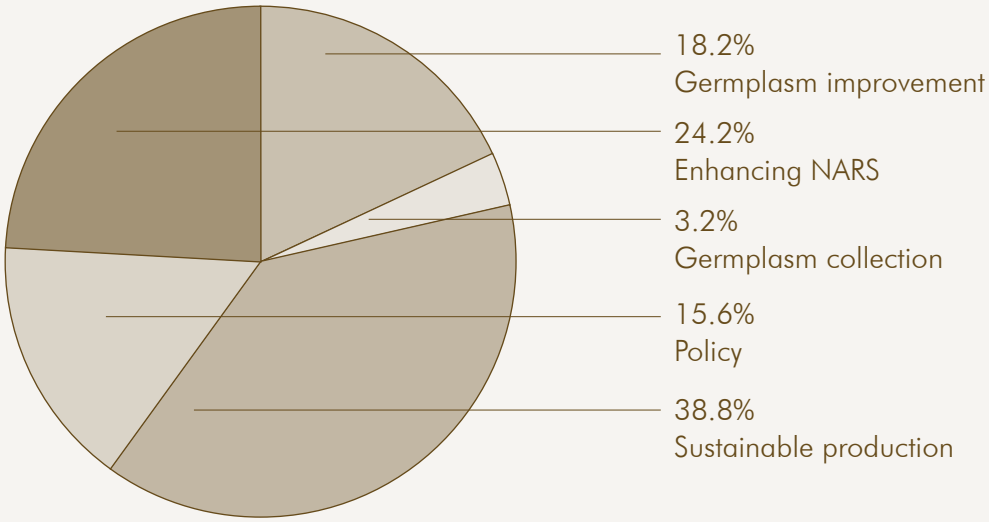


Figure 2. Core research expenditure by CGIAR output, 2004



Core research expenditure by CGIAR output, 2003



Publications

Contributions by IITA staff to scientific literature that became available during 2004, 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, which are based on work done while they were at the Institute.

Journal articles

Acha, I.A., H. Shiwachi, R. Asiedu, and M.O. Akoroda. 2004. Effect of auxins on root development in yam (*Dioscorea rotundata*) vines. Tropical Science 44: 80–84.

Adandonon, A., T.A.S. Aveling, and M. Tamò. 2005. Occurrence and distribution of cowpea damping-off and stem rot and associated fungi in Bénin. Journal of Agricultural Science 142: 1–6.

Adati, T., S. Nakamura, M. Tamò, and K. Kawazu. 2004. Effect of temperature on development and survival of the legume pod borer, *Maruca vitrata* (Fabricius) (Lepidoptera: Pyralidae) reared on a semi-synthetic diet. Applied Entomology and Zoology 39: 139–145.

Adeleke, M.T.V., M. Pillay, and B.E. Okoli. 2004. Meiotic irregularities and fertility relationships in diploid and triploid *Musa* L. Cytologia 69: 387–393.

Ahonsi, M.O., A.M. Emechebe, D.K. Berner, and S.T. Lagoke. 2004. Effects of ALS-inhibitor herbicides, crop sequence, and fertilization on natural soil suppressiveness to *Striga hermonthica*. Agriculture, Ecosystems and Environment 104: 453–463.

Alabi, O. and A.M. Emechebe. 2004. Evaluation of seed treatment chemicals for the control of seedling bacterial blight of cowpea in Northern Nigeria. Archives of Phytopathology and Protection 37: 119–122.

Alabi, O.Y., J.A. Odebiyi, M. Tamò, and L.E.N. Jackai. 2004. Effect of hostplant resistance on growth and developmental parameters of the flower bud thrips, *Megalurothrips sjostedti* (Trybom) on some resistant cowpea (*Vigna unguiculata* [L.] Walp.) cultivars. Crop Protection 23: 83–88.

Asawalam, D.O., W.O. Enwezor, N.N. Agbim, and S. Hauser. 2004. Biological activity of surface casting tropical earthworms in relation to nutrient cycling and soil fertility. Nigerian Journal of Soil Science 14: 56–63.

Atiri, G.I., F.O. Ogbe, A.G.O. Dixon, S. Winter, O. Ariyo, and G. Thottappilly. 2004. Status of cassava mosaic virus diseases and cassava begomoviruses in sub-Saharan Africa. Journal of Sustainable Agriculture 24(3): 5–35.

Badu-Apraku, B., M.A.B. Fakorede, A. Menkir, A.Y. Kamara, and A. Adam. 2004. Effects of drought-screening methodology on genetic variances and covariances in Pool 16 DT maize population. Journal of Agricultural Science 142: 1–8.

Badu-Apraku, B., M.A.B. Fakorede, A. Menkir, A.Y. Kamara, L. Akanvou, and Y. Chabi. 2004. Response of early maturing maize to multiple-stresses in the Guinea savanna of West and Central Africa. Journal of Genetics and Breeding 58: 00–00.

Badu-Apraku, B., M.A.B. Fakorede, A. Menkir, K.A. Marfo, and L. Akanvou. 2004. Enhancing the capacity of national scientists to generate and transfer maize technology in West and Central Africa–research implementation, monitoring, and evaluation. Journal of Experimental Agriculture 41(2).

Badu-Apraku, B., M.A.B. Fakorede, and S.O. Ajala. 2004. Enhancing human resources for maize research and development in West and Central Africa: a networking approach. Journal of Natural Resources and Life Sciences Education. 33: 77–84.

Badu-Apraku, B., M.A.B. Fakorede, S.O. Ajala, and L. Fontem. 2004. Strategies of WECAMAN to promote the adoption of sustainable maize production technologies in West and Central Africa. Journal of Food, Agriculture, and Environment 2 (3&4):106–113.

Balogun, M.O., S.Y.C. Ng, H. Shiwachi, N.Q. Ng, and I. Fawole. 2004. Comparative effects of explant source and genotype on in vitro tuberization in *Dioscorea alata* and *D. rotundata*. Tropical Science 44: 196–200.

Beed, F.D. 2004. Week in the life of a plant pathologist at Biological Control Center for Africa, International Institute of Tropical Agriculture, Cotonou, Republic of Benin, West Africa. British Society for Plant Pathology News 45: 18–20.

Benesi, I.R.M., M.T. Labuschagne, A.G.O. Dixon, and N.M. Mahungu. 2004. Stability of native starch quality parameters, starch extraction, and root dry matter of cassava genotypes in different environments. Journal of the Science of Food and Agriculture 84: 1381–1388.

Benesi, I.R.M., M.T. Lubuschagne, A.G.O. Dixon, and M. Mahungu. 2004. Genotype x environment interaction effects on native cassava starch quality and potential for starch use in the commercial sector. African Crop Science Journal 12(3): 205–216.

Bhattacharjee, R., P. Aikpokpodion, M. Kolesnikova-Allen, K. Badaru, and R. Schnell. 2004. West African cocoa: a pilot study on DNA fingerprinting of the germplasm from Cross River State of Nigeria. INGENIC Newsletter 9: 15–20.

Blade, S.F., T. Warkentin, and A. Vandenberg. 2004. Cutlass field pea-cultivar description. Canadian Journal of Plant Science 84: 533–534.

Blomme, G., H. de Beule, R.L. Swennen, A. Tenkouano, and D. de Waele. 2004. Effect of nematodes on root and shoot growth of in vitro-propagated and sword sucker-derived plants of six *Musa* spp. genotypes. Nematology 6: 593–604.

Blomme, G., I. Blanckaert, A. Tenkouano, and R. Swennen. 2004. Relationship between electrical capacitance and root traits. InfoMusa 13: 14–18.

Bogale, M., P.R. Speijer, T. Mekete, W. Mandefro, M. Tessera, and C.S. Gold. 2004. Survey of plant parasitic nematodes and banana weevil on *Ensete ventricosum* in Ethiopia. Nematologia Mediterranea 32: 223–227.

Boukar, O., L. Kong, B.B. Singh, L. Murdock, and H.W. Ohm. 2004. AFLP and AFLP-derived SCAR markers associated with *Striga gesnerioides* resistance in cowpea (*Vigna unguiculata* (L.) Walp.). Crop Science 44: 1259–1264.

Brentu, C.F., P.R. Speijer, K.R. Green, B.M.S. Hemeng, D. de Waele, and D.L. Coyne. 2004. Microplot evaluation of the yield reduction potential of *Pratylenchus coffeae*, *Helicotylenchus multicinctus*, and *Meloidogyne javanica* on plantain cv. Apantu-pa (*Musa* spp., AAB-group) in Ghana. Nematology 6: 455–462.

Ceballos, H., C.A. Iglesias, J.C. Pérez, and A.G.O. Dixon. 2004. Cassava breeding: opportunities and challenges. Plant Molecular Biology 56: 503–516.

Chang, K.F., S.F. Hwang, R.J. Howard, and S.F. Blade. 2004. Aster yellows phytoplasma associated with chai hu plants in Canada. Zeitschrift fur Pflanzenkrankheiten und Pflanzenchutz 111(3): 218–224.

Chang, K.F., S.F. Hwang, R.J. Howard, and S.F. Blade. 2004. Effects of soil temperature, seeding depth and seeding date on *rhizoctonia* seedling blight and root rot of chickpea. Canadian Journal of Plant Science 84: 901–907.

Chikoye D. 2004. Winning the war against speargrass (*Imperata cylindrica*): problems and opportunities. Nigeria Journal of Weed Science 17: 91–100.

Chikoye, D., F. Ekeleme, and G. Gbehounou. 2004. Suppression of speargrass (*Imperata cylindrica*) in maize using sweetpotato and two leguminous cover crops. Nigerian Journal of Weed Science 17: 35–42.

Chikoye, D., S. Schulz, and F. Ekeleme. 2004. Evaluation of integrated weed management practices in maize in northern Nigeria. Crop Protection 23: 895–900.

Chiwona-Karltum, L., L. Brimer, J.D. Kalenga, A. Mhone, J. Mkumbira, L. Johansson, M. Bokanga, N.M. Mahungu, and H. Rosling. 2004. Bitter taste in cassava roots correlates with cyanogenic glucoside levels. Journal of the Science of Food and Agriculture 84: 581–590.

Coyne, D.L., K.L. Sahrawat, and R.A. Plowright. 2004. The influence of mineral fertilizer application and plant nutrition on plant-parasitic nematodes in upland and lowland rice in Côte d'Ivoire and its implications in long-term experiments. Experimental Agriculture 40: 245–256.

Coyne, D.L., W. Khizzah, and J. Whyte. 2004. Root-knot nematode damage to cassava in Kenya. Roots 9: 3–6.

Crouch, J.H. and R. Ortiz. 2004. Applied genomics in the improvement of crops grown in Africa. African Journal of Biotechnology 3(10): 489–496.

Dercon, G., A. Dewulf, and M. Craps. 2004. How issues get framed and reframed when different communities meet: a multilevel analysis of a collaborative soil conservation initiative in the Ecuadorian Andes. Journal of Community and Applied Social Psychology 14: 177–192.

Diels, J., B. Vanlauwe, M.K. van der Meersch, N. Sanginga, and R. Merckx. 2004. Long-term soil organic carbon dynamics in a subhumid tropical climate: 13C data in mixed C3/C4 cropping and modeling with ROTHC. Soil Biology and Biochemistry 36: 1739–1750.

Downham, M.C.A., M. Tamò, D.R. Hall, D.I. Farman, B. Datinon, and S. Adetonah. 2004. Developing pheromone traps and lures for *Maruca vitrata* (F.) (Lepidoptera: Pyralidae) in Bénin, West Africa. Entomologia Experimentalis et Applicata 110: 151–158.

Dubois, T., A.E. Hajek, H. Jiafu, and Z. Li. 2004. Efficacy of fiber bands impregnated with *Beauveria brongniartii* cultures against the Asian longhorned beetle, *Anoplophora glabripennis* (Coleoptera: Cerambycidae). Biological Control 31: 320–328.

Dubois, T., C.S. Gold, D. Coyne, P. Paparu, E. Mukwaba, S. Athman, S. Kapindu, and E. Adipala. 2004. Merging biotechnology with biological control: banana *Musa* tissue culture plants enhanced by endophytic fungi. Uganda Journal of Agricultural Sciences 9(1): 445–451.

Ekeleme, F., D. Chikoye, and I.O. Akobundu. 2004. Impact of natural, planted (*Pueraria phaseoloides*, *Leucaena leucocephala*) fallow an
and Environment 103: 581–593.

Publications

Ekeleme, F., D. Chikoye, and I.O. Akobundu. 2004. Size and composition of weed communities of a degraded alfisol (Oxic Paleustaff) after planted and natural fallows in southwestern Nigeria. Basic and Applied Ecology 5: 25–33.

Ekeleme, F., F. Forcella, D.W. Archer, D. Chikoye, and I.O. Akobundu. 2004. Simulation of shoot emergence pattern of cogongrass (*Imperata cylindrica*) in the humid tropics. Weed Science 52: 961–967.

Elsen, A., B. Goossens, B. Belpaire, A. Neyens, P. Speijer, and D. de Waele. 2004. Recolonization by nematodes of hot water treated cooking banana planting material in Uganda. Nematology 6: 215–221.

Emechebe, A.M., J. Ellis-Jones, S. Schulz, D. Chikoye, B. Douthwaite, I. Kureh, G. Tarawali, M.A. Kormawa, and A. Sani. 2004. Farmer perception of the *Striga* problem and its control in northern Nigeria. Experimental Agriculture 40: 215–232.

Fandohan, P., D.J. Gbenou, B. Gnonlonfin, K. Hell, W.F.O. Marasas, and M.J. Wingfield. 2004. Effect of essential oils on the growth of *Fusarium verticillioides* and Fumonisin contamination in corn. Agricultural and Food Chemistry 52: 6824–6829.

Fandohan, P., K. Hell, W.F.O. Marasas, and M.J. Wingfield. 2003. Infection of maize with *Fusarium* species and maize contamination with Fumonisin in Africa. Journal of African Biotechnology 2(12): 570–579.

Ferguson, M.E., M.D. Burow, S. Schultz, P. Bramel, A.H. Paterson, S. Kresovich, and S. Mitchell. 2004. Microsatellite identification and characterization in peanut (*A. hypogaea L.*). Theoretical and Applied Genetics 108(6): 1064–1070.

Ferguson, M.E., P.J. Bramel, and S. Chandra. 2004. Gene diversity among botanical varieties in peanut (*Arachis hypogaea L.*) Crop Science 44: 1507-1510.

Fokunang, C.N., A.G.O. Dixon, and T. Ikotun. 2004. Effect of temperature on the survival and infectivity of *Pseudotheraptus devastans* vector. Mycopathologia 158(3): 385–392.

Franke, A.C., S. Schulz, B.D. Oyewole, and S. Bako. 2004. Incorporating short-season legumes and green manure crops into maize-based systems in the moist Guinea savanna of West Africa. Experimental Agriculture 40: 463–479.

