

Final Report: Testing soil microbial stimulators for enhancing vine health

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Introduction

Grapevines benefit from a symbiotic relationship with arbuscular mycorrhizal fungi (AMF). Together the vine and the AMF form mycorrhizae, which play an important role in vine health, grapevine nutrition, and water relations. A range of products - generally referred to as soil microbial stimulators - are sold with the goal of encouraging the formation of mycorrhizae. While anecdotal reports from the grape and wine industry suggest these products can provide a benefit to the vine, none have been systematically tested in Northeast vineyards.

Arbuscular mycorrhizae penetrates the cortical cells of roots to form arbuscules (Fig. 1) to aid nutrient exchange. The hyphal coils are long, branched portions of the fungus that act as a virtual root system for the vine. The hyphae enter the root and create vesicles for nutrient storage structures where nutrients are transferred between fungus and plant (arbuscules).

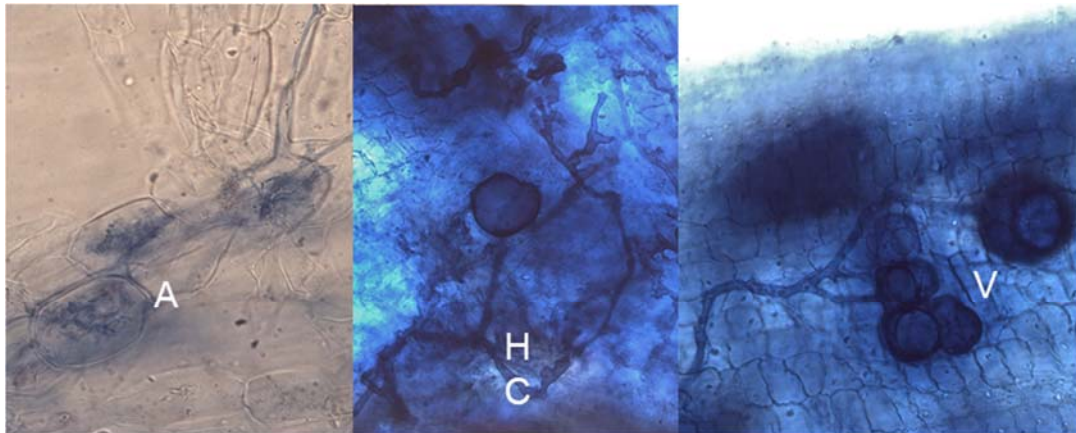


Fig 1. Arbuscular mycorrhizal fungal structures in the fine roots of grapevine. Samples were collected 5 months after inoculation. A: Arbuscules, HC: Hyphal coils, V: Vesicles, 40x magnified.

Experimental methods

In order to screen products for further testing in vineyards, we initiated a greenhouse trial in 2019 using potted vines of Cabernet Sauvignon (own-rooted) and the rootstock 3309C. We decided to use only products that contained the species *Glomus*, as it has been shown to improve AMF formation on other crops. (Note that many biofertilizers are for sale that do not contain *Glomus*). In the experiment, five commercial biofertilizers were compared to a control (Table 1). Five months following application, the vines were destructively harvested to determine whether the biofertilizers had resulted in the formation of AMF and whether vine growth or nutrient acquisition was improved with the treatments.

Product number	Name	Contained species
1	Big Foot Concentrate	<i>Glomus intraradices</i> <i>Glomus mossae</i> <i>Glomus aggregatum</i> <i>Glomus etunicatum</i> N,P,K Humic acids Softwood biochar Worm castings
2	BioOrganic	<i>Glomus mosseae</i> <i>Glomus clarum</i> <i>Glomus aggregatum</i> <i>Glomus intraradices</i> <i>Glomus deserticola</i> <i>Glomus etunicatum</i> <i>Glomus monosporus</i> <i>Gigaspora margarita</i> <i>Paraglomus brasilianum</i>
3	Mycogrow Soluble	<i>Glomus intraradices</i> <i>Glomus mosseae</i> <i>Glomus aggregatum</i> <i>Glomus etunicatumb</i> <i>Glomus deserticola</i> <i>Glomus monosporum</i> <i>Glomus clarum</i> <i>Rhizopogon villosulus</i> <i>Rhizopogon luteoulus</i> <i>Rhizopogon amylopogon</i> <i>Rhizopogon fulvigleba</i> <i>Pisolithus tinctorius</i> <i>Suillus granulatus</i> <i>Laccaria bicolor</i>
4	MycoApply Endo Granular	<i>Glomus mossae</i> <i>Glomus intraradices</i> <i>Glomus aggregatum</i> <i>Glomus etunicatum</i> Clay
5	MycoApply All Purpose	<i>Glomus mossae</i> <i>Glomus intraradices</i> <i>Glomus aggregatum</i> <i>Glomus etunicatum</i> <i>Rhizopogon villosullus</i>

Results

All five products tested increased the proportion of roots that were colonized by AMF (Fig. 2), although the Cabernet Sauvignon roots responded more strongly to the products than the 3309C roots.

