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Cover crops under the vines: a viable alternative for weed management in Mediterranean vineyards

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A *Trifolium fragiferum* (strawberry clover) cover crop was used as an alternative for weed control under the vines in an irrigated vineyard located in a semiarid area of Northern Spain. The cover crop allowed a satisfactory and cost-effective management of weeds, without causing relevant changes in yield and grape and wine characteristics. After 4 years of study, we demonstrated that the use of a cover crop under the vines can be an economically profitable alternative to herbicide or intra-row mechanical tillage.

When we think of Mediterranean landscapes, vineyards and olive groves are probably the first things that come to mind. In this iconic mental image, without even realising it, we see these fields as completely tilled, with their soils free of any adventitious vegetation. Certainly, this has been what crops have looked like for centuries, with growers aiming to reduce weed competition to its minimum. Nevertheless, this is changing little by little due to a shift in the agroecological vision of growers, together with a partial migration of vineyards to more fertile and irrigable places, resulting in cover crops becoming an increasingly popular option for soil management in the Mediterranean.

The use of cover crops in vineyard inter-rows has been extensively studied worldwide (for a systematic revision see Abad *et al.*, 2021a[1]; Abad *et al.*, 2021b[2]), with results highlighting their suitability due to their beneficial effects on vineyards. However, the space under the vines is still kept free of vegetation, either by carrying out inter-row tillage or using herbicides, despite the drawbacks linked to such practices in terms of speed of work, weed control efficiency, cost and environmental impact.

In this context, three institutions in Navarra (INTIA, UPNA and EVENA), in collaboration with the Bodegas Ochoa winery, established a research plot in order to compare the control of weeds under the vines using a cover crop with conventional mechanical tillage. In detail, *Trifolium fragiferum* (strawberry clover) was sown under the vines in February 2018 in a 17-year-old 'Merlot' vineyard, covering a 40 cm-wide strip under the vines and using a 15 g/m^2 dose. During the four years of the experiment, sowing was carried out only at that time as cover crop performance was satisfactory (Figure 1). The under-vine cover crop (UV) was compared with inter-tillage management (T), which consisted of four tillage operations per season (November, March, May and July) (Figure 2). Irrigation was equally used for both treatments, following a deficit irrigation strategy, with an average water use of 13 L/m^2 per week between early July and early September.

Monitoring the evolution of soil coverage with vegetation in the area under the vines (Figure 3) showed that the sown clover cover crop was effective, with a gradual increase in the area occupied by this species reaching 70 % coverage in the second year, and > 85 % in the following years. The number of plant species identified as weeds barely changed between the soil management practices, but their extension decreased along the seasons in UV, whereas in T vines they remained relatively stable, covering about 45 % of the under-vine area.

The impact of using a cover crop under the vines on yield was not big, but it was relevant, since a tendency of an 8 % decrease was observed (Figure 4); this was linked to a slightly lower water availability for the vines, which caused less vegetative growth and a slightly lower fruit set. In any case, this decrease could be easily corrected with occasional increases in irrigation doses. The wines produced from UV and T vines showed no differences, although the former slightly increased the floral and fruit parameters in the olfactory phase.



FIGURE 1. Under-vine (UV) strawberry clover cover crop in its first (left) and fourth (right) year.



FIGURE 2. Mechanically tilled (T) plants in August during the third season of the experiment.

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This increment was likely associated with the slight increase in must nitrogen NFA observed in UV, linked to the N fixing ability of the cover crop species.

Finally, it should be noted that the economic analysis (data not shown) demonstrated that this weed control technique could be economically profitable, provided no re-sowing is needed during the first two years — a period of time that should in principle be easily attainable.

Therefore, it can be concluded that it is possible to use a cover crop under Mediterranean climate conditions and with irrigation support, as an alternative to the usual weed control under the vines by chemical or mechanical means. Additionally, if we consider the environmental impact of growing grapes, in many contexts it may be more sustainable to use under-vine cover crops and irrigate slightly more to compensate for the decrease in yield, provided that the cover crops have the expected positive impacts on soil health indicators (Abad *et al.*, 2021b[3]). As is the case for most agronomic practices, the specific factors related to each field and the production goals will condition the suitability of using cover crops; nevertheless, this practice should be included as a choice in the decision-making portfolio of viticulturists. ■

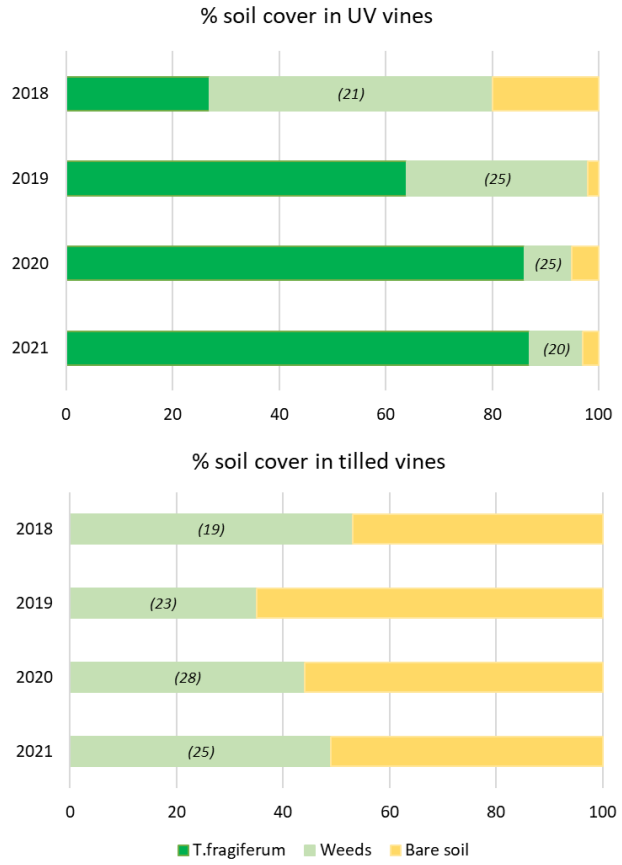


FIGURE 3. Evolution of soil cover percentage by the cover crop, weeds and bare soil during the four years of the experiment. The numbers in brackets indicate the no. of weed species identified in each treatment and year.

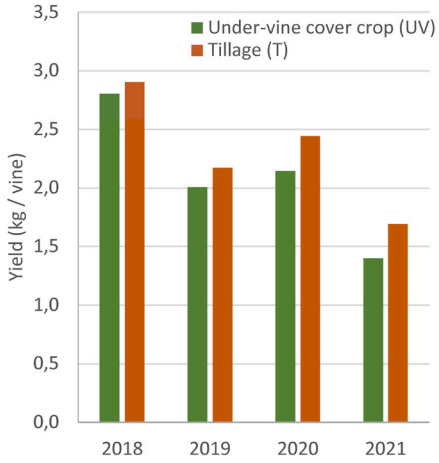


FIGURE 4. Implications of the use of a cover crop along the four years of experiment.

Sources: *Sourced from the research article: Abad, J., Marín, D., Santesteban, L. G., Cibriain, J. F., & Sagüés, A. (2020). Under-vine cover crops: Impact on weed development, yield and grape composition. OENO ONE, 54(4), 881–889 and F.J. Abad PhD thesis "Evaluation of the interest of using a cover below the line as a soil management strategy in vineyards grown under Mediterranean climate conditions".*

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