Co-design and on-farm experimentation of practices combining conservation agriculture and agroforestry

Sieffert André, Antoine Morinay, Tarik Zniber, Alain Canet, Séverin Lavoyer, Pascale Moity-Maïzi, Rodolphe Sabatier, Raphaël Paut, Marc Tchamitchian

L10.P.63

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Sieffert A.[1] (andre.sieffert@adaf26.org), Morinay A.[1], Zniber T.[1], Canet A.[2], Lavoyer S.[3], Maïzi-Moity P.[4], Sabatier R.[5], Paut R.[5], Tchamitchian M.[5]

[1] *Association Drômoise d'Agroforesterie, 26160 Pont-de-Barret, France*; [2] *Arbre et Paysage 32, 32000 Auch, France*; [3] *French Agroforestry Association, 32 000 Auch, France*; [4] *Institut des Régions Chaudes, Montpellier SupAgro, 34000 Montpellier, France*; [5] *Unité Ecodéveloppement, INRA, 84140 Montfavet, France*

Agroforestry (AF) studies tend not to take much into consideration the different options available for the management of crops per se, generally taking into account classical techniques. However, in these single farming systems, reduced or no-tillage methods using mulch or cover-crops defined as Direct seed Mulch based Cropping systems (DMC) are gaining momentum. According to recent studies, DMC systems result under specific conditions in an enhancement of biological activity of soils and optimization of soil-plant-microorganisms interactions which in turn can enhance the resistance of crops towards plant pathogens. DMC systems have however been rarely combined with AF systems. A straightforward explanation lies in the high level of expertise needed to follow each of the two approaches, which makes their combination highly complex. But more fundamental issues such as the difficulties to manage root competition between trees and vegetables without ploughing are also at stake.
The objectives of our work is (1) the co-design and co-implementation with farmers of DMC and AF systems, (2) the study on how these systems and their combination affect the farming system in its whole and (3) the continuous diffusion of the results of this study. We focus on a co-design which is a result from a thorough collaboration between the farmers and our partners which are AF structures and experts in different fields. We started our work in 2016 and are currently collaborating with a network of 34 farms (arable crops, breeding and horticulture) in the South-East of France which are using or developing DMC and/or AF systems (e.g. vegetable-orchards, agroforestry in arable crops) since 2007 and up. Ndoli (2018)[1] has already shown that under specific conditions the combination of DMC and AF systems can lead to a reduced productivity as in the case of maize grown under trees. Hence, one of our aims is to identify technical and design options optimizing the combined management of crops and trees in DMC systems and allowing the success of the farming system in the long run. We direct this identification into an iterative process with the co-design of the farms.
The co-design of the DMC and AF systems is implemented based on the diagnosis of the farming system at various levels associated to the farmer's objectives. On-farm experiments are then processed by the farmers in order to test the viability of the design. The ADAF carries out with the farmer and in relation with the technical partners the monitoring and evaluation of various parameters which assess the agronomic, environmental and socio-economic performances of the farm as well as the soil and crops conditions. Focus is also made, through a systemic approach, on the specific linkage between crop culture and tree management (e.g. workforce repartition and adaptation in vegetable-orchards).

Keywords: co-design, conservation agriculture, on-farm experimentation, systemic approach, participatory development.

References:

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