PRACTICE ABSTRACT NO.01

Managing trade-offs between ecosystem services through service crops termination strategy

Problem

Service crops provide ecosystem services (ES) in vineyards but may generate competition with grapevine (Garcia et al., 2018). More knowledge is needed regarding to the service crop termination strategy and its effects on soil and grapevine-related ecosystem services (Alonso-Ayuso et al., 2020; Hefner et al., 2020; Kornecki and Kichler, 2022).

Solution

Adapting the termination date and tool enables to find trade-offs between soil ecosystem functions (i.e. improvement of microbial biomass, organic matter, soil inorganic nitrogen, weed control, water availability) and grapevine performances (water stress, vigor, yield components and berry quality).

Figure 1. Service crops in Mediterranean vineyard (*Vicia faba*, *Avena sativa* and *Sinapsis alba* mixture), Hérault, France

Applicability box

Geographical coverage

Mediterranean vineyards

Application period

All seasons

Required time

Sowing service crops in autumn

Service crop termination at the end of winter or early spring, close to grapevine budburst

Optional additional mowing/rolling/tillage between spring and summer

Period of impact

All year long

Equipment

Mowing machine / Roller-crimper / Cultivation machine

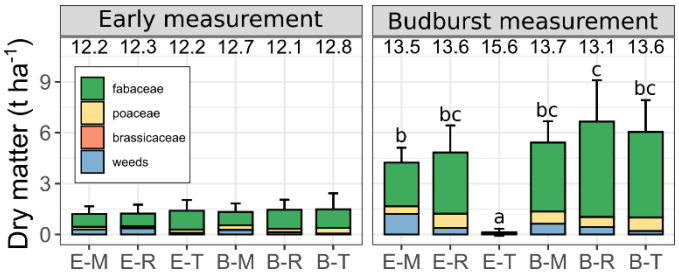
Outcome

Maintaining service crop till vine budburst increases biomass two to three-fold compared with early termination (~6 weeks earlier). Tillage termination preserves soil water stocks and inorganic nitrogen. Budburst and roller termination increase soil microbial activity. Tillage termination boosts vigor, water and nitrogen status, enhancing yield. Service crops management allows reaching satisfactory yields depending on objectives.

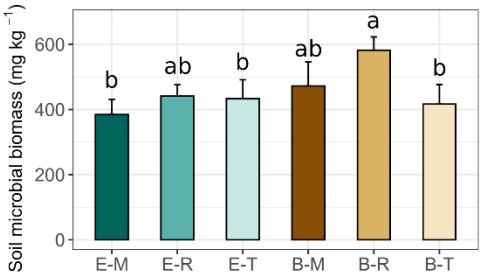
Practical recommendations

- Before defining the service crops termination strategy, identify i) the targeted yield and berry quality, depending on the economic valuation of the production (e.g. PDO), ii) the targeted services (i.e. green manure, soil organic matter improvement, weed control) and iii) the pedoclimatic constraints
- Sowing service crops mixture maximizes its emergence rate and biomass production because following the climate around service crop sowing, some species may not germinate or emerge well
- Sowing as early as possible allows taking advantage of the first autumn rains and promotes biomass production, resulting in a better success of the cover crops
- A high sowing density promotes emergence and biomass production, particularly when using farm-saved seeds and/or sowing machines that do not enable precise control of the sowing depth
- Roller-crimper termination is more effective when performing a round trip in the inter-rows
- The effectiveness of a roller-crimper is reduced with service crops that have low biomass and height, particularly in the case of *Poaceae* species
- For the termination strategy involving soil tillage, the mower should be used 2-3 days before tilling to avoid clogging issues from the residues

