

# Influence of arbuscular mycorrhizal fungi on distribution and relative concentration of Grapevine rupestris stem-pitting associated virus in Merlot

Emanuel Gaši<sup>1</sup>, Tomislav Radić<sup>1\*</sup>, Giorgio Gambino<sup>2</sup>, Mate Čarija<sup>1</sup>, Amedeo Moine<sup>2</sup>, Katarina Hančević<sup>1</sup>

<sup>1</sup> Institute for Adriatic Crops and Karst Reclamation, Put Duilova 11, 21000 Split, Croatia

<sup>2</sup> Institute for Sustainable Plant Protection, National Research Council (IPSP-CNR), Strada delle Cacce 73, 10135 Torino, Italy

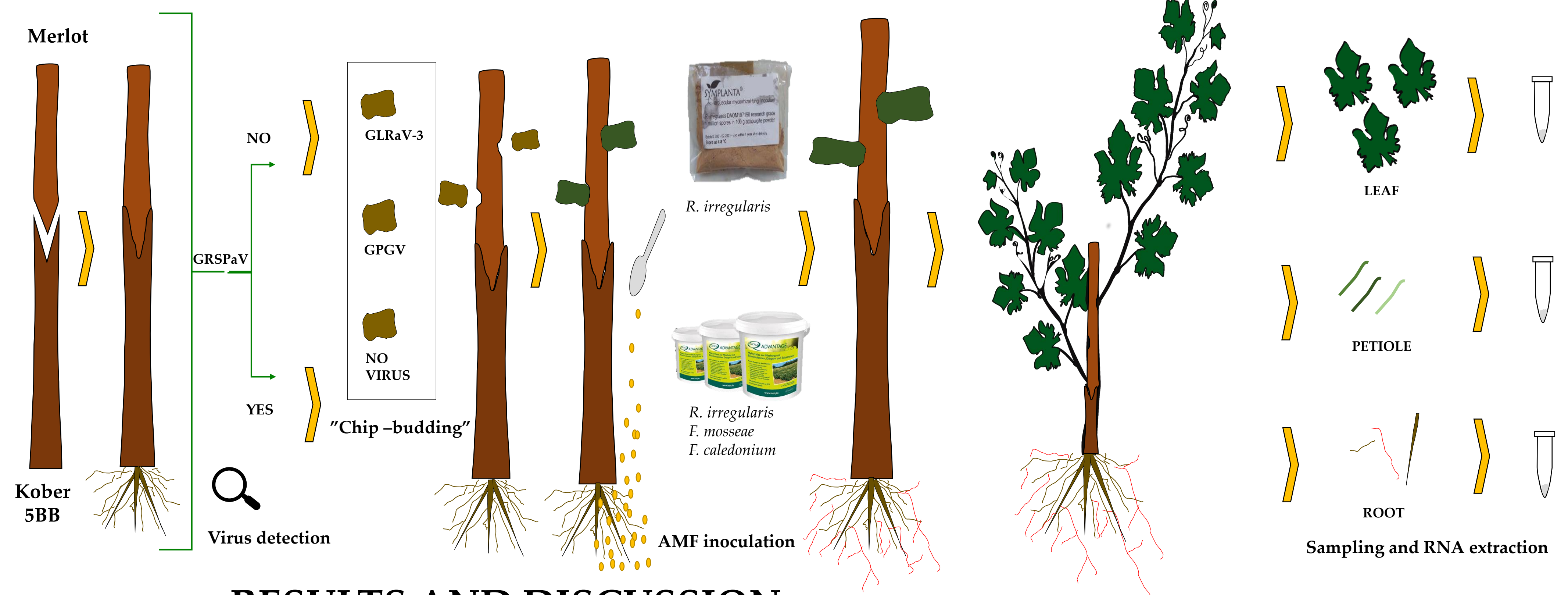
\*Corresponding author(s): Tomislav.Radic@krs.hr

## INTRODUCTION

Arbuscular mycorrhizal fungi (AMF) can have positive impact on plants facing biotic stress, although its impact on virus replication and spatial distribution in grapevine is ambiguous (Miozzi et al., 2019). One of the most widespread viruses in grapevine is *Grapevine rupestris stem-pitting associated virus* (GRSPaV), described by intra-plant irregular distribution with most abundant virus titer ascribing to berries (Gambino et al., 2012), phloem, and petiole tissue for in situ, and in the roots for in vitro analyzed grapevines (Hu et al., 2018). To investigate influence of AMF on GRSPaV distribution, quantification was performed.

