DURAS Project: Innovative partnerships for sustainable development
Agropolis International is a campus devoted to the "green" sciences. It represents an exceptional well of scientific and technical skills: 2,300 scientist-managers in more than 100 research units in Montpellier and Languedoc-Roussillon, 300 of them working abroad, in some 60 countries.

The Agropolis International scientific community is structured into broad domains corresponding to the major scientific, technological and economic issues of development:

- Mediterranean and tropical agronomy and agricultural production sectors
- Biotechnology and agri-food technology
- Biodiversity, natural resources and ecosystems
- Water, environment and sustainable development
- Societies and sustainable development
- Genomics and integrative biology of plants and animals
- Food and health
- Food quality and security

A place where knowledge can be put to use and disseminated, a space for training and technology transfer, a platform for hosting international exchanges, the Agropolis International scientific community undertakes collective expertise missions and helps to supply the scientific and technical wherewithal for development policies to be developed and implemented.

GFAR
Global Forum on Agricultural Research

The Global Forum on Agricultural Research (GFAR) is a multi-stakeholder platform that enables all those concerned with the future of agriculture and the role it must play in development the world over to come together and seek to respond to the world's needs. Its actions are focused on four main sectors:

- World advocacy
- Inter-regional partnership
- Knowledge sharing
- Development of institutions for the future

The GFAR seeks to integrate research into the societies it wants to serve, and to place farmers and the clear needs of the poorest at the very heart of the concerns of agricultural research and innovation systems. The Global Forum does not directly conduct research programmes. The actions it supports are undertaken by the organisations, networks and agencies involved in (and accountable for) the development and use of agricultural knowledge to promote development throughout the world.

The GFAR brings together the various stakeholders and fosters collective actions through cooperative, equitable processes that promote rapid startup of operations and help ensure that agricultural innovation generates the expected development impacts.

MAEE
French Ministry of Foreign and European Affairs

The DURAS Project was financed through the Priority Solidarity Fund (FSP) of the French Ministry of Foreign and European Affairs (MAEE).

The Priority Solidarity Fund (FSP) is MAEE's project aid instrument designed to finance, through grants, various institutional, social, cultural and research development support extended by the MAEE to countries under its priority solidarity zone (ZSP).
The main objective of the DURAS Project was to foster greater involvement of southern stakeholders in the agricultural research and innovation process and to ensure as well as ensuring that their voices were heard at the international level.

The project has three components namely (a) support for the facilitation role of the GFAR Secretariat; (b) development of functional information and communication systems; and (c) implementation of a Competitive Grants Scheme.

Launched in April 2004 with €4M in funding from the French Ministry of Foreign and European Affairs' Fonds de solidarité prioritaire (FSP), DURAS was officially closed on 30 June 2008. It was jointly implemented by the Global Forum on Agricultural Research (GFAR) and by Agropolis International in Montpellier.

The articles featured in this special issue of Dossier d'Agropolis International are the 12 stakeholder-led initiatives supported under DURAS' Competitive Grants component. These were selected from more than 300 proposals received following its 2004 Calls for Proposals on four themes identified by GFAR stakeholders through a series of research priority setting exercises. These themes include (1) Agro-biodiversity and genetic resources management for food security; (2) Local knowledge in natural resources management; (3) Agro-ecology and other sustainable farming practices; and (4) Linking farmers to markets and support to agro-SMEs.
We would like to think that the DURAS Project is like no other. It was designed to support the facilitation role of the Global Forum on Agricultural Research (GFAR) in its effort to promote the opening up of the agricultural research system, particularly by ensuring that research priorities are identified in a participatory fashion and that the less vocal stakeholders, most notably civil society groups, are mobilized and able to meaningfully participate in agricultural research for development (ARD) processes. It was also conceived so that stakeholders could share and exchange information through available interactive regional agricultural information systems.

At the heart of DURAS is its competitive grants system. Following an original selection and evaluation process that put a premium on building multi-stakeholder partnership, 12 projects were funded over a period of about three years, each involving an array of disciplines and partners from around the world.

This special issue of Dossier d’Agropolis is devoted to these 12 projects. Each article is written by the project participants. It is an attempt to capture in a few pages what is otherwise a complex, if not complicated, experience and the context within which these partnerships were built. It also presents some key results and some lessons learned along the way.

It is therefore with great interest that we are sharing these stories with you, in the hope that this will inspire others to look at partnership building as part of the research process and that the process is also a result in itself. Finally, we hope that by sharing these stories we will be able to somehow bring others to look at partnerships not as transaction costs but as investments to be made by all so that research can serve its purpose.

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To be effective, agricultural research for development should be defined, driven, implemented and managed in partnership with all stakeholders, and particularly with civil society. It should turn local and traditional knowledge to account, promote it and build upon it while employing participatory approaches.

This novel, multi-stakeholder approach, as promoted by GFAR (Global Forum on Agricultural Research), was the inspiration for the implementation of the DURAS’ Project.

Its main objective was to foster greater involvement of southern stakeholders in the agricultural research and innovation process and to ensure that their voices were heard at the international level.

It was launched in April 2004 with €4M in funding from the French Ministry of Foreign and European Affairs’ Fonds de solidarité prioritaire (FSP). It was officially closed on 30 June 2008.

Carried out in partnership with Agropolis International, the DURAS Competitive Grants Scheme supported 12 multi-stakeholder projects implemented in more than 20 countries in Africa and three countries in Asia.

Three components

- **Component 1: Support the GFAR Secretariat's facilitation role.** This component consisted primarily of direct support for the GFAR Secretariat’s facilitation role in strengthening regional fora in agricultural research by enabling relevant stakeholders such as non-government organizations (NGOs) and farmers’ organizations (FOs) to actively participate in the ARD process, e.g., identification and review of regional research priorities, as well as in contributing to efforts to consolidate and coordinate NGO and FO networks, particularly in Sub-Saharan Africa and in the Asia-Pacific region. This component was aimed at supporting the emergence and development of stakeholder-led initiatives as ways of operationalizing some of the regional ARD priorities identified.

- **Component 2: Reinforce the functional information communication management (ICM) system.** This component was oriented towards the information communication management (ICM) system. It supported maintenance and continued development of the electronic GFAR (www.egfar.org), including its electronic repository, and publication of GFAR’s electronic newsletters. Likewise, this second component was pivotal in the development of Regional Agricultural Information Systems (RAIS) in all of the five regional fora. Regional ICM training workshops were organized in order to help information managers develop strategies for their organizations and establish structures and procedures for effective information management. ICM tools were used in RF activities related to advocacy, capacity building and regional knowledge sharing (strengthening linkages among network members).

1. Acronym for Promotion du développement durable dans les systèmes de recherche agricole au Sud (Promotion of sustainable development in agricultural research systems in the South)
Component 3: Implement a Competitive Grants Scheme.

The third component, considered central to the DURAS project, was the implementation of a Competitive Grants Scheme (CGS). It was designed to encourage and promote innovation as well as the scaling up of innovative ARD practices developed in the south. It also aimed to enhance southern partners’ scientific capacity. The thematic focus of the Calls for Proposals was the priority research agenda identified by the regional fora covered by the project, i.e., APAARI (Association of Asia-Pacific Agricultural Research Institutes), AARINENA (Association of Agricultural Research Institutes in the Near East and North Africa) and FARA (Forum for Agricultural Research in Africa).

An innovative mechanism...

DURAS encourages people to work together. To be eligible for funding, a proposed project should be led by an organization from the South, implemented in at least two Southern countries, and involve at least three types of stakeholders – one of which should be from civil society. Partnership quality was an important criterion in the selection of funded projects.

DURAS enables people to work together. €5000 in funding was provided to 24 preselected proposals to fund proposal writing workshops involving project partners.

DURAS facilitates sharing and learning. Regular interactions among the 12 funded projects were organized in order to co-define indicators, document experience and generate lessons, among others objectives.

Implementation of the 12 projects was expected to contribute in “opening up” process of research institutes (in countries involved) towards a more systems-oriented approach to national agricultural research. This was expected to make for a more functional relationship among the various stakeholders, especially non-traditional actors such as NGOs and farmers’ groups, in the research and development continuum.

Another expected outcome was new ways to improve North-South and South-South collaboration, with the emphasis on the partnership building process as well as the partnerships so formed and the learning process involved. Through the DURAS CGS, it was hoped that stakeholders would become more aware of the value of putting partnership at the core of ARD processes and that such research partnerships would receive greater encouragement so that agricultural research could contribute more meaningfully to sustainable development.
In sub-Saharan Africa, where food security is a vital consideration in all sustainable development initiatives, poultry stands out as a thriving channel of subsistence or commercial production that deserves encouragement. It is available to the poorest, and in particular to women at home. In that context, this project focused on how to manage livestock populations more sustainably over the long term through better knowledge of their zootecchnical and genetic characteristics.

The project “Morphological, zootecchnical and genetic characterization of local poultry populations (Gallus gallus) in the coastal countries of West Africa” was implemented in three countries on the coast of West Africa: Benin, Côte d’Ivoire and Ghana. Two different agroecological zones as project sites were selected for each country: a forested area in the southern region of each of the three countries, a savannah area in northern Ghana and Benin, and in the centre of Côte d’Ivoire.

The project, which was started in October 2005 and ran for two and a half years, involved graduate and agricultural research teams in all three countries and in France. It also involved rural people and development agents (NGOs, technical services…) in the process. The project’s main objective was to take advantage of local poultry populations while using local food resources to increase farmers’ income and ensure food security.

Poultry: an economic and food resource suited to the region

Poultry is an important livestock component in the humid regions of sub-Saharan Africa, where cattle farming is limited by trypanosomiasis. In these regions the number of birds is estimated at 1.5 billion, representing over 70% of the total number of birds in Africa.

Local populations account for 80% of Africa’s total poultry stock, representing 25-70% of its meat and 12-36% of its egg production. The total value of poultry production is estimated at 4,025 billion CFA francs, or about 100 billion euros.

Family-farm poultry production is popular and widespread for several reasons:
- given its short life cycle, chicken is a highly renewable resource;
- local poultry populations are suited to difficult poultry raising conditions (poor diet, little or no vaccination coverage);
- capital and production costs are low compared to selling price, making it an attractive source of income;
- meat and eggs are highly valued by the people and are important sources of protein.

Identifying the strengths and weaknesses of traditional husbandry

For information collection and the validation of methodologies for poultry characterization, this project pursued two major activities:
- surveys to identify farmers’ production systems and the characteristics of local hens; and
- experiments designed to characterize the poultry populations involved: molecular and phenotypic characterization (morphological features such as colour of plumage, skin and egg, plumage structure, size, skeleton, comb type etc.) and zootecchnical performance.

In each country two experimental flocks were established (savannah...
Poultry is an important component of animal farming in the humid regions of sub-Saharan Africa.

Managing animal genetic resources

To allow comparison between countries and between populations within a country, two actions were taken: breeding nuclei from local fowl populations were purchased and placed in breeding stations, and crosses were done with Label Rouge chickens (T55 x SA51). Local cocks were mated with “Label Rouge” hens. The performance of their offspring was measured (growth traits, egg-laying and feed efficiency), a high-yielding population was stabilized and chicks with higher growth potential were returned to farmers.

This approach, like the use of local poultry resources, is part of an overall sustainable animal genetic resource management strategy. The endeavour will need to be carried further by retaining the breeding nucleus and multiplying it to continue to improve it by selection.

Reducing chick mortality

In traditional poultry husbandry, there is a high mortality rate among chicks from hatching to weaning. Farm typology surveys have shown that most deaths are observed in young subjects and are due to predators (raptors, snakes, etc) and accidents (drowning or being run over by cars or motorcycles). Diseases are in third place.

This research project allowed the identification of the diseases that occur in each agroecological zone, the season at which they occur, their frequency etc. It has allowed for the development of an integrated health and medical prophylaxis program.

Different feeds made from local products were also offered based on the age of animals as well as their energy, protein and mineral needs. Models for simple and inexpensive coops were also tested and popularized.

Likewise, the experiments done by the CGDRAV NGO are particularly remarkable. In the course of those experiments, chick mortality fell from 43.95 to 16.23% between hatching and one week of age. This was accomplished by improving the diet and living conditions of the animals and by following an appropriate preventive health program. The experiments were carried out with the pilot poultry raisers whose participation was of utmost importance to the project. They acted as the interface between researchers and users, and are now serving as a reference point for other producers. ***

and forest) made up of birds purchased in the villages during the surveys. These flocks were reared at research stations. Genetic variability within and between populations was estimated through molecular polymorphism analysis. Genotyping using the microsatellite method was also carried out. Approximately 500 blood samples and DNA extractions were collected.