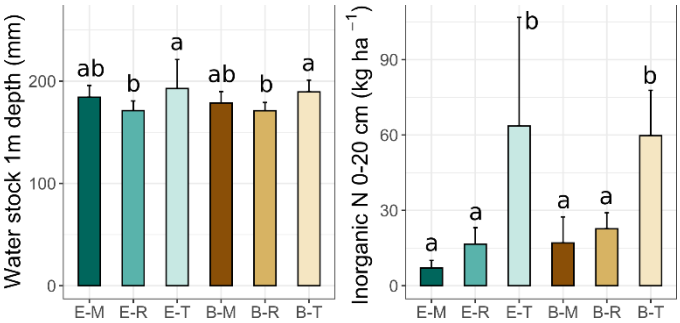
Practical testing/ Farmers' experiences



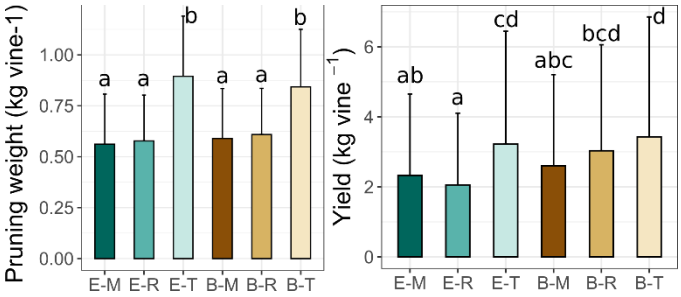
Dry matter of service crops and weeds measured at the two termination dates (2022) in each treatment, and C:N ratio of the sown species. The biomass sampled before the termination of E treatments are shown in the left part of the plot (Early), the biomass sampled before the termination of B treatments are shown in the right part of the plot (Budburst). E: early termination; B: termination at budburst; M: mowing machine; R: roller; T: tillage



Microbial biomass measured at the end of the experiment (November 2022) in each treatment (0-20 cm). E: early termination; B: budburst termination; M: mowing machine; R: roller; T: tillage



Soil water stock in mm and soil inorganic nitrogen measured around grapevine flowering on 1 m and 20 cm depth, respectively, in 2022. N: nitrogen; Date of termination: E: early termination; B: budburst termination; tools for termination: M: mowing machine ; R: roller, T: tillage



Grapevine pruning weight and yield measured at harvest in 2022 (last year of experiment). Date of termination: E: early termination; B: budburst termination; tools for termination: M: mowing machine; R: roller; T: tillage

- Termination at budburst enables producing two to three-fold more biomass than early termination, and only the termination with soil tillage ensures that the service crop does not regrow between the two dates
- The combination of budburst termination and no-till practices increases microbial biomass compared to other treatments (i.e. those with soil tillage, or early destruction)
- Soil tillage helps to preserve soil water resources at the vine flowering stage due to better efficiency in destruction and the prevention of cover crop regrowth
- Incorporating residues into the soil increases the mineralization of organic nitrogen, thereby enhancing the stocks of available mineral nitrogen at the grapevine flowering stage
- Compared to other treatments, destruction with soil tillage increases vine vigor, due to reduced competition for water and improved availability of soil mineral nitrogen, and it allows for an increase in average yield

Further Information

Alonso-Ayuso, M., Gabriel, J.L., Hontoria, C., Ibáñez, M.Á., Quemada, M., 2020. The cover crop termination choice to designing sustainable cropping systems. Eur. J. Agron. 114, 126000. https://doi.org/10.1016/j.eja.2020.126000

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Hefner, M., Gebremikael, M.T., Canali, S., Sans Serra, F.X., Petersen, K.K., Sorensen, J.N., De Neve, S., Labouriau, R., Kristensen, H.L., 2020. Cover crop composition mediates the constraints and benefits of roller-crimping and incorporation in organic white cabbage production. Agric. Ecosyst. Environ. 296, 106908. https://doi.org/10.1016/j.agee.2020.106908

About this practice abstract and Biodiversify

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Biodiversify is a PRIMA 2019 project (https://www1.montpellier.inra.fr/wp-inra/biodiversify/) investigating how agricultural biodiversification (i.e. mixed cropping, cover cropping and agroforestry) can increase ecosystem services, sustainability and resilience of Mediterranean agriculture.

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