Fregene, M., H. Matsumura, A. Akano, A. Dixon, and R. Terauchi. 2004. Serial analysis of gene expression (SAGE) of hostplant resistance to the cassava mosaic disease (CMD). Plant Molecular Biology 56: 563–571.

Gold, C.S., G. Night, P.E. Ragama, G.H. Kagezi, W. Tinzaara, and A.M.K. Abera. 2004. Field distribution of banana weevil (*Cosmopolites sordidus* (Germar)) adults in cooking banana stands in Uganda. Insect Science and its Application 24: 242–248.

Gold, C.S., G.H. Kagezi, G. Night, and P.E. Ragama. 2004. The effects of banana weevil, *Cosmopolites sordidus* (Germar) damage on highland banana growth, yield and stand duration in Uganda. Annals of Applied Biology 145: 263–269.

Gold, C.S., P.C. Smithson, B.D. McIntyre, H. Ssali, G. Night, and S. Okech. 2004. Potassium and magnesium fertilizers on banana in Uganda: yields, weevil damage, foliar nutrient status, and DRIS analysis. Nutrient Cycling in Agroecosystems 69: 43–49.

Gold, C.S., P.E. Ragama, R. Coe, and N.D.T.M. Rukazambuga. 2004. Selection of assessment methods for evaluating banana weevil damage on highland cooking banana. Ugandan Journal of Agricultural Sciences 9: 274–280.

Gold, C.S., W.K. Tushemereirwe, A. Kangire, J. Kubiriba, and M. Nakyanzi. 2004. Diseases threatening banana biodiversity in Uganda. African Crops Science Journal 12: 19–26.

Grenier, C., P.J. Bramel, J.A. Dahlberg, A. El Ahmadi, M. Mahmoud, G.C. Peterson, D.T. Rosenow, and G. Ejeta. 2004. Sorghums of the Sudan: analysis of regional diversity and distribution. Genetic Resources and Crop Evolution 51(5): 489–500.

Hell, K., P. Fandohan, D.J. Gbenou, B. Gnonlonfin, W.F.O. Marasas, and M.J. Wingfield. 2004. Effect of essential oils on the growth of *Fusarium verticillioides* and Fumonisin contamination in corn. Agricultural and Food Chemistry 52: 6824–6829.

Hell, K., P. Fandohan, W.F.O. Marasas, and M.J. Wingfield. 2003. Infection of maize with *Fusarium* species and maize contamination with Fumonisin in Africa. Journal of African Biotechnology 2(12): 570–579.

Herzberg, F., N.M. Mahungu, J. Mignouna, and A. Kullaya. 2004. Assessment of genetic diversity of local varieties of cassava in Tanzania using molecular markers. African Crop Science Journal 12(3): 171–187.

Ishiyaku, M.F. and B.B. Singh. 2004. Genetic studies and transgressive segregation for large seeds in cowpea. MAURIK Bulletin 6: 10–14.

Ishiyaku, M.F. and B.B. Singh. 2004. Inheritance of purple pigmentation on vegetative parts in cowpea (*Vigna unguiculata* (L.) Walp.). Scientia Horticulturae 102: 369–373.

Kagoda, F., D. Coyne, C. Kajumba, and J. Dusabe. 2004. Early screening of cassava for resistance to root-knot nematodes. Ugandan. Journal of Agricultural Sciences 9: 590–593.

Kamara, A.Y., A. Menkir, M.A.B. Fakorede, S.O. Ajala, B. Badu-Apraku, and I. Kureh. 2004. Agronomic performance of maize cultivars representing three decades of breeding in the Guinea savannas of West and Central Africa. Journal of Agricultural Sciences 142: 1–9.

Kav, N. and S.F. Blade. 2004. Proteome-level changes in the roots of *Pisum sativum* L. in response to salinity. Annals of Applied Biology 145: 217–230.

Kiiza, B., S. Abele, and R. Kalyebara. 2004. Market opportunities for Ugandan banana products: national, regional, and global perspectives. Ugandan Journal of Agricultural Sciences 9(1): 743–749.

Kikuno, H., H. Shiwachi, M. Onjo, and R. Asiedu. 2004. Influence of explant condition on microtuberization of yams. Japanese Society for Tropical Agriculture 48(2): 71–72.

Kolawole, G.O., H. Tijani-Eniola, and G. Tian. 2004. Phosphorus fractions in fallow systems of West Africa: effect of residue management. Plant and Soil 263: 113–120.

Kolesnikova-Allen, M., R. Bhattacharjee, P. Aikpokpodion, S. Taiwo, and I. Ingelbrecht. 2004. An improved semi-automated rapid method of extracting genomic DNA for molecular marker analysis in cocoa, *Theobroma cacao L*. Plant Molecular Biology Reporter 22(4): 435a–435h.

Koona, P. and L.E.N. Jackai. 2004. The potential of pod-shaving in studies of the role of trichomes in *Vigna* resistance to the pod-bug *Clavigralla tomentosicollis* Stål (Hemiptera: Coreidae). International Journal of Tropical Insect Science 24: 298–303.

Koona, P., E.O. Osisanya, L.E.N. Jackai, and J. Tonye. 2004. Infestation and damage by *Clavigralla tomentosicollis* and *Anoplocnemis curvipes* (Hemiptera: Coreidae) in cowpea plants with modified leaf structure and pods in different positions relative to the canopy. Environmental Entomology 33: 471–476.

Kormawa, P.M., C.I. Ezedinma, and B.B. Singh. 2004. Factors influencing farmer-to-farmer transfer of an improved cowpea variety in Kano State, Nigeria. Journal of Agriculture and Rural Development in the Tropics and Subtropics 105: 1–13.

Legg, J.P. and C.M. Fauquet. 2004. Cassava mosaic geminiviruses in Africa. Plant Molecular Biology 56(4): 585–599.

Legg, J.P., B. Owor, G. Okao-Okuja, R. Obonyo, and M.W. Ogenga-Latigo. 2004. The effect of cassava mosaic geminiviruses on symptom severity, growth and root yield of a cassava mosaic virus disease-susceptible cultivar in Uganda. Annals of Applied Biology 145(3): 331–337.

Legg, J.P., B. Owor, R. Obonyo, G. Okao-Okuja, S. Kyamanywa, and M.W. Ogenga-Latigo. 2004. Field studies of cross protection with cassava in Uganda. Journal of Phytopathology 152: 243–249.

Legg, J.P., F. Ndjelassili, and G. Okao-Okuja. 2004. First report of cassava mosaic disease and cassava mosaic geminiviruses in Gabon. Plant Pathology 53(2): 232.

Legg, J.P., G. Okao-Okuja, L. Traore, and M.A. Jorge. 2004. Viruses associated with cassava mosaic disease in Senegal and Guinea Conakry. Journal of Phytopathology 152: 69–76.

Legg, J.P., P. Sseruwagi, M.E.C. Rey, and J.K. Brown. 2004. The cassava mosaic geminiviruses occurring in Uganda following the 1990s epidemic of severe cassava mosaic disease. Annals of Applied Biology 145: 113–121.

Legg, J.P., P. Sseruwagi, W.S. Sserubombwe, J. Ndunguru, and J.M. Thresh. 2004. Methods of surveying the incidence and severity of cassava mosaic disease and whitefly vector populations on cassava in Africa: a review. Virus Research 100: 129–142.

Legg, J.P., S. Bigirimana, P. Barumbanze, and R. Obonyo. 2004. First evidence for the spread of East African cassava mosaic virus – Uganda (EACMV–UG) and the pandemic of severe cassava mosaic disease to Burundi. Plant Pathology 53(2): 231.

Lema, K.M., K. Tata-Hangy, and M. Bidiaka. 2004. Management of African root and tuber scale using improved cassava genotypes and mineral fertilizers. African Crop Science Journal 12(3): 217–221.

Lum, A.F., D. Chikoye, and S.O. Adesiyan. 2004. Control of *Imperata cylindrica* (speargrass) with nicosulfuron and its effects on the growth, grain yield, and food components of maize. Crop Protection 24: 41–47.

Lum, A.F., D. Chikoye, and S.O. Adesiyan. 2004. Evaluation of nicosulfuron for control of speargrass (*Imperata cylindrica*) in Nigeria. International Journal of Pest Management 50: 327–330.

Mahungu, N.M., V.S. Sandifolo, A.G.O. Dixon, J.A. Whyte, A. Mhone, J.M. Teri, M.N. Alvarez, M.I. Andrade, S. Kolijn, S. Jumbo, and C.C. Moyo. 2004. Contribution of SARRNET to food security in the SADC region. African Crop Science Journal 12(3): 311–319.

Masanza, M., C.S. Gold, A. van Huis, and P.E. Ragama. 2004. Use of crop sanitation for the management of the banana weevil in Uganda. Ugandan Journal of Agricultural Sciences 9: 636–644.

Menkir, A., B. Melake, C. Thé, I. Ingelbrecht, and A. Adepoju. 2004. Grouping of tropical midaltitude maize inbred lines based on yield data and molecular markers 108(8): 1582–1590.

Mestres, C., C.S. Bassa, E. Fagbohoun, M. Nago, K. Hell, P. Vernier, D. Champiat, J. Hounhouigan, and K. Cardwell. 2004. Yam chip food subsector: hazardous practices and presence of aflatoxins in Bénin. Journal of Stored Product Research 40: 575–585.

Mhone, A., V. Sandifolo, S. Jumbo, C. Mwale, F. Gondwe, C. Moyo, and N.M. Mahungu. 2004. Chitipi Farms in Malawi: a success story of cassava in the state sector. Roots 9(1): 2.

Moyo, C.C., I.R.M. Benesi, F.P. Chipungu, C.H.L. Mwale, V.S. Sandifolo, and N.M. Mahungu. 2004. Cassava and sweetpotato yield assessment in Malawi. African Crop Science Journal 12(3): 295–303.

Mskita, W., B. Bissang, B.D. James, H. Baimey, H.T. Wilkinson, M. Ahounou, and R. Fagbemisi. 2005. Prevalence and severity of *Nattrassia mangiferae* root- and stem-rot pathogen of cassava in Bénin. Plant Disease 89: 12–16.

Mudiope, J., D.L. Coyne, E. Adipala, and R.A. Sikora. 2004. Monoxenic culture of *Pratylenchus sudanensis* on carrot discs with evidence of differences in reproductive rates between geographical isolates. Nematology 6: 617–619.

Publications

Neuenschwander, P. 2004. Harnessing nature in Africa: biological pest control can benefit the pocket, health, and the environment. Nature 432: 801–802.

Neumann, S., N.D. Paveley, F.D. Beed, and R. Sylvester-Bradley. 2004. Nitrogen per unit leaf area affects the upper asymptote of *Puccinia striiformis* f.sp. *Tritici* epidemics in winter wheat. Plant Pathology 53(6): 725–732.

Nkamleu, G.B. 2004. L'échec de la production agricole en Afrique francophone. Economie Rurale No. 279, Janvier–Février 2004.

Nkamleu, G.B. 2004. Productivity growth, technical progress, and efficiency change in Africa agriculture. African Development Review 16(1): 203–222.

Nwoke, O.C., B. Vanlauwe, J. Diels, N. Sanginga, and O. Osonubi. 2004. Impact of residue characteristics on phosphorus availability in West African moist savanna soils. Biology and Fertility of Soils 39: 422–428.

Nwoke, O.C., B. Vanlauwe, J. Diels, N. Sanginga, and O. Osonubi. 2004. The distribution of phosphorus fractions and desorption characteristics of some soils in the moist savanna zone of West Africa. Nutrient Cycling in Agroecosystems 69: 127–141.

Odu, B.O., J.d'A. Hughes, R. Asiedu, N.Q. Ng, S.A. Shoyinka, and O.A. Oladiran. 2004. Responses of white yam (*Dioscorea rotundata*) cultivars to inoculation with three viruses. Plant Pathology 53: 141–147.

Odu, B.O., R. Asiedu, J.d'A. Hughes, S.A. Shoyinka, and O.A. Oladiran. 2004. Evaluation of resistance to yam mosaic virus (YMV), genus Potyvirus in white yam (*Dioscorea rotundata Poir.*). Field Crops Research 89: 97–105.

Oikeh, S.O., A. Menkir, B. Maziya-Dixon, R.M. Welch, and R.P. Glahn. 2004. Assessment of iron bioavailability from 20 elite late-maturing tropical maize varieties using an in vitro digestion/Caco-2 cell model. Journal of the Science of Food and Agriculture 84:1202–1206.

Oikeh, S.O., A. Menkir, B. Maziya-Dixon, R.M. Welch, R.P. Glahn, and G.J.R. Gauch. 2004. Environmental stability of iron and zinc concentrations in grain of elite early-maturing tropical maize genotypes grown under field conditions. Journal of Agricultural Science 142: 1–9.

Okech, H.O., C.S. Gold, S. Abele, C.M. Nankinga, P.M. Wetala, P. van Asten, A. Nambuye, and P. Ragama. 2004. Agronomic pests and economic factors influencing sustainability of banana—coffee systems of western Uganda and potentials for improvement. Uganda Journal of Agricultural Sciences 9(1): 432–444.

Okech, S.H.O., P.J.A. van Asten, C.S. Gold, and H. Ssali. 2004. Effects of potassium deficiency, drought, and weevils on banana yield and economic performance in Mbarara, Uganda. Ugandan Crop Science Journal 9: 511–519.

Okechukwu, R.U. and E.J.A. Ekpo. 2004. Sources of resistance to cowpea bacterial blight disease in Nigeria. Journal of Phytopathology 152: 345–351.

Okike, I., M.A. Jabbar, V.M. Manyong, J.W. Smith, and S. Ehui. 2004. Factors affecting farm-specific production efficiency in the savanna zones of West Africa. Journal of African Economies 13(1): 134–165.

Okogun, J.A., B.T. Otuyemi, and N. Sanginga. 2004. Soybean yield determinants and response to rhizobial inoculation in an on-farm trial in the northern Guinea savanna of Nigeria. West African Journal of Applied Ecology 6: 30–39.

Onzo, A., R. Hanna, A. Janssen, and M.W. Sabelis. 2004. Interactions between two neotropical phytoseiid predators and consequences for biological control of a shared prey. Biocontrol Science and Technology 14: 63–76.

Onzo, A., R. Hanna, and M.W. Sabelis. 2004. Biological control of cassava green mites in Africa: impact of the predatory mite *Typhlodromalus aripo*. Entomologische Berichten 65(1): 2–7.

Oorts, K., B. Vanlauwe, J. Pleysier, and R. Merckx. 2004. A new method for the simultaneous measurement of pH-dependent cation exchange capacity and ph buffering capacity. Soil Science Society of America Journal 68: 1578–1585.

Paparu, P., T. Dubois, C.S. Gold, E. Adipala, B. Niere, and D. Coyne. 2004. Inoculation, colonization, and distribution of fungal endophytes in *Musa* tissue culture plants. Ugandan Journal of Agricultural Sciences 9(1): 583–589.