The growth and laying performance of the descendants of the original breeding nuclei were evaluated: reproductive traits (number of eggs laid, hatching rate and chick viability) and production characteristics (mean egg weight, weight at various ages, carcass quality). Finally, taste tests were done to identify all characteristics of the local poultry populations.

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Poultry is an important component of animal farming in the humid regions of sub-Saharan Africa.
Encouraging an activity suited to vulnerable population groups

In choosing varieties in the light of food security priorities, the development of poultry farming deserves particular encouragement. It reduces poverty and enhances household nutrition by adding animal protein. As such, local poultry makes the best and obvious option: it is the only animal production system within the reach of the local population from all social strata, and especially among women who have shown a keen interest in the industry. Accordingly, women’s groups have been trained in poultry farming to involve them in project implementation and in the development of strategies to improve poultry farming in rural areas.

Likewise, a special partnership was formed with all local farmers who were made aware of the project’s value and objectives. Four farmers’ associations were organized and trained on appropriate coop construction, diet formulation and stock management.

The importance of the conservation and utilization of genetic resources was impressed upon the local people, who actively participated by responding to questionnaires and provided local chicken varieties for breeding. During the surveys, however, some farmers refused to sell the birds required for the breeding nucleus. An awareness campaign needed to be done before the desired numbers could be collected. This called for patience, perseverance, thorough explanations and mutual understanding.

Easing access to sustainable development

Up until that time, poultry production development endeavours had most often involved programs to transfer the technologies and germplasm used in industrialized countries, without taking into account sustainable development factors.

This project’s strategy focused instead on how to manage livestock populations more sustainably over the long term through better knowledge of their zootechnical and genetic characteristics.

Four research structures, two NGOs, three development structures and five professional organizations were mobilized, as well as individual farmers. The project strengthened interactions between the partners and stakeholders and produced meaningful results that can be successfully extended to other African countries.

Traditional poultry farming also features a high chick mortality rate from hatching to weaning.
A regional network of multi-stakeholder platforms for a participatory evaluation of banana and plantain varieties

Plantain is one of the pillars of food security in Central and West Africa’s rain forest zone, which produces 45% of the world’s plantain. In order to help improve banana and plantain, the INNOBAP project has set itself the goal of testing and introducing into that area new and more productive varieties that are better suited to the constraints and expectations of farmers, processors and consumers than those now being grown.

Plantain is consumed on the spot or processed and sold on local and regional markets, but it is also sold on city markets and exported. In Central and West Africa, almost all plantain is produced by smallholders, whose yields are very low. The economic and social impact of plantain enhancement will therefore be substantial.

It is estimated that the technological innovations developed by researchers should allow yields to be increased from the current 4-7 t/ha/yr to 20-25 t/ha/yr. In particular, the introduction of new varieties, harder, more productive and with good cooking qualities, could make a considerable contribution both agronomically and commercially. Once widely disseminated, such improvements should have economic and social spin-offs of great benefit to the region.

CARBAP acts as the cornerstone of the project

To help implement these innovations, the INNOBAP (Innovation on banana and plantain) project entitled “A Regional Network of Dialogue and Exchange Platforms to Improve the Identification of Farmers’ Needs and the Dissemination of New Varieties of Banana and Plantain” has been implemented by the African Research Centre on Bananas and Plantains (CARBAP) with CIRAD support. Its purpose was to establish a network of multi-stakeholder platforms devoted to exchanges and cooperation between the actors of the plantain value chain: participatory evaluation and dissemination of new banana and plantain varieties. Eight platforms were created in the four participating countries: Benin, Cameroon, Gabon and Guinea.

CARBAP has a world-class reference collection of more than 650 varieties of banana and hosts a regional genetic improvement programme that develops hybrids from local plantain cultivars. At stake in this project, for CARBAP and CIRAD, was the identification and promotion of the most appropriate varieties in view of end users’ expectations, through the cooperation of all value-chain stakeholders.

Governance by stakeholders and multi-stakeholder sociotechnical platforms

In each of the participating countries, two platforms were created (one in the peri-urban zone, the other in the rural area) in places relevant to the plantain value chain: Ambam and Kombé (Cameroon), Oyem and Ntoum (Gabon), Coyah and N’Zerekore (Guinea), and Tori-Bosito and Zé (Benin).

Each platform was designed as a sociotechnical undertaking with a “technical” component whose focus was agronomic and post-harvest testing of a range of new banana varieties and a formal consultation, exchange and sharing framework involving researchers, extension agents, NGOs and various user categories (planters, processors, restaurateurs, nurserymen, merchants, etc.). The partnership, which was managed by the representatives of value chain stakeholders, was organised on the basis of the following six principles of its self-designed charter: legitimacy, competence, efficiency, democracy, solidarity and transparency. ***
Each platform consisted of two main organs:
- a steering committee (SC) with a membership of 5 to 6 persons representing various stakeholder categories;
- a Local Users and Experts Association (LUEA) with 20 to 30 members wishing to share their experiences and having expertise in the various activities of the value chain (farmers, researchers, extension agents, etc.).

The overall SC mandate was to accomplish the platform’s ultimate purpose, by defining orientations and making the necessary strategic decisions: ad hoc objectives, action plan, funding, programming, distribution and promotion of results, to keep the process going...

Each platform’s field organisation was structured on a mother-and-baby model consisting of two entities:
- a common reference plot (CRP or “mother plot”) with 10 banana varieties to be evaluated during the project’s initial phase;
- a network of individual evaluation plots (IEPs, or “baby plots”) belonging to the pilot farmers. Each of the 20 IEPs was to test three varieties chosen among the 10 varieties grown on the CRP.

The decision on where the CRPs would be put up was made in consultation with the local actors and on the basis of their accessibility and whether they allowed for varietal evaluation meetings and workshops to be held after the harvest. The selected fields were made available to the platform by farmers’ associations, agricultural development agencies, NGOs or individual farmers. Individual evaluation plots were as volunteered by farmers, preference being given however to geographic proximity so that travel and exchanges between stakeholders would be easier.

Field and culinary evaluation of the varieties

Evaluation and selection of varieties proceeded on the basis of agronomic criteria in the field but also on the basis of culinary qualities and usage constraints related to on-site consumption, transport, processing or marketing of fresh or processed produce.

For purposes of agronomic field evaluation, the LUEA was invited by the SC to make an overall evaluation of the varieties on the CRP at key stages in the banana production cycle (growth, flowering, harvest). Though there was some variability depending on the platform, the main evaluation criteria used by farmers were: hardiness, drought tolerance, resistance to foliar diseases, fruit and bunch size, ratooning, cycle duration and pseudo-stem size. The order of priority of the criteria varied from researchers to farmers but in the aggregate, both partners have the same priorities.

After the harvest, the evaluation done by the LUEA focused on bunch size, the fruits’ physicochemical and sensory qualities (size, length, colour and firmness of the pulp), and the culinary properties of the various varieties (the essential criterion). In cooperation with the processing and farming operations involved in the project, researchers and extension workers developed taste tests based on several protocols and on recipes for dishes popular in the host regions.

Likewise, farmers having IEPs did their own agronomic and taste tests on the three varieties received, at home with their family, friends or neighbours. They freely gave their opinions on those varieties’ culinary properties according to their own acceptability criteria, in order to select varieties that met their
concerns (local consumption, sale on local markets, sale to processing, sale to wholesalers for city or regional markets, etc.).

In all, 215 persons took part in the agronomic and post-harvest appraisals and shared their assessments of 30 banana and plantain varieties.

Outcomes and lessons learned

The project’s overall goal was achieved, as it conducted a participatory evaluation managed by value chain stakeholders and established a regional multi-stakeholder partnership system. The platforms served as loci for learning and training on banana growing, but also as a formal agency for cooperation between civil society and researchers, to promote the exchange of scientific and traditional knowledge of the different varieties. In that way, new light was shed on the interactions between researchers, outreach agencies and associations of value chain stakeholders. A further outcome was enhanced awareness among all concerned of the need to organise to implement a common policy.

Value chain stakeholders enthusiastically took part in the evaluation workshops and are in general pleased with the varieties introduced by the eight platforms. Two plantain cultivars selected by CARBAP were particularly favoured for their culinary versatility and for their large fruits and bunches, crucial to their market value.

A few plantain hybrids were favoured for their resistance to foliar diseases, their small pseudo-stem size and their usefulness in certain recipes. One cooking banana cultivar caught the attention of chip manufacturers because of the exceptional width of its fruits. Several farmers adopted new varieties that they are now selling on local markets.

As farmers’ and processors’ groups have recommended, the introductions of other new varieties by CARBAP through the platforms will be further developed taking into account the expectations expressed and the lessons learned from this project.

In methodological terms, the INNOBAP approach based on the concept of “mother-and-baby trials” has proved its worth. As it requires little in the way of investment and only simple cooperation and facilitation techniques, it is easily reproducible and will benefit civil society directly.

However, beyond these successes, some questions have yet to be answered, such as the platforms’ management independence vis-à-vis the research organisations, the inadequate flow of information between stakeholders and platforms, and above all the system’s viability. During the review workshops, solutions for better management and enhancement of the system were put forward. The main challenge is to keep the system running and keep up stakeholders’ motivation while making it available to other operational areas, to ensure a more meaningful impact on production and on the whole value chain.

To that end, lenders and public authorities will have to create the conditions for the platforms to be sustained, as has already been requested by stakeholders at the local and regional levels—which in turn will mean building stakeholders’ capacity and creating new income-generating activities. In that connection, it should be noted that in response to a CARBAP request endorsed by the Central African Economic and Monetary Community (CEMAC), CIRAD and the Subregional Platform of Farmers’ Organisations in Central Africa (PROPAC), the European Union in 2009 approved a grant in aid of the implementation of plantain innovation platforms in Central Africa.

Partnership

Lead organisation: Central African Research Centre on Bananas and Plantains (CARBAP Cameroon)

Partners:

- **Benin**: Institut National des Recherches Agricoles du Bénin (INRAB), Union des Producteurs du Sud (UPS), Groupe d’Appui, d’Accompagnement et de Recherche en milieu réel au Sud du Bénin (Garuma), Centre régional de promotion de l’Agriculture (CeRPA), Programme spécial pour la sécurité Alimentaire (PSSA)
- **Cameroon**: Institut of Agricultural Research for Development (IRAD), Service d’Appui aux Initiatives Locales de développement (SAILD), Cameroon Gatsby Trust, National Agricultural Extension and Research Programme (PNVRA), Groupement d’Initiative Commune Ngo Som, Fédération des Unions de Groupements d’Initiative Commune de la Mua, Groupement d’Initiative Commune PAPES (plant propagation, southern Cameroon), project for the promotion of professional agriculture (PROMOPA)
- **Gabon**: Centre National de Recherche Scientifique et Technologique, (Institut de Recherche Agronomiques et Forestières (CENAREST/IRAF), Institut Gabonais d’Appui au Développement (IGAD), Jardin d’Eden, Tartare Plus, ANFECOM, Concertation Nationale des organisations de producteurs (CNOP/Gabon)
- **Guinea**: Institut de Recherche Agronomique de Guinée (IRAG), Chambre régionale d’agriculture de Guinée forestière, Chambre régionale d’Agriculture de la Guinée Maritime (CRA/GM), Coopérative des producteurs de banane de Cocody (Coop-Bac), Ferme Fangs Bioko Kadiatou (FABIK), Union des Producteurs de Bananes de Makokou (UPBM), Union des producteurs de banane de Natékété (UPBN), Chambre Régionale d’Agriculture de Guinée Forestière (CRA/GF)
- **France**: Agricultural Research for Development (CIRAD), Université Montpellier 3

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It is not rare for small-scale farmers in the South to develop their own agricultural innovations. Less common are deliberate R&D efforts to support these innovation processes. DURAS has supported a pilot programme that challenged this by testing Local Innovation Support Funds (LISFs) in Cambodia, Ethiopia, South Africa and Uganda. By using locally managed funds, farmers finance their own research and learning activities. This microcredit system builds small farmers’ autonomy and catalyses multi-partner experimentation guided by the farmers’ ideas.

It is now recognised that agricultural development and natural resource management (NRM) do not unfold in a linear fashion, with new knowledge always being produced by research and passing through outreach services and systems before finally reaching farmers. Rural people are not merely the beneficiaries of this new knowledge: they may also create it or facilitate its creation.

That recognition led to new approaches to agricultural research for development (ARD), designed to improve innovation and local learning systems through a multi-stakeholder approach.

Stimulate and support local innovation

If small-scale farmers are to play a central role in the ARD approach, it is essential that changes take place in the way research funds are allocated. Funding smallholders directly allows them to decide what kind of “external” support they need from researchers or extensionists, and puts them in the driving seat of ARD. The project “Farmer Access to Innovation Resources: Action Research on Innovation Support Funds” (FAIR) is based on the recognition of farmer’s unique potential to direct relevant research and to innovate.