## MATERIALS AND METHODS

The grapevine was grafted and treated as shown in the scheme below. Tissue was sampled in May, June and August of one growing season. Total RNA was extracted, purified and used as a template for cDNA synthesis. Relative GRSPaV quantification was carried out on real-time qRT-PCR, and normalized with actin and ubiquitin as housekeeping genes (Gambino et al., 2011).

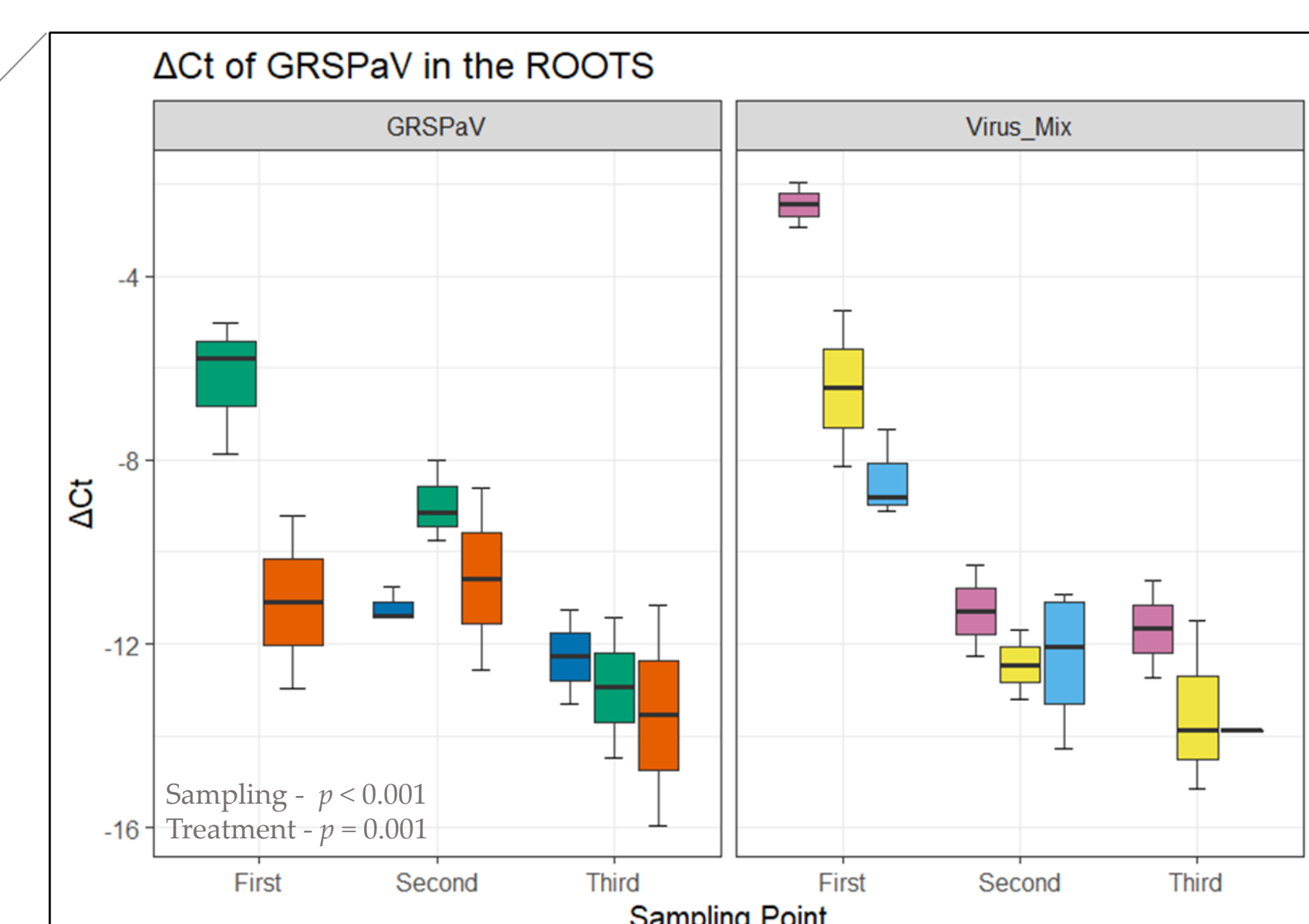
