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Use of service plants with fruit trees: Impacts on tree development and soil functioning

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Abstract

Agroforestry (AF) applied to fruit trees is promising for helping to cope with major global challenges, such as climate change and biodiversity loss. However, knowledge about such systems takes a very long time to acquire, and mature AF orchards in temperate regions are very scarce.

To circumvent this issue, a mesocosm experiment was created in which a pear tree is accompanied by four different perennial herbaceous plants at varying modalities of density and management. One of the tested hypotheses comes from 'syntropic' agriculture, which suggests that intensive use of companion plants at very high density with frequent pruning can be beneficial for plant development and soil health.

Our results overall show that in our (constrained) system, the growth of pear trees is not favored by the presence of companion plants, but that the competition for resources that they trigger can be entirely offset by frequent management (pruning + mulching with the chopped material). Furthermore, mineral nutrition and certain soil functions related to nutrient cycling seem to be enhanced by the presence of companion plants, even though nitrogen appears as a major potential bottleneck.

Keywords: Service plants, Agroforestry, Syntropic agriculture, Soil functions

Introduction

During the second half of the 20th century, fruit growing underwent a period of rapid intensification, leading to the current dominant system of low-diversity monoculture orchards on dwarfing rootstocks, that are heavily dependent on chemical inputs. Nowadays, the regular emergence of new pests associated with a gradual ban on pesticides, the volatility of input and selling prices, and global climate change are challenging fruit production in Europe. In particular, these changes increase the risk of yield losses and lead to significant irregularity in harvests from year to year, making the profession increasingly precarious (Legave, 2009).

Moreover, the environmental impacts of modern agriculture tend to indicate that this model of intensive production is reaching its limits (Aubin and Barbosa Cavalcanti, 2017). In Europe, around 60% of the soils are degraded or considered as unhealthy, partly due to intensive farming practices (soil compaction, chemical inputs…) (Panagos et al., 2025). In this context, agroforestry (AF), which is known to deliver services in terms of biodiversity, soil fertility, climate, and water balance, appears to be an interesting practice for addressing these challenges and improving long-term orchards' robustness (Jacobs et al., 2022; Rolo et al., 2023). In fruit production, AF consists in the addition of perennial plants (high-stem trees, shrubs…) between and/or around fruit trees, to create a more complex multilayered system. Although still scarce in Europe, interest is strongly rising for so-called 'syntropic' farming practices as developed in the tropics, which hypothesize that the intensive use of service plants at high density associated with frequent pruning and restitution of the chopped material to the ground can be beneficial for plant development, soil functions, and global system health (Andrade et al., 2020; Jacobi et al., 2025).

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Material and Methods

Our study aims at understanding the extent to which adding service plants at different densities and managing them benefits fruit tree development and soil functioning. To address this issue, we set up an experiment in which pear trees (*Pyrus communis Harrowlove®/OHF87)* were grown in jars (110L) in association with a guild of four perennials plants (*Sambucus nigra, Artemisia vulgaris, Melissa officinalis, Symphytum officinalis*). The experimental design was composed of 6 repetitions of 7 treatments, corresponding to 3 densities of companion plants (D0: none, D1: 1 specimen; D2: specimens of each plant) and 2 modalities of management (R0: none, R1 or R2: return of organic matter from the pruned plants), studied over two growing seasons. Soil biological activity (β-glucosidase, urease, phosphatase and FDA), and nutrient availability (POXC, nitrates and ammonium) were assessed after major management interventions on the companion plants.

Results and Discussion

Our results showed that returning the chopped organic matter significantly increased pear trees growth as expected (Leterme, 2014; Andrade et al., 2020). We also observed that the presence of unmanaged service plants significantly reduced pear trees' development, suggesting that their presence induces competition for resources (light and nutrients). However, when the service plants were managed it appeared that this competitive effect can be partially or completely offset, especially if the plantation density doesn't exceed a certain level (Fig. 1A).

Regarding soil biological activity, we obtained variable results depending on the enzymes. However, for some of them, interesting trends emerged. For example, the presence of companion plants increased β-glucosidase activity in the soil, particularly when these plants were managed (pruning + mulching). Mulching alone was not sufficient to explain the differences with the control. This suggests that accompanying fruit trees with perennial plants may promote the recruitment of microbial communities involved in the carbon cycle and thus stimulate soil functioning (Fig. 1B).