This action-research programme has focused on Local Innovation Support Funds (LISFs), whereby local stakeholders receive funding in four countries of the South where this was piloted: Cambodia, Ethiopia, South Africa and Uganda. The questions at the heart of the project were the following: would alternative funding mechanisms managed by farmers contribute to a paradigm shift in the way in which research is formulated and managed? Could it be done in such a way as to be cost-effective and sustainable in the long term?

The programme was implemented under the umbrella of PROLINNOVA, an international multi-stakeholder partnership programme initiated by NGOs and intended to build a worldwide learning network to promote local innovation in ecological agriculture and NRM. It involved communities and individual farmers, grassroots community organisations (GCOs), NGOs, researchers and extensionists.

LISF proposal selection

The LISFs’ modus operandi and governance systems changed considerably from country to country. In some countries, most of the selection process and fund management was done by GCOs. In others, lead NGOs and other development agencies had a stronger role to play.

In all countries, nevertheless, committees were set up to select proposals, and in all of these farmers participated actively in decision-making.

1. In 2007, upon ending the DURAS-supported phase, the programme partners mobilised support from the Rockefeller Foundation. With this, it has been able to work in the following additional countries: Ghana, Kenya, Nepal and Tanzania.

2. The Programme also worked in Nepal, but funded through sources other than DURAS.
The main prerequisites for an application to the LISF generally shared the following criteria:

- The proposed activity must be (i) a personal idea, (ii) technologically, economically, environmentally and socially sound, and (iii) reproducible among the poorest in society;
- There should be reasonable prospects of value addition through LISF support;
- There should be some equity contribution from the farmer or farmer group initiating the experiment, whether in cash or kind;
- The candidate(s) must be prepared to: (i) work under an approved plan, (ii) track the activity, document it and report on it, and (iii) share the results with others, e.g. receiving visitors and imparting his or her new knowledge to them.

Of the 274 applications submitted in the four countries between 2005 and 2007, 160 (58%) were awarded funding. Farmers used the funds in a range of activities related to crop and animal husbandry. Most funds went to experiments by farmers (or farmer groups) on a wide variety of innovative practices, while some funding was granted to enable farmers within the pilot countries to visit each other. Over time, more conscious efforts were made to increase the number of women in decision-making structures that approve applications and in supporting women’s initiatives in R&D. As a result, women’s participation has improved and the total percentage of applications done by individual women has reached almost 30% of the total applications.

Initially, there was a tendency for farmers to see LISF funds as a means to purchase normal inputs for production. The aid legacy runs deep, and the experience of FAIR has been that it is necessary for the supporting NGOs and government agencies to work closely with farmers to ensure a clear understanding of the purpose of the funds. Even so, many farmers still wanted to do much of the experimentation on their own.

The supporting partners encouraged a more collaborative approach between farmers and other actors (e.g. formal researchers) in jointly formulating proposals for joint experimentation. It should be noted that the more LISF management was decentralised to the farmer/CBO level, the more relevant the proposals were for the local farmers. Sometimes, the supporting partners had to make great efforts to help farmers transform their ideas into research proposals that met the selection criteria. It has been the experience in FAIR that lack of formal training in experimental design and limited abilities to express ideas in writing and to estimate costs are factors that make it difficult for farmers to prepare acceptable proposals on their own. They often need access to local technical support for sound proposal formulation and documentation.

** Farmers central to LISF implementation and management

NGOs presented LISF information to farmers and rural communities as an integral part of their activities and services in those communities. In some pilot countries, a mass media approach was taken. Methods included local radio broadcasts and farmer fairs. ***
Two application models were developed:
- **The more centralised model, involving a multi-stakeholder approach.** The application is sent to a facilitating organisation and presented to a selection committee, which sets criteria and approves or rejects applications. Exchanges between farmers and partners are facilitated under this model. However, it is only really governed by farmers to a limited extent and its transaction costs are higher.
- **The totally decentralised model is directly managed by local farmers.** Applications are selected by GCOs, while the facilitating organisation plays only a supporting role. That model gives local smallholders easier access, and has a more moderate transaction cost. However, the quality of selected proposals is a problem. There is a danger that the LISFs will only fund what farmers spontaneously suggest, and it is more difficult to secure involvement of formal researchers in the approved proposals.

**Sustainable management of a decentralised funding system**

The FAIR project was created in order to develop a sustainable system, co-managed by farmers, that would give them access to resources for farmer-led innovation. After the initial duration of the pilots, much progress was made in decentralising money management to groups of farmers or GCOs, though challenges were still arising. One of the key challenges faced is monitoring. The more decentralised, the harder it is to ensure good reporting of both the process and the result of the experiment funded.

The innovations made possible by these micro-grants benefit not only farmers and their local communities; they may also be of real scientific interest. A better understanding of the impacts of these experiments will emerge from tracking their effects over a longer timeframe. Are the practices associated with these experiments retained, improved upon or refined over time, or do farmers revert to former practices? Have new practices led to reduced risk or improved production, and have they ultimately contributed to more sustainable livelihoods for that farmer and perhaps the wider community?

Does the involvement of farmers in planning and implementing their own research, and in evaluating the proposals of other farmers, equip them better to interact with other stakeholders in ARD, i.e. does this experience strengthen farmers’ voices in decision-making about ARD? These are challenging questions that are being looked at more closely as the pilot initiative reaches a more mature stage.

If the experiments show promise both in social and economic terms, other aspects must be looked at more closely at a later stage of the project. LISF fund replenishment options need to be developed to enable them to be sustained. In some countries, the award is treated as a loan.

This has been partially effective. Loan portions have been retained within farmer groups and have tended thereafter to be used as part of their loan capital to support normal production activity. Moreover, the question has been raised: if formal researchers are not expected to repay loans for conducting research, why should farmer researchers be expected to do this? Should not some small part of funds available for ARD in the country be allocated to farmer-led research?

Finally, LISFs have served to focus the attention of ARD stakeholders on developing more useful models for financing research relevant for smallholders. The innovation system and the role of the farmer within that system are put in the foreground. This bodes well for better and more effective practice.

**Partnership**

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<th>Lead organisation:</th>
<th>Farmer Support Group (South Africa)</th>
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<td>Partners:</td>
<td>Centre d’Etude et de Développement Agricole Cambodge (CEDAC) Cambodia, ETC Foundation (the Netherlands), Agri-Service Ethiopia (ASE) Ethiopia, Farmer Support Group (FSG) South Africa, Environmental Alert Uganda</td>
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Cultivated ecosystem management in the Cameroon rainforest zone: identification of stakeholders and constraints on sustainability

Population growth, together with the growing demand for foodstuffs in urban areas, is increasing pressure on the rainforest’s resources. The following is an example from Cameroon of a contribution to better sustainable management of cultivated ecosystems in those areas using a set of methods involving advisory support to, and participatory learning by, farmers, whereby farmers’ innovations are noted, supported and put to use.

According to the Food and Agriculture Organisation of the United Nations (1999), Cameroon’s annual deforestation rate is 6%, 85% of which may be ascribed to family farms. In order to develop a repertoire of “best practices” in natural resources management based on advisory support, the project “Innovations and farmer knowledge in the management of forest ecosystems in West and Central Africa: Diversification of forestry systems and perennial food crops” sought to identify current practices among farmers in those areas and their impact on natural resources, and to identify major constraints on the sustainable management of cultivated ecosystems. Examples of how it works are two of the project’s pilot villages, Melen and Bokito in southeastern Cameroon.

Two forest areas with edge settlements dependent on natural resources

What sets Melen and Bokito apart is their ecology, their population density, their pressure on farmland, and their roads. Melen, located in a dense bimodal humid forest area, has low population density (10 inhabitants per square kilometre), puts moderate pressure on farmland and has poor roads. Bokito, in the forest-savannah transition zone, has relatively high population density (70 inhabitants per square kilometre), puts strong pressure on arable land and is well served by roads.

A project in which scientists and stakeholders cooperate on cultivated ecosystems management

This study has brought together agricultural research, universities, NGOs, farmers and the people of the two sites in southern Cameroon. It was implemented with the support of resource persons and students working with the farmers. Data collection was through surveys and interviews with a sample of 40 farmers in each site. Resource persons, such as local authorities (traditional chiefs, religious leaders), agricultural extensionists or farmers’ organisations operating at the study sites were also asked how they see farmers’ practices impinging on ecosystem development in their areas. Finally, field visits and briefings were held regularly to roll up the findings of the surveys and interviews.

A changing economic and social context

Changes in the ecology and the local social environment, and even broader alterations of the regional, national or global economic environment, affect the fate of family farms. Indeed, the economic crisis of the 1990s, which affected cash crop prices, and the drop in government support were among the factors that led farmers to diversify and intensify their agropastoral activities. ***
They focused more on fruit and food production (roots, tubers, plantain, maize in Cameroon and Ghana, rice and groundnuts in Guinea) to meet growing demand in the cities, which was spurred by a significant increase in urban populations (3% annually) and improved roads.

Growth in farming at the expense of the forest

To adapt to these changes, rural people spontaneously adopted three types of innovations: organisational, technical and resource management (fish and wildlife).

They are moving to new agricultural practices such as a short or “interrupted” fallow cycle, which, over time, saps the land’s productivity. Once virtually unknown in the study sites, monoculture market gardening too is slowly moving in, to the detriment of crop sequences. Bottomlands once considered unsuitable for agriculture are also being developed. Traditional slash and burn agriculture remains important.

Thus, older and younger farmers take divergent strategies: maintenance, of the cocoa- and coffee-based systems brought by colonisation, for survival or development of systems based on market garden crops for family food and income. Agricultural activities are now emphasised, to the detriment of other forest-related activities (hunting, fishing, non-timber forest products), whose resources are steadily declining and whose practice is no longer regulated by the local people. Food crops were formerly women’s work, but that too is changing with the arrival of new players, as these crops are no longer grown only for subsistence: they now generate some income, like the so-called cash crops.

Farmers with varied strategies

Farmers react differently to change depending on their age, their production targets, their family situation and their orientation, towards marketing or subsistence. Four types of farmers have been identified, with quite diverse strategies for managing cultivated ecosystems (fallow periods, crop type, use of inputs, etc.). Such producers are more or less open to innovations and their interest in looking for “useful” information is variable.

Among younger farmers (25-35 years), for example, there is a trend towards monoculture-type agriculture with high agricultural inputs, with more pronounced fertiliser use in the forest-savannah transition zone and with greater yields than in other types of traditional farms (cocoa, coffee). Thus, these farmers have new needs and new demands (inputs, labour, financing, product marketing), which in turn call for new services to be developed (financing systems, training, and advisory support).

From information dissemination to its assimilation by end users

These various types of farmers have access to many and varied sources of agricultural guidance and information. Besides the most active institutional structures (parastatal regulatory bodies, Ministry of Agriculture extensionists, specialised radio broadcasts), there are NGOs, farmers’ organisations, social groups (tontines, contribution arrangements, religious groups, etc.) and private operators, particularly sellers of agricultural inputs. Farmers do not always pay strict attention to the information they get from these sources. In managing their farms, farmers usually pick and choose from the techniques and practices offered, which they combine with their own experience. The choice will vary depending on the physical and financial resources available to heads of households and the growth strategy they adopt to enhance the productivity of their land.

Social groups have a unique role in relaying information on innovations, particularly in the area of agriculture. They cater for various social sensibilities, with structural and organisational affinities. Among the motivations for forming such groups is the members’ willingness to exchange experiences and to pool their energies to reduce the burden of work and/or expand the area under cultivation.
Varied actions by stakeholders in cultivated ecosystem management

In terms of forest ecosystems, the actions and impacts of these various stakeholders are observed at three levels:

**At the first level** are stakeholders with a direct impact on cultivated ecosystems in terms of cultivation practices and techniques. Such impact depends on the physical, human and financial resources at their disposal: farmers, farmers’ or producers’ organisations, working groups, tontines and religious associations.

**At the second level** are the stakeholders having great influence over the decisions made by the first group: institutional management structures, NGOs. Their support is oriented more towards improving the productivity of cultivated land and rational resource management.

**At the third level** are the sellers and buyers of agricultural produce. Their main targets are cocoa farmers and those who are moving towards monoculture. They have close relations with the level-2 stakeholders—to provide farmers with information on the products they offer, but also to identify their targets.

Best practices for the sustainable management of cultivated ecosystems

In the study area, the gradual emergence of innovative cropping systems and agricultural practices brings with it new farmer needs and demands:

- inputs (fertiliser, herbicides) but also labour (land preparation, crop maintenance);
- training on farming techniques for new crops; and
- advisory support in the management of many activities with many different themes: forward work programme, financing, use of income, etc.