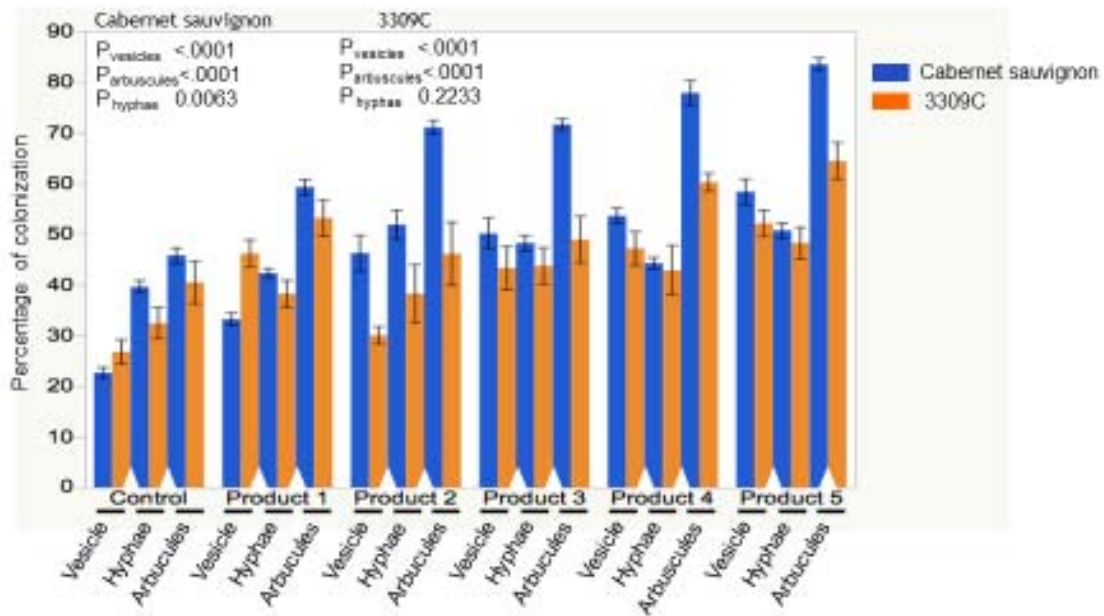


Fig 2: Significance differences were found among the treatments for AMF structures in cv. Cabernet sauvignon and rootstock 3309C

In general, the biofertilizers increased the dry weight of shoots, roots, and trunk in the vines (Fig. 3) likely as a result of increased nutrient content in the leaves (data not shown). Most micro and macronutrients were increased in concentration in the treated vines.

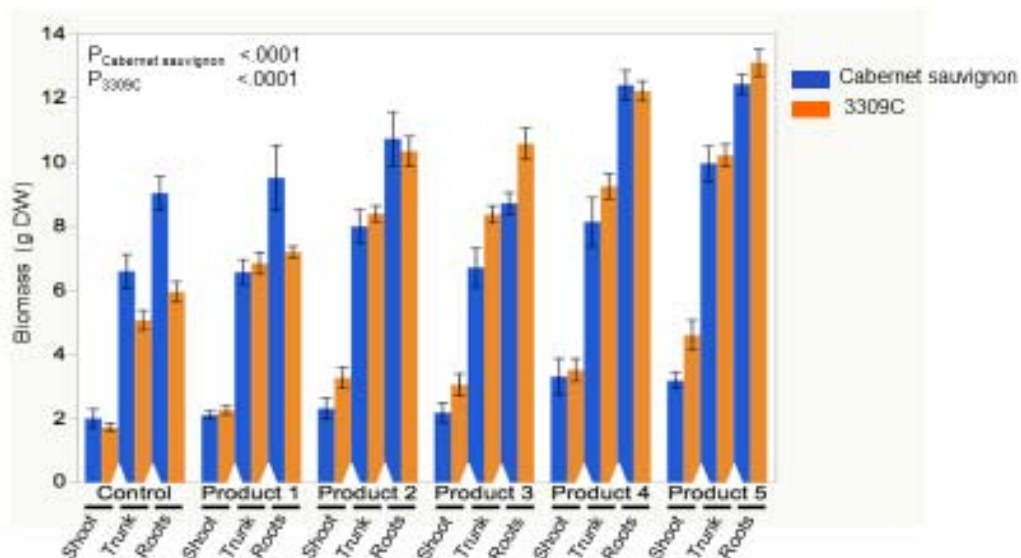


Fig. 3. AMF increased shoot, trunk and root biomass for all the treatments in cv. Cabernet sauvignon and rootstock 3309C

Summary

All five of the products tested warranted further testing in the vineyard. In a complimentary vineyard trial funded by the New York Farm Viability Institute, the products have also demonstrated their ability to form AMF in field-grown vines as well, although whether those AMF structures are increased long-term without repeated applications is unknown.

Outcomes

Reports on this work were shared with the Northeastern winegrape industry via the Penn State Wine and Grape Team newsletter and in the Cornell Veraison to Harvest newsletter.

The results of this study informed our larger field studies, allowing us to be more efficient with our resources.

Acknowledgements

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