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VIP

Technology Transfer and Development Newsletter

Collective management of agricultural biodiversity in Africa

The FAO and the secretariat of the Convention on Biological Diversity (CBD) consider that the erosion of agro-biodiversity (genetic diversity within agricultural systems) is very worrying, in particular for tropical zones. In these regions, poor rural communities have drawn on their adaptability and their resilience in their age-old traditional management of cultivated species. But the "green revolution", with its high energy costs due to mechanisation and use of chemical inputs, has led to uniformisation and artificialisation of agricultural land that was previously diverse... This intensive model has often proven unsuitable for African family-based farming faced with unfavourable economic and environmental conditions.

There are possible alternatives for *in situ* dynamic biodiversity management: they enable a move towards gradual and sustainable intensification of traditional African cropping systems. These new practices require the harnessing of the local knowledge of farmers and that of researchers, to be integrated into a research-action for development. The French Fund for the World Environment (FFEM) and the French National Research Agency (ANR) have entrusted Cirad with the role of facilitating the efforts by the various players involved in this *in situ* management of cultivated biodiversity, and of developing through participative selection new varieties of typically African cereal food crops, such as millet and sorghum.

FOCUS

75 % of food plant seeds used in Africa are exchanged via traditional seed systems.

Products

A multi-agent generic model on seed dynamics

The open-source publication of a *generic multi-agent model* for developing national applications for specific seed systems is one of the major results obtained under these projects. Two "role-playing games" have been developed (one for Mali and one for Chile), which can be re-applied in activities relating to seed dynamics and in dialogue between players. There are many possible applications: for explaining smallholder seed choices, discussing scenarios in relation with the market or in response to the impact of climate change, and setting up agricultural policies, among other examples.

> VIP contact: didier.bazile@cirad.fr

New sorghum varieties from participative selection

There are three varieties, *Gnossiconi*, *Kapelga* and *Flagnon*, entered in the varietal catalogue of Burkina Faso, and bred by seed cooperatives. Two of these varieties are the result of the introduction into the PS scheme of local varieties collected and stored over the past 40 years in the gene bank of the Institute of the Environment and Agricultural Research (INERA, Burkina Faso). They are prized for their yield stability, the quality of their grains and their early harvest. These varieties are also distributed in Mali through the networks of smallholder organisations and NGOs.

Two free-access seed production guides

Sorghum seed production under smallholding conditions in Mali, Amadou Sidibé, Kirsten vom Brocke, Harouna Coulibaly, Jean-Charles Evrard, Ed. Cirad, 2011

Sorghum seed production under smallholding conditions in Burkina Faso, Kirsten vom Brocke, Clarisse Barro-Kondombo, Gilles Trouche, David Kambou, Grégoire Palé, Dominique Compaoré, Ed Cirad, 2011.

> VIP contact: kirsten.vom_brocke@cirad.fr

Training

Capacity building of local players in rapidly evolving fields such as decentralised participative seed production, tracking of biodiversity indicators and intellectual property systems, is an essential challenge for sustainability of agro-environmental protection actions.

Empowering local players

Some training is now coordinated by the Malian organisation "Association of Professional Smallholder Organisations" (AOPP): capacity building of smallholder organisations regarding seed issues; training for seed trading smallholders in seed production and quality control techniques, in sustainable management of genetic resources and in financial aspects; capacity building of producers, technical agents and agents of partner NGOs in participative selection.

Companion modelling research school (decentralised to Dakar)

This involves simulating dynamics and running simulations with various types of player to share representations. This action is aimed at developing a West African research network on companion modelling. During the school, several stages of a companion modelling approach will be covered: co-construction of common representation; tool design; simulations; monitoring, observation and evaluation of the effects.

http://cormas.cirad.fr/ComMod/fr/training/1302_Dakar/

Multi-agent systems (MAS) and companion modelling dedicated to renewable resources management

The objective of this training is to provide an initiation in multi-agent systems applied to the problems of simulation and renewable resources management. As a result, the trainees are familiarised with the general state of the art regarding modelling for renewable resources management, and gain an overview of the various fields of application of multi-agent systems and in-depth knowledge of multi-agent simulation methods for renewable resources management.

These courses are aimed at modellers and IT specialists wishing to gain an insight into multi-agent systems, and to researchers involved in environmental management and with an awareness of modelling.

http://cormas.cirad.fr/fr/formati/septembre2012.htm
ee also: http://www.cirad.fr/enseignement-formation/formation-professionnelle/

> VIP contact: florence.paulet@cirad.fr

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Editor: Patrick Caron, Director of Research and Strategy

Coordination: Technology Transfer and Development Office

Editorial Committee: CIRAD network of Technology Transfer and Development Coordinators - vip-cirad@cirad.fr

Avenue Agropolis, TA 181 / 04 - 34398 Montpellier Cedex 5, France
Tél : +33 4 67 61 44 61 - Fax : +33 4 67 61 56 57

www.cirad.fr/innovation-expertise

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LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

