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PRESSEMITTEILUNG

Agroforst in viticulture:
Trees strengthen vines – with the same wine quality

Vitiforst promotes biodiversity and promises more climate resilience in viticulture in Central Europe / Collaborative project led by the University of Hohenheim complements long-standing pilot trial

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Vines in the shade of trees: So-called Vitiforst systems can significantly improve the water supply and nutrient availability for the vines – without changing the quality of the wine. Researchers at the Universities of Hohenheim and Freiburg have reached this conclusion together with multiple wine-growing families in Ayl (Rhineland-Palatinate). Since 2007, the team has been investigating the interactions between vines and trees in the "Arbustum" project on a trial area of around 0.5 hectares – with promising results. But other basic knowledge is still missing. The "VitiForst – woody plants in viticulture to increase climate protection and biodiversity" project now aims to scientifically evaluate this concept and test its practical suitability in German wine-growing regions. The Rems Valley and the Kaiserstuhl were selected as focus regions. The Baden-Württemberg Ministry of Science, Research and the Arts (MWK) is supporting this project with a total amount of around 600,000 euros.

Agroforestry systems combine the cultivation of crops with woody plants such as trees or shrubs. In viticulture, this type of land use is called vitiforst. It is considered a promising strategy for making viticulture sustainable and more climate-resilient in the long term.

"The idea is not new: Even the Romans used trees as natural climbing aids for vines. Even today, traditional vitiforst systems with walnut or olive trees and vines can still be found in southern Europe," says Prof. Dr. Christian Zörb from the Department of Quality of Plant Products and Viticulture at the University of Hohenheim.

So far, however, little is known about the interactions between trees and vines in such systems. For example, trees can form a physical barrier for weeds and insects, change the microclimate, increase biodiversity, boost soil fertility, or even improve air and water quality. On the other hand, trees can also be competitors for resources such as light, space, nutrients, or water.

Long-term "Arbustum" trial in Rhineland-Palatinate

Since 2007, researchers from the Universities of Hohenheim and Freiburg have been investigating the effects of the combined cultivation of vines and trees on the water balance, nitrogen supply, and the resulting wine quality on a 0.5-hectare trial area in the wine-growing community of Ayl (Trier-Saarburg district). Winegrowers from the municipality of Ayl take care of the vines, while the local forestry office prunes the trees.

The focus is on the Riesling and Sauvignon Blanc grape varieties, which are cultivated both as single vines and in combination with oak or poplar trees. “The choice of tree species was deliberate: While oaks are considered frugal and slow-growing, poplars require more water and nutrients and grow correspondingly quickly – ideal conditions for a direct comparison,” says Jakob Hörl, research assistant and coordinator of the project.

Improved water and nitrogen supply thanks to “hydraulic lift”

The results are very promising. Surprisingly, the researchers did not observe any competition between trees and vines for water. On the contrary: The vines have more water at their disposal – even during dry periods. Riesling in particular benefited from the improved water supply in the mixed crops.

The researchers attribute this to a phenomenon known as “hydraulic lift.” “The deep-rooted trees transport water and nutrients from deeper layers of soil upwards, making them available to the shallow lateral roots of the vines,” explains Jakob Hörl. There are no differences between the two tree species.

At the same time, around 20 percent more nitrogen was available to the vines in the mixed systems, which is transported with the water to higher soil layers. Nitrogen is a very important macronutrient for vines and is of enormous importance for the growth and development of plants and grapes. It also influences the formation of important aroma components and the associated quality of must and wine.

More biodiversity in the vineyard

The researchers also observed changes in the soil life of the vineyard: Whereas oaks primarily promoted microbial diversity, highly specialized microbial communities formed in interaction with poplars, the long-term effect of which on yield and plant health is still unclear.

However, the joint cultivation of vines and trees not only increases microbial diversity, but also changes the root metabolites of the vines – i.e. the chemical compounds that the plants excrete via the roots – compared to pure vine cultivation. This was particularly pronounced in combination with oaks.

These changes are apparently part of a root-to-root communication process with the neighboring trees: “Our results show that vitiforst systems are far more than just a creative alternative to traditional viticulture,” says Prof. Dr. Zörb. “They promote soil biodiversity and enable a form of plant communication that works via root excretions. Such synergistic effects can increase the resilience of the production system.”

No change in wine quality

Does all this also influence the taste of the wine? To investigate this question, the participating winegrowers harvested the grapes of the two grape varieties separately from each cultivation system (pure vine and mixed cultivation with oak or poplar) and vinified them. This resulted in six wines that were sensory evaluated by trained persons.

