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Expertise of the scientific community

Agronomy
Crops and cropping systems

Number 12

■ **The 'Design of cropping systems' (CONSYST)** team develops methods for assessing existing systems and designing new ones on the basis of the agroecological principles presented above, in given socioeconomic and biophysical contexts.

These teams work with a technical and engineering team ('Cropping systems, modelling, experimentation') to produce indicators, models and tools, in partnership with development organizations and companies.

In temperate agroforestry conditions, agroforestry plots located in a station for long-term experimental studies (Vézénobres, Restinclières, France) are compared with agricultural and forestry control plots. In this work, the unit supervises other research and development teams.

In integrated viticultural systems, cropping systems that provide environmental services are tested at the *Domaine du Chapitre* (Hérault, France). A long-term experiment on low-input cropping systems will be set up in collaboration with the Domaine viticole de l'INRA (Bordeaux, France) and development partners *(Institut Français de la Vigne et du Vin,* inter-branch professions).

For tropical agroforestry systems (farmers' and experimental plots in Costa Rica and Cameroon), the research platform in partnership (PCP) Agroforestry Systems with Perennial Crops in Costa Rica has formalized relations with the *Centro Agronómico Tropical de Investigación y Enseñanza* and various Central American institutions. The PCP *'Grand Sud Cameroun'* associates several CIRAD research units with the *Institut de Recherche Agricole pour le Développement,* and the *Universités de Dschang et de Yaoundé 1.*

The *Association Française d'Agroforesterie* is the unit's major link with agricultural development for field transfer of research knowledge. The UMR also benefits from the Montpellier research network based project 'Towards a federative research on modelling and simulation platforms' and that of the Record project to facilitate exchanges within an international network on the integrated modelling of agricultural systems. Moreover, a European partnership initiated by the unit as part of the Seamless project (integrated assessment of agricultural systems) is now firmly established in an association with the same name, which will provide a framework for new initiatives with the Universities of Wageningen and Bonn. ■

Sustainable production and innovation for smallholders in developing countries

The improvement and stabilization of smallholders' agricultural production are key challenges for international agronomic research. Soils in tropical environments are varied but fragile and the climatic conditions are harsh, with a high probability of catastrophic events occurring. Socioeconomic conditions for smallholders in such regions are also often difficult and volatile, with limited access to markets and credit. In such conditions, innovative systems proposed should preserve and make efficient use of available natural resources in the short- and long-term, maintain or even increase productivity, while limiting the environmental impacts of agricultural activities. CIRAD, along with its partners in industrialized and developing countries, is thus involved in a process to develop/assess direct seeding mulch-based cropping systems (DMC) adapted to tropical conditions.

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These systems are based on no tillage, permanent plant cover, diversified rotations and the use of multifunctional cover crops. They have proved effective in stabilizing grain production (better water and nutrient use) and in enhancing certain ecosystem services (erosion control, carbon storage, soil biology, etc.). Modelling on plot and farm scales helps to accurately characterize the complex functioning of these systems and to assess their potential integration in production systems. A participatory process for the co-development of these innovative cropping systems is currently being implemented in different countries to promote their dissemination. It involves many exchanges between researchers in different disciplines, technicians and the different types of producers concerned, thereby contributing greatly to the reciprocal learning process necessary for everyone and gradually familiarizing farmers with DMC.

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▲ *Bean crop under DMC in Madagascar.*