



# Harnessing microbes for vine growth, nutrient uptake and disease protection

## The benefits of arbuscular mycorrhizal fungi

Dr Romy Moukarzel, postdoctoral research fellow from Lincoln University in New Zealand, summarizes research into the factors affecting arbuscular mycorrhizal fungi (AMF) in grapevines.

Viticulture is a major economic activity in many countries and grapes are one of the most widely grown fruit crops. According to the New Zealand Winegrowers report (2020), there are around 40,000 hectares of grapes in production and more being planted in response to strong demand. The biggest driver for the New Zealand wine industry is the key role of sustainability and investing in solving environmental issues. To achieve this, part of the focus should be on integrating sustainable strategies, such as the use of beneficial microbes like arbuscular mycorrhizal fungi (AMF), to improve grapevine health and production. This group of fungi are able to colonise up to 80 per cent of vascular plant species in which they form symbiotic and mutualistic relationships with the plants. AMF are increasingly recognised as important in vineyard systems with low fertility and low water inputs. These beneficial fungi are known to increase plant growth and development, nutrient

uptake, tolerance to drought and other abiotic stresses and enhance pathogen resistance as presented in Figure 1.

There is increasing interest in identifying the ecosystem services AMF provide, especially with respect to supporting the development of sustainable viticulture. However, unlike many other fungi, AMF are unable to be cultured away from their plant host and are difficult to identify; with little known about the AMF communities associated with grapevines in New Zealand. Further, there is a significant gap in knowledge regarding the potential effect of vineyard management practices on these communities and hence the resilience of the ecosystem services they provide. The advent of new techniques has enabled these communities to be investigated. Therefore, this research aimed to identify the AMF communities associated with grapevines in New Zealand and the effect of abiotic and

biotic factors on these communities. It focussed on investigating the role of AMF communities rather than individual isolates/species as other studies have tended to do and it determined the effect of vineyard management practices on these communities.

A number of vineyards were surveyed across the North Canterbury and Marlborough vineyard regions in order to identify the AMF communities associated with grapevine rootstocks and the abiotic/biotic factors, including management practices, influencing the AMF communities' composition and diversity. Glasshouse 'home' and 'away' pot experiments were set up to investigate the different rootstock responses when planted in their own (home) and other (away) rootstocks AMF communities. These experiments have determined the beneficial effects of whole AMF communities on plant growth and resilience to biotic stress due to pathogen infection.

AMF spores isolated from trap cultures set up from the collected grapevine roots, and along with DNA extracted directly from the collected roots, enabled the identification of AMF communities associated with grapevine in these two regions. The AMF communities were diverse and contained members belonging to *Ambispora* spp., *Claroideoglossum* spp., *Glomus* spp., *Funneliformis* spp., and *Rhizophagus* spp. The AMF community analyses revealed that the rootstock was a major biotic factor affecting the composition and diversity of the AMF community where the rootstocks sampled from the same site harboured different AMF communities. Soil physicochemical properties including pH, moisture content, carbon and nitrogen significantly influenced the AMF community composition in all sites. The summary

