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Linking scientific and empirical knowledge: an interactive web app to design agroforestry market gardening systems

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Abstract
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Theme: Education, information sharing, and awareness raising in agroforestry

Keywords: agroforestry, intercropping, vegetables, fruit trees, decision-support tool

Abstract

Introduction

Among agroforestry systems, a particular form of intercropping has developed in recent years in Europe: the agroforestry market gardening system (Warlop, 2016). This particular form of professional agroforestry, where vegetables are grown in intercropping with fruit trees or berries, is found mainly in organic agriculture, on small areas (Fig. 1). Farmers combine a wide variety of crops and rely mainly on short food supply chains (Léger et al., 2018). Due to their highly agro-ecological nature, these systems seem able of addressing many of the specific challenges of developed European regions.

However, the great diversity of crops in terms of phenology (tubers, leaf, root or fruit vegetables, pome, stone or nuts fruits, berries, etc.), the number of combinations, the various biological interactions to take into account and the nature of these interactions make it very difficult to acquire references on these systems. While research is underway to understand the interactions between fruit trees and vegetables (Imbert et al., 2019), the nearly unlimited number of crop combinations makes this work very tedious.

In parallel, there is a substantial "grey literature" on this subject. This literature includes popular books, gardening books, websites and specialized magazines. It mainly compiles empirical knowledge resulting from the capitalization of site-specific experiments. The objective of the present work is therefore to combine scientific and grey literature in order to provide a decision support tool for farmers or new agroforestry practitioners.



Figure 1. An example of market gardening agroforestry system (pear – potatoes – peach intercropping)



Material & Methods

We carried out a review on horticultural intercropping systems in the scientific and grey literature. With regard to scientific literature, studies were identified from a search in the Institute for Scientific Information Web of Knowledge and Google Scholar databases. We requested the following terms: (inter-crop* OR agroforestry OR mixed crop*) AND (fruit* OR orchard OR vegetable* OR market gardening). 74 papers were analysed, resulting in 534 experiments (an experiment was defined by a unique crop combination in site and year). With regard to grey literature, books and documents were identified by search engines. 28 documents were analysed, resulting in 6525 combinations. A combination was defined as a unique data on an intercropping, either qualified as a "positive" or "negative" interaction.

Results

All the data from our literature review were combined in a web-based interactive platform. The user can choose one or more crops. Several forms of graphic representations are then available. When data is available in the scientific literature, Land Equivalent Ratio values are provided for the selected crop as well as all the other crops with which it can be intercropped. When it is available in the grey literature, the data is compiled and weighted. The platform also makes it possible to select several crops and generates a network representation (see Fig. 2 below). The web-based application is available at: https://paut-et-al.shinyapps.io/IC_review_en/¹

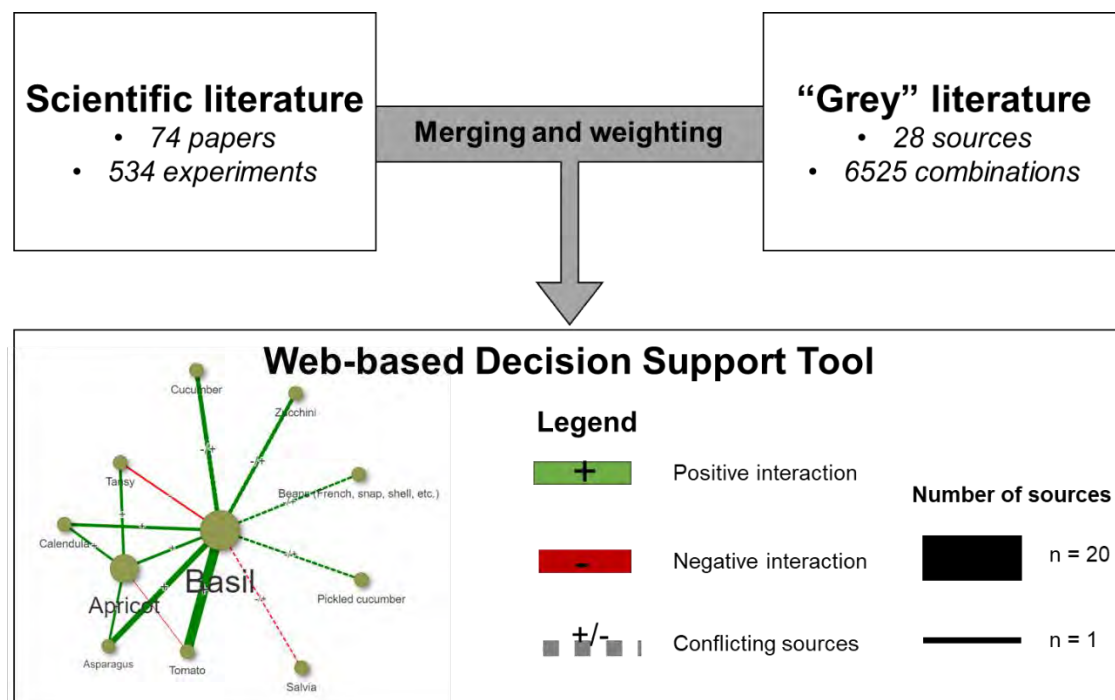


Figure 2. Screenshots of the web-based application

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