Pillay, M., R. Ssebuliba, J. Hartman, and D. Vuylsteke. 2004. Conventional breeding strategies to enhance the sustainability of *Musa* biodiversity conservation for endemic cultivars on farm. African Crop Science Journal 12(1): 63–69.

Rotimi, M.O., P. Speijer, and D. de Waele. 2004. Effect of soil moisture and organic matter levels on plantain root reaction to *Radopholus similis*. International Journal of Nematology 14: 122–128.

Sanni, L.O., O.B. Oyewole, A.O. Dipeolu, K. Adebayo, I.A. Ayinde, J.L. White, K.I. Tomlins, and A. Westby. 2004. Effect of traditional variations in processing and storage on the quality of Nigerian *fufu*. Journal of Food Technology 2(4): 225–231.

Sanni, L.O., S.B. Kosoko, A.A. Adebowale, and R.J. Adeoye. 2004. The Influence of palm oil and chemical modification on the pasting and sensory properties of *fufu* flour. International Journal of Food Properties 7(2): 229–237.

Shiwachi, H. 2004. Current status and future of yam production. The 96th Meeting of the Japanese Society for Tropical Agriculture 48(2): 121–125.

Shiwachi, H., C.C. Okonkwo, and R. Asiedu. 2004. Nutrient deficiency symptoms in yams (*Dioscorea* spp.). Tropical Science 44: 155–162.

Ssango, F., P.R. Speijer, D.L. Coyne, and D. de Waele. 2004. Path analysis: a novel approach to determine the contribution of nematode damage to East African highland banana (*Musa* spp., AAA) yield loss under two crop management practices in Uganda. Field Crops Research 90: 177–187.

Stengård Hansen, L. H. Skovgård; and K. Hell. 2004. Life Table Study of *Sitotroga cerealella* (Lepidoptera: Gelichiidae), a strain from West Africa. Journal of Economic Entomology 97(4): 1484–1490.

Su, H., S.F. Hwang, R.J. Howard, and S.F. Blade. 2004. Differences in the growth stages of *Erysiphe pisi* on cultivars of field pea (*Pisum sativum L.*). Zeitschrift fur Pflanzenkrankheiten und Pflanzenchutz 111(1): 126–136.

Tata-Hangy, K., R. Hanna, T. Muaka, and M. Solo. 2004. Effect of cassava leaf harvesting on a cassava green mite predator in the Democratic Republic of Congo. African Crop Science Journal 12(3): 289–293.

Tenkouano, A. and R.L. Swennen. 2004. Progress in breeding and delivering improved plantain and banana to African farmers. Chronica Horticulturae 44: 9–15.

Thenkabail, P.S., N. Stucky, B.W. Griscom, M.S. Ashton, J. Diels, B. van Der Meer, and E. Enclona. 2004. Biomass estimations and carbon stock calculations in the oil palm plantations of African derived savannas using IKONOS data. International Journal of Remote Sensing 25: 1–27.

Tian, G. and G.O. Kolawole. 2004. Comparison of various plant residues as phosphate rock amendment on savanna soils of West Africa. Journal of Plant Nutrition 27: 571–583.

Tinzaara, W., C.S. Gold, C. Nankinga, M. Dicke, A. van Huis, P. Ragama, and G.H. Kagezi. 2004. Integration of pheromones and the entomopathogenic fungus for the management of the banana weevil. Ugandan Journal of Agricultural Sciences 9: 621–629.

Tripathi, L. 2003. Genetic engineering for improvement of *Musa* production in Africa. African Journal of Biotechnology 2: 503–508.

Tripathi, L. and J.N. Tripathi. 2003. Role of biotechnology in medicinal plants. Tropical Journal of Pharmaceutical Research 2: 243–253.

Tripathi, L., J.N. Tripathi, and W.K. Tushemereirwe. 2004. Strategies to resistance to bacterial wilt disease of banana through genetic engineering. African Journal of Biotechnology 3: 688–692.

Tripathi, L., J.N. Tripathi, R.T. Oso, J.d'A. Hughes, and P. Keese. 2003. Regeneration and transient gene expression of African *Musa* species with diverse genomic constitution and ploidy levels. Tropical Agronomy 80: 182–187.

Tumuhaise, V., C.M. Nankinga, C.S. Gold, S. Kyamanywa, P. Ragama, and W.K. Tushemereirwe. 2004. Kairomone trapping system for delivery of *Beauveria bassiana* to control the banana weevil. Ugandan Journal of Agricultural Sciences 9: 630–635.

van Asten, P.J.A., A. van 't Zelfde, S.E.A.T.M. van der Zee, and C. Hammecker. 2004. The effect of irrigated rice cropping on the alkalinity of alkaline soils in West Africa. Geoderma 119: 233–247.

van Asten, P.J.A., C.S. Gold, S.H. Okech, S.V. Gaidashova, W.K. Tushemereirwe, and D. de Waele. 2004. Soil quality problems in East African banana systems and their relation with other yield loss factors. InfoMusa 13(2): 20–25.

van Asten, P.J.A., S.E. Barro, M.C.S. Wopereis, and T. Defoer. 2004. Using farmer knowledge to combat low productive spots in an irrigated rice scheme in Burkina Faso. Land Degradation and Development 15: 383–396.

Vayssières, J.F., F. Sanogo, and M. Noussourou. 2004. Inventaire des espèces de mouches des fruits (*Diptera tephritidae*) inféodées au manguier au Mali et essais de lutte raisonnée. Fruits 59(1): 3–16.

Wendt, J.W. and M.F. Atemkeng. 2004. Soybean, cowpea, groundnut, and pigeonpea response to soils, rainfall, and cropping season in the forest margins of Cameroon. Plant and Soil 263(1–2): 121–132.

Yang, R. and S.F. Blade. 2004. Identifying isoyield environments for field pea production. Crop Science 45(1): 106–113.

Yang, R., S.F. Blade, and M. Bandara. 2004. Efficiency of spatial analyses of field pea (*Pisum sativum L.*) variety trials. Crop Science 44: 49–55.

Yilwa, V.M., O.P. Ifenkwe, and B.B. Singh. 2004. Genetic association of flower color and pod-pigmentation in cowpea. Nigerian Journal of Experimental and Applied Biology 5: 91–95.

Yilwa, V.M., O.P. Ifenkwe, and B.B. Singh. 2004. Inheritance of purple color pigmentation in cowpea flowers. Nigerian Journal of Botany 17: 119–127.

Zarafi, A.B., A.M. Emechebe, A.D. Akpa, and O. Alabi. 2004. Effect of metalaxyl on incidence of pearl millet downy mildew disease in northern Nigeria. Archives of Phytopathology and Plant Protection 37: 261–268.

Books and book chapters

Abele, S. and K. Frohberg (eds). 2004. Subsistence agriculture in Central and Eastern Europe: How to break the vicious circle? Studies on the Agricultural and Food Sector in Central and Eastern Europe, Vol. 22. IAMO, Halle/Saale, Germany.

Abele, S. and K. Frohberg. 2004. Pages 1–7 *in* Introduction, subsistence agriculture in Central and Eastern Europe: how to break the vicious circle? Studies on the Agricultural and Food Sector in Central and Eastern Europe, edited by S. Abele, and K. Frohberg. Vol. 22, IAMO, Halle/Saale, Germany.

Abele, S., K. Frohberg, M. Hartmann, A. Matthews, and P. Weingarten. 2004. Development of agricultural market and trade policies in the CEE candidate countries. Institut für Agrarentwicklung in Mittel- und Osteuropa, Studies on the Agricultural and Food Sector in Central and Eastern Europe. Halle (Saale), Germany (Agrimedia).

Publications

Abele, S., U. Fiege, and K. Reinsberg. 2004. The dynamics of agricultural labor demand and their impact on rural labor markets in Central and Eastern Europe. Pages 243–250 in Perspektiven der Landnutzung–Regionen, Landschaften, Betriebe–Entscheidungstraeger und Instrumente, Schriften der GEWISOLA, Vol. 39 (2004). Münster-Hiltrup (Landwirtschaftsverlag).

Alabi, M.O., J.C. Obiefuna, O.O. Fashola, S.O. Bakare, O. Olaleye, and M.I.S. Ezenwa. 2004. Lowland rice-based cropping systems in Nigeria. Page 1044 *in* The Nigeria Rice Memorabilia. Global Summit, Abuja, Nigeria.

Blade, S.F., T. McAllister, and L. Delanoy. 2004. Bud the spud moves west: the expansion of the Canadian potato industry. Canadian Agriculture at a Glance. Statistics Canada. Government of Canada publication 96-325-XPB. 323p.

Bonwoo Koo, P.G. Pardey, N. Kameswara Rao, and P.J. Bramel. 2004. ICRISAT genebank. Pages 69–88 *in* Saving seeds: the economics of conserving crop genetic resources ex situ in the future centers of the CGIAR, edited by Bonwoo Koo, P.G. Pardey, B.D. Wright and others. CABI Publishing, Cambridge, MA, 02139, USA.

Bramel, P. 2004. Seed vouchers and fairs minimum dataset: analysis of CRS experiences. Pages 10–23 *in* CRS Seed Vouchers and Fairs, edited by P.J. Bramel, T. Remington, and M. McNeil. CRS East Africa, Nairobi, Kenya.

Bramel, P.J. 2004. Page 168 *in* Assessing the risk of losses in biodiversity in traditional cropping systems: a case study of pigeonpeas in Andhra Pradesh, edited by P.J. Bramel. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India.

Bramel, P.J. and T. Remington. 2004. Relief seed assistance in Zimbabwe. Page 159–177 *in* Addressing seed security in disaster response: linking relief with development, edited by L. Sperling, T. Remington, J.M. Haugen, and S. Nagoda. International Center for Tropical Agriculture (CIAT), Cali, Columbia.

Bramel, P.J., B.V. Ford-Lloyd, S. Chandra, and HJ Newbury. 2004. Assessment of degree and distribution of genetic diversity in pigeonpea landraces using SSR markers. Pages 75–102 *in* Assessing the risk of losses in biodiversity in traditional cropping systems: a case study of pigeonpeas in Andhra Pradesh, edited by P.J. Bramel. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India.

Bramel, P.J., S. Kiran, L.J. Reddy, B. Ford-Lloyd, and S. Chandra. 2004. Degree and distribution of pigeonpea landrace morphological diversity in traditional cropping systems in Andhra Pradesh. Page 1–44 in Assessing the risk of losses in biodiversity in traditional cropping systems: a case study of pigeonpeas in Andhra Pradesh, edited by P.J. Bramel. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India.

Bramel, P.J., S. Kiran, L.J. Reddy, K.S. Varaprasad, and S. Chandra. 2004. Farmer seed systems for pigeonpea in coastal Andhra Pradesh. Pages 103–118 *in* Assessing the risk of losses in biodiversity in traditional cropping systems: a case study of pigeonpeas in Andhra Pradesh, edited by P.J. Bramel. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India.

Bramel, P.J., S. Nagoda, J.M. Haugen, D. Adugna, T. Dejene, T. Bekele, and L.T. Traedal. 2004. Relief seed assistance in Ethiopia. Pages 111–134 *in* Addressing seed security in disaster response: linking relief with development, edited by L. Sperling, T. Remington, J.M. Haugen, and S. Nagoda. International Center for Tropical Agriculture (CIAT), Cali, Columbia.

Bramel, P.J., T. Remington, and M. McNeil (eds). 2004. CRS Seed Vouchers and Fairs. CRS East Africa, Nairobi, Kenya. 173p.

Bramel, P.J. 2004. Summary of sources of risk to genetic erosion of traditional pigeonpea landraces in Andhra Pradesh. Pages 155–168 *in* Assessing the risk of losses in biodiversity in traditional cropping systems: a case study of pigeonpeas in Andhra Pradesh, edited by P.J. Bramel. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India.

Carsky, R.J., N. Sanginga, S. Schulz, B. Douthwaite, V.M. Manyong, J. Diels, B. Vanlauwe, and J.D.H. Keatinge. 2004. The ability to fix N is not the only key to delivery of the benefits of BNF to farmers: experience of IITA in the savannas of Africa. Pages 145–161 *in* Symbiotic nitrogen fixation: prospects for enhanced application in tropical agriculture, edited by R. Serraj. Science Publishers, Inc., Enfield, NH, USA.

Fashola, O.O., G.O. Olaniyan, J. Aliyu, and T. Wakatsuki. 2004. Water management practices for sustainable rice production in Nigeria. Page 1044 in The Nigeria Rice Memorabilia. Global Summit, Abuja, Nigeria.

Hauser, S. 2004. Review of Crop variety improvement and its effect on productivity: the impact of International Agricultural Research. Pages 91–92 in Biological Agriculture and Horticulture, edited by R.E. Evenson and D. Gollins.

Kamara, A.Y., J.G. Kling, S.O. Ajala, and A. Menkir. 2004. Vertical root-pulling resistance in maize is related to nitrogen uptake and yield. Pages 228–232 *in* Integrated approaches to higher maize productivity in the new millennium, edited by D.K. Friesen and A.F.E. Palmer. Proceedings of the 7th Eastern and Southern Africa Regional Maize Conference, 5–11 February 2002, Nairobi, Kenya: International Maize and Wheat Improvement Center (CIMMYT) and Kenya Agricultural Research Institute (KARI).

Pillay, M., A. Tenkouano, G. Ude, and R. Ortiz. 2004. Molecular characterization of genomes in Musa and its applications. Pages 271–286 *in* Banana Improvement: cellular, molecular biology, and induced mutations, edited by S.M. Jain and R. Swennen. Kluwer Academic Publishers, Dordrecht, The Netherlands, Science Publishers, Inc. Enfield (NH, USA), Plymouth (UK).

Reddy, L.J., S. Chandra, H. Pooni, and P.J. Bramel. 2004. Rates of outcrossing in pigeonpeas under intercropped conditions. Pages 133–142 *in* Assessing the risk of losses in biodiversity in traditional cropping systems: a case study of pigeonpeas in Andhra Pradesh, edited by P.J. Bramel. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India.

Reddy, LJ, YV Reddy, and S. Chandra. 2004. Degree of cross-pollination between pigeonpea and its various wild relatives. Pages 143–148 *in* Assessing the risk of losses in biodiversity in traditional cropping systems: a case study of pigeonpeas in Andhra Pradesh, edited by P.J. Bramel. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India.

Reinsberg, K., T. Doucha, and S. Abele. 2004. Strukturwandel und Beschäftigung im Agrarsektor: Eine vergleichende Analyse der Tschechischen Republik und der neuen Bundesländer, Pages 427–431 in Perspektiven der europäischen Agrar- und Ernährungswirtschaft nach der Osterweiterung der Europäischen Union, Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbauese V, edited by H. Ahrens, M. Grings, and V. Petersen. Münster-Hiltrup.