In these rapidly changing forest areas, sustainable management of cultivated ecosystems requires coordinated joint actions by stakeholders at several levels: implementation of “best practices” by operators; regulation of access to and use of village natural resources; application by the State, in consultation with the people, of a natural forest resource conservation policy. These changes seem essential, and if other parts of the world are to be able to adapt them, they must take into account the variety of strategies used by individual farmers, the communication difficulties that may still exist (distance, language), and the problems involved in developing food product sales (marketing, product processing and storage, etc.).

**Partnership**

| Lead organisation: Institute of Agricultural Research for Development (IRAD, Cameroon) |
| Association for the Development of Farm Workers of the Centre (ADEAC Cameroon) Centre d’Appui aux Organisations Professionnelles Agricoles (Guinée) Agricultural Research for Development (CIRAD, France) Citrus Growers Association (Ghana) Fédération Nationale des Planteurs de Café de Guinée Institut de Recherche Agronomique de Guinée (IRAG), Ministry of Food and Agriculture (MoFA) / Eastern Region and District Extension Service (Ghana), Oil Palm Research Institute (Ghana), Service d’Appui aux Initiatives Locales de Développement (SAILD, Cameroon), Service National de la Promotion Rurale et de la Vulgarisation (SNPRV, Guinée), SOS Vert: Association pour l’Économie Solidaire et le Développement Vert (non-profit association, Cameroon), University of Dschang (UDS), Faculty of Agronomy and Agricultural Sciences (FASA, Cameroon), University of Ghana. |

| Partners: | Countries involved: Cameroon, Ghana, Guinea |
| Contacts: | Aboubakar Njoya, aboubakarnjoya@yahoo.fr & Jean-Marie Kalms, jean-marie.kalms@cirad.fr |
Population pressure coupled with economic development leads to overuse and loss of fertility of upland slopes in Asia. This deterioration is exacerbated by the increase in cattle (Vietnam) and goat (Laos) husbandry. The collaborative approach to fostering crop-livestock integration through the development of innovative agricultural alternatives based on local farmers’ knowledge and better fertilizer management has resulted in widespread adoption of technologies, significant increases in income, and rapid local dissemination of information.

The uplands of Southeast Asia are under great environmental pressure caused by converging natural and socioeconomic factors: population has grown rapidly since the 1960s; upland areas are encroached upon and cultivated; fallow times are decreasing; soil erosion is accelerating; soil fertility is declining due to agricultural practices unsuited to steep slopes. In this difficult ecological context, farmers have responded by spontaneously developing livestock smallholdings (cattle and pigs in Vietnam, goats in Laos) in response to the changing economic market.

Farmers’ innovations, local knowledge and the spread of a sustainable agro-pastoral system

The DURAS project “Local knowledge and technical innovation for income improvement and soil fertility management by husbandry integration in upland farming systems in Vietnam and Laos” sought to:

■ identify spontaneous innovative practices in use in local communities that are useful in the management of uplands natural resources;
■ define locally appropriate production systems that can provide a livelihood, have a positive environmental impact and are both socially acceptable and environmentally sustainable;
■ promote the adoption of these new agricultural practices by creating a viable relationship between producers, local policymakers, extension workers and researchers.

The project was able to identify farmers’ innovations and has complemented farming knowledge with field trials as well as scientific and technical training. It fostered the establishment of a profitable agro-pastoral system based on optimized fallowing, multi-year fodder production, including the rotation and association of food crops. This is expected to benefit all uplands inhabitants, especially the most disadvantaged.

Farmers, extension agents and researchers working together

Two municipalities served as pilot sites: Tien Xuan in Vietnam and Ban Lak Sip in Laos. Inside and outside these communities, there was active cooperation by farmers and their families, farm advisors and scientists during the project’s diagnosis and implementation phases (experimental plots, demonstration sites, workshops…).

The project favoured a participatory approach throughout the process where every decision made was made in close consultation with all stakeholders. The cooperation by all three groups of development actors was the main key to the project’s success.

This is important to highlight since the pilot villages were designated project participants. Local people’s level of involvement was also a strong indicator of popular interest: 100% of the farmers from the pilot villages attended the meetings and training offered. Not only were the courses...
The exchange of local and scientific knowledge helped to develop a personalized diagnosis and a schedule for each site. Farmers’ involvement at this stage of the project helped them clearly understand the framework of their cooperation and their responsibilities in the implementation of in-situ tests and demonstrations. The positive results of these tests significantly advanced local buy-in to the project and helped promote it outside the town and district.

Active collaboration, local training and dissemination of practical information

Numerous field visits, plus around 20 workshops and farmer field schools, enabled new technologies to be adapted to farmers’ demands and expectations and rounded out the researchers’ scientific knowledge. In addition to increasing farmers’ incomes, this cooperation, based on mutual exchange, strengthened their capacity for land management, integrated livestock management and pest control. In Vietnam, in addition to instruction on growing temperate forage crops in the plains during winter and tropical forage crops on slopes to rehabilitate and protect the soil, training was also given, at farmers’ request, on fertilization techniques and protection of rice crops (in the plains) and cassava (on the slopes). In all, 350 people in the pilot sites were trained, while another three communes later spontaneously joined the project.

In addition, technical advice was given in a widely distributed plain-language report. A first “technology package” on soil conservation, forage crops and nutrient management in food crops was distributed.

In the second year of the project, some 1,500 booklets on soil erosion monitoring, forage crops and nutrient management were distributed. In the final stage of the project, a brochure and a video showing its practical achievements were published, together with other projects in Vietnam and scientific knowledge gained from outside institutions.

All of this information was widely shared with local communities, district and provincial extension agencies, and NGOs. Farmers had access to a solid selection of interdisciplinary techniques, beyond the pilot sites and the experiments that were conducted.
Year-round forage crops for cattle in Vietnam

To ensure a continuous supply of cattle feed, the cultivation of various forage species, both temperate (e.g. Arvena strigosa, Medicago sativa, Avena…) and tropical (e.g. Brachiaria, Paspalum atratum, Panicum maximum, Stylosanthes guianensis…) were tested on slopes and bottomlands. The forage species selected (A. strigosa, P. atratum, P. maximum) proved well adapted to local agro-climatic conditions (protection against soil erosion, high drought resistance and tolerance of nutrient-poor soil). Cattle feed and soil fertility have improved significantly since they were planted; slope erosion, moreover, has been stopped. In Tien Xuan, the cattle herd increased over two years from 1,572 to 1,768 head, while at the same time, average erosion fell from 10-20 t/ha/yr to less than 1 t/ha/yr.

Many different products and increased yields in Laos

In Laos, activities focused on improving the uplands fallow cycle and on a small goat farm. The paper mulberry (Broussonetia papyrifera), a versatile tree that occurs naturally in fallow fields, showed it could restore soil and combat erosion.

Activities focusing on crop rotation and intercropping in the plains, to increase yields and economic gains, showed the value of the pigeon pea (Cajanus cajan). When intercropped with annual crops, it improves soil fertility.

System profitability as a guarantee of sustainability

Much more than the ecological dimension, there are two prerequisites for farmers to adopt new technologies; they must first meet their expectations, then have positive economic effects.

On the pilot Vietnam site, the average rice harvest increased by 10% and farm income by VND (Vietnamese dong) 2,800,000/ha per crop—a very significant increase for this poor region (average annual income in 2006 VND 15,000,000/yr, or about US$1,000). Hybrid rice varieties have a 21% higher rate of return and relative incomes rose by VND 4,800,000/ha per crop (or US$480). As a direct result, 40 households signed up to buy hybrid rice varieties.

For cassava, the techniques being tested yielded returns 28% higher than for traditional yields, increasing revenues by VND 6,400,000/ha/yr (US$590).

Dissemination and adoption of results for sustainable upland agriculture

Farmers’ perceptions, as surveyed after the training, indicated that the majority favoured adoption of the proposed techniques. Post-project interviews showed that the information had been spontaneously passed on even outside the pilot sites, as farmers told others that the techniques recommended were appropriate and easy to implement.

The project demonstrated, by example, that erosion could be stopped and soil restored on slopes by means of appropriate agricultural technology that is promoted by the farming community. It is clear, however, that the economic dimension was farmers’ key motivation, and the exclusive focus of the dialogue between farmers and researchers.

Though environmental protection, soil restoration and erosion control were mentioned, they were never the crux of the arguments used to persuade farmers to adopt a given technology.

The sustainability of the actions taken is difficult to assess at this point, two years into the project cycle. But there is hope, given farmers’ enthusiastic participation and the immediate improvement in their living conditions. If further progress is to be made, the project will have to be carried forward through an investment in technical services by agriculture departments.

Finally, it is clear that the project’s profitability is likely to spur the adoption of sustainable agriculture in the poor mountainous regions of Southeast Asia. The integration of livestock smallholdings appears to be a viable alternative in the fight against poverty, while it will also help restore soil fertility and promote local people’s access to economic markets.

Partnership

Project leader: Soils and Fertilizers Research Institute (SFRI) Vietnamese Academy for Agricultural Science, MARD (Vietnam)

Partners: RU 176 (Solutions) of the Institut de recherche pour le développement (IRD, Vietnam and Laos), RU 18 (Husbandry Systems) (Agricultural Research for Development, CIRAD, Vietnam), National Agriculture and Forestry Research Institute (NAFRI, Laos), National Institute of Animal Husbandry (Vietnam), People’s committee of Tien Xuan Commune (Vietnam), People’s committee of Ban Lak Sip village (Laos).

Countries involved: Vietnam, Laos

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In sub-Saharan Africa, where soil fertility is deteriorating while the price of fertiliser increases, the use of organic fertiliser as a sustainable alternative appears easy to implement. To enhance the production and use of these fertilisers, experiments involving local and scientific knowledge have been conducted in four agro-pastoral savannah areas. The economic and ecological impacts of these innovations are difficult to measure, but they have yielded encouraging results in terms of yield and intervillage trade.

The declining soil fertility observed in this region of Africa is due to the spread of continuous cultivation and the abandonment of fallowing. The crops of cotton, cereals or maize that are grown are demanding in terms of mineral elements; but the price of mineral fertilisers is up, while the price of cotton is down. In this context, farmers are showing increasing interest in organic fertiliser, but the value they place on it is variable by area.

The technical solutions and models proposed by researchers do exist, but are being ignored by farmers. The purpose of the project "Valorising local knowledge on crop-livestock integration for the sustainable management of sub-humid savannah ecosystems in Africa" was to increase the involvement of stakeholders in the field and enable them to adapt their practices. The project experimented with a participatory action research (PAR) process designed to improve the use of organic fertiliser, taking the greatest possible advantage of farmers’ knowledge and expertise.

The project aimed to improve soil fertility and sustainable use of village territories’ farmland, pasture and woodland resources, in particular through the characterisation, evaluation and enhancement of local knowledge, capacity building and management information, and the establishment of PAR. To achieve this, the project set itself the following objectives:

- To co-construct the soil fertility problem with local stakeholders starting from their local knowledge and expertise;
- To identify with them the possible options for improving the production and use of organic fertiliser to restore soil fertility;
- To pilot these innovations with them on their farms and assess their effect on the sustainability of the production system.

The PAR approach seeks to formalise a joint project wherein scientists work with local stakeholders who are involved at all stages of the research: diagnosis of the problematic situation; the contracting phase (development of the governance system, problem definition and work programme); the phases of completion (implementation through experiment) and of review and dissemination of the findings.
Pooling of knowledge based on exchange and contracting

Depending on the country, consultation frameworks between local stakeholders and scientists have taken different forms. In some villages, a transitional structure has formalised the link between local socio-professional organisations (SPOs, or farmer/producer groups) and researchers. That structure comprised a Village Coordination Committee (VCC) for liaison between researchers and the SPOs, a steering committee (VCC representatives, researchers) to manage the project, and a scientific guidance committee. On the basis of that organisation, local stakeholders and researchers identified research topics aimed at strengthening crop-livestock integration in production units through two experimental foci: improved production of organic fertiliser and its rational use in the field.

Organic fertiliser production generated considerable excitement, with an increase in the number of volunteers as soon as the work began. Meetings of the project coordinating committee, involving scientists and farmers, led field teams to compare notes on their experiences in order to develop protocols, present results, organise joint activities (intervillage exchange) and debriefing meetings. The scientific committee played a strategic role in methodological adjustments.

Such a participatory approach must balance the various stakeholders’ time scales so that learning processes will be successful. It must rely on good facilitators, mediators and translators to ensure that information will circulate.

