*les dossiers*
# d'AGROPOLIS INTERNATIONAL

*Expertise of the scientific community*

# Agronomy
## Crops and cropping systems

Number 12

The aim is to address major issues facing developing countries. Based on the scientific activities of the team operating in Brazil—the cradle of tropical DMC—these issues are dealt with throughout the unit's geostrategic and partnership system: Central Africa (Cameroon), North Africa (Tunisia), Indian Ocean region (Madagascar), Asia (Cambodia, Laos, Vietnam, Thailand, China), and the West Indies (Guadeloupe).

Through its partnership network, the unit is setting up stations where priority research topics are investigated to gain insight into the processes and enhance DMC management, along with direct engineering applications to promote ecological intensification.

There are several research priorities:

- DMC and soil organic matter dynamics
- DMC and soil biological activity
- DMC and pest, weed and disease management, as illustrated by three examples: *Striga*, soilborne white grubs ('Optimization of pest management by ecological mechanisms for sustainable improvement of agrosystem productivity' research project) and rice blast ('Agricultural management of rice blast resistance', *Agence Nationale de la Recherche*, France)
- DMC and plant breeding: improved rice varieties (SEBOTA).

Major collaborations are under way with institutions in France (*Agence Française de Développement, Fonds Français pour l'Environnement Mondial, Ministère des Affaires étrangères et européennes*) and abroad (Madagascar, Laos, Cameroon, China, Brazil, Vietnam, Cambodia, Thailand), such as the *Groupement Semis Direct* in Madagascar, Kasetsart University (Thailand), etc. ■

# Ecological intensification of cocoa- or coffee-based agroforestry systems


▲ *Agroforestry cocoa plantation in central Cameroon.*

Agroforestry stands in which cocoa and coffee trees are grown alongside many different woody, forest or fruit species are complex systems with high environmental and socioeconomic value. These sustainable systems require few chemical inputs and, in addition to coffee and cocoa, they provide farmers with a range of self-consumed or marketed fruits, timber and medicinal products. They also participate in biodiversity conservation and carbon storage. There is, however, considerable potential for improving the performances of the different constituents of these systems in which interactions between the many associated species are complex.

Research carried out by CIRAD and partners, particularly in Latin America and Africa, is aimed at developing models of functional associations that take farmers' expectations and environmental constraints into account. This implies describing cocoa- or coffee-based agroforestry systems, analysing their ecophysiological functioning, assessing their agroecological and socioeconomic performances, while also characterizing farmers' cropping practices. The findings of this research has shed light on the dynamics of these systems, which vary differently over time depending on the local soil-climate conditions, situations and farmers' strategies.

Further insight has been gained on agroecological and socioeconomic factors that determine the sustainability of these agroforestry systems and variations in their performances over time. The development of decision support and prediction tools based on the ecophysiological functioning of the species present also enables quantification of different complex processes (nutrient cycle, light interception, resource distribution). It is thus possible to meet farmers' needs by proposing them the most suitable cropping practices for intensifying cocoa- and coffee-based agroforestry systems, while not reducing their high environmental value.

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