Tripathi, L. and J.N. Tripathi. 2004. Application for biotechnology conservation and genetic enhancement of *Musa* germplasm. *In* Genetic resources and biotechnology, edited by D. Thangadurai, and Y. Pullaiah. Regency Publications, New Delhi, India.

Truman, P., P. Daphne, S. Taylor, L. Sanni, and M.O. Akoroda. 2004. A cassava industrial revolution in Nigeria: the potential of a new industrial crop. A publication of Global Cassava Development Strategy. FAO and IFAD. 48p.

Wakatsuki, T., M. Buri, and O.O. Fashola. 2004. Rice green revolution and restoration of degraded inland valley watersheds in West Africa through participatory and self-support sawah development. Page 304 *in* Participatory strategy for soil and water conservation, edited by M. Mihara and E. Yamaji. ERECON, Tokyo, Japan.

Wolz, A., S. Abele, and K. Reinsberg. 2004. Der Beitrag des Sozialkapitals zur Erklärung des Entwicklungspotentials der Landwirtschaft in den Transformationsländern. Pages 67–76 *in* Perspektiven der europäischen Agrar- und Ernährungswirtschaft nach der Osterweiterung der Europäischen Union, edited by H. Ahrens, M. Grings, V. Petersen. Münster-Hiltrup, Landwirtschaftsverlag.

Conference proceedings

Abele, S. 2004. Innovations for plant production in the risky environment of semi-arid Niger: a multi-level modeling assessment. Paper presented at the International Conference on Tropical Agriculture (Deutscher Tropentag), 5–7 October 2004, Berlin, Germany. http://www.tropentag.de/2004/abstracts/full/41.pdf

Adeniyi, O.J., M.O. Akoroda, and S.Y.C. Ng. 2004. Cryopreservation of cassava (*Manihot esculenta* Crantz). Pages 502–505 *in* Triennial Symposium of the ISTRC—AB, September 2004, IITA, Ibadan, Nigeria.

Aikpokpodion, P.O., Q. Ng, and M.O. Akoroda. 2004. Pages 157–161 *in* Proceedings of the 8th Triennial Symposium of ISTRC—AB, September 2004, IITA, Ibadan, Nigeria.

Aina, O.A., A.G.O. Dixon, and E.A. Akinrinde. 2004. Trait association and path analysis for yield of cassava genotypes grown in various agroecologies in Nigeria. Pages 399–404 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Akoroda, M.O. 2004. Cassava systems in Nigeria: root yield management. Pages 581–583 *in* Proceedings of the 8th Triennial Symposium of ISTRC—AB, September 2004, IITA, Ibadan, Nigeria.

Akoroda, M.O. 2004. Cryopreservation of cassava (*Manihot esculenta* Crantz). O.J. Adeniyi, M.O. Akoroda, and S.Y.C. Ng. Pages 502–505 *in* Proceedings of the 8th triennial symposium of the ISTRC—AB, September 2004, IITA, Ibadan, Nigeria.

Akoroda, M.O. 2004. Managing cassava stem cuttings for optimum root yields. 7 Pages. Proceedings of the 9th Triennial Symposium of ISTRC—AB, 1–5 November 2004, Mombasa, Kenya.

Akoroda, M.O. 2004. Sustainable commercial cassava cultivation. Page 10 in Proceedings of the 9th Triennial Symposium of ISTRC—AB, 1–5 November 2004, Mombasa, Kenya.

Ariyo, O.A., A.G.O. Dixon, G.I. Atiri, and S. Winter. 2004. Comparison of conventional and molecular-based techniques in cassava mosaic disease resistance screening of new cassava genotypes tested in dry and humid zones of Nigeria. Pages 257 *in* Resilient crops for water limited environments, edited by D. Poland, M. Sawkins, J.M. Ribaut, and D. Hoisington. Proceedings of a workshop organized by Rockefeller and CIMMYT, 24–28 May 2004, Cuernavaca, Mexico.

Asadu, C.L.A. and A.G.O. Dixon. 2004. Combined use of soil fertility indicators and crop yields for determining appropriate cassava-based crop mixture for soils of eastern Nigeria. Pages 240–246 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Ayeni, S., A. Avocanh, and F.D. Beed. 2004. Perception of farmers in Bénin, West Africa, towards *Imperata cylindrica*. Page 45 *in* Proceedings of the 4th International Weed Science Congress, 20–24 June 2004, Durban, South Africa.

Bamkefa, B., T.J. Onyeka, A.G.O. Dixon, R.U. Okechukwu, and R. Bandyopadhyay. 2004. Distribution of bacterial blight and fungal diseases of cassava in Cameroon. Proceedings of the Triennial symposium of the ISTRC—Africa Branch 31 October–5 November 2004, Kenya.

Beed, F.D. 2004. Development of plant pathogens as bioherbicides for weed control. Pages 6–8 in Proceedings of the Committee for Development of Plant Pathogens as Bioherbicides for Weed Control (multistate S-1001), 8–9 February 2004, Kansas City, USA.

Beed, F.D., R. Charudattan, and A. Den Breeyen. 2004. Biological control of *Imperata cylindrica*. Page 33 in Proceedings of the 4th International Weed Science Congress, 20–24 June 2004, Durban, South Africa.

Benesi, I.R. M., M.T. Labuschagne, A.G.O. Dixon, and N.M. Mahungu. 2004. Page 104 *in* Native starch quality of Malawi cassava T, Cali, Colombia.

Publications

Benesi, I.R.M., M.T. Labuschagne, A.G.O. Dixon, N.M. Mahungu, and C.D. Viljoen. 2004. Page 154 in Reliability of constant traits in morphological characterization of cassava as compared to AFLP markers. International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Blade, S.F., K. Lopetinsky, M. Olson, P. Laflamme, and C. Phillips. 2004. High protein lupins: diversifying the pulse industry in western Canada. 4th International Crop Science Congress. Online refereed proceedings. http://www.cropscience.org.au/icsc2004/poster/3/4/7/418_bladesf.html

Brown, R.L., R.L.Z. Chen, A. Menkir, D.G. White, and T.E. Cleveland. 2004. Identification of natural resistance to aflatoxin elaboration in maize. Page 367 *in* Proceedings of the 15th International Plant Protection Congress, 11–16 May 2004, Beijing, China.

Chikoye, D., T. Avav, J. Ellis-Jones, U. Udensi, G. Tarawali, and others. 2004. Promoting the use of integrated speargrass management strategies in soybean, yam, and cassava production systems in the moist savanna zone of Nigeria. Paper presented during the 2nd Stakeholders Conference on Speargrass Management for Poverty Reduction Amongst Small-Scale Farmers in West Africa, 13–15 September 2004, Makurdi, Nigeria.

Coyne, D., R. Bandyopadhyay, A. Tenkouano, S. Hauser, and C.S. Gold. 2004. Current issues and trends in plantain research at IITA with emphasis on nematode problems. Page 130 *in* Abstract presented at the 1st International Congress on Banana: harnessing research to improve livelihoods, 6–9 July 2004, Penang, Malaysia.

Demo, P., M.O. Akoroda, and D.K. Njualem. 2004. A model for rational determination of prices of seed potato (*Solanum tuberosum* L.) tubers of different size grades using agronomic data. Pages 79–81 *in* Proceedings of the 8th Triennial Symposium of ISTRC—AB, September 2004, IITA, Ibadan, Nigeria.

Edebiri, O., I.N. Egeonu, and M.O. Akoroda. 2004. Evaluating sweetpotato clones for consumers in southwestern Nigeria. Pages 421–425 *in* Proceedings of the 8th Triennial Symposium of ISTRC—AB, September 2004, IITA, Ibadan, Nigeria.

Emechebe, A.M., B. James, T.K. Atala, I. Kureh, M.A. Hussaini, A. Menkir, A.C. Odunze, J.P. Voh, S.G. Ado, and S.O. Alabi. 2004. SP-IPM pilot site initiative: farmer-participatory evaluation of *Striga hermonthica* management in Northern Nigeria. Paper presented at the 15th International Plant Protection Congress, 11–16 May, Beijing, China.

Fadayomi, N.O. and D. Chikoye. 2004. Prediction of sugarcane (*S. officinarum*) yield losses using the relative leaf area model. Pages 16–17 *in* The 32rd Annual Conference of the Weed Science Society of Nigeria, 31 October–4 November 2004, Ibadan, Nigeria.

Fernandez-Rivera, F., I. Okike, V.M. Manyong, T.O. Williams, R.L. Kruska, and S.A. Tarawali. 2004. Classification and description of major farming systems incorporating ruminant livestock in West Africa. Pages 89–122 *in* Sustainable crop–livestock production for improved livelihoods and natural resource management in West Africa, edited by T.O. Williams, S.A. Tarawali, P. Hiernaux, and S. Fernandez-Rivera. Proceedings of an international conference held at IITA, 19–22 November 2001, Ibadan, Nigeria. ILRI, Nairobi, Kenya; and CTA, Wageningen, The Netherlands. 528 + 12 p.

Franke, A.C., S. Schulz, M.A. Hussaini, J. Ellis-Jones, A.M. Emechebe, and D. Chikoye. 2004. On-farm testing of *Striga hermonthica* control technologies in the northern Guinea savanna. Page 27 *in* Papers presented at the 8th International Parasitic Weeds Symposium, Durban, South Africa, 24–25 June 2004.

Gold, C.S., P.J.A. van Asten, S.H. Okech, W.K. Tushemereirwe, and C.M. Nankinga. 2004. Page 42 *in* Integrated management of
productivity in East and Southern Africa: Rockefeller Foundation Grantees Workshop, 20–23 September 2004, Nairobi, Kenya.

Gowda, B.S., C.J. Botanga, B.A. Peterson, B. Mudrak, C. Fatokun, A. Emechebe, and M.P. Timko. 2004. Mapping and cloning of race-specific resistance genes to *Striga gesnerioides* and *Alectra vogelii* in cowpea. Page 5 *in* Papers presented at the 8th International Parasitic Weeds Symposium, 24–25 June 2004, Durban, South Africa.

Jefwa, J.M., E. Kahangi, L. Rutto, D. Odee, D. Mubiru, P. van Asten, C. Gold, S. Okech, A. Elsen, C. Gichuki, E. Kibugu, B. Vanlauwe, and N. Sanginga. 2004. Banana inputs, production, and marketing in Kenya and Uganda. Pages 66–67 *in* Enhanced soil productivity in East and Southern Africa: Rockefeller Foundation Grantees Workshop, 20–23 September 2004, Nairobi, Kenya.

Kamara, A.Y., D. Chikoye, A. Menkir, I. Kureh, L. Franke, and O. Ibikunle. 2004. Combating *Striga hermonthica* in the West African savannas using host-plant resistance and legume trap crops. Proceedings of the 8th International Parasitic Weeds Symposium in collaboration with the 4th International Weed Science Congress, 24–25 June 2004, Durban, South Africa.

Kolawole, G.O., J., Diels, V.M. Manyong, K. Wallays, G. Dercon, E.N.O. Iwuafor, A.M. Falaki, R. Merckx, and J. Deckers. 2004. Pages 158–160 *in* Balanced nutrient management system technologies in the northern Guinea savanna of Nigeria: validation, adaptation, and perspective, edited by A. Bationo, J. Kimetu, and J. Kihara. Proceedings of the International Symposium of the African Network for Soil Biology and Fertility (AFNET) of TSBF Institute of CIAT, May 2004, Yaoundé, Cameroon.

Kormawa, P., M. Tshiunza, A. Dixon, E. Udo, and V. Okoruwa. 2004. Varietal characteristics of cassava: farmers' perceptions and preferences in semiarid zone of West Africa. Pages 61–68 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Kureh, I., A.M. Hussaini, A.C. Odunze, D. Chikoye, A.M. Emechebe, G. Tarawali, L.A. Franke, and J. Ellis-Jones. 2004. Agronomic performance of integrated *Striga hermonthica* management strategies in maize. Page 13 *in* Papers presented at the 32nd Annual Conference of the Weed Science Society of Nigeria, 31 October–4 November 2004, Obafemi Awolowo University, Moor Plantation, Ibadan, Nigeria.

Kureh, I., D. Chikoye, M.A. Emechebe, M.A. Hussaini, G. Tarawali, A.C. Odunze, and J. Ellis-Jones. 2004. Agronomic performance of integrated *Striga* management strategies. Page 13 *in* Papers presented at the 32rd Annual Conference of the Weed Science Society of Nigeria, 31 October–4 November 2004, Ibadan, Nigeria.

Lokko, Y., M. Gedil, A. Dixon, S. Offei, and E. Danquah. 2004. Identification of molecular markers associated with a new source of resistance to the cassava mosaic disease. Pages 482–486 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Lokko, Y., M. Gedil, and A. Dixon. 2004. QTLs associated with resistance to the cassava mosaic disease: new directions for a diverse planet. *In* Proceedings of the 4th International Crop Science Congress, 26 September–1 October 2004, Brisbane, Australia. http://www.cropscience.org.au/icsc2004/poster/3/7/4/1154_lokko.htm

Massaquoi, F.B., A. Jalloh, and A.G.O. Dixon. 2004. Genetic relationships among local cassava germplasm in Sierra Leone based on agrobotanical characteristics. Pages 469–476 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Mbwika, J.M., P. Ntawuruhunga, C. Karuki, and M. Makhoka. 2004. Strategies for transforming cassava subsector analysis to ensure food security, income generation, and economic growth in East, Central, and Southern Africa. Page 117 *in* Proceedings of the Regional Workshop on Improving the Cassava Subsector, April 2002, Nairobi, Kenya.

Meludu, N.T., O.O. Ajani, and M.O. Akoroda. 2004. *Gari*: food for the rich or the poor consumers in Nigeria. Pages 166–169 *in* Proceedings of the 8th Triennial Symposium of ISTRC—AB, September 2004, IITA, Ibadan, Nigeria.

Menkir, A., J.G. Kling, B. Badu-Apraku, C.G. Yallou, and O. Ibikunle. 2004. Use of inbreeding as a tool to improve resistance to *Striga* in maize. Page 26 *in* Proceedings of the 8th International Parasitic Weeds Symposium in collaboration with the 4th International Weed Science Congress, 24–25 June 2004, Durban, South Africa.

Messiga, A.J.N.A., M. Mwangi, R. Bandyopadhyay, and C. Nolte. 2004. The status of fungal tuber rots as a constraint to cassava production in south Cameroon. Page 42 *in* Proceedings of the Triennial symposium of the ISTRC—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Mwangi, M., C. Nolte, and R. Bandyopadhyay. 2004. The status of cassava mosaic disease, bacterial blight, and anthracnose as constraints to cassava production in southern Cameroon. Proceedings of the Triennial symposium of ISTRC—Africa Branch 31 October–5 November 2004, Mombasa, Kenya.