In order to make farmers aware of the techniques used elsewhere in similar conditions, but also to train them in some theoretical aspects, the project established intervillage exchanges and training sessions. Through these exchanges, farmers realised that a change in organic fertiliser enrichment practices was both desirable and achievable at the community level. Similarly, experimental approaches and innovation opportunities emerged.

In the villages of Koumbia and Kourouma (Burkina Faso), technical training given in the Dioula language at farmers’ request appeared to have a less decisive impact than intervillage exchanges. The training did however enable discussions to be held with farmers on the biological mechanisms involved in the development of quality fertiliser, regeneration processes and loss of fertility, supplementing indigenous knowledge to some extent.

The project also helped network a group of scientists conducting research on the dynamics of cropping relative to livestock production in agro-pastoral systems of West and Central Africa. Further, it promoted a strengthening of research institutions’ capacity through student training. Scientific publications completed the otherwise limited and incomplete information available. Dissemination of the findings, via the production of technical documentation for local stakeholders, still remains to be done.

Fertiliser typology and characteristics

Analytical work on indigenous knowledge performed at Dentiola (Mali) and Koumbia and Kourouma (Burkina Faso) has identified many different types of fertiliser, their characteristics, the risk factors associated with each, and how they are managed.

In Mali, four types of organic fertiliser are recognised by farmers: manure, household garbage, nightsoil and field composting.
The latter is relatively well-developed and has the advantage of turning biomass fertiliser to account without transport.

Farmers tend to apply fertiliser in a rational manner. Some, having very little fertiliser, will even locate specific places in the field found deficient in fertility.

In Burkina Faso, most manure sites are located near dwellings, in the form of household compost heaps and compost pits. Biomass produced in the field (e.g. cotton stalks) is burned, and straw residues from range pasturing are left in the fields.

**Organic fertiliser production and local application techniques**

To perform the experiments, the VCCs selected farmers according to criteria set out in a specification. The plot and the crop to be used for the experiment were chosen by the farmers. A technician and a village farmer were responsible for follow-up. The farmer undertook to organise visits to his plot by other village farmers.

Farmers took a particular interest in the new mode of fertiliser production introduced: cotton stalk composting. More than half of them have opted to use it.

At Koumbia and Kourouma, the rate of completion of compost pits is satisfactory to date, with 78% of the 18 pits planned having been dug. Fertiliser production is underway and the first pits will be emptied at the beginning of the next crop year.

Measurements on maize plots show a significant increase in grain yield through the application of fertiliser, and seedlings developed better. However, there was no significant difference between the test and control plots as regards straw production and grass cover.

The significant standard deviations are partly attributable to very different climatic conditions in 2007 between the two villages (near normal rainfall in Kourouma and drought in Koumbia).

On the cotton fields, it is difficult to reach a conclusion, as the sample was limited to two farmers. Overall, however, the organic fertiliser did have a positive effect on yield.

**Convincing results but an economic and environmental impact that is difficult to assess**

Given these results, it can be concluded that the main objectives of the project were achieved. However, it is difficult to say what the project’s economic and ecological impacts may be, as it was conducted for too short a time and with too limited means to achieve significant impact in the nine villages.

Nevertheless, the results are very encouraging. It paved the way for the conduct of further research on the promotion of sustainable development in agro-pastoral systems in sub-Saharan Africa, for the methods employed are clearly applicable on a broader scale, in other areas of agriculture (e.g., animal husbandry and ecosystem management: seeds, soil, livestock, production unit economics, farmland, pasture and woodland, climate change...) but also in other contexts (drylands, wetlands, urban agriculture...).

**Partnership**

| Lead organisation: International Centre for Animal Husbandry Research and Development in Sub-humid Regions (CIRDES, Burkina Faso) |
| Partners: Association Tchadenne des Acteurs de Développement Rural (ATADER), Bureau d’Études et de Liaison des Actions Concertées et de Développement (BELACD, Chad), Agricultural Research for Development (CIRAD, France), Commission Régionale des Utilisateurs des Résultats de la Recherche (CRU, Mali), Institut d’Économie Rurale (IER, Mali), Institut de l’Environnement et de Recherches Agricoles (INERA, Burkina Faso), Institute of Agricultural Research for Development (IRAD, Cameroon), Chad Agricultural Research Institute for Development (ITRAD, Chad), Regional Applied Research Centre for the Development of Central African Savannahs (PRASAC) Support for Local Development (SADEL, EIG, Cameroon), Union des Sociétés Coopératives d’Éleveurs Producteurs de Lait du Houet (UEPL, Burkina Faso), Union Nationale des Producteurs de Coton du Burkina (UNPCB, Burkina Faso), Union Régionale des Jeunes Professionnels Agricoles des Hauts Bassins (URJPA HB, Burkina Faso) |
| Countries involved: Burkina Faso, Cameroon, Mali, Chad |
| Contacts: Abdoulaye Gouro, gouro@fasonet.bf & Eric Vall, eric.vall@cirad.fr |
In Southern countries, market garden produce is an important food resource and a growing export business. Plant-parasitic nematodes harm the industry and are thought to generate up to 15% of global agricultural losses. Multidisciplinary research on these pests has been conducted in search of an integrated biological protection easily transferable to farmers. Beyond the scientific results the project achieved, its other outstanding success lies in the establishment of the NeMed research network.

Chemical control using methyl bromide was until recently the most common method of controlling plant-parasitic nematodes on vegetable crops. However, methyl bromide was banned in 2005 under the Montreal Protocol, which established support measures for developing countries that are to remain in place until 2015. Thus, farmers in the countries of the Maghreb and the Sahel are currently seeking alternate ways of controlling nematodes.

Towards new strategies for managing plant-parasitic nematodes

In this overall context, Algeria, Morocco, Tunisia, Senegal and France joined together in the project “Nematus: an integrated approach to nematode management in Mediterranean and Sahelian vegetable crop systems”, a research partnership that combined research and agricultural technologies. The project’s ultimate objective was to promote sustainable production while maintaining the health of humans and the environment.

To help farmers diversify their nematode control techniques, the technical and scientific project sought to develop new pest management strategies that could be easily transferred to end users by:

- exploitation of natural resources (antibiosis, crop management systems, sources of resistance) in vegetable crop systems in the Mediterranean and the Sahel;
- development of sustainable agro-ecological management of nematode communities (taking advantage of interspecific competitions);
- forging a research and development partnership between the private sector (crop production) and the public sector (research and training);
- development of South-South and North-South partnerships taking a multidisciplinary (nematology, mycology) and multi-institutional approach (research institutes, universities, farmers).

NeMed Network: Ecology and plant nematode community management in southern Mediterranean ecosystems

In view of the real advances in partnership achieved at project mid-term (2007, Agadir, Morocco), the Nematus group decided to open the project review meeting to the nematologist community in North African countries. Accordingly, the first international workshop on “Ecology and management of plant-parasitic nematode communities in southern Mediterranean ecosystems” (NeMed) was organized in Sousse (Tunisia) in March 2008. Some 40 stakeholders attended from the five countries involved as well as Egypt and Libya. The event was attended by representatives from research, higher education and R&D organisations as well as students.

This led to the establishment of a network of the same name (NeMed) to promote an ecosystemic approach to nematode management in the southern Mediterranean through a shift from research into agricultural nematology to research into the ecology of pest communities and their abiotic and biotic interactions.
(host plants and natural predators mainly). Ultimately, that experience should in turn lead to the emergence of a Sahelian network based on the same goals. The consolidation of such networks is expected to ensure the continuity of linkages forged during the implementation of the Nematus project.

During the workshop, many recommendations were made, some designed to support North-South scientific cooperation aimed at:

- encouraging links with farmers (as experts) while maintaining a high level of internationally competitive basic and applied research;
- periodically renewing the workshop to carry on the discussion on Maghreb nematode problems;
- establishing thematic groups to facilitate the transfer and exchange of scientific information between teams;
- creating a directory of permanent active workers doing research on nematodes (lecturers, researchers, engineers).

### Knowledge and technology transfer to the South

In terms of capacity building, the Nematus project has enabled students to be trained (master's degrees and doctorates in Algeria and Tunisia; engineers in Morocco, Algeria, Tunisia and Senegal). It provided for short stays at Institut de recherche pour le développement (IRD, Montpellier and Marseille, France) by permanent staff, to acquire skills in molecular biology and data analysis.

Information was disseminated through publications, degree papers, theses, institutional journals, trade papers, and reports to national and international conferences. Regional workshops and thematic seminars were arranged during review meetings. Finally, a set of protocols was circulated to all partners and a website was put up comprising an online forum and mailing list.

The workshop findings were disseminated. Oral presentations of workshop participants were made available in the Nematus website’s intranet space. These 20 papers should also be collected in a single document (Proceedings), with abstracts in three languages (French, English, Arabic).

The NeMed workshop participants came up with the following recommendations:

- scientists to develop research areas based on cross-cutting regional themes such as complex cropping systems, ecosystems of agricultural oases, rhizosphere and soil biology (soil microflora, microfauna and macrofauna);
- organization of training workshops in the field (engineers); and
- research teams from the South to submit proposals in international bilateral Calls for Proposals.

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1. www.montpellier.inra.fr/CBGP/Nematus/index_Nematus.htm
Turning parasite biodiversity into an ecology of management aids

The project has been successful because the countries of the Maghreb are ecologically alike. The nematode problems encountered on vegetable crops are similar in the Maghreb and the Sahel.

The Nematus program explored the diversity of plant-parasitic nematodes and the associated parasitic microflora. By investigating nematodes and how they affect plants within agro-systems, it created a database that will serve as a baseline for future studies.

Numerous taxa were identified. It is interesting to note that the generic diversity of plant-parasitic nematode communities is greater in Senegal and Algeria than in Morocco and Tunisia. In addition, nematode communities are less diverse in the most anthropized market garden systems. Characterization of the most agronomically important species continues, particularly with respect to life history traits (penetration rate, reproduction, fecundity).

The project also explored interactions between species: synergies between nematodes and pathogenic soil flora and antagonisms between nematophagous fungi and plant pathogens. The detection and isolation of strains of nematophagous fungi or fungi that produce toxic substances is under way. These will be further developed at a later date as biological control agents. The project has succeeded in developing experimental strains of native nematophagous fungi suited to the Maghreb’s environmental conditions.

Useful results for sustainable development

The project has managed to go beyond the population approach to biocontrol (plant-parasite interactions) and to understand the global pathogenesis of plant-parasitic nematode communities: the real issue in the ecologically sustainable management of plant-nematode pathosystems.

The project found out alternative ways of managing plant-parasitic nematodes to enable it to initiate a process that is destined to improve vegetable production, particularly in the Maghreb countries, from the agronomic, environmental and economic standpoint. However, it should now turn to ways of integrating its findings and pursuing the strategy it has adopted, one that combines nematology and mycology.

Further, its research activities should be opened to the whole North African and Sahelian community. It is essential to promote an exchange of experiences between Southern partners in order to develop integrated protection models suited to different cropping systems, but also to transfer the knowledge acquired to market gardening networks supervised by agricultural development NGOs.

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The Nematus project explored the diversity of plant-parasitic nematodes and the associated parasitic microflora.

Partnership

Project leader: Company MARAISSA Groupe AZURA (Morocco)

Partners: Unité de Formation et de Recherche Sciences agronomiques et Développement Rural de l’Université de Thies (UFR SADR, Senegal), Institut Supérieur Agronomique Chott-Mariem (Tunisia), Institute of Development Research (IRD, France), Université Saad Dahlab Blida (Algeria)

Countries involved: Algeria, Morocco, Senegal, Tunisia

Contacts: Pierre Boniol, direction@azura-maroc.com & Thierry Mateille, thierry.mateille@ird.fr
Farmers and researchers join forces to spur West African agriculture through symbiotic microorganisms

To improve agricultural crop production in West Africa, a study on crop inoculation with microorganisms was carried out, with very promising results in terms of yield. The project confirmed that this green technique is a good substitute for chemical fertilisers that poor farmers can ill afford. More generally, it opens up new prospects for marginal agriculture in arid regions.

In West Africa, there are many constraints on agriculture: poor soil, salinity, lack of water... The results are low productivity, poor farm incomes, and food insecurity. The solutions usually recommended, such as chemical fertiliser applications, the use of new seed varieties, or water control, are unsuited to this vulnerable part of the world because not everyone can afford them and they may harm the environment.

Other research-based solutions exist but have not become widely known in West Africa, in part because of researchers’ limited knowledge of farmers’ organisational dynamics (and vice versa). Hence, the project “Facilitating Western African farmers’ adoption of inoculation technology using microorganisms to improve plant production” helped remove those constraints by having farmers’ organisations use microorganisms to improve plant production.