Expertise, project and partnership

Cereal food crop biodiversity conservation projects in West Africa

Sustainable management projects of biodiversity in Mali (FFEM, 2002-2007 phase1; 2010-2013 phase 2) and the IMAS project (ANR, 2008-2012), which also operates in Latin America, are concerned with the diversity of food plants in one of their regions of diversification. They have been active in Burkina Faso and Mali since 2002. Coordinated by Cirad, they bring together national crop science research institutions, national universities, centres of the consultative group on international agricultural research (CGIAR), local NGOs and smallholder organisations in innovative approaches to seed selection and management. They integrate scientific and local knowledge in approaches supporting the local smallholders' models of agro-biodiversity management.

http://www.cirad.bf/fr/pase2-ffem.php
http://imas.agropolis.fr/


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One of the best ways of sustainably preserving cultivated biodiversity is to use it. The objective is to improve productivity of varieties while retaining their adaptive potential to the various constraints, and maintaining their multiple usages. This is what is known as "*in situ* dynamic management".

Modelling systems and supporting the players

The methodology is based on co-construction of innovative tools - multi-agent models capable of integrating the viewpoints of the different players - and then simulating the dynamic aspects of biodiversity management to analyse the impacts of future developments.

The approach is based on inter-disciplinary participative modelling of mechanisms ensuring the preservation and use of varietal diversity, as well as access to seeds for the smallholders. At the end of this process where the viewpoints are pooled together, a shared generic conceptual model of the seed systems has been developed, which represents an abstract overview of agro-biodiversity management. These models then undergo validation and calibration with the farmers, and they are then used to explore scenarios through role playing. The research methods used by the various disciplines are those of i) analysing plant genetic diversity; ii) institutional economics and sectoral studies; iii) socio-anthropology; iv) system crop science and geography; and v) modelling of complex systems, in combination with participative approaches and research-action.

> VIP contact: didier.bazile@cirad.fr

Setting up concerted Intellectual Property Right (IPR) systems

The International Treaty on Phytogenetic Resources for Food and Agriculture (ITPGRFA, 2004) signed within the comprehensive FAO agreements recognises the rights of farmers to local genetic resources and to so-called "farm-based" production of traditional local varieties. The multilateral system of fair and equitable sharing of the benefits arising from use of these resources is aimed at protecting traditional food systems with the three-fold objective of sustainable preservation of biodiversity, ensuring food security and reducing the vulnerability of family farming.

The participants in Mali have been able to make progress in the design of a "mixed" IPR system: catalogue entry (a legal obligation to commercialize a variety which becomes known and then is protected from misappropriation by a third party) is combined with an application for Plant Breeder Rights to the African Intellectual Property Organisation (APIO), for certain commercially important varieties. Discussions around an "ITPGRFA strategy" providing smallholders with access to the resources created within the framework of the FFEM project have been initiated by Mali's research sector and the smallholder organisations.

> VIP contact: dominique.dessauw@cirad.fr

RESEARCH issues

Participative selection to harness local genetic resources

Participative selection (PS) was designed to integrate into rational selection programmes the practices and knowledge that smallholders have developed in interaction with their natural environments. In this way it is able to better satisfy the actual requirements of populations (see products).

In PS, all the players contribute to defining the selection criteria, setting up and monitoring the trial plots and therefore the final choices of varieties. This approach harnesses local varieties and the associated knowledge of famers and users, with the support of the researchers' tools and knowledge.

Improving access to seeds and protecting farmers' rights

Access to quality seeds for a diversified range of varieties is a crucial challenge for family smallholdings, which account for the majority of African food production. Alongside formal seed systems often focused on the "big crops" (maize or rice), there are traditional seed production and exchange networks. These networks are efficient channels of distributing varieties (local and improved), and they play an essential role in preserving *in situ* diversity of local cereals. The challenge is to bring together formal and informal systems so that farmers have easier access to seeds of varieties suited to their requirements. So we need to change the methods and rights of access for producers to these quality seeds within the framework of concertation between players from politics, research, smallholder organisations and other organisations involved in seed services *(see expertise)*.

Developing indicators for tracking genetic diversity of sorghums and millets

The description and analysis of the African systems dynamics of varietal diversity are central issues. These systems use traditional variety populations, whose genetic composition varies over time and space in response to environmental constraints. The presence of this biodiversity is a guarantee of sustainability, in particular against climate vagaries. Research into biodiversity indicators (inter and intra-species) and tracking them over time are crucial for defining agricultural policies ensuring the preservation of the various components of genetic diversity. With sorghum for example, only some little smallholdings preserve minor varieties, which are under threat of disappearing, though they are of high value for genetic diversity on a village scale.

This still very new objective is harnessing field information surveys, satellite data and modern tools such as companion modelling and molecular markers (see expertise).

> Contact: gilles.trouche@cirad.fr