Mwangi, M., R. Bandyopadhyay, and A.G.O. Dixon. 2004. The status of fungal rot diseases as constraints to cassava production and utilization in eastern Democratic Republic of Congo. Proceedings of the Triennial Symposium of ISTRC—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Nkamleu, G.B. 2005. Children at risk in the agricultural sector of sub-Saharan Africa: determinants of child labor participation in cocoa farming of Côte d'Ivoire. The 6th Annual Global Development Conference, 24–26 January 2005, Dakar, Senegal.

Nkamleu, G.B. 2005. Rural labor and migration in West and Central Africa: a review of research. Paper presented at Labor Policy Workshop, 6th Annual Global Development Conference, 24–26 January 2005, Dakar, Senegal.

Nkamleu, G.B. and J. Gockowski. 2004. Study of socioeconomic factors influencing child labor and schooling in cocoa sector: a survey in Côte d'Ivoire. Paper presented at the 78th Agricultural Economics Society Annual Conference, 2–4 April 2004, Imperial College, South Kensington, London.

Nkamleu, G.B. and V.M. Manyong. 2004. Factors affecting adoption of agroforestry practices by farmers in Cameroon, West Africa. Page 77 *in* Book of abstracts of the first World Congress of Agroforestry, 27 June –2 July 2004, Orlando, Florida, USA.

Offei, S.K., E.Y. Danquah, E. Okai, H.D. Mignouna, and A.G.O. Dixon. 2004. Genetic diversity in 96 accessions of cassava as revealed by random amplified polymorphic DNAs (RAPDs). Pages 476–481 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Okechukwu, R.U., C.C. Okonkwo, F.M. Quin, R. Asiedu, and A.G.O. Dixon. 2004. Archiving root and tuber research data. Pages 376–379 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Onyeka, T.J., E.J.A. Ekpo, and A.G.O. Dixon. 2004. Cassava root-rot disease in West Africa: review of recent literature and the field situation in Nigeria. Pages 584–588 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Owolade, F.O., A.G.O. Dixon, and S.O. Osunlaja. 2004. Sources of resistance to cassava anthracnose disease. Pages 577–580 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Pillay, M. 2004. Development of improved banana hybrids for eastern Africa. Paper presented at 1st International Conference on Musa, 6–13 July 2004, Malaysia.

Publications

Pillay, M. 2004. Molecular methods for the identification of bananas and plantains. Paper presented at Banana Cultivar Names and Synonyms Workshop, 23–25 March 2004, Kampala, Uganda.

Pillay, M. and N. Haelewyck. 2004. Chromosome numbers in banana accessions from Papua New Guinea. Paper presented at 1st International Conference on Musa, 6–13 July 2004, Malaysia.

Pillay, M. and S. Abele. 2004. Market opportunities for banana leaves in Uganda. Paper presented at the workshop on assessing the opportunities for developing and diversifying markets for bananas and banana-based products in sub-Saharan Africa, 2–6 February 2004, Kampala, Uganda.

Shiwachi, H., C.C. Okonkwo, and R. Asiedu. 2004. Nutrient deficiency symptoms in yams (*Dioscorea* spp.). Paper presented at the 96th Meeting of the Japanese Society for Tropical Agriculture 48(2): 73–74. Okayama.

Shiwachi, H., T. Ayankanmi, and R. Asiedu. 2003. A technique for grafting water yam (*Dioscorea alata*). Pages 268–271 *in* Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch, Ibadan, Nigeria.

Shiwachi, H., T. Ayankanmi, R. Asiedu, and M. Onjo. 2003. Induction of germination in dormant yam (*Dioscorea* spp.) tubers with inhibitors of gibberellins. Pages 268–271 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Singh, B.B. 2004. Cowpea research, production, and utilization: a global view. Page 370 *in* Conference Handbook of the 5th European Conference on Grain Legumes, 7–11 June 2004, Dijon, France. European Association for Grain Legume Research (AEP), Paris, France.

Singh, B.B. 2004. Recent advances in cowpea genetics and breeding. Page 124 *in* Conference Handbook of the 5th European Conference on Grain Legumes, 7–11 June 2004, Dijon, France. European Association for Grain Legume Research (AEP), Paris, France.

Singh, B.B. and H. Ajeigbe. 2004. A grassroot participatory model for accelerated seed production and technology transfer in West Africa. Paper presented at the ASA Annual Meeting, Seattle, USA. Agronomy Abstracts.

Singh, B.B. and H. Ajeigbe. 2004. Breeding grain type and dual-purpose cowpea varieties for intensifying cereal–legume systems in the tropics. Paper presented at the ASA Annual Meeting, Seattle, USA. Agronomy Abstracts.

Singh, B.B., F. Hakizimana, R. Ortiz, and E.A. Kueneman. 2004. Pages 56–70 *in* Soybean production and utilization in Africa, edited by F. Moscardi, C.B. H-Campo, O.F. Saraiva, P.R. Galerani, F.C. Krzyzanowsky, and M.C.C-Panizzi. The 7th World Soybean Conference Proceedings, 29 February–5 March 2004, Foz du Iguassu, PR, EMBRAPA, Brazil.

Singh, B.B., H. Ajeigbe, and S.G. Mohammad. 2004. Recent progress in cowpea breeding for biotic and abiotic stresses. Paper presented at the ASA Annual Meeting, Seattle, USA. Agronomy Abstracts.

Singh, B.B., H.A. Ajeigbe, C. Endondo, I.B. Mohammed, and O.O. Olufajo. 2004. An improved planting pattern for cowpea-based intercrops in West Africa. Pages 67–68 *in* Proceedings of the 5th European Conference on Grain Legumes and 2nd International Conference on Legume Genomics and Genetics, 7–11 June 2004, Dijon, France. European Association for Grain Legume Research (AEP), Paris, France.

Tshiunza, M., R.U. Okechukwu, M. Bokanga, and A.G.O. Dixon. 2004. Current status of cassava processing technology in semiarid areas of Central and West Africa. Pages 224–229 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

van Asten, P.J.A. 2004. Keynote presentation on natural resource management: actual and potential soil quality constraints in East African highland banana systems and their relation with other yield loss factors. Page 190 *in* Proceedings of the 1st International Congress on *Musa*, 6–9 July 2004, Penang, Malaysia.

Vayssières J.F., R. Wharton, G. Delvare, F. Sanogo, 2004. Diversity and pest control potential of hymenopteran parasitoids of *Ceratitis* spp (Diptera, Tephritidae) from mangos in Mali. Pages 461–464 *in* Proceedings of the 6th International Symposium on Fruit Flies of Economic Importance, 6–10 May 2002, Stellenbosch, South Africa.

Vayssières J.F., Y. Carel, and M. Coubes. 2004. Demographic parameters and main biotic factors of two *Dacini* species, *Bactrocera cucurbitae* and *Dacus ciliatus* (Diptera, Tephritidae) in reunion Island. Pages 91–95 *in* Proceedings, of the 6th international symposium on fruit flies of economic importance, 6–10 May 2002, Stellenbosch, South Africa.

Vayssières J.F.and F. Dal. 2004. Responses of the Ethiopian fruit fly, *Dacus ciliatus* (Diptera, Tephritidae) to colored rectangles, spheres, and ovoids. Pages 111–116 *in* Proceedings, of the 6th International symposium on fruit flies of economic importance, 6–10 May 2002, Stellenbosch, South Africa.

Wendt, J. W., and R. Ndango, Assessing soil sustainability by detecting changes in soil properties due to INRM: Laboratory methods. Paper presented at AFNET International Soil Fertility Symposium, 17–24 May 2004, Yaoundé, Cameroon.

Wydra, K., E. Agbicodo, B. Ahouhuendo, A. Batino, R.M. Cooper, A. Dixon, R. Jorge, V., B. Kemp, K. Kpemoua, K. Rudolph, V. Verdier, F. Witt, M. Zandjanakou, and V. Zinsou. 2004. Integrated control of cassava bacterial blight by (1) combined cultural control measures and (2) host plant resistance adapted to agroecological conditions, and (3) improved pathogen. Pages 506–515 *in* The small processor and development of local food industries for market economy, edited by M.O. Akoroda. Proceedings of the 8th Symposium of the International Society for Tropical Root Crops—Africa Branch (ISTRC—AB), 12–16 November 2001, IITA, Ibadan, Nigeria.

Abstracts

Abele, S. 2004. Innovations for plant production in the risky environment of semi-arid Niger: a multilevel modeling assessment. Page 176 *in* Rural poverty reduction through research for development and transformation, edited by K.J. Peters, D. Kirschke, W. Manig, A. Buerkert, R. Schultze-Kraft, L. Bharati, C. Bonte-Friedheim, A. Deininger, N. Bhandari, and H. Weitkamp. International Research on Food Security, Natural Resource Management and Rural Development; Book of Abstracts, Deutscher Tropentag 2004 Berlin. Koethen 2004.

Aina, O.O., A.G.O. Dixon, and R.A. Akinrinde. 2004. Influence of soil water stress on vegetative growth and yield of cassava genotypes under screen house conditions. Page 89 *in* Book of Abstracts, 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Akoroda, M.O., A.G.O. Dixon, P. Ilona, R. Okechukwu, and F. Ogbe. 2004. Managing stem cuttings of cassava for optimum yields. Page 68 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Akoroda, M.O., R. Okechukwu, C. Ezedinma, L.O. Sanni, J. Lemchi, E. Okoro, and A.G.O. Dixon 2004. Sustainable commercial cassava cultivation: the case of Nigeria. *In* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 30 October–5 November 2004, Mombasa, Kenya.

Anderson, P. and B. James. 2004. Increasing the quality and usefulness of Integrated Pest Management Research: an overview. Page 53 *in* Abstracts of the 15th International Plant Protection Congress, 11–16 May 2004, Beijing, China.

Aribisala, O. S., M.O. Akoroda, A.G.O. Dixon, R.U. Okechukwu, and P. Ilona. 2004. Estimating the forage yield of 43 cassava mosaic disease (CMD)-resistant genotypes under three agroecologies of Nigeria. Page 85 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Ariyo, O.A., A.G.O. Dixon, and G.I. Atiri. 2004. Resistance screening to whitefly infestation in a range of cassava genotypes established in multilocational trials of IITA in Nigeria. Page 67 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Ariyo, O.A., G.I. Atiri, A.G.O. Dixon, M. Koerbler, and S. Winter. 2004. Effectiveness of different artificial virus transmission techniques in screening cassava for resistance to cassava mosaic disease. Page 80 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Ariyo, O.A., M. Koerbler, A.G.O. Dixon, G.I. Atiri, and S. Winter. 2004. Enhanced symptom severity and pseudorecombination of geminiviruses are important factors in possible breakdown of resistance to cassava mosaic disease. Page 47 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Asadu, C.L.A. and A.G.O. Dixon. 2004. Response of cassava to soil nutrient variations in crop mixtures grown on an alfisol by continuous cultivation in eastern Nigeria. Page 28 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Bah, E.S., A.G.O. Dixon, and A. Jalloh. 2004. Relative growth performance of eight improved cassava genotypes and four popular improved checks in three diverse agroecological zones in Guinea. Page 96 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Bah, E.S., A.G.O. Dixon, and P. Ilona. 2004. Evaluation de la mosaique Africaine du manioc en Guinée. Page 81 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Bamire, A.S., V.M. Manyong, I.O. Sanusi, and D.O. Awotide. 2004. Ex-ante cost–benefit analysis of cassava roots in Nigeria. Page 71 *in* Book of Abstracts of the 9th Symposium of the International Society of Tropical Root Crops—Africa Branch (ISTRC—AB), 31 October–5 November 2004, Mombasa, Kenya.

Bamkefa, B.A., T.J. Onyeka, A.G.O. Dixon, R.U. Okechukwu, and R. Bandyopadhyay. 2004. Distribution of bacterial blight and fungal diseases of cassava in Nigeria. Page 80 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Benesi, I.R.M., M.T. Labuschagne, A.G.O. Dixon, and N.M. Mahungu. 2004. Native starch quality of Malawian cassava genotypes in different environments. Page 104 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Benesi, I.R.M., M.T. Labuschagne, N.M. Mahungu, A.G.O. Dixon, and C.D. Viljeon. 2004. Reliability of constant traits in morphological characterization of cassava as compared to AFLP markers. Page 154 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Bhattacharjee, R., M. Kolesnikova-Allen, P. Aikpokpodion, S. Opoku, J-C. Motamayor, K. Badaru, Y. Adu-Ampomah, R. Schnell, and I. Ingelbrecht. 2004. Unlocking genetic diversity in West African cocoa germplasm. Page 20 *in* Scientific Program and Abstracts. Regional Conference on Plant Genetic Resources and Food Security in West and Central Africa, 26–30 April 2004, IITA, Ibadan, Nigeria.

Publications

Blade, S.F. and K. Ampong-Nyarko. 2004. Canadian crop diversification: lessons learned. 2nd Australian New Crops Conference. University of Queensland, Gatton, Australia.

Chikoye, D. 2004. Promoting integrated management of *Imperata cylindrica* in the savanna of West Africa. Page 6 *in* Abstracts of papers presented at the 4th International Weed Science Congress, 20–24 June 2004, Durban, South Africa.

Coyne, D., R. Bandyopadhyay, A. Tenkouano, S. Hauser, and C.S. Gold. 2004. Current issues and trends in plantain research at IITA with emphasis on nematode problems. Page 130 *in* Abstract Guide for the 1st International Congress on *Musa*: harnessing research to improve livelihoods, 6–15 July 2004, Penang, Malaysia.

Dahan, R., B. James, M. Kharrat, E.H. El Shirbini, O. Mamdouh, M. Meskine, M.E.H. Maatougui, and A. Zemrag. 2004. *Orobanche* IPM in cereal–legume systems in North Africa. Page 50 *in* Abstracts of the 15th International Plant Protection Congress, 11–16 May 2004, Beijing, China

Dixon, A.G.O., G. Ssemakula, F. Ogbe, A. Ariyo, Y. Lokko, P. Ilona, and J. Mkumbira. 2004. Cassava mosaic disease in sub-Saharan Africa: variations in the pathogen, sources of resistance, and host-plant resistance breeding for sustainable control. Page 51 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Dixon, A.G.O., J. Whyte, N. Mahungu, G. Ssemakula, J. Mkumbira, and P. Ilona. 2004. Genetic improvement of cassava in sub-Saharan Africa: capitalizing on African landraces. Page 51 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Dixon, A.G.O., M.O. Akoroda, L. Sanni, C. Ezedinma, M. Patino, and R. Okechukwu. 2004. The cassava challenge in sub-Saharan Africa: increasing productivity, market opportunities, and profitability. Page 24 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Ekanayake, I.J., M.T. Lahai, C.M. Githunguri, O.J. Oyetunji, E. Okogbenin, and A.G.O. Dixon. 2004. Ecophysiological knowledge system of cassava deficit- and excess-moisture tolerance at whole plant level. Page 71 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Emechebe, A.M. 2004. Ways to manage *Striga* infestations without herbicides in West and Central Africa. Page 11 *in* Papers presented at the 8th International Parasitic Weed Symposium, 24–25 June 2004, Durban, South Africa.

