

## UMR SYSTEM

### Functioning and management of tropical and Mediterranean cropping systems

(Fonctionnement et conduite des systèmes de culture tropicaux et méditerranéens)

### Director

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### Research area

The JRU Functioning and management of tropical and Mediterranean cropping systems (SYSTEM) produces knowledge and develops tools for the evaluation, management or designing of cropping systems combining economic performance and preservation of natural resources and the environment. Emphasis is on the integrated management of inputs and the combination of species with productive or environmental functions in order to ensure stable agronomic performances (yield and quality) and soil fertility management while limiting environmental impacts (pollution of water, erosion, biodiversity, etc.). Studies cover a large range of these multi-species and multifunctional systems in various tropical and mediterranean contexts :

- intercropping high-value perennial crops (vineyards, coffee, cocoa, wood and multipurpose trees) with grasslands or annual crops,
- direct seeded mulch based cropping systems based on annual grain crops and relay-cropping with perennial forage crops,
- complex hand-managed agroforestry systems in the humid tropics with a high number of cultivated species.

These cropping systems are used as a background and as an application context to develop research on two scientific domain of the systemic agronomy :

- Methodologies for the design or the evaluation of cropping systems analysed as complex piloted systems combining a biophysic and a decisional dimensions at field and farm levels.
- Knowledge on the relationships between structure, functions and services in multispecies cropping systems.

These research use a large range of methodologies including conceptual and numerical simulation, experiments, surveys and participatory design of systems.

UMR System is leading MS and PhD curriculae on agro-ecology and cropping systems in SupAgro Montpellier.

Website: [www.montpellier.inra.fr/internet/recherche/unites/unites/system.html](http://www.montpellier.inra.fr/internet/recherche/unites/unites/system.html)

### Research highlights

The major aspects contributing to the international repute of the research unit are :

- Analysis and modeling of agroforestry cropping systems in Europe and in the sub-humid tropics,
- Analysis and modeling of vineyards cropping systems,
- Analysis and modeling of direct seeded mulch based cropping systems in the tropics,
- Methodologies to design multifunctional cropping systems.
- Relationships between soil water availability, growth and dynamic of these systems.

### Staff profile

	Total permanent staff	Total Scientists*	Scientists with "HDR <sup>1</sup> "	Post-doct fellows	PhD
Staff	30	18	3	5	8

\*Scientists per member institution: 9 CIRAD, 6 INRA, 3 SupAgro

<sup>1</sup> French university degree for confirmed thesis supervisor

## Research teams

- Methodologies for design or assessment of cropping systems
- Role of the biological diversity of cultivated species in the productivity and sustainability of farming systems

## Platforms and other tools

- Experimental platforms to study the various cropping systems (two around Montpellier, one in Brasil, one in Costa Rica),
- Networks of farmers and regional platforms for participatory research on the design of innovative cropping systems (two in France, one in Brasil, one in Costa Rica, one in Zimbabwe, one in Mali)
- Simulation models or contribution to simulation platforms for the various cropping systems.

## Most important international partnerships

- The SEAMLESS Association (especially the Plant Production System group in Wageningen) on integrated modeling for farming systems assessment ([www.seamless-ip.org](http://www.seamless-ip.org)),
- The CATIE (Costa Rica) for agroforestry systems,
- EMBRAPA (Brazil) for Direct Seeded Mulch Based Systems,
- The TSBF center (Zimbabwe) for soil fertility and tropical cropping systems,
- More punctual collaborations with a large range of national research centers in Europe, in Australia and in the tropic.

## Facts and figures

### Publications in international ranking journals

- ❖ 2007 : 14
- ❖ 2006 : 15
- ❖ 2005 : 14

### Representative publications

Celette, F., Wery, J., Chantelot, E., Celette, J., Gary, C., 2005. Belowground interactions in a vine (*Vitis vinifera* L.)-tall fescue (*Festuca arundinacea* Shreb.) intercropping system: Water relations and growth. **Plant and Soil** (276), 205-217.

Graves, A., Burgess, P., Liagre, F., Terreaux, J.-P., Dupraz, C., 2006. Development and use of a framework for characterising computer models of silvoarable economics. **Agroforestry Systems** (67), 301.

Maltas, A., Corbeels, M., Scopel, E., Oliver, R., Douzet, J.M., da Silva, F.A.M., Wery, J., 2007. Long-term effects of continuous direct seeding mulch-based cropping systems on soil nitrogen supply in the Cerrado region of Brazil. **Plant and Soil** (298), 161-173.

Rapidel, B., Defèche, C., Traoré, B., Lançon, J., Wery, J., 2006. In-field development of a conceptual crop functioning and management model: A case study on cotton in southern Mali. **European Journal of Agronomy** (24), 304-315.

Tixier, P., Risede, J.M., Dorel, M., Malézieux, E., 2006. Modelling population dynamics of banana plant-parasitic nematodes: A contribution to the design of sustainable cropping systems. **Ecological Modelling** (198), 321-331.

### List of softwares developed within the unit (when applicable)

- Development of the Hi-sAFe model for agroforestry systems,
- Contribution to the development of the crop model (APES) of SEAMLESS for tropical crops, perennial crops and for crop associations,
- Contribution to the improvement of several crop models (STICS in France and APSIM in Australia).

### Total annual budget

Soon to be provided