Microorganisms to bring soil to life

Scientifically speaking, the project relied on the fact that soil contains naturally occurring microorganisms (bacteria and fungi) that live in symbiosis with plants. They are involved in plants’ uptake of water and minerals, while the plants provide them with energy through photosynthesis.

Inoculation, a massive injection of selected bacteria and fungi, can compensate if there are no naturally occurring ones, or too few. It improves soil fertility and agricultural productivity—two key issues in West Africa.

Two main groups of microorganisms enter into symbiosis with plants. Rhizobia associate with legumes (groundnuts, cowpeas, beans, soy, acacia, mesquite, Pterocarpus...) and allow the plants to assimilate atmospheric nitrogen. Mycorrhizal fungi form a symbiotic relationship with almost all plants, promoting their absorption of water and nutrients such as phosphorus.

In arid and semi-arid areas where plants must cope with a lack of nutrients and severe stress, for example from drought, salinity, and pests, that limit their viability, inocula appear particularly appropriate. The inoculation technique, though well suited to West Africa’s soil conditions but also its economic climate, and widely practised the world over for some decades, had up to now been unknown in the region. ...
Empowerment of farmers’ organisations at all stages

The effect of inoculation was tested on two major crops. The first, soybeans, confirmed the technique’s positive and sometimes spectacular effects: in Djimini-Velingara (Senegal), inoculation multiplied soybean seed and above-ground biomass production four- or five-fold. Researchers found, however, that cowpeas did not respond to inoculation. They were unable to obtain convincing results.

During meetings of various stakeholders, farmers present told researchers they were willing to share in the risk of failure. The results, however, proved more than promising, even though they were sometimes achieved by less than academic means. For example, one group of producers, finding that their uninoculated plants were lagging behind the control plot, applied to the latter a dose of fertiliser just high enough to achieve the same yield as the inoculated plot. This showed that inoculation can replace fertilizers.

In Mali, fearing that the inoculation of cowpeas would affect their taste, the farmers responsible for the test plots organised tastings, the upshot of which was that the seeds of inoculated plants seemed to be more tender than those of the uninoculated ones.

A better mutual understanding among the various stakeholders

The project brought together various players in five countries (Benin, Burkina Faso, Mali, Niger and Senegal): researchers and farmers through national rural platforms belonging to the Network of Farmers’ and Agricultural Producers’ Organisations of West Africa (ROPPA) and the microbiology laboratories present in each country.

It conducted two main activities. First, it sought to put farmers and researchers on an even footing, to promote familiarity and mutual esteem. It held local, regional and national meetings as well as workshops that acquainted farmers with the scientific work being done in the laboratory. They were invited to look through magnifying glasses and microscopes and to perform microbiology and molecular biology manipulations. The project’s second focus was the creation of pilot plots to test the overall effect of inoculation under various environmental conditions and to demonstrate its effectiveness.

The project’s primary outcome was the creation of frameworks for dialogue between the researchers and farmers involved. In Senegal, where these frameworks took shape before the start of the project, they created a real rapport between the partners. In Mali, they appeared well established by the end of the project, and Benin was on course to do equally well.

They were more difficult to implement in Burkina Faso and Niger, in part due to the stakeholders’ unavailability, but now appear possible following the sharing of experiences in other countries.
Rapid technology *implementation by farmers*

The positive effect of inoculation, in particular on soybeans, quickly led farmers to seek inoculum supplies. A number of options are under consideration to meet the demand. In 2008 the farmers of Senegal’s Kolda region set as an R&D priority the establishment of a local production unit. They may also call on specialised international companies.

Whatever the solutions for inoculum production, all partners agree that it is essential for researchers and users to set strict standards for distribution, in line with the practices developed in the rest of the world but taking into account the specific situation of West Africa.

Networking of key *stakeholders to share information*

To extend the human journey initiated by this study, at the project review meeting in Bamako in late April 2008, representatives from each of the project partners decided to set up the INOCAO (inoculation in West Africa) network. It will be open to other stakeholders (economists, sociologists, lawyers, nutritionists, breeders, environmentalists...), agricultural and rural advisory bodies and policy makers (politicians, media...) and will be mandated to tackle questions related to the integration of symbiotic microorganisms into local agriculture.

Within INOCAO, farmers and researchers will work on various activities: research and development projects but also training projects (Master’s in Plant and Microbial Biotechnology in the Sahel at the University of Dakar) and popularisation (an international workshop on learning, production and sharing of innovations that took place in Ouagadougou, Burkina Faso, in October 2008).

**Lessons for sustainable *agriculture***

The INOCAO network has set itself two priority areas of activity: promoting the use of inocula and further research on the subject, including studies of microorganisms’ diversity and their ecology, specific crop requirements, the future of inocula, their impact on the environment and soil fertility, etc.

A further outcome of the project has been the realisation that, to promote participation by civil society, including farmers’ organisations, in the development of agricultural innovations, it is important to:

- create direct links between researchers and farmers;
- establish partnerships with representative organisations, not just individuals;
- apportion financial and technical responsibility between all stakeholders;
- persuade researchers to accept the loss of some of their “power”;
- make farmers aware of the research process, not just its findings;
- take advantage of the “snowball” effect of some groups’ success to forge a long-lasting cooperative relationship, and also seek to spread the technique of microorganism inoculation to other areas as a real alternative to chemical fertilisation.

### Partnership

**Lead organisation:** Cadre Local de Concertation des Organisations de Producteurs (CLCOP) de Keur Momar Sarr (Senegal)

**Partners:** Network of Farmers’ and Agricultural Producers’ Organisations of West Africa (ROPPA), Conseil National de Concertation et de Coopération des Ruraux (CNCR), Institut de recherche pour le développement (IRD, France)

**Countries involved:** Benin, Burkina Faso, Mali, Niger, Senegal

**Contacts:** Hamet Aly Sow, hametaly.sow@asprodeb.org or hametaly@yahoo.fr & Marc Neyra, Marc.Neyra@ird.fr
Global markets show a growing interest in local produce with high cultural value, or “terroir” products. While many emerging countries do have the necessary resources to compete on that market, few have a proper legal protection framework. In southern Africa, cooperation between scientists and small farmers having specific knowledge of this kind has been undertaken in an attempt to set up a system for the recognition of geographical indications. The potential impact is at once economic, cultural, social and environmental.

In southern Africa there is no specific public regulatory system for the protection of geographical indications (GIs). Protection can be granted based on trademarks law (for collective trademarks or certifications).1 This lack of public recognition of the specificity of the GI instrument and of its potential for market access and rural development for local communities penalises farmers and endangers local resources, threatened by biopiracy. In an effort to assess the value of establishing a specific institutional framework to support GIs in South Africa and Namibia, the project “Linking farmers to markets through valorization of local resources: The case for intellectual property rights of indigenous resources” was initiated. It focuses on two central questions:

- How can local communities protect their resources and differentiate their products through GIs?
- What is the nature of the requisite institutional and legal framework?

The project had two main objectives: to improve farmers’ income by allowing them to enter the GI niche market, and to protect indigenous resources and knowledge. Four pilot products were selected for South Africa (Rooibos tea, Honeybush tea, Karoo lamb, Nguni cowhides) and two for Namibia (Kalahari melon seed oil, Karakul pelts).

In the absence of any public system, small farmers are penalised. To meet the GI differentiation criteria, products must have three characteristics: unique qualities, recognized by scientists and consumers, and association with a defined territory and with specific skills.

While the GI concept was not unknown in South Africa, it was new to Namibia. In both countries, there was an acute need for awareness and reflection on the importance of protecting local resources. So the challenge was to get stakeholders and policymakers to realise the potential of these resources and their fragility. The relevance and feasibility of such a concept in these countries also needed to be determined, while close co-operation was essential between scientists and all industry stakeholders, including small farmers with little involvement in business organisations who had hitherto had difficulty entering the market.

1. The law provides for GI protection under trademarks law (for collective trademarks or certifications). In this context, however, no local products have been registered under GIs in Southern Africa.
2. There is, in particular, a special system to protect wines and spirits.
The DURAS Project: Innovative Partnerships for Sustainable Development

A collaborative approach in the call for proposals, knowledge management and capacity building

Emphasis was placed on capacity building and information sharing. An inventory of specific local knowledge and resources was produced. To ensure that the potential of GIs was thoroughly investigated, a call for proposals was sent, via the media (i.e. radio and specialized agricultural newspapers) and the partners’ network, to NGOs, ministries, farmers’ organizations and industry bodies.

The project's first stage was the establishment of workshops to build stakeholders’ capacity with respect to four flagship products (Rooibos, Honeybush, Karoo lamb and Nguni hides, later replaced by Camdeboo mohair) that had potential to meet the GI criteria of distinction. Briefing sessions were held on the other two cases selected (Karoo lamb and Kalahari melon seed oil).

The methodology used in that process was inspired by a textbook written by the American Association for the Advancement of Science. An outreach guide for farmers was produced by adapting the textbook to the context of southern Africa and distributed at training workshops.

The Honeybush tea industry is still emerging, but the value of (GI) geographical indications certification is unanimously recognized.

A differentiated approach that involves farmers in preserving their traditional knowledge and biodiversity

In the next phase of the project, the research team and the stakeholders agreed on the process linkage. GI committees representing industries were set up for some pilot cases (Rooibos, Honeybush, Karoo lamb). The committees ensured that information would be shared between research teams and industry, and studied the possibility of drafting a code of GI practice and specifications. For each of the other pilot products, one member of the research team acted as the primary industry contact and documented the case.

The pilot cases were thoroughly worked up and all key elements of the GI strategy were analysed: product characteristics and links to the “terroir” market plus legal and organisational aspects.

Among the cases studied, the Rooibos case is the initiative that goes furthest in protecting intellectual property, and hence is driving GIs forward in South Africa. Having been exposed to the risks of intellectual property rights misuse by an attempt from an American company’s attempt to reserve the name “Rooibos” through an individual trademark, industry stakeholders and provincial governments worked to gain recognition for Rooibos as a GI within South Africa, but also to register it with the European Union as a Protected Denomination of Origin (PDO).

The South African Rooibos Council (SARC), which since 2005 has brought together farmers, processors and traders, is the industry representative. Following discussions and learning workshops, SARC appointed a dedicated GI working committee whose activities consist mainly of:

- consideration of appropriate means for defending intellectual property;
- ensuring better quality control;
- the drafting (now under way) of a biodiversity-conscious specification.

The situation remains complex. Though protection against any encroachment on the name Rooibos may protect against international competition and spur agricultural development in South Africa, that success is also likely to cause adverse effects. The economic incentive may prompt farmers to expand the production area—as is indeed called for in the specification being negotiated—to the detriment of product quality and biodiversity.

3. AAAS, 2003. Issues and Options for Traditional Knowledge Holders in Protecting their Intellectual Property and Maintaining Biological Diversity


5. In the case of Rooibos, they were indeed called upon to do the drafting.
Karoo lamb has been part of South African culture for a hundred years. The traditional use of the name “Karoo lamb” on the façades of restaurants and local guesthouses points to strong cultural and geographical ties. At present, however, there is no collective system to guarantee its origin. To determine the product’s commercial potential and its eligibility for a GI, its quality and unique taste were scientifically tested. The results showed that the Karoo grazing plants did give the meat a special flavour. However, these specific plants are not limited to the traditionally recognized Karoo lamb area, nor do they grow throughout that area. That problem points out the need to properly address the question of specific expertise, which calls for delicate negotiation and for which recognition may be difficult to achieve given the local industry’s disorganisation.

The Honeybush tea industry is still emerging, but the value of GI certification is unanimously recognized. Because of the great differences in the manner of cultivating and processing Honeybush, the working committee has chosen to expand its remit to the issue of product standardisation.

As the process developed, certification for Nguni hides came to be seen as inappropriate: GI was not the best option for developing that sector, which was replaced by Camdeboo mohair. For mohair and Karakul pelts, research showed that these products had been able to use the GI philosophy to establish themselves as recognisable brands. Their modus operandi was however very different: state involvement is very important for Karakul, while Camdeboo mohair is under totally private management.

A partnership was established with CRIAA, an NGO deeply involved in the production of Kalahari melon seed oil. The industry is at a very early stage of organization and marketing, but a start has been made on structuring it: participants have been informed of the implications of GIs and a forum has been established.

A mechanism for interaction between GIs, trade and biodiversity

This project has clearly been enriched by the active participation of the various industry stakeholders and the trust built up between them and the scientists. Hence, it has been possible to do regular reassessments of the participatory research processes and to do research at a local level while maintaining a global vision of the benefits of GIs in southern Africa.

The program is also strongly connected to the political system, helping to open a public debate on GIs. The drafters of the new intellectual property law participated in the seminars, and the pilot industries will soon test the applicability of the legislation. That political commitment encourages people to take an open attitude to the cumbersome qualification process required by GIs.

