

Increase plant health through mycorrhizal fungi

Problem

Different types of pests and abiotic stress factors (e.g., deficiency of nutrients, drought) reduce the quantity and quality of agricultural and horticultural crops worldwide. Arbuscular mycorrhizal fungi (AMF) are obligate symbionts of a large majority of land plants that provide multiple ecosystem services. The symbiotic interaction of AMF with grapevine roots improves plant development, fitness, health, and fruit quality by improving access to nutrients and water as well as soil structure and tolerance to abiotic stresses and soil-borne pathogens or root diseases. Mycorrhizal symbiosis is a beneficial symbiosis where nutrients are exchanged between the two partners (sugars from plants to AMF; water and micronutrients from AMF to plants). In viticulture, practices such as soil management and the use of fertilisers, herbicides, and pesticides alter microbial diversity and AMF community composition, as well as the ecosystem services they provide.

Applicability box

Theme

Cover cropping, arbuscular mycorrhiza, nutrition

Geographical coverage

Vineyards in European/Mediterranean area

Application time

Summer/autumn sowing

Period of impact

Continuous (including sowing and mulching periodically)

Equipment

Basic sowing method

Solution

Grapevine is a woody perennial crop with a winter dormancy after leaves drop. The rise of plant diversity, winter soil-covering vegetation, and the strong reduction of tillage positively impact ecosystem services provided by AMF by increasing their abundance and richness while maintaining the integrity of the common mycelial network. Winegrowers can make use of different types of cover crops and mixtures for a permanent cover rich in weeds and adapted to the vineyard. However, they cannot control weed species that could compete with grapevine for water and nutrients.

Winegrowers might also try various cover plants (e.g., single plants species like cheatgrass or a mixture of *Poaceae* and *Fabaceae*) in association with grapevine. *Fabaceae* form mycorrhizal and rhizobial symbiosis. These plants fix atmospheric nitrogen, which is then transformed to ammonia, a nitrogen source that is either returned to the soil after cutting down the plant or given to the grapevine plant through the common mycorrhizal networks linking plant roots. However, it should be considered that some plants do not or only slightly form arbuscular mycorrhizal symbiosis. This is true for the following plant families: *Brassicaceae* (e.g., mustard, cabbage, horseradish), *Chenopodiaceae* (e.g., redroot pigweed), *Boraginaceae* (e.g., forget-me-not, bell, or borage), *Caryophyllaceae* (e.g., cowbell, clove pink, red campion), *Polygonaceae* (e.g., sorrel), *Resedaceae* (e.g., wild mignonette), *Scrophulariaceae* (e.g., false pimpernel).

Cover crops can moreover be used as a repellent for parasitic organisms that are harmful to the vine. The chemical composition of root exudates can modify and even inhibit (e.g., *Brassicaceae*) the growth of arbuscular mycorrhizal communities.

Outcome

Regarding climate change, one challenge encountered by winegrowers is to define cover crops adapted to their local conditions and the timeframe for seeding cover crops.

Once well established, cover cropping can drive winegrowers to reduce the use of pesticides and fungicides, while also increasing the ecosystem services provided by both plants (e.g., reservoir of biodiversity, bee-forage plants) and mycorrhizal fungi (e.g., nutrition, protection).

Practical recommendation

- **Select species as cover crops to limit the proportion of non-mycorrhizal plants in the vineyard.**
- **A timeframe for seeding cover plants between flowering and post-grape harvest avoids drought effects on seed germination, while also getting soil covered before bud break.**
- **Sow the cover crop between or within wine rows to maximise the effect.**
- **Roll up or cut the cover crops when the ecosystem services (e.g., nitrogen supply) they provide reach the expected effect to avoid nutrient and water competition.**

Further information

Weblinks

- Check the [Organic Farmknowledge Platform](#) for more practical recommendations.
- BIOVINE web page: <https://www.biovine.eu/>

About this fact sheet and BIOVINE

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