Emechebe, A.M., B. James, T.K. Atala, I. Kureh, M.A. Hussaini, B.B. Singh, A. Menkir, A.C. Odunze, J.P. Voh, S.G. Ado, and S.O. Alabi. 2004. Farmer-participatory on-farm evaluation of *Striga hermonthica* management options in the Nigerian northern Guinea savanna pilot site of the SP-IPM. Page 51 *in* Abstracts of the 15th International Plant Protection Congress, 11–16 May 2004, Beijing, China.

Ezedinma, C., J. Lemchi, R. Okechukwu, L. Sanni, F. Ogbe, M. Akoroda, and A.G.O. Dixon. 2004. Status of cassava production in southern Nigeria. Page 100 *in* Book of Abstracts, 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Ezedinma, C., J. Lemchi, R. Okechukwu, L. Sanni, M. Akoroda, F. Ogbe, P. Ilona, C. Okarter, and A. Dixon. 2004. Understanding the traditional cassava commodity market in Nigeria: a preliminary analysis. Page 106 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Fregene, M., A. Kullaya, C. Suarez, L. Montes, C. Azurdia, B. Raji, A. Dixon. E. Okai, E. Kizito, U. Gullberg, W. Castelblanco, J. Gutierrez, and C. Buitrago. 2004. Simple sequence repeat diversity of local cassava varieties from Tanzania, Nigeria, Ghana, Uganda, Sierra Leone: lessons from genetic diversity and differentiation of a vegetatively propagated crop in a secondary center of diversity. Page 112 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Gold, C.S., C.M. Nankinga, B.I. Niere, A.M.K. Abera, S.H. Okech, and D. Coyne. 2004. Biological control of the banana weevil in Africa with emphasis on microbial control. Page 141 *in* Abstract Guide for 1st International Congress on *Musa*: harnessing research to improve livelihoods, 6 July–15 July 2004, Penang, Malaysia.

Gold, C.S., S. Okech, P. van Asten, T. Dubois, and C. Nanginka. 2004. *Beauveria bassiana* against the banana weevil. *In* Abstract Guide for the 1st International Congress on *Musa*: harnessing research to improve livelihoods, 6–15 July 2004, Penang, Malaysia.

Hankoua, B.B., N.J. Taylor, S.Y.N. Ng, I. Fawole, J. Puonti-Kaerlas, A.G.O. Dixon, M. Pillay, C.M. Fauquet, and I. Potrykus. 2004. Production of the first transgenic cassava plants in Africa: progress and challenges. Page 132 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Hanna, R., M. Tindo, L. Wijnans, G. Goergen, K. Tatahangy, K. Lema, M. Toko, J.M. Ngéve, A. Dixon, and J. Gockowski. The African root and tuber scale problem in Central Africa: the nature of the problem and the search for control options. Page 57 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Hughes, J.d'A., R. Asiedu, M. Ayodele, A.G.O. Dixon, and A. Tenkouano. 2004. Safe and effective international movement of vegetatively propagated crops in sub-Saharan Africa. Page 66 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Ilona, P.C., A.G.O. Dixon, and C.I. Ezedinma. 2004. Adding value to the cassava commodity chain in Nigeria: a breeder's perspective. Page 76 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Jacobson, K., S. Hauser, D. Coyne, and D. de Waele. 2004. Efficiency of fallow and hot water treatment in reducing nematodes in Cameroon. Page 136 *in* Abstract Guide for 1st International Congress on Musa: harnessing research to improve livelihoods, 6–15 July 2004, Penang, Malaysia.

John, E.I., J.d'A. Hughes, E.J.A. Ekpo, and D. Coyne. 2004. Incidence of cucumber mosaic virus (CMV), genus Cucumovirus causing infectious chlorosis of *Musa* spp. in Nigeria. Page 119 *in* Abstract Guide for the 1st International Congress on Musa: Harnessing research to improve livelihoods, 6–15 July 2004, Penang, Malaysia.

Jone, A., I. Zannou, R. Hanna, M. Toko, B. Agboton, and E. Mambo. The status of cassava green mite biological control in Mozambique. Page 55 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October-5 November 2004, Mombasa, Kenya.

Kamara, A.Y., A. Menkir, D. Chikoye, I. Kureh, and N. Sanginga. 2004. The potential of resilient crops in the cereal–legume production systems of the dry and moist savannas of West and Central Africa. Page 25 in Extended abstracts for an international symposium on improving human welfare and environmental conservation by empowering farmers to combat soil fertility degradation, 17–21 May 2004, Yaoundé, Cameroon.

Kamara, A.Y., A. Menkir, D. Chikoye, I. Kureh, L. Franke, and O. Ibikunle. 2004. Cereal–legume rotation to control *Striga* and improve on-farm yield of maize in northern Guinea savanna: effects of one-year rotation. Page 34 *in* Book of Abstracts of the 4th International Weed Science Congress, 20–25 June 2004, Durban, South Africa.

Kanju, E.E., N.M. Mahungu, J.A. Whyte, and A. Dixon. 2004. Association between zigzag stem habit and tolerance to cassava brown streak virus disease. Page 45 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Kariuki, C.W., R. Hanna, M. Toko, B.M. Ngari, and R. Irungu. 2004. Biological control of cassava green mite in Kenya – spread and persistence of the predatory mite *Typhlodromalus aripo*, and impact on cassava green mite and cassava root yield. Page 54 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Lee, S.U., A.B. Luma, D. Coyne, and V.M. Williamson. 2004. Characterization of the yam nematode, *Scutellonema bradys* in West Africa. Korean Society for Parasitology, 28–29 October 2004, Hanyang University College of Medicine, Korea http://www.parasitol.or.kr

Lema, K.M., A. Dixon, N. Mahungu, P. Ilona, J. Kimfuema, S. Lukombo, and S. Nluta. 2004. Rehabilitation of the cassava production in the Democratic Republic of Congo through germplasm development and deployment, and the promotion of new food products. Page 39 *in* Book of Abstracts, 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Lokko, Y., A. Dixon, S. Offei, E. Danquah, and M. Fregene. 2004. Genetic diversity among different sources of resistance to the cassava mosaic virus disease using SSR markers. Page 94 *in* Book of Abstracts, 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Lokko, Y., M. Gedil, and A. Dixon. 2004. QTLs for resistance to the cassava mosaic disease in African cassava accessions. Page 758 *in* Book of Abstracts of the 11th International Plant and Animal Genome Conference (PAG XII), 10–14 January 2004, San Diego CA, USA.

Lokko, Y., M. Gedil, and A. Dixon. 2004. SSR-based genetic linkage analysis of resistance to the cassava mosaic begomovirus in cassava. Page 94 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Manyong, V.M., A.S. Bamire, I.O. Sanusi, and D.O. Awotide. 2004. Ex-ante evaluation of nutrition and health benefits of biofortified cassava roots in Nigeria: the DALYs approach. Page 17 *in* Book of Program, Abstracts, and Participants of the African Association of Agricu
scientists", 6–8 December 2004, Nairobi, Kenya.

Maziya-Dixon, B., A. Dixon, R. Asiedu, and H. Ceballos. 2004. Biofortification of root and tuber crops: a novel approach to improving nutrition and health in Africa. Page 22 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Maziya-Dixon, B., A.G.O. Dixon, and A.A. Adebowale. 2004. Targeting different end uses of cassava: genotypic variation for dry matter, cyanogenic potential and pasting properties. Page 119 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Maziya-Dixon, B., A.G.O. Dixon, R. Asiedu, R. Kapinga, M. Andrade, M. Bonierbale, and H. Ceballos. 2004. Biofortification of root and tuber crops: a novel approach to improving health and nutrition in Africa. Page 22 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Maziya-Dixon, B., R.A. Sanusi, I.O. Akinyele, E.B. Oguntona, and E. Harris. 2004. Iron status of children under-5 in Nigeria: results of the Nigeria Food Consumption and Nutrition Survey. Page 43 *in* Book of Abstracts, 2004 INACG Symposium. Iron deficiency in early life: challenges and progress, 18 November 2004, Lima, Peru.

Publications

Maziya-Dixon, B.B., I.O. Akinyele, R.A. Sanusi, E.B. Oguntona, S. Nokoe, and E. Harris. 2004. Vitamin A status of children under-5 in Nigeria: results of the Nigeria Food Consumption and Nutrition Survey. Page 56 *in* Book of Abstracts 22nd IVACG Meeting. Vitamin A and the common agenda for micronutrients, 15–17 November 2004, Lima, Peru.

Messiga, A.J.N.A., M. Mwangi, R. Bandyopadhyay, and C. Nolte. 2004. The status of fungal tuber rots as a constraint to cassava production in South Cameroon. Page 42 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Mkumbira, J., R. Okechukwu, and A.G.O. Dixon. 2004. Advances in cassava yield improvement at IITA. Page 94 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Mkumbira, J., R. Okechukwu, and A.G.O. Dixon. 2004. Breeding for root quality traits in cassava. Page 95 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Mwangi, M., C. Nolte, and R. Bandyopadhyay. 2004. The status of cassava mosaic disease, bacterial blight and anthracnose as constraints to cassava production in South Cameroon. Page 42 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Mwangi, M., R. Bandyopadhyay, A.G.O. Dixon, and K. Tata-Hangy. 2004. The status of fungal rot diseases as constraints to cassava production and utilization in eastern Democratic Republic of Congo. Page 41 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Ngéve, J.M., R. Hanna, and M. Tindo. 2004. Characteristics of cassava landraces and their reactions to diseases and pests in Cameroon. Page *41* in Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Niere, B., C.S. Gold, D. Coyne, T. Dubois, A. Shahasi, and E. Mukwaba. 2004. *Radopholus similis* management in banana: prospects for the use of endophytic nonpathogenic isolates of *Fusarium oxysporum*. In Book of Abstracts 27th ESN International Symposium, 14–18 May 2004, Rome, Italy.

Niere, B., D. Coyne, C.S. Gold, A. Shahasi, and T. Dubois. 2004. The potential of fungal endophytes for nematode management in *Musa*. *In* Abstract Guide for 1st International Congress on *Musa*: harnessing research to improve livelihoods, 6–15 July 2004, Penang, Malaysia.

Niere, B., D. Coyne, C.S. Gold, A. Shahasim, and T. Dubois. 2004. The potential of fungal endophytes for nematode management in *Musa*. Page 134 *in* Abstract Guide for the 1st International Congress on *Musa*: harnessing research to improve livelihoods, 6–15 July 2004, Penang, Malaysia.

Ntawuruhunga, P., A.G.O. Dixon, F. Anneke, J. Okidi, and F. Otim Okello. 2004. Cassava, the crop of the future in East and Central Africa. Page 22 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya

Nukenine, E. and A. Dixon. 2004. Host-plant resistance to cassava green mite in Africa and its interaction with biological control. Page 83 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Ogbe, F.O., A.G.O. Dixon, J.d'A. Hughes, and F. Alabi. 2004. Mixed infections by biological variants of African cassava mosaic virus and their associated severe symptoms on cassava in Nigeria. Page 50 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Ogunjobi, A.A., A.G.O. Dixon, and O.E. Fagade. 2004. Genetic diversity among *Xanthomonas axonopodis* pv *Manihotis* isolated from the western states of Nigeria. Page 54 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Okai, E., J. Otoo, S. Kresovich, S. Michelle, M.T. Labuschagne, A. Dixon, and M. Fregene. 2004. Genetic diversity of cassava (*Manihot esculenta* Crantz) in Ghana using SSR markers. Page 40 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Okechukwu, R.U., J. Mkumbira, A.G.O. Dixon, and A.Y. Kamara. 2004. Genetic gain in cassava disease resistance. Page 96 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Okechukwu, R.U., M.O.A. Akoroda, A.G.O. Dixon, P. Ilona, C. Ezedinma, L.O. Sanni, J. Lemchi, F. Ogbe, and E. Okoro. 2004. Preempting a virulent cassava virus attack on Nigeria: fast track selection approach. Page 35 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Okoro, E., A. Dixon, C. Ezedinma, M Akoroda, J. Lemchi, and F. Ogbe. 2004. The role of the National Agricultural Extension System in cassava subsector development in Nigeria. Page 109 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Onitilo, M., L. Sanni, B. Maziya-Dixon, and A. Dixon. 2004. Varietal differences in the physicochemical, functional, pasting properties and granule size of starches from different CMD-resistant varieties. Page 62 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Owolabi, O.A., B.D. Omotola, and B. Maziya-Dixon. 2004. Readiness of Nigerian institutional arrangements on food and nutrition
□
Society of Nigerian Annual Conference, 27–30 October 2004, Jos, Plateau State, Nigeria.

Oyekanmi, E.O., D.L. Coyne, O. Osonubi, O.E. Fagade, and A. Adesoye. 2004. Microbial approach for the management of symbiotic nitrogen fixation constraints posed by *Meloidogyne incognita* on soybean. Contribution No: 238. Page 347 *in* Legumes for the benefit of agriculture, nutrition and the environment; Part III. Abstracts of posters–biotic and abiotic stress responses, June 2004, Dijon, France.

Pallangyo, B., D. Gnanvossou, R. Hanna, E. Nsami, and O. Mfugale. 2004. Distribution and abundance of cassava pests in Tanzania with a note on the spiraling whitefly. Page 83 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Pallangyo, B., R. Hanna, M. Toko, D. Gnanvossou, V. Mgoo, M. Otema, A. Onzo, and O. Mfugale. 2004. The biological control campaign of cassava green mite in Tanzania. Page 55 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Patino, M.T.O. and A.G.O. Dixon. 2004. Brazilian lessons for the cassava industry in Nigeria. Page 79 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Patino, M.T.O., A.G.O. Dixon, C. Ezedinma, J. Lemchi, R. Okechukwu, and L. Sanni. 2004. Cassava small-scale enterprises in Brazil: lessons for the cassava industry in Nigeria. Page 108 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Pillay, M., A. Tenkouano, D. Makumbi, C. Lwanga, and D. Talengera. 2004. Improvement of East African highland bananas. Page 9 *in* Abstracts presented at the 1st International Congress on Banana: harnessing research to improve livelihoods, 6–9 July 2004, Penang, Malaysia.

Raji, A.A., B. Odeseye, J. Akinyemi, T. Odunlami, F. Odeyemi, and I. Ingelbrecht. 2004. Efficient regeneration of cowpea (*Vigna unguiculata* L. Walp) via adventitious shoot formation. Plant and Animal Genome Conference XII, 10–14 January 2004.