On the ground, good collaboration has contributed to a better understanding of GIs’ potential to improve small farmers’ market access. It has also facilitated the establishment of a partnership between local organizations, researchers, government institutions and NGOs. Work teams’ activities were also kept going after the end of the project. In conclusion, GIs have potential that goes beyond name reservation and quality guarantee: the collective actions they imply may also be beneficial to biodiversity, collective channel management and marketing.

6. Centre for Research Information in Africa.
Pigmeat accounts for two thirds of all meat consumed in Asia. In Vietnam and Cambodia, consumers are buying more and more meat, but there is increasing demand for quality meats. In those countries, where pig farming is mainly domestic, it is still hard to control the organoleptic and health quality of meats. A project has been undertaken to enhance these small livestock farmers’ competitiveness by helping them adapt to new consumer expectations.

In Southeast Asia, many urban consumers are willing to pay more for pigmeat that is healthier and has better nutritional and organoleptic properties. However, the quality challenge is a daunting one in Vietnam and Cambodia, where pigs are still raised on family farms.

These small-scale producers are unaware of how to produce leaner, healthier meat that would be more competitive on world markets: they cling to traditional husbandry techniques, do not practice selective pig breeding and often do not know about dietary supplementation principles.

A project to enhance small livestock producers’ capacities

To provide models to help these farmers in the new market environment, the project “Improving the pig and pigmeat marketing chain to enable small producers to serve consumer needs in Vietnam and Cambodia” was intended to afford small producers access to high-value-added contracts (improving the health and taste quality of the meat) and higher selling prices (a fairer distribution of profit margins and better incomes for producers). To achieve these objectives, research has been carried out on markets, the pig industry and production conditions on family farms. The subsequently adopted innovative strategies were then adapted to each country’s specific problems.

The project was implemented in the provinces of Takeo, in Cambodia, and Hai Duong in Vietnam, two production areas that supply the large cities of Phnom Penh (Cambodia), Hanoi, Hai Phong and Quang Ninh (Vietnam). The questions were as follows:

- What are the new market conditions? What innovations do they call for?
- How can family farms be encouraged to participate in the new subsectors?
- What support measures and policies are needed?

Some answers were obtained, particularly through the action research approach (especially in Vietnam) and the participatory approach in cooperation with all pig industry stakeholders.

Central to the Effort in Vietnam: Producer cooperatives

In Vietnam, the programme achieved success chiefly through producer cooperatives. These are still powerful mediators, promoting dialogue between small producers and pigmeat distribution networks.

Indeed, the beneficiaries of the project—pig producers—are members of the Federation of Cooperatives (FC) of Nam Sach, which was already in operation a year before project startup; it had extensive field knowledge, as its seven constituent cooperatives had been founded between 2002 and 2005. It had mediated a number of actions before project startup to improve pig quality and enhance producers’ capacity, particularly by introducing improved swine breeds or feed supplements.

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FC has been able to establish high-quality production processes through discussions between producers, distributors and advisory bodies. The stages of production (breeding, slaughtering, preparation and distribution) have been standardised and domestic quality management rules implemented to prevent disease outbreaks and monitor food safety.

Throughout this process, the involvement of State agencies (departments of agriculture, rural development or veterinary science), research scientists, meat packers and retailers has been of great assistance. Other pilot projects undertaken by FC include the development of highly sanitary pig farms; the introduction of seals of approval and health certificates; consolidation of trade networks; enhancement of FC members’ capacity through training. With the help of the Polytechnic University, the Federation has also sought alternatives to the use of borax as a preservative.

Improving pigmeat quality has helped create jobs within FC, whose products have been well received by consumers at trade fairs and demonstrations. FC has helped increase producers’ incomes in various ways, including through centralized purchasing. Finally, in addition to the veterinary services and vaccination campaigns it runs, it provides disease prevention guidelines for its members.

Implementation of action research in Cambodia

Cambodian farmers have received support from CelAgrid (Centre for Livestock and Agriculture Development), particularly on breeding techniques and locally procured feed (strong market demand). To be eligible for the pilot project activities, producers had to be willing to participate in action research and share their knowledge with other farmers. In the course of the activities the economic efficiency of the proposed techniques, as compared to traditional practices, was demonstrated.

Not only did the farmers involved make their manpower available for field research, they also attended courses at the Farmer Field School (FFS). The FFS methodology was particularly suited to farm families with little education in that it was participatory and visually based (video projectors). The teaching was both theoretical and practical and based on close interaction between trainers and trainees; technical Consultants were on hand to help farmers apply what they learned in the field. Tests administered before and after the course showed how well the concepts taught had been integrated: 46.5% of the small farmers had given more than 50% correct answers during a baseline assessment, while by the end of the project 78.2% could do so.

The courses were designed to meet farmers’ stated needs so that they could adapt to market requirements (e.g. improved animal feed).

In order to disseminate these innovative techniques as widely as possible, a field day was organized to which non-participating families, village chiefs and members of municipal councils were invited. The FFS also enhanced producers’
self-sufficiency by producing daily bulletins for radio and television broadcasts on the pig market and selling prices in particular.

CelAgrid brought farmers and slaughterhouses together to help obtain better prices. Small farmers, who formerly had access to just two local sales channels (unofficial slaughterhouses within the village and intermediaries outside the village who sold their purchases on to official slaughterhouses), could now sell to many more different buyers. As they found their new partners offered more competitive prices, 25% of them now sell their pigs to new buyers.

A basis for new national policies

In both countries, the project has helped identify the support that producers require and the production problems that arise from market obligations. Farmers have a better understanding of how to market their livestock: they have helped create and consolidate a participatory network in the pig industry; they have succeeded in improving the quality and safety of their food products and are now interacting with State agencies, which, for their part, are now more aware of small farmers’ specific problems and therefore better able to provide them with targeted support.

To implement the pilot activities, an array of skills were required in various areas (science, sociology, economics, institutional, etc.) and many partners had to be mobilised (farmers, farmers’ organizations, companies, dealers, slaughterhouses, supermarkets, universities, research institutes, NGOs, public utilities).

An equitable relationship has been established between all industry stakeholders, while family farmers’ concerns are being taken more seriously and their incomes have increased, especially through the efforts of farmers’ organisations. All of these results are all the more positive—and a priori lasting—in that they have laid the groundwork for new policy proposals.

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<th>Partnership</th>
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<tr>
<td><strong>Project Leader:</strong> Rural Development Center (RUDEC) / Institute of Policy and Strategy for Agriculture and Rural Development (IPASARD, Vietnam)</td>
</tr>
<tr>
<td><strong>Partners:</strong> Centre for Livestock and Agricultural Development, University of Tropical Agriculture (Cambodia), CIRAD—Markets and Agriculture Linkages for Cities in Asia (MALICA) and Research Consortium on Risks Associated with Livestock Intensification (PRISE) (France), Heifer International (Cambodia), International Livestock Research Institute (ILRI, Philippines), Lok Farmer Association, Takeo Province (Cambodia), Long Co Company Limited (Vietnam), Nam Sach Animal Production Cooperative, Hai Duong Province, (North Vietnam), Phu Unleag Slaughterhouse (Cambodia), Srah Taleun Farmers’ Association, Takeo Province (Cambodia), Women’s Union of Nam Sach District, Hai Duong Province (North Vietnam)</td>
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<td><strong>Countries involved:</strong> Cambodia, Vietnam</td>
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<tr>
<td><strong>Contact:</strong> Vu Trong BINH, <a href="mailto:trongbinh@fpt.vn">trongbinh@fpt.vn</a></td>
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Improving pigmeat quality has helped create jobs within Federation of Cooperatives in Nam Sach Province in Vietnam whose products have been well received by consumers at trade fairs and demonstrations.
If well conducted, the development of small and medium-sized farm enterprises (SMEs) in the south could help reduce poverty and conserve natural resources. A project was undertaken to promote the sustainable development of farm SMEs by providing targeted support to entrepreneurs. In Vietnam and Kenya, examples of successful businesses gave four pilot SMEs, under the supervision of a broad network of experts, an insight into the entrepreneurial spirit. Participatory training in business management was provided, primarily to women.

The governments of Vietnam and Kenya have both introduced numerous economic reforms in accordance with international guidelines. These new guidelines are in the areas of environmental management; price liberalisation; encouragement of private enterprise; and modernisation of financial systems and taxes. These economic goals, coupled with a policy of decentralisation, are directly linked with a desire to reduce poverty and better manage these countries’ natural resources.

The project “Poverty and Pace Setters (POPSe): From sector support for farm product marketing to targeting entrepreneurs by building networks among the poverty struck” shows how agro-SMEs can help combat poverty and ensure environmental sustainability.

The project also had a secondary objective: to help poor entrepreneurs integrate new technologies into their traditional techniques in order to promote their products and open up new markets.

The initial questions were:
- How to act: what are the pitfalls?
- What are the prerequisites for a community group to establish an agricultural SME with the most disadvantaged?
- Are agro-SMEs a good way to fight poverty?

SMEs mainly driven by women

The program supported four groups that were very different from each other in terms of geographical location and socio-cultural context:

In Vietnam, the project looked at two cases:
- in Hue Province, a group of women entrepreneurs who manufacture and market nuoc-mâm (fish sauce);
- in Hanoi, a cooperative that grows vegetables naturally, without chemical inputs (“safe vegetable”, later reclassified as “organic”).

In Kenya:
- in Kibwezi, groups of women collecting, packaging and selling honey;
- in Kajiado, a periurban group producing camel milk.

Different types of structures were involved: local community groups, cooperatives and women’s self-help groups. Women’s initiatives should be noted, as they constitute a project priority; this holds especially for poor rural women, who (as in this case) enter what are called “niche” markets.
Multi-stakeholder analysis of successful examples of agri-SMEs

The first step was to assess how the SME market works in Vietnam and Kenya, to assess the challenges and difficulties involved and the success factors that open markets to agricultural SMEs. The researchers surveyed 79 successful agricultural entrepreneurs in both countries, forming a complex picture of the keys to entrepreneurial success. An open questionnaire was used to determine, for each of these models: its business profile; its market access; whether there was any quality control; success factors.

On the basis of extensive interviews and brainstorming sessions, the best business dynamics were defined and recommendations for the four agro-SMEs were made by all stakeholders. This multi-stakeholder approach allowed the needs of all stakeholders to be taken into account. Finally, the information was scaled up with a view to encouraging the development of formal recommendations for the sustainable development of agricultural SMEs.

An interactive platform to promote knowledge sharing and learning

The study has given emphasis to the involvement process of different categories of stakeholders and their networks. Through the participatory approach and careful facilitation process put in place, knowledge transmission endeavours were made immediately achievable. Their purpose was mainly to help poor entrepreneurs to adopt a real entrepreneurial attitude.

The interactions consisted of consensus building workshops involving different stakeholders; training; field demonstrations; local meetings; and sharing of experiences between communities but also between countries. Project leaders in Kenya did visit their Vietnamese counterparts.

The research team became a partner to the GCOs, which took part in decision-making with other stakeholders at all stages of the project. Many cross-cutting stakeholder meetings were held involving all concerned. All means available to ensure communication were used: daily, weekly or monthly meetings; face-to-face meetings between the project leader and the pilot enterprises.

The learning process worked well because it was based on transparent interactions; it was kept going throughout the project design and implementation phases. Each person’s role was carefully defined by the research teams and external stakeholders were integrated into the training process.

Participants acquired basic knowledge on trade, but the focus was on adapting the training to the specific needs of each SME. Researchers learned a great deal about local knowledge through the interactions between partners, while government departments supported the project and took advantage of it to get closer to the people.

Many participants shared their experiences and made agricultural research for development (ARD) recommendations. The research team assessed the main difficulties and challenges for both countries’ agri-SMEs.
Its findings were combined with the innovative processes developed by scientists and compiled before being transmitted to key actors through interviews.

Many recommendations were also made in the areas of accounting, credit and introduction of new technologies.

**Improving research and management capacity**

In Vietnam, in the case of nuoc-mâm, group members were trained so that they in turn would be able to teach. In addition, the project support group evolved through discussions with local authorities and women’s associations. In that way, cooperatives were strengthened and their mission, of doing their own production and marketing, was reaffirmed.

The research also focused on imbuining the group with a respect for natural resources. That means strengthening institutional capacity to raise awareness of the dual challenge of environmental issues and improved product quality. Technical advice must also be given. It should nevertheless be noted that the case of a market gardening co-operative gave inspiration to local authorities, who provided special support for the product upgrading initiative (vegetables labelled “organic”).