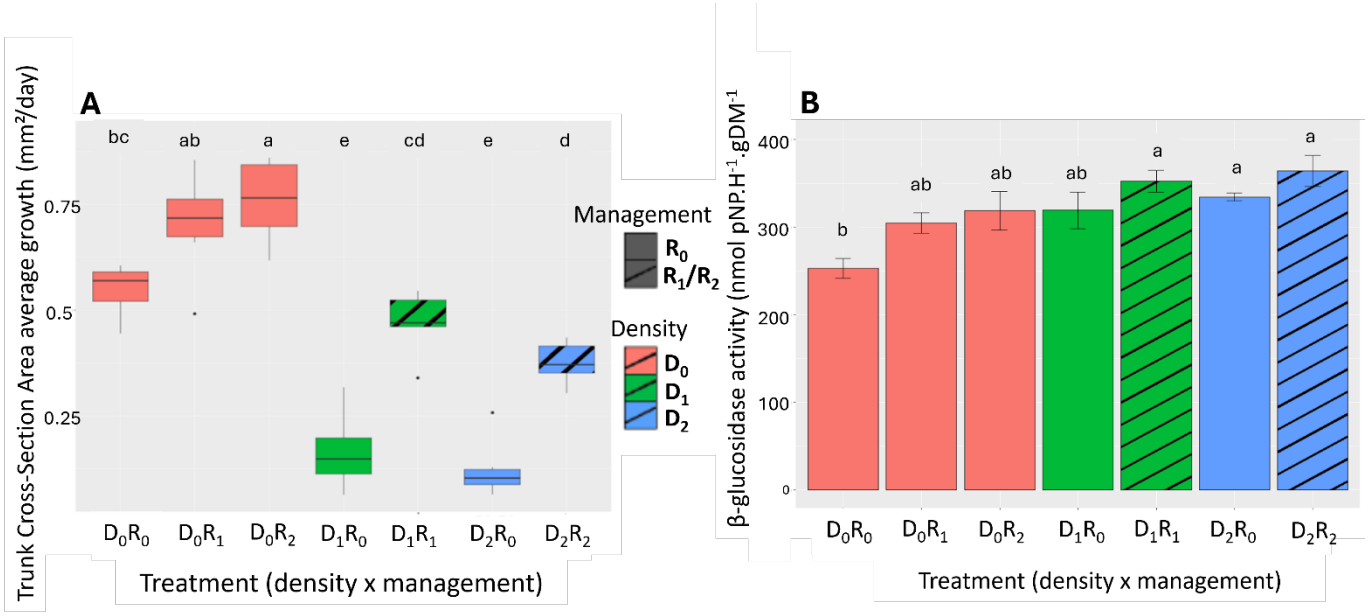

Figure 1: A: Average overall growth rate of trunk cross-sectional area by modality;
B: Average enzymatic activity of *β*-glucosidase depending on the modalities

References

Andrade, D., F. Pasini, and F.R. Scarano. 2020. Syntropy and innovation in agriculture. Curr. Opin. Environ. Sustain. 45: 20–24. doi: 10.1016/j.cosust.2020.08.003.

Aubin, L., and J.S. Barbosa Cavalcanti. 2017. Des origines rituelles de l'agriculture à l´Anthropocène. Réflexions sur un paradigme en formation aux multiples visages: l´agroécologie. Rev. Anthr. doi: 10.51359/2525-5223.2017.24045.

Jacobi, J., C. Andres, F.F. Assaad, S. Bellon, X. Coquil, et al. 2025. Syntropic farming systems for reconciling productivity, ecosystem functions, and restoration. Lancet Planet. Health 9(4): e314–e325. doi: 10.1016/S2542-5196(25)00047-6.

Jacobs, S.R., H. Webber, W. Niether, K. Grahmann, D. Lüttschwager, et al. 2022. Modification of the microclimate and water balance through the integration of trees into temperate cropping systems. Agric. For. Meteorol. 323: 109065. doi: 10.1016/j.agrformet.2022.109065.

Legave, J.-M. 2009. Comment faire face aux changements climatiques en arboriculture fruitière ? Innov. Agron.: 165–177. doi: 10.17180/KFCW-6M74.

Leterme, E. 2014. La biodiversité amie du verger. Rouergue.

Panagos, P., A. Jones, E. Lugato, and C. Ballabio. 2025. A Soil Monitoring Law for Europe. Glob. Chall. 9(3): 2400336. doi: 10.1002/gch2.202400336.

Rolo, V., D. Rivest, É. Maillard, and G. Moreno. 2023. Agroforestry potential for adaptation to climate change: A soil-based perspective. Soil Use Manag. 39(3): 1006–1032. doi: 10.1111/sum.12932.