Raji, A.A., J. Martin, O.N. Eke-Okoro, A. Dixon, C. Buitrago, and M. Fregene. 2004 Assessment of simple sequence repeats (SSR) diversity of cassava landraces in Nigeria. Page 165 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Sanni, L., C. Ezedinma, J. Lemchi, F. Ogbe, R. Okechukwu, M. Akoroda, E. Okoro, B. Maziya-Dixon, P. Ilona, and A. Dixon. 2004. Cassava postharvest needs assessment survey in Nigeria. Page 79 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Sanni, L., M. Akoroda, T. Phillips, and A. Dixon. 2004. Strategies for effective cassava postharvest system in Nigeria. Page 112 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Sanni, L., R. Okechukwu, C. Ezedinma, M. Akoroda, J. Lemchi, F. Ogbe, E. Okoro, P. Ilona, and A. Dixon. 2004. Innovative processing and utilization technologies for cassava in Africa. Page 75 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Tamò, M. and P. Neuenschwander. 2004. Important invasive alien species in agricultural systems: opportunities for biological control. Page 51 *in* Abstracts of the 15th International Plant Protection Congress, 11–16 May 2004, Beijing, China.

Tata-Hangy, K., J. Legg, R. Hanna, M. Toko, K.M. Lema, A. Dixon, and N.M. Mahungu. 2004. Incidence and distribution of cassava diseases and pests in the Democratic Republic of Congo. Page 44 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Tata-Hangy, K., R. Hanna, M. Toko, and K. M. Lema. 2004. Population dynamics of the African root and tuber scale on cassava in the Bas-Fleuve District of the Democratic Republic of Congo. Page 54 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Tindo, M., R. Hanna, L. Wijnans, C. Nolte, J. M. Ngéve, and G. Goergen. 2004 Pre-planting removal of host plant residues to reduce African root and tuber scale infestations on cassava in mixed-food crop fields in Cameroon. Page 56 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Toko, M., R. Hanna, J. Legg, M. Andrade, A. Jone, D. Coyne, B. Agboton, G. Okao-Okuja, R. Obonyo, M. Otema, and E. Mambo. 2004. Incidence and distribution of cassava pests and diseases in Mozambique. Page 93 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Wijnans, L., M. Tindo, and R. Hanna. 2004. Preliminary survey of entomopathogenic fungi associated with the African root and tuber scale *Stictococcus vayssierei* Richard. Page 79 *in* Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops—Africa Branch, 31 October–5 November 2004, Mombasa, Kenya.

Winter, S., O. Ariyo, M. Koerbler, K. Dietrich, and A.G.O. Dixon. 2004. Studying begomoviruses infections in susceptible and resistant cassava breeding lines. Page 97 *in* Book of Abstracts of the 6th International Scientific Meeting of the Cassava Biotechnology Network, 8–14 March 2004, CIAT, Cali, Colombia.

Others

Abele, S., K. Frohberg, M. Hartmann, A. Matthews, and P. Weingarten. 2004. Consumption trends for dairy and livestock products, and the use of feeds in production in the CEE accession and candidate countries (European Commission–Directorate General for Agriculture).

Publications

Adekunle, A.A, A. Dixon, J.P. Ilona, L. Mathada, and S. Adisa. 2004. Growing cassava commercially in Nigeria: an illustrated guide. IITA, Ibadan, Nigeria. 22p.

Akoroda, M.O. 2004. Checklist for commercial cassava cultivation. Field course on competitive commercial cassava cultivation used in the training of 44 farm managers of large cassava farms in southern Nigeria, 18–22 October 2004, Nigerian Starch Mills Farm, Opuoma-Egbema, Imo State, Nigeria. 4p.

Akoroda, M.O., R.U. Okechukwu, P. Ilona, E. Okoro, C. Ezedinma, J. Lemchi, F. Ogbe, L.O. Sanni, and A.G.O. Dixon. 2004. Monitoring tour of preemptive management of cassava mosaic disease field activities in Nigeria. IITA, Ibadan, Nigeria. 93p.

Beed, F.D., R. Charudattan, and A. Den Breeyen. 2004. Biological control of *Imperata cylindrica* in SE USA and West Africa. International Bioherbicide Group (IBG) newsletter 7.

Blomme, G., H. Mukasa, D. Ocan, G. Sebuwufu, P. Rubaihayo, A. Tenkouano, and R. Swennen. 2004. Relationships among root traits, shoot traits, and bunch weight in banana and plantain (*Musa* spp.): an overview of conducted research. Poster presented at the 1st International Congress on Banana: harnessing research to improve livelihoods, 6–9 July 2004, Penang, Malaysia.

Chikoye, D. 2004. Characteristics and management of *Imperata cylindrica* in smallholder farms in developing countries. Food and Agriculture Organization Plant Production and Protection 120: 81–88.

Coyne, D. and R. Plowright. 2004. Nematode parasites of rice. Information Pamphlet. West Africa Rice Development Association and International Rice Research Institute. 6p.

David, S. 2004. Farmer field schools: a revolution in training for sustainable cocoa production. Poster presented at a symposium on *Theobroma cacao*: ancient crop, medicinal plant, surprising future, at the National Academy of Science, 10 February 2004, Washington DC, USA.

Fe
Paper commissioned by Rockefeller Foundation for 2004 FRATI meeting on Genetic Resources, 6–8 October 2004. Published online.

Ferguson, M., R. Ortiz, and W.J. van der Walt. 2004. New opportunities for regional crop breeding and research in Africa. Southern Africa Plant Breeders Association Annual Meeting Abstracts.

Fermont, A.M., H.M. Obiero, P.J.A. van Asten, Y. Baguma, and E. Okwuosa. 2004. Improved cassava varieties increase the risk of soil nutrient mining: an ex-ante analysis for western Kenya and Uganda, AFNET Conference, Cameroon.

Guirguissou, M.A., P.Y. Adégbola, O. Coulibaly, K. Hell, and E. Amouzou. 2004. Factors affecting the use of improved clay store for maize storage in Bénin. 4th International Crop Science Congress, Australia.

Hell, K., R. Bandyopadhyay, and R. Sikora. Strategies for the management of mycotoxins in maize in Bénin, West Africa, Tropentag, Berlin.

Hell, Kerstin. 2004. Fungal pathogens and mycotoxin contamination of cowpea implications for food quality and trade in West Africa–PRONAF Meeting.

Hell, Kerstin. 2004. The most viable options for the management of mycotoxins in developing World AATF meeting, Nairobi, Kenya. http://europa.eu.int/comm/agriculture/publi/reports/ccconsumption/fullrep_en.pdf

Hughes, J., K. Makinde, S. Olembo, R. Bandyopadhyay, M. Ayodele, and V. Manyong. 2004. Scoping study: impact of sanitary and phytosanitary (SPS) issues on the safe trade in plant and animal products in the Economic Community of West African States (ECOWAS). IITA, Ibadan, Nigeria. 133p.

Hughes, J., S. Offei, and B. Ronellenfitch. 2004. Plant viruses in sub-Saharan Africa: a laboratory manual. IITA, Ibadan, Nigeria. 118p.

Kobenan, K., G.P. Gnonhouri, E. Akyeampong, A. Tenkouano, and K. Tomekpe. 2004. Evaluation of *Musa* hybrids in Côte d'Ivoire. Poster presented at the 1st International Congress on Banana: harnessing research to improve livelihoods, 8–14 March 2004, Penang, Malaysia.

Kullaya, A., K. Mtunda, H. Kulembeka, M. Ferguson, J. Marin, C. Ospina, E. Barrera, A. Jarvis, N. Morante, H. Ceballos, J. Tohme, and M. Fregene. 2004. Molecular marker-assisted and farmer participatory improvement of cassava germplasm for farmer/market-preferred traits in Tanzania. Poster presented at the International Scientific Meeting of the Cassava Biotechnology Network, 6 2004, CIAT, Cali, Colombia.

Lokko, Y., A.G.O. Dixon, S.K. Offei, and E.Y. Danquah. 2004. Genetic analysis of resistance to the cassava mosaic virus disease. Proceedings of the 4th International Crop Science Congress, September 2004, Brisbane, Australia. http://www.cropscience.org.au/icsc2004/poster/3/7/4/1198_lokko.htm

Manyong, V.M., A. Ikpi, and J.K. Olayemi. 2004. Agriculture in Nigeria: identifying opportunities for increased commercialization and investment. Summary Report. IITA, Ibadan, Nigeria. 38p.

Menkir, A. 2004. Advances in breeding maize for resistance to *Striga* at IITA. Paper presented at the African *Striga* Control Project Planning Workshop, 2–6 June 2004, Ouagadougou, Burkina Faso.

Ntawuruhunga, P. and J. Okidi. 2004. East Africa Root Crops Network (EARRNET). Contribution to agricultural development: transforming cassava into a broad-based commercial crop. Poster presentation to the joint ASARECA/COMESA Ministers and Committee of Directors of ASARECA meeting, 13–16 October 2004, Nairobi, Kenya.

Onyeka, T.J, A.G.O. Dixon, R. Bandyopadhy, R.U. Okechukwu, and B. Bamkefa. 2004. Survey of the distribution and current status of bacterial blight and fungal diseases of cassava in Nigeria. IITA, Ibadan, Nigeria. 37p.

Oyekanmi, E.O., O.E. Fagade, D.L. Coyne, and O. Osonubi. 2004. Biological approach for the management of symbiotic nitrogen fixation constraints posed by *Meloidogyne incognita* on soybean. Page 69 *in* Conference book. Oral presentation at: Science Association of Nigeria conference, 21–25 March 2004, University of Ibadan, Nigeria.

Surya, A., S. Blade, Z. Mir, J. Moyer, and D. Friebel. 2004. First North American forage fenugreek cultivar "Tristar". Canadian Society of Agronomy annual meeting, Edmonton, Alberta.

Taiwo, M.A., J.d'A. Hughes, and A.R. Akomah. 2004. Natural infection of *Datura stramonium* L. by an unusual strain of Pepper veinal mottle virus genus Potyvirus in Nigeria, 31 July–4 August 2004. APS Annual Meeting, Anaheim, USA.

Taiwo, M.A., J.d'A. Hughes, and K.E. Oke. 2004. Incidence and prevalence of maize streak virus (MSV) genus Mastrevirus and maize mottle/chlorotic stunt virus in Lagos, Nigeria, 31 July–4 August 2004. APS Annual Meeting, Anaheim, USA.

Villiers, S. and M. Ferguson. 2004. Inventory of agricultural biotechnology for Southern Africa. IITA, Nairobi, Kenya.

Weise, S. 2004. The Sustainable Tree Crops Program: a new development paragdigm. Poster presented at a symposium on *Theobroma cacao*: ancient crop, medicinal plant, surprising future, at the National Academy of Science, 10 February 2004, Washington DC, USA.

Wendt, J.W. 2004. Measuring soil change. Paper presented at the Training Program on DSSAT Version 4: assessing crop production, nutrient management, climatic risk and environmental sustainability with simulation models, 23–28 August 2004, Arusha, Tanzania.

Governing board

Mortimer Hugh Neufville (Chair)
Executive Vice President
National Association of State Universities and Land Grant Colleges (NASULGC)
USA

Aboulaye Babale
Chair, Board of Trustees
Institute of Agriculture Research for Development (IRAD)
Yaoundé, Cameroon

Barbara Becker
Executive Manager
Swiss Centre for International Agriculture (ZIL)
Zürich, Switzerland

Michael P. Collinson
Agricultural Economist
Goring-on-Thames, UK

Hartmann
Director General
IITA, Ibadan, Nigeria

Bryan Harvey
Saskatoon, Canada

Akira Iriyama
President, Sasakawa Peace Foundation
Tokyo, Japan

Maurice Izard
President of the Center of Montpellier (CIRAD)
Montpellier, France

Abubakar Jauro
Permanent Secretary
Ministry of Environment, Abuja, Nigeria

Cees Karssen
Plant Physiologist
Wageningen, The Netherlands

Joy Kwesiga
Gender Mainstreaming Division
Academic Registrar's Department
Makerere University, Kampala, Uganda

Henri Maraite
Université Catholique de Leuvain
Belgium

Birger Lindberg Møeller
Royal Veterinary & Agricultural University (RVAU)
Denmark

O. O. Ogunkua
Permanent Secretary
Federal Ministry of Agriculture and Rural Development, Abuja, Nigeria

O.C. Onwudike
Vice Chancellor
Michael Okpara University of Agriculture,
Umudike, Nigeria

Gry Synnevag
Center for International Environment & Development Studies
Agricultural University of Norway
Tivoli, Norway

Adama Traoré
Chair
Comité National de la Recherche Agronomique (CNRA)
Bamako, Mali

Professional staff

Hartmann, director general, *Ibadan*

Office of the Director General
J. Cramer, secretary to the board, *Ibadan*
F.O. Oke, secretary to the DG, *Ibadan*

Research-for-Development Council
R. Asiedu, elected councillor, *Ibadan*
S. Blade, director, research-for-development (West Africa), *Ibadan*
P. Bramel, director, research-for-development (East & Southern Africa), *Kampala*
A.G.O. Dixon, elected councillor, *Ibadan*
J.d'A Hughes, admin representative, *Ibadan*
V. M. Manyong, elected councilor, *Ibadan*
R. Ortiz, chair, admin. representative, *Kampala**

Research-for-Development Office
S. Blade, director, research for development (West Africa), *Ibadan*
B. Harbers, technical writer, *Ibadan*
A. Oberg, executive office manager, *Ibadan*
R. Ortiz, director, research-for-development, *Kampala**
A. Schoening, project officer, contracts and grants, *Ibadan*

IITA Stations and Officers-in-Charge
M. Akoroda, High Rainfall Station, *Onne*
S. Blade, Headquarters-Nigeria, *Ibadan*
B.D. James, Biological Control Center for Africa (BCCA), *Cotonou*
R. Ortiz, director, research-for-development, *Kampala**
B.B. Singh, Kano Station, *Kano*
S. Weise, Humid Forest Ecoregional Center (HFC), *Yaoundé*

Project Coordinators
I. Ingelbrecht, Project A, *Ibadan*
M. Tamò, Project B, *Cotonou*
J. Gockowski, Project C, *Yaoundé*
J. Wendt, Project D, *Kampala*
A. Tenkouano, Project E, *Yaoundé*
D. Chikoye, Project F, *Ibadan*

Project A – Preserving and Enhancing Germplasm and Agrobiodiversity
Scientists
R. Asiedu, yam breeder, *Ibadan*
C.A. Fatokun, Nigerian biotechnology program coordinator, *Ibadan*
M.E. Ferguson, biotech manager SADC livelihoods project, *Nairobi*
I. Ingelbrecht, head, biotechnology lab, *Ibadan*
M. Kolesnikova-Allen, cocoa geneticist, *Ibadan*
B. Maziya-Dixon, maize food technologist, *Ibadan*
F. Moonan, *Musa* geneticist, *Ibadan*
M. Pillay, banana breeder, *Ibadan*
V. Mahalakshmi, genebank curator, *Ibadan*
L. Tripathi, biotechnologist, *Ibadan/Kampala*
B. Badu-Apraku, maize breeder/coordinator WECAMAN, *Ibadan*
W. Adekunle, NABP communications coordinator, *Ibadan*

Postdoctoral Fellows
S. Hearne, plant molecular geneticist, *Nairobi*
H. Kikuno, yam physiologist, *Ibadan*

Visiting Scientists
W.S. Alhassan, modeler, *Accra**
Y. Lokko, biotechnologist, *Ibadan*
K.A. Marfo, economist, *Ibadan**
S. Oikeh, food technologist, *Ibadan**
A. Raji, biotechnologist, *Ibadan*

Consultants
R. Bhattacharjee, cocoa germplasm biotechnologist, *Ibadan**
D.J. Dumet, genebank conservation consultant, *Ibadan*
A. Okoruwa, soybean food technologist, *Ibadan*

Associate Experts
F. Baah, food technologist, *Ibadan*
M. Kaur, plant molecular biologist, *Nairobi*

Project B – Developing Biological Control Options
Scientists
M. Ayodele, plant pathologist, *Ibadan*
R. Bandyopadhyay, pathologist, *Ibadan*
F. Beed, weed pathologist, *Cotonou*
O. Coulibaly, agricultural economist, *Cotonou*
D. Coyne, nematologist, *Ibadan*
G. Goergen, entomologist, *Cotonou*
C.S. Gold, entomologist, *Kampala*
R. Hanna, acarologist, *Cotonou*
K. Hell, postharvest biologist, *Cotonou*
C. Herron, virologist – cassava brown streak disease, *Dar-es-Salaam*
J.d'A. Hughes, virologist, *Ibadan*
B.D. James, entomologist, *Cotonou*
C. Kooyman, grasshopper/IPM specialist, *Cotonou*
J.P. Legg, virologist (joint appointment with NRI), *Kampala*
P. Neuenschwander, scientist emeritus, *Cotonou*
M. Tamò, insect ecologist, *Cotonou*

Postdoctoral Fellows
T. Dubois, entomologist, *Kampala*
F. Mwangi, plant pathologist, *Ibadan*

Visiting Scientists
B. Odu, germplasm health scientist
S. Offei, virologist, *Ibadan**
M. Tindo, entomologist, *Yaoundé*
M. Toko, acarologist, *Cotonou*

Professional staff

Associate Experts
K. Agboka, insect ecologist, *Cotonou*
P. Boons, entomologist, *Cotonou*
L. Winjians, entomologist, *Yaoundé*

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.M. Manyong, agricultural economist, *Ibadan*
J. Helsen, PROSAB manager, *Maiduguri*

Postdoctoral Fellow
A. Alene, impact assessment economist, *Ibadan*

Associate Expert
A. Tipilda, anthropologist, *Ibadan*

Visiting Scientists
P. Amaza, agricultural economist, *Maiduguri*
A. Bamire, agricultural economist, *Ibadan*

Consultants
K.N. Amegbeto, yam economist, *Ibadan**
N. de Haan, rural sociologist, *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**
B.W. Khizzah, agronomist, *Kampala**
S. Kolijn, postharvest specialist, *Maputo*
N-M. Mahungu, agronomist/coordinator, SARRNET, *Lilongwe*
P.M. Ntawuruhunga, coordinator, SARRNET, *Kampala*
J. Wendt, soil chemist, *Kampala*

Postdoctoral Fellows
S. Abele, economist, *Kampala*
E.E. Kanju, cassava breeder/pathologist, *Dar es Salaam*

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

Visiting Scientists
S.H.O. Okech, entomologist, *Kampala**
P. Ragama, statistician, *Kampala*
C. Muchopa, policy economist, *Harare**

Consultants
J.M. Mbwika, PESA co-developer, *Nairobi*
C. Nankinga, insect pathologist, *Kampala*
T. Phillips, PESA Interim leader/developer, *Guelph*
J.B.A. Whyte, breeder/SADC livelihoods project manager, *Lilongwe*

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

Scientists
M. Akoroda, agronomist, *Onne*
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*
C. Ezedinma, economist, *Onne*
S. Hauser, soil physicist, *Yaoundé*
K. Lema, coordinator, DR Congo cassava project, *Kinshasa*
C. Nolte, soil fertility specialist, *Yaoundé*
O. Patino, agro-enterprise specialist, *Ibadan*
L. Sanni, postharvest specialist, *Onne*
H. Shiwachi, yam physiologist, *Ibadan**
A. Tenkouano, plantain/cassava breeder, *Yaoundé*
S. Weise, STCP manager, *Yaoundé*

Postdoctoral Fellow
Mkumbira, J., cassava breeder, *Ibadan*

Associate Expert
V. Robiglio, GIS specialist, *Yaoundé*

Visiting Scientists
D. Cornet, yam agronomist (CIRAD), *Cotonou*
J. Lemchi, zonal manager (CMD), *Onne*
L. Norgrove, STCP/MARS scientist, *Yaoundé**
F. Ogbe, virologist, *Ibadan*
R. Okechukwu, database/statistics manager (CMD), *Ibadan*
N. Ssemakula, cassava breeder, *Ibadan*

Consultants
G.B. Nkamleu, economist, *Yaoundé*
E. Okoro, project manager (CMD), *Onne*
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, Côte d'Ivoire NPP manager, *Abidjan*

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

Scientists
B. Badu-Apraku, breeder/coordinator WECAMAN, *Ibadan*
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*
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**
F. Massawe, cowpea breeder, *Kano*

Associate Experts
A.C. Franke, agronomist, *Ibadan*
O.K. Nielsen, weed scientist, *Ibadan**

Visiting Scientist
R. Abaidoo, soil microbiologist, *Ibadan*

Consultants
G. Tarawali, agronomist, *Ibadan*
J.A. Okogun, soil scientist, *Ibadan**
C. Nwoke, 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, *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*
V.S. Ekun, laboratory manager, *Ibadan*
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. Yussuf, multimedia specialist, *Cotonou*

Budget and Finance
O. Sholola, chief financial officer, *Ibadan*
B.A. Adeola, senior accountant, *Ibadan*
N.M. Adewumi, corporate accounting manager, *Ibadan*
J.E. Bolarinwa, payroll accountant, *Ibadan*
E. Estoque, chief financial officer, *Ibadan**
S.A. Ogunade, treasury manager, *Ibadan*
K.O. Olatifede, special projects accountant, *Ibadan*
J. Ukpong, FIS senior analyst, *Ibadan*

Communications and Information Services

D. Mowbray, head, communications and information services, *Ibadan**
Y.A. Adedigba, head, library and documentation, *Ibadan**
T. Babaleye, public affairs manager, *Ibadan*
E.O. Ezomo, principal librarian (collection and data), *Ibadan*
L. Abraham, communications writer, *Ibadan**
Y. Olatunbosun, editor, *Ibadan*
A. Oyetunde, coordinating editor, *Ibadan*
P. Philpot, manager, multimedia unit, *Ibadan**

Corporate Services

O.I. Osotimehin, head, corporate services, *Ibadan*

Auxiliary Services
H. Cameron, manager, hotel and catering services, *Ibadan*
W. Ekpo, security manager, *Ibadan**
R. Ogundun, materials logistics manager, *Ibadan**
M.O. Olanrewaju, asst. manager, hotel and catering services, *Ibadan*
F. Oshikanlu, head, travel services, *Ibadan*
S. Owolabi, purchasing manager, *Ibadan*
D. Sewell, manager, aircraft operations, *Ibadan*
O. Showemimo-Sanusi, materials manager, *Ibadan*

Computer Services
J. Scott, manager, *Ibadan*

Human Resources
O. Adebayo, physician, *Ibadan*
S. Ayebameru, executive assistant, *Ibadan*
O. Babalola, senior pharmacist, *Ibadan*
O. Babasanya, personnel manager, *Ibadan*
C. Eykyn, deputy head, international school, *Ibadan*
C. Inniss-Palmer, head, international school, *Ibadan*
J. Ogunbayo, employee services manager, *Ibadan*
A. Ohanwusi, planning/training manager, *Ibadan*
P. Ojo, medical laboratory services officer, *Ibadan*
E. Piennar, teacher, international school, *Ibadan*
O. Sikuade, head, IITA clinic, *Ibadan*
V. Waiyaki, human resources manager, *Ibadan*

Internal Audit
R.A. Fagbenro, senior internal auditor, *Ibadan*
O. Adeyeha, senior auditor, *Ibadan*

Management Information Systems
N.N. Eguzozie, head, MIS, *Ibadan*
L.O. Afemikhe, senior technical analyst (computer), *Ibadan*
R. Cruickshank, software trainer, *Ibadan*

Physical Plant Services
W. Quader, head, physical plant services, *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, telecommuncation 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

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*

Projet Niébé pour l'Afrique (PRONAF)
O. Coulibaly, agricultural economist, coordinator

Southern Africa Root Crops Research Network (SARRNET)
S. Kolijn, postharvest specialist
M-N. Mahungu, agronomist/coordinator

Professional staff

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

ASP 11 (Cornell Univ.-led) (Accra)
W. Alhassan*

CIFOR (Yaoundé)
O. Ndoye

CIRAD (Cotonou)
D. Cornet
J.F. Vayssières

HSPH/APIN (Ibadan, Abuja)
M. Aina
W. Odutolu

**Left during the year*

ICLARM (Yaoundé)
R. Brummett

ICRISAT (Kano)
J.J. Adu-Gyamfi

IFDC (Ibadan)
O. Obademi

ILRI (Ibadan)
M. Bassey
J. van Binsbergen

IRAD (Yaoundé)
B. Nguimgo

IRD (Cotonou)
P. LeGall

NRI (Kampala)
J.P. Legg (joint appointment)

IPGRI (Nyombe)
A.N. Attey (joint appointment)

WARDA (Ibadan)
O. Osiname
M-G. Saethre*
F. Nwilene

WVOB (Kampala)
C. Dochez

Statistics

New appointments	31
Resignations/terminations	29
Country citizenships	40
Female/male ratio	ca. 1:3

Abbreviations used in this report

AFLP	*amplified fragment length polymorphism*
BMZ	*Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)*
CBO	*community-based organization*
CBSD	*cassava brown streak disease*
CGM	*cassava green mite*
CMD	*cassava mosaic disease*
DANIDA	*Danish International Development Agency*
DFID	*Department for International Development (UK)*
DNA	*deoxyribonucleic acid*
EACMV-Ug	*East Africa Cassava Mosaic Virus-Uganda variant*
EAHB	*East African highland banana*
ESARC	*Eastern and Southern Africa Regional Center*
FAO	*Food and Agriculture Organization of the United Nations*
GIG	*Global Issues Group*
GIS	*geographic information system*
GTZ	*Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)*
IBC	*IITA's Institutional Biosafety Committee*
ICP	*inductively coupled plasma*
ICRISAT	*International Crops Research Institute for the Semi-Arid Tropics*
IIBC	*International Institute of Biological Control*
ILRI	*International Livestock Research Institute*
LEXSYS	*Legume Expert System*
NARO	*National Agricultural Research Organization*
NARS	*national agricultural research systems*
NGO	*nongovernmental organizations*
NGS	*northern Guinea savanna*
NRI	*Natural Resources Institute (UK)*
QTL	*quantitative trait loci*
RAPD	*random amplified polymorphic DNA*
RUSEP	*Rural Sector Enhancement Project*
RUVT	*regional uniform variety trials*
SADC	*Southern Africa Development Community*
SARRNET	*Southern Africa Root Crops Research Network*
SMS	*short message service*
SP-IPM	*Systemwide Program on Integrated Pest Management*
SS	*Sudan savanna*
SSR	*single sequencing reaction*
WECAMAN	*West and Central Africa Maize Network*

IITA Locations

IITA Headquarters
Oyo Road, PMB 5320, Ibadan, Nigeria
Tel +234 2 2412626
Fax +234 2 2412221
E-mail iita@cgiar.org
Web www.iita.org

International mailing address
IITA, c/o Lambourn (UK) Limited
Carolyn House
26 Dingwall Road
Croydon CR9 3EE
United Kingdom

Lagos/Ikeja Office
Plots 531 & 532 WEMPCO Road, Ogba Estate
PO Box 145, Ikeja, Nigeria
Cell +234 803 4023913

IITA High Rainfall Station, Onne
PMB 008, Nchia-Eleme
Port Harcourt, Rivers State, Nigeria
Tel +871 682341880, 761841076
Fax +871 682341882
E-mail iita-onne@cgiar.org

IITA Abuja Station
IITA Farm, PMB 82, Beside old water works
Kubwa Village, Abuja, Nigeria
Tel +234 9 5239598
Cell +234 803 4023910

IITA Kano Station
Sabo Bakin Zuwo Road
PMB 3112, Kano, Nigeria
Tel +234 64 645350, 645351, 645353, 624046
Fax +234 64 645352
E-mail iita-kano@cgiar.org

Cameroon
IITA Humid Forest Ecoregional Center
BP 2008 (Messa)
Yaoundé, Cameroon
Phone +237 2237434, 2237518
Fax +237 2237437
E-mail iita-humid@cgiar.org

République du Bénin
IITA Biological Control Center for Africa
BP 08-0932 Cotonou, Bénin
Tel +229 350553, 350188, 350600
Fax +229 350556
E-mail iita-benin@cgiar.org

Ghana
West Africa Seed and Planting Material Network
(IITA/GTZ/WASNET)
PO Box 9698, K.I.A., Accra, Ghana
Tel/Fax +233 21 765567
Cel +233 24 329531
E-mail wasnet@ghana.com

Democratic Republic of Congo
Immeuble Mobil
198, Avenue Isiro-commune de la Combe
Kinshasa, R.D. Congo
Tel +243 98 535 939
Fax +243 880 7737
E-mail a.lema@cgiar.org; alema.iitadrc@ckt.cd

Uganda
Eastern and Southern Africa Regional
Center (IITA-ESARC)
Namulonge, PO Box 7878
Kampala, Uganda
Tel +256 41 223445, 221009
Fax +256 41 223459
E-mail iita-uganda@cgiar.org

Kenya
Plant Biodiversity and Genomics Facility
c/o International Livestock Research Institute (ILRI)
PO Box 30709, Nairobi, Kenya
Tel +254 2 630743
Fax +254 2 631499
E-mail m.ferguson@cgiar.org

Mozambique
PO Box 2100, Av. FPLM No. 2698
Maputo, Mozambique
Telefax +258 1 461610
E-mail sarrnetmoz@teledata.mz

Malawi
SADC/IITA/SARRNET Project
Chitedze Research Station
PO Box 30258
Lilongwe 3, Malawi
Tel: +265 1 707014
Fax: +265 1 707026
E-mail sarrnet@malawi.net

Tanzania
c/o Mikocheni Agricultural Research Institute
PO Box 6226, Dar es Salaam, Tanzania
Tel +255 22 2700092
Fax +255 22 2700090
E-mail sarrnet-tz@acexnet.com

IITA

Research to Nourish Africa

Supported by the
Consultative Group on International Agricultural Research

International Institute of Tropical Agriculture | Institut international d'agriculture tropicale **ISSN 0331 4340**