In Kenya, the project has taken one further step by linking the small-scale value addition and processing of milk and honey to the broader KARI (Kenya Agricultural Research Institute) Programs on enhancing the delivery of extension packages, on natural resource management as well as enterprise development.

**Transferability to other SMEs**

The project compiled the lessons learned and made them easy for poor entrepreneurs to assimilate through interactions between agricultural SMEs, experts, and local governmental authorities. In the future, recommendations of the workshop on consensus building can be used to identify new research questions and proposals for implementation.

Testing at the local level attracted much interest such that new networks of partners developed spontaneously. Another indicator of project sustainability: the initial action research sometimes moves to a more institutional plane. Indeed, the process implemented led to alliances between entrepreneurs and political/institutional authorities at the community level. That was a success beyond the project’s original intentions: the fight against poverty must indeed rely on such alliances.

New techniques were introduced (cultivation and production, food processing and preservation) that improved the incomes of small entrepreneurs and GCOs. Savings were also achieved by pooling resources and sharing existing research infrastructures. However, the project was based on managerial knowledge transfer rather than on technical developments. From that point of view, the project may be adapted to any business, as under the approach used a range of situations may be assessed and the best potential identified regardless of the field.

Much effort was made to adapt agricultural SMEs to requirements that include marketing, identification and selection of a niche market, network management and logistics. From a sustainable development perspective, however, these operations should be combined with an analysis of environmental, economic and social impacts.

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**Partnership**

**Project leader:** Centre for Rural Economic Development Research; Union for New Technology Applying Research (Vietnam)

**Partners:** Department of Water & Environmental Studies, Linköping University (Sweden), University of Nairobi and Institute of Dryland Research and Utilization (Kenya), Kajiado North District, Kajiado District (Kenya), Kibewa Division, Makueng District (Kenya) (women’s community group), Van Noi safe vegetable cooperatives (Vietnam), Fish sauce production group in Hue (Vietnam)

**Countries involved:** Kenya, Vietnam

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The project looked at the situation of a group of women entrepreneurs who manufacture and market nuoc-mâm (fish sauce) in Hue Province, Vietnam.
Production of quality sorghum or millet malt for small-scale or semi-industrial food production in West Africa

Sorghum or millet malting is a widespread traditional practice in West Africa. It is used to produce fermented and unfermented beverages or is incorporated into infant cereals. The malting process has many benefits (nutrition, texturing) but the cottage-scale production conditions cause health risks inconsistent with market expectations. To improve malt production and properties, but also the malsters’ income, a project to support specialised small and medium enterprises (SMEs) was carried out.

Cereal malt is one of the main raw materials used to prepare various traditional alcoholic beverages of West Africa: dolo (Mali, Burkina Faso), tchoukoutou and chakpalo (Benin, Togo, Niger, Côte d’Ivoire), burukutu or pito (Nigeria, Ghana), dam (Togo), but also non-alcoholic beverages like gowé (Benin). Malts are also incorporated into infant cereals to reduce their viscosity and increase their energy density.

“Malting” is a process whereby seeds are germinated then dried under favourable conditions of heat and humidity to obtain a product (malt) that is rich in enzymes, vitamins and other soluble compounds. The technology has three main steps: soaking, germinating and drying grains.

Market-aware malt production

Malting is largely a cottage industry, usually performed at home by women, and one that requires great expertise. However, the traditional techniques used are ill suited to market constraints, particularly in cities: the risks to human health are serious, and the malts’ technological quality is uneven. Indeed, chancy production conditions affect the malts’ enzymatic activity—including amylase—, the main reason for adding them to various food products. The development of cyanogenic compounds, enterobacteria or moulds can impair their organoleptic qualities and healthfulness.

The project “Production of quality sorghum or millet malts for small-scale or semi-industrial food production in West Africa” sought to create the necessary conditions for small-scale production, but also marketing, of high-quality sorghum and millet malts for beverage and baby food undertakings. To do so required taking advantage of indigenous knowledge of the varieties (sorghum and millet) and traditional production practices; evaluating the various markets’ quality and quantity requirements; developing and validating production methods suited to the scale of these undertakings; promoting and optimising the production and marketing of malt and malt derivatives. Improved malt production methods were validated in the field at two pilot SMEs: ALITECH Industries in Benin and Unité de Maltage de Ouidtinga (UMAO) in Burkina Faso.

The project was carried out in three stages:

1. Surveys were done in the field to gather data on the socioeconomic production environment, crop varieties and traditional processing methods used.
2. The malting process for gowé and dolo was optimised in the laboratory, then at the SMEs. Good manufacturing practices were developed and transferred to personnel through training.
3. The innovations were tested at the SMEs. Malt quality was assessed by measuring diastatic, microbiological and amylase activity. The fluidifying and nutritional properties of malt-based infant cereals were also measured.
A fruitful exchange between researchers, SMEs and maltsters

Beninese, Burkinabé and French scientists worked with various local stakeholders, particularly with women maltsters, who are very important in the sector. Farmers and processors played a key role in sharing their knowledge of traditional materials, technology, markets and finished products. Conversely, they could assess the quality of products of new technologies and make improvements calculated to maintain the desirable characteristics of traditional malts. That participatory approach helped reconcile the views of all stakeholders. It should be noted, however, that it may also cause delays in the protocol.

An immediate managerial, technical and scientific benefit to SMEs

The project helped build SMEs’ capacity. The cross-cutting exchanges between countries proved fruitful and concrete: UMAO, for example, developed a new malthouse that inspired ALITECH to produce another. Proprietors familiarised themselves with the technology and health criteria used by scientists to assess the quality of their products. Staffs were trained in best practices for manufacturing and hygiene, with positive impacts on business management and quality follow-up.

The results were also positive for young researchers. They benefited from exchanges with SME workers, integrating their advice into their research protocol and becoming more attuned to market issues.

Transfer of scientific results to economic agents

The scientific contributions enabled technologies and products to be developed, matched supply to demand and centralised knowledge by developing an enterprise-focused strategy and channelling efforts and resources. The results were published in trade journals and data sheets, and best manufacturing practices were disseminated.

Product awareness and promotion campaigns took place on local radio stations and at trade fairs and shows. Women maltsters’ active contribution should be highlighted. In Burkina Faso, for example, having taken training in sorghum malting, they participated in fairs on *dolo* and formed an association. That involved some risk, however, for these *dolotières*: First, they cannot afford the necessary investments in new technology; and second, SMEs’ adoption of these innovations may be at the expense of their own market.

Gain a better knowledge of malt markets and the varieties used

There is high demand for sorghum and millet malt in the pilot countries. In Burkina Faso, 40% of the total sorghum production (some 500,000 tonnes) is malted each year for *dolo*. In Benin, the beverage industry imports between 3,500 and 7,000 tonnes of malt annually. There is also the infant cereal market, which is smaller but demands higher quality.

In urban areas of Benin, sorghum varieties are defined by colour and size. “Big red sorghum” is the most commonly used for malt production for *gowé*, *tchoukoutou* and *dolo*, although no fewer than 10 varieties of sorghum may be used in manufacturing *tchoukoutou*. In Burkina Faso, red sorghum varieties are mainly used to manufacture *dolo*, while white sorghum is used for food.
The project focused on laboratory testing and classification of 19 varieties of sorghum and four varieties of millet according to their end use. Five sorghums were found quite suitable for beer manufacture in Benin, as against two in Burkina Faso. The use of millets to produce malt for infant cereals was validated.

**Scientific and technical improvement of processes in use**

Scientific analyses showed that traditional malt production could generate aflatoxins, sometimes in excess of the limits (8 µg/kg) recommended by the Codex Alimentarius. The total aerobic and coliform bacteria, yeasts and filamentous fungi identified in Benin and Burkina Faso malts also exceeded the limits set out in the Codex.

Technical improvements that could be scaled to the cottage industries were proposed: using an alkaline solution for soaking sorghum malt to increase its diastatic properties; treatments to reduce bacterial contamination; etc.

*Dolo* and *goué* production processes were improved. Two new forms of *goué* were developed: a liquid one resembling yogurt and another that could be stored dry at room temperature for six months.

In view of the high biological risk in traditional maltings, ALITECH developed an optimised method to produce a malt of consistently good physicochemical quality, which however still needs to be improved for use in infant cereals. In Burkina Faso, the Institut de recherche pour le développement (IRD), for its part, tested a standard process for producing millet malt for infant cereal: it is in line with health recommendations, but it is unclear whether it can be produced under existing cottage-industry conditions.

**A positive employment and food security outlook**

Through this collaborative project, SMEs emerged that specialise in the production of quality malt and the partners enhanced their capacity to share and use their knowledge to apply innovative technologies: more in line with consumer demand; with easier market access; and providing value for money.

The promotion of a malt of a consistent quality will allow better use of local cereals throughout Africa.

The productivity gains achieved should generate new jobs and better incomes, facilitate women’s work, and allow the sector to better serve an increasingly demanding urban market.

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**Partnership**

**Lead organisation:** Centre Régional de Nutrition et d’Alimentation Appliquées, Faculté des Sciences Agronomiques, Université d’Abomey-Calavi (Benin)

**Partners:** ALITECH INDUSTRIES (Benin), Agricultural Research for Development (CIRAD, France), Institut de recherche pour le développement (IRD, France), Institut de Recherche en Sciences Appliquées et Technologiques / Centre national de la recherche Scientifique et technologique (IRSAT/CNRST, Burkina Faso), Unité de Maltage de Ouidtinga (UMAO, Burkina Faso)

**Countries involved:** Benin, Burkina Faso

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DURAS project workshops
Coverage of 12 DURAS funded projects in Africa and in Asia

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Linkages between France (CIARAD, INRA, IRD, Université Montpellier 3) and African & Asian countries
Linkages between the Netherlands (ETC Ecoculture) and African & Asian countries
Linkages between Sweden (Linköping University) and African & Asian countries
<table>
<thead>
<tr>
<th>Acronym</th>
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<tbody>
<tr>
<td>AARINENA</td>
<td>Association of Agricultural Research Institutions in the Near East and North Africa</td>
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<tr>
<td>APAARI</td>
<td>Association of Asia-Pacific Agricultural Research Institutes</td>
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<td>ARD</td>
<td>Agricultural Research for Development</td>
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<tr>
<td>CARBAP</td>
<td>African Research Center on Bananas and Plantains</td>
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<tr>
<td>CelAgrid</td>
<td>Center for Livestock and Agriculture Development</td>
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<td>CEMAC</td>
<td>Central African Economic and Monetary Community</td>
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<td>French Agricultural Research Centre for International Development</td>
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<td>CRIAA</td>
<td>Centre for Research Information in Africa</td>
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<td>CRP</td>
<td>Common Reference Plot</td>
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<td>CSO</td>
<td>Civil Society Organisations</td>
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<td>DURAS</td>
<td>Promotion of sustainable development in agricultural research systems in the South</td>
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<td>FC</td>
<td>Federation of Cooperatives</td>
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<td>FCFA</td>
<td>Franc de la Communauté Financière Africaine</td>
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<td>Global Forum on Agricultural Research</td>
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<td>GI</td>
<td>Geographical Indications</td>
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<td>ICM</td>
<td>Information and Communication Management</td>
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<td>IEP</td>
<td>Individual Evaluation Plots</td>
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<td>INNOBAP</td>
<td>Innovation on banana and plantain</td>
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<td>INOCAO</td>
<td>Réseau « Inoculation en Afrique de l’Ouest »</td>
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<td>Ministère des Affaires étrangères et européennes</td>
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<td>French Ministry of Foreign and European Affairs</td>
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<td></td>
<td>“Ecology and Management of Plant-Parasitic Nematode Communities in Southern Mediterranean Ecosystems” Network</td>
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<td>NRM</td>
<td>Natural resources management</td>
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<td>PAR</td>
<td>Participatory Action Research</td>
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<tr>
<td>PROPA</td>
<td>Plateforme Régionale des Organisations de Producteurs d’Afrique Centrale</td>
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<td>RAIS</td>
<td>Regional Agricultural Information System</td>
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<td>Research Unit</td>
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<td>UMAO</td>
<td>Unité de Maltage d’Ouidtinga</td>
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<td>USD</td>
<td>American Dollars</td>
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<td>VCC</td>
<td>Village Coordination Committee</td>
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<td>VND</td>
<td>Vietnamese Đồng</td>
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The Dossiers d’Agropolis International series is a deliverable of Agropolis International that is produced within the scope of its mission to promote the expertise of the scientific community.

Each Dossier is devoted to a broad scientific theme, and includes a clear overview that is a ready reference for all laboratories and teams associated with Agropolis International that are conducting research on the target theme.

This series is meant to boost the awareness of our different partners on the expertise and potential available within our scientific community, but also to facilitate contacts for the development of scientific and technical cooperation and exchange.