Vitiforestry: integrating trees into vineyards

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[1]Ver de terre Production

How Does Agroforestry Enhance Sustainability in vineyards ?

Vitiviniculture involves the association of two perennial plants: trees and vines, on the same plot of land. Several models exist, such as rows of trees between the vines, shrub hedges at the periphery or within plots, or even isolated trees directly integrated into the vineyard rows. Originating in Antiquity, this traditional method integrates the vine into its ecosystem, using trees as living supports and fostering a symbiotic relationship.

The ecological benefits of vitiforestry are multiple: on one hand, better utilization of water and nutrients, and on the other hand, greater biological diversity, including soil, fauna, and flora. Additionally, trees create a favorable microclimate through shading, wind reduction, maintaining humidity during heatwaves, and better drainage during storms.They play a crucial role in mitigating the extreme temperature fluctuations caused by climate change. In addition, agroforestry offers the possibility of diversifying production, particularly through the harvesting of tree products: timber, energy, fruits, or nuts, among others.

FIGURE 1. Trees planted along the edges of vineyard plots, spaced several meters from the vine rows © Marie-Pierre Lacoste

Adaptation of tree species and management practices to viticultural goals and environmental conditions

The choice of tree species and their management methods must be adapted to the pedoclimatic context as well as the long-term goals of the vineyard owner, such as improving biodiversity, producing timber or fruit, and protecting against extreme temperature fluctuations or lateral wind effects. Choosing tree species with a lifecycle similar to that of the vine is essential to avoid species that may outlast the vines, such as short-lived trees like the peach tree in long-duration vineyards.

Tree rows are often oriented along a north-south axis to maximize sunlight exposure and optimize production. The density and planting distances of trees must be adjusted according to the specific characteristics of the plot, mechanization constraints, maintenance requirements, and regulatory standards, including those related to specifications or AOCs. Recommendations are 30 to 50 stems per hectare, with a spacing of 3 to 5 meters between trees and the first vine row, and 25 to 30 meters between tree alignments.

Environmental benefits of trees and hedgerows

Trees and hedgerows absorb excess water during heavy rainfall events, reducing the risk of waterlogging. Additionally, they help mitigate frost damage by acting as buffers against extreme cold. During dry periods, the evapotranspiration process increases humidity, benefiting surrounding vegetation. The shading provided by trees also helps lower temperatures during heatwaves. In terms of air circulation, dense hedgerows function as windbreaks, while tree alignments, pruned to a high canopy, enhance ventilation and cooling of vineyard rows. Thanks to their deep root systems, trees enhance water and nutrient infiltration and retention, while also loosening the soil and reducing the risk of asphyxiation.

- Natural regeneration, through the preservation of spontaneous trees, enhances resilience and vigor, as these trees are native species better adapted to the local environment.
- The climatic effects of these tree-based systems depend on factors such as leaf density, tree spacing, orientation, and height, all of which influence their overall impact.
- Vitiforestry is an agroecological practice that should be integrated with other techniques, such as the use of cover crops, input reduction, or irrigation management.

They play a crucial role in restoring biodiversity by creating ecological corridors and fostering natural interactions between plants, beneficial fauna, and pest organisms. These natural dynamics contribute to a technical reduction in the need for chemical inputs. Additionally, the contribution of organic matter — such as leaves, roots, and mulched wood — enriches soil fertility and stimulates microbial activity.

Competition for Water and Nutrients

While trees with deep root systems access water resources that are generally unavailable to vines, competition for water primarily occurs within the first two or three vine rows adjacent to the tree lines. Re-search indicates that nitrogen competition tends to be more significant than water competition (Trambouze & Goma-Fortin, 2013). To mitigate this, managing the root system through techniques such as root ringing (using a toothed tool) every three years can limit root expansion to-wards the vines. Furthermore, incorporating cover crops, especially legumes, can capture nitrogen and return it to the soil, benefitting the vines.

Canopy Management

Proper canopy management is crucial for reducing water usage. Winter pruning can help decrease both the canopy and root volume, leading to partial biodegradation of fine roots. Green pruning, conducted during the growing season, limits transpiration, further conserving water. Regular pollarding every 5 to 10 years also helps manage the canopy size, ensuring that the trees do not overly compete with the vines.

FIGURE 2. Field trees planted every 10 meters in a staggered pattern on a terraced vineyard to provide gradual shading coverage, (a), Vine married to a spontaneous oak tree. One tree every 5 meters planted in 2022 along the line to create a "sparse canopy" and thus a rotating shade (b), Trees growing spontaneously on the plot to providing shade (c), Multi-strata agroecological linear infrastructure within vineyard rows (d) © Ver de Terre production

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