AMF relationship with grapevines

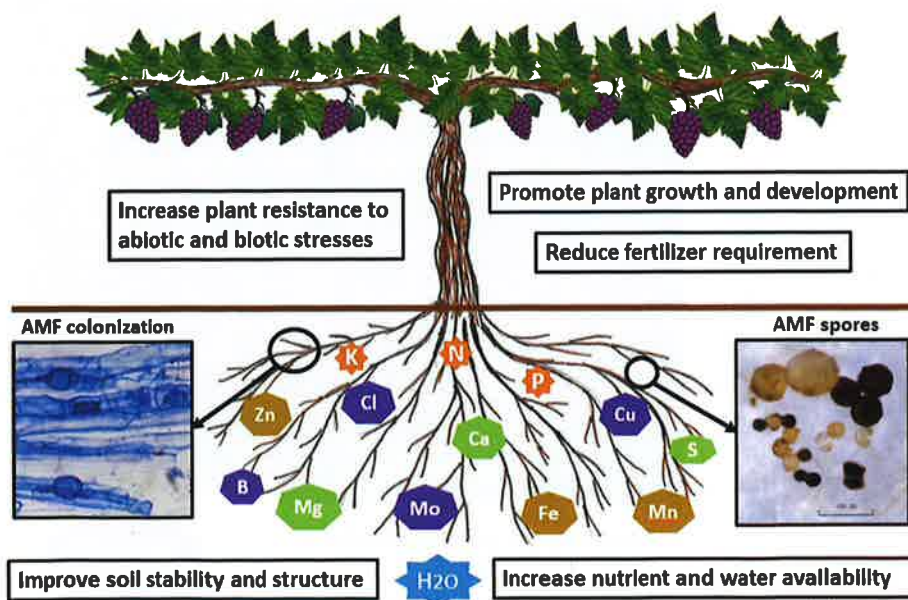
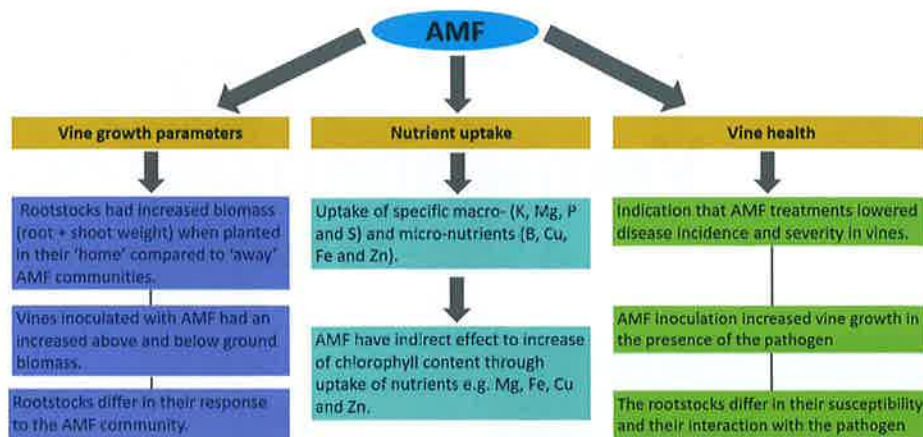


Figure 1. AMF relationship with grapevines.

Soil physicochemical properties including pH, moisture content, carbon and nitrogen significantly influenced the AMF community composition in all sites.



of the key results of the potted vines experiments showing the effect of AMF on plant health and growth parameters is presented in Figure 2.

This research also showed that AMF species' diversity and community composition was different in organically and conventionally-managed vineyards. Management practices and their interaction with the rootstock cultivar are the main driver of the AMF community colonising the roots, showing that some rootstocks might be more suited to organic systems due

to the AMF communities they support under this management practice. This could provide an increased benefit under organic systems supporting higher biodiversity.

This project has increased the knowledge of the ecosystem services that AMF provide and the management practices that influence their communities. A rootstock will select a particular AMF community to colonise from the diverse community present in a site, with this AMF community shown to provide additional benefits to the

Figure 2. The effect of AMF on plant health and growth parameters.

rootstock. Therefore, it is important to ensure that the vineyard sites have a diverse community of AMF that the rootstock can select from to provide the most benefit. This could be done by minimising agricultural practices that negatively affect these communities and by adopting AMF friendly management practices, such as cover crops and no tillage that can be beneficial in promoting the formation and diversity of AMF in the vineyards. **GW**

## AWG

### AUSSIE WINE GROUP

- **MOG levels verified from 0.02% (premium) to 0.4% (high volume)**
- **Increase winery throughput by 40%**
- **23% increase in through put at the winery intake from MOG1 to MOG0**
- **No MOG related expenses at the winery**
- **Improved wine making style**
- **Increase grape harvest weight**
- **Decrease juice loss through harvester fans**
- **Models to suit any grape harvester - any vineyard**
- **No grape maceration**
- **No loss of harvesting speed**
- **Easy to set up, operate and maintain**

Tamburlaine Organic Wines purchased the AWG sorters for Vintage 2021. We found them easy to operate and the quality of the sample was amazing with berries and juice in the bins. We were happy with the AWG Sorters with what was achieved.

Mark Pengilly  
Manager - Orange Vineyards  
Tamburlaine Organic Wines, NSW

+61 419 959 330
aussiewinegroup@gmail.com

@aussiewinegroup
www.aussiewinegroup.com.au