Vertical project: designing fruit agroforestry systems for a renewed horticulture

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Abstract

New orchard systems need to thought for achieving better sustainability. Crop diversification could be an option for improving ecological balance within the plot, and increase ecosystemic services. By involving different actors of the fruit chain, we investigated several scenarios for agroforestry systems, and developed multi-criteria assessment tool to rank these scenarios and identify best ones.

Keywords: agroforestry, agroecology, functional biodiversity, sustainability

Introduction

Although it's addressing multiple issues for modern farming, agroforestry mixing fruit trees and annual crops (mainly vegetables) has not been so well documented under temperate climate. Therefore, contribution of these fruit species in diversified systems is not well known, as for effect of neighbouring crops on fruit trees health, and global ecosystemic balance.

One expected amenity of agroforestry is to increase biodiversity and natural pest regulation within the plot. While fruit trees are among the crops that rely most on plant protection products, we made the hypothesis that introduction of annual crops in the perennial system can lead to effective biocontrol and to input reduction, while developing other synergies between crops (shadow beneficial effects, water limitation, ….) or social amenities. However, fruit trees have other characteristics than timber species (height, pruning, protection...) and their relevance in agroforestry needs to be shown. Can plot diversification lead to higher resilience, and reduced trees dependance to pesticides? Is fruit tree (grafted with regular rootstocks) shadow big enough to have a useful effect, in different climatic conditions? How do fruit rootstocks behave under such agrosystems? Can they help in reducing water and nutrients use and losses?

Material and methods

On two locations (Durette[3]/TAB[4]) in southern France, each one with specific characteristics (crop rotation, marketing, surface...), the partners of a 6-years project, funded by Ministry of Agriculture, and called *Vertical*, designed in 2012 and 2013 innovative cropping systems under a participative approach, addressing those specific constraints, in order to optimize their performance.

The iterative design process as described by Pelzer et al. (2012) was used (figure 1).

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[3] http://www.grab.fr/durette
[4] http://rhone-alpes.synagri.com/portail/parlons-plate-forme-tab

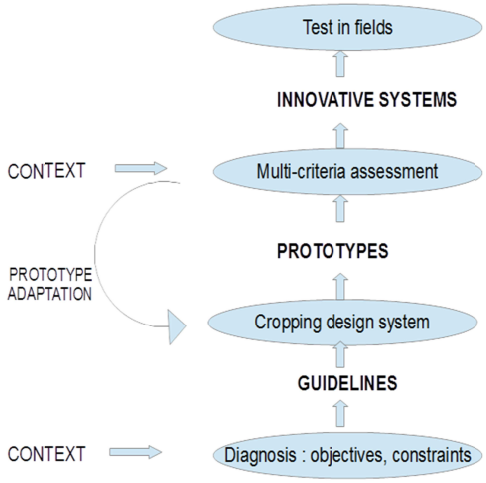

Figure 1: Multi-criteria assessment process for complex inovative cropping systems.

Results and Discussion

These systems have been implemented in 2013 and 2014.

Although objectives remain the same, each location made specific choice according to their constraints and organization frame.

Table 1: main characteristics and leverages used in each agroecological system.

	TAB platform	**Durette**
Cropping system	Cereals, grain crops (rape, sorghum)	High crop diversification (vegetables)
Fruit system	Stone fruits	All rosaceous species Vigourous rootstocks Tolerant cultivars
Diversification	high stem timber trees	Animal introduction (chicken) High stem timber trees
Agroecological infrastructures	hedges, strips, nests, rocks & wood pills	
Cultural practices	Reduced fertilization Adapted pruning Long rotation cycles Organic plant protection when needed	
Marketing	Long marketing channels	Short marketing channels

Decision rules have been implemented in order to manage systems in a proper way.

Sustainability indicators have been discussed and selected to (i) monitor and (ii) to assess these systems. Some specific biodiversity groups have been followed in order to better characterize initial environmental situation, following the national program dedicated to ordinary biodiversity in agricultural land (called OAB[5]).

[5] http://observatoire-agricole-biodiversite.fr

An e*x ante* assessment tool has been developed under a participatory approach, to stimulate the co-design of new performant plots, taking into account stakeholders priorities and expertise. Most determining components of sustainability have been decided and weighed through concertation and negociation.

This tool will shortly be adapted to *ex-post* assessment, so that advisors but also farmers ruling fruit agroforestry systems can identify their main bottlenecks and assets. A link to the national bottom-up network of commercial fruit agroforestry systems (called *Smart*[6]) could be achieved this way.

Both systems are managed under decision rules. Performance criteria are collected for a pluriannual assessment of their sustainability.

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Reference

Pelzer, E. *et al.* (2012). Assessing innovative cropping systems with DEXiPM, a qualitative multi-criteria assessment tool derived from DEXi. *Ecological indicators* **18**: 171-182. doi:10.1016/ j.ecolind.2011.11.019.

Citation of the full publication

The citation of the full publication will be found on Ecofruit website as soon as available.

[6] http://www.agroforesterie.fr/smart