Particularly pleasing from the point of view of the researchers and participating winegrowers: The sensory and chemical analyses showed that although there were small differences in the sugar and acidity content of the wines, these were not significant or detrimental to quality. “The sensory quality of the wine is retained – despite the changed cultivation conditions,” summarizes Prof. Dr. Zörb.

“The shade provided by the trees probably plays an important role here,” says Jakob Hörl. “This reduces the risk of sunburn on the grapes, but also pushes the harvest further into the fall thanks to the delay in ripening. Many aromatic substances in wine benefit from the alternation between cold nights and warm days.”

Vitiforst as an opportunity for sustainable viticulture

These results from the long-term pilot test show: “Agroforestry systems offer a future-oriented alternative in viticulture, as they conserve resources and promote biodiversity. They stabilize the water balance, improve the nutrient supply, protect against extreme weather events and maintain wine quality – a persuasive concept in times of climate change,” says Jakob Hörl.

It also opens up new marketing potential: Consumers increasingly want sustainable products, produced in a climate-friendly manner. “Wine from an agroforestry system” could fulfill this wish and at the same time become a quality and unique selling point.

At the same time, the research team points out that the increased maintenance effort and additional costs involved in implementing such a system should not be underestimated. Good planning, site-specific variety selection, and targeted marketing are crucial for success.

VitiForst model project: forward-looking for organic viticulture too

The success of a vitiforst system depends on a well-orchestrated interplay of suitable tree species and grape varieties, the arrangement of the woody plants in the vineyard, and their integration into the operational processes. “These interactions are complex and depend on the site-specific conditions and management,” says project manager Prof. Dr. Zörb.

“The integration of woody plants is an important building block for organic viticulture in particular. Apart from our trial in Ayl, there is hardly any scientific knowledge on the effects and potential of vitiforst systems in Central Europe. We want to close these knowledge gaps with the “VitiForst” project,” continues the expert.

In the first phase of the project, the researchers were already able to identify potentials and challenges for organic viticulture in Baden-Württemberg. An accompanying survey of stakeholders also revealed an unexpectedly high level of interest in using such systems in practice in the future.

New test areas and investigations in focus regions

In the second phase, new trial areas are now being established at the two state institutes for viticulture in Baden-Württemberg, the State Viticulture Institute Freiburg (WBI) and the State Teaching and Research Institute for Viticulture and Fruit Growing Weinsberg (LVWO). Based on the knowledge gained in Ayl, the project participants are working on further issues there.

In addition, the researchers are investigating the effects of existing agroforestry-like woody structures, such as hedges, vineyard embankments, and individual trees, in two focus regions – the Rems Valley and the Kaiserstuhl. They also support companies in the field in setting up such systems.

The aim of those involved in the project is to jointly develop this promising cultivation system further and make use of the demonstrably positive physiological and ecological interactions in viticulture. In addition to the University of Hohenheim and the University of Freiburg, the University of Applied Sciences Nürtingen-Geislingen (HfWU), the State Viticulture Institute Freiburg (WBI), and the State Teaching and Research Institute for Viticulture and Fruit Growing (LVWO Weinsberg) are also involved in the project.

BACKGROUND: VitiForst – woody plants in viticulture to increase climate protection and biodiversity

The aim of the “VitiForst” research project is to conduct interdisciplinary research into the interactions and effects of woody plants in organic viticulture in Baden-Württemberg and to record their potential for climate protection and biodiversity. To this end, two long-term trial plots will be established at each of the two state research institutes for viticulture (WBI Freiburg, LVWO Weinsberg) and the transfer into practice will be investigated in two focus regions in the Rems Valley and the Kaiserstuhl.

Research and practice work closely together. Cooperation with organic wineries and other regional players enables close links with winegrowing practice and promotes the direct transfer of knowledge. The project areas are not only to be used for research, but also as permanent demonstration and educational sites – for example for practical days, excursions, or training courses – and thus serve the transfer of practical experience.

The Baden-Württemberg Ministry of Science, Research and the Arts (MWK) is supporting this project with a total amount of around 600,000 euros, with 370,000 euros of which going to the University of Hohenheim.

Background: Research heavyweights

37.1 million euros in third-party funding was acquired by researchers at the University of Hohenheim in 2024 for research and teaching. The “Research heavyweights” series presents outstanding research projects with a financial volume of at least 350,000 euros for applied research and 150,000 euros for non-applied research.
> “Research heavyweights” series

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