

# CO-DESIGN AND ON-FARM EXPERIMENTATION OF SUSTAINABLE MANAGEMENT PRACTICES COMBINING CONSERVATION AGRICULTURE AND AGROFORESTRY IN THE SOUTH-EAST OF FRANCE



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## A LOCAL RESEARCH AND DEVELOPMENT PROJECT INVOLVING FARMERS, RESEARCHERS AND TECHNICIANS

### OBJECTIVES

- (1) Co-design and co-implementation with farmers of AF and Direct seeding Mulch-based Cropping (DMC) systems.
- (2) Ex-post system and multi-scale analysis to assess how these practices and their combination affect the farming system.
- (3) Creation of a database and diffusion of results to farmers and technicians and researchers.

### SHORT CALENDAR

- 2016** Beginning of the project, local communication with stakeholders and farmers.
- 2017-2018** Constitution of a farmers network (ASVIDA group : « Agroecology and Living Soils in Drôme and Ardèche »);  
 Training for farmers on AF and DMC systems and other specific topics;  
 Definition of co-design and survey methodologies;  
 Initial diagnosis of farming systems at T<sub>0</sub>;  
 Co-design of « on-farm » AF and DMC systems;  
 First tree plantations for AF systems on arable and horticultural farms.
- 2019** Start of on-farm surveys and evaluation of results for AF and DMC systems.

### Researchers

- Iterative co-design of AF and DMC prototypes
- Co-implementation of prototypes
- Farmer's experimentation as source of innovation
- Technical exchanges and field visits between farmers for improvement of cropping systems.

### Technicians

### Farmer

### Farmers Group

- Participatory approach for the design of AF prototypes and DMC systems or combined systems.
- Evaluation of the multiperformance of systems.
- Study of the decision rules of AF and DMC systems.
- Field monitoring for DMC systems (crop yield, foliar pH and redox potential, crop resistance to pathogens, soil organic matter, earthworm abundance, soil porosity, ...).
- Annual evaluation of results for AF and DMC systems.
- Scaling-up of systems at local level.

### Vegetable Orchard Systems and DMC Systems



### Agroforestry Systems for arable crops and DMC Systems



1. Vegetable orchard planted in 2017 on 1,2 ha.
2. Beans and fennel on compost and mulch.
3. Experiment with sorgho sown after beans.
4. Management of hedges implanted in arable crop systems.
5. Oat and faba bean as cover crop between two corn cultures.
6. Direct sown wheat/red clover association after a flax/buckwheat cover in a combined AF/DMC system with intraparcellar trees planted in 2017.

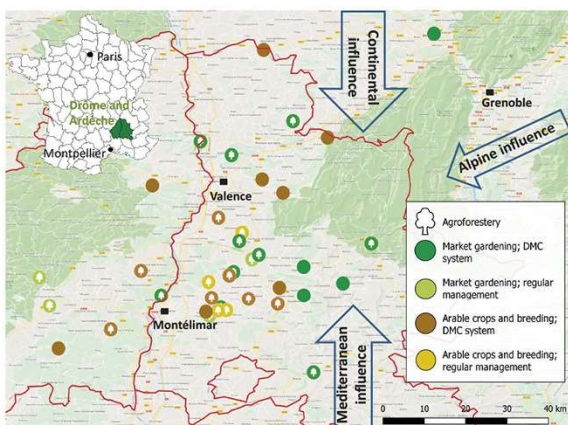


### MAIN HYPOTHESES

- Combining AgroForestry (AF) and DMC systems also combines the assets of both practices and could respond to farmer's objectives in terms of multiperformance and adaptation to climatic changes.
- Direct seeding Mulch-based Cropping (DMC) systems enhance biological activity of soils and optimize soil-plant-microorganisms interactions<sup>(1)</sup> which in turn can enhance the quality of soils<sup>(2)</sup>, the biochemical composition and quality of crops and the resistance of crops towards plant pathogens.

### POSSIBLE CONSTRAINTS OF COMBINING AF AND DMC SYSTEMS

- High level of expertise required for the farmers.
- Double constraint on soil warming in early spring<sup>(3)</sup>.
- Management of root competition by trees for reduced tillage<sup>(3)</sup>.
- Difficulties for implementing DMC techniques on organic farms (without herbicides).
- Task organization management in a multi-purpose system<sup>(4)</sup>.



A diversified network of pilot farms

### References :

- (1) Husson O. (2013) Redox potential (Eh) and pH as drivers of soil/plant/microorganism systems. *Plant Soil*, 362 (1-2), 389-417
- (2) Husson O. et al. (2018) Conservation Agriculture systems alter the electrical characteristics (Eh, pH and EC) of four soil types in France. *Soil & Tillage Research*, 176, 57-68
- (3) Ndoli A. (2018) Farming with trees - A balancing act in the shade. PhD Thesis, University of Wageningen, 144 pp.
- (4) Paut R. et al (2019) Reducing risk through crop diversification: An application of portfolio theory to diversified horticultural systems. *Agricultural Systems*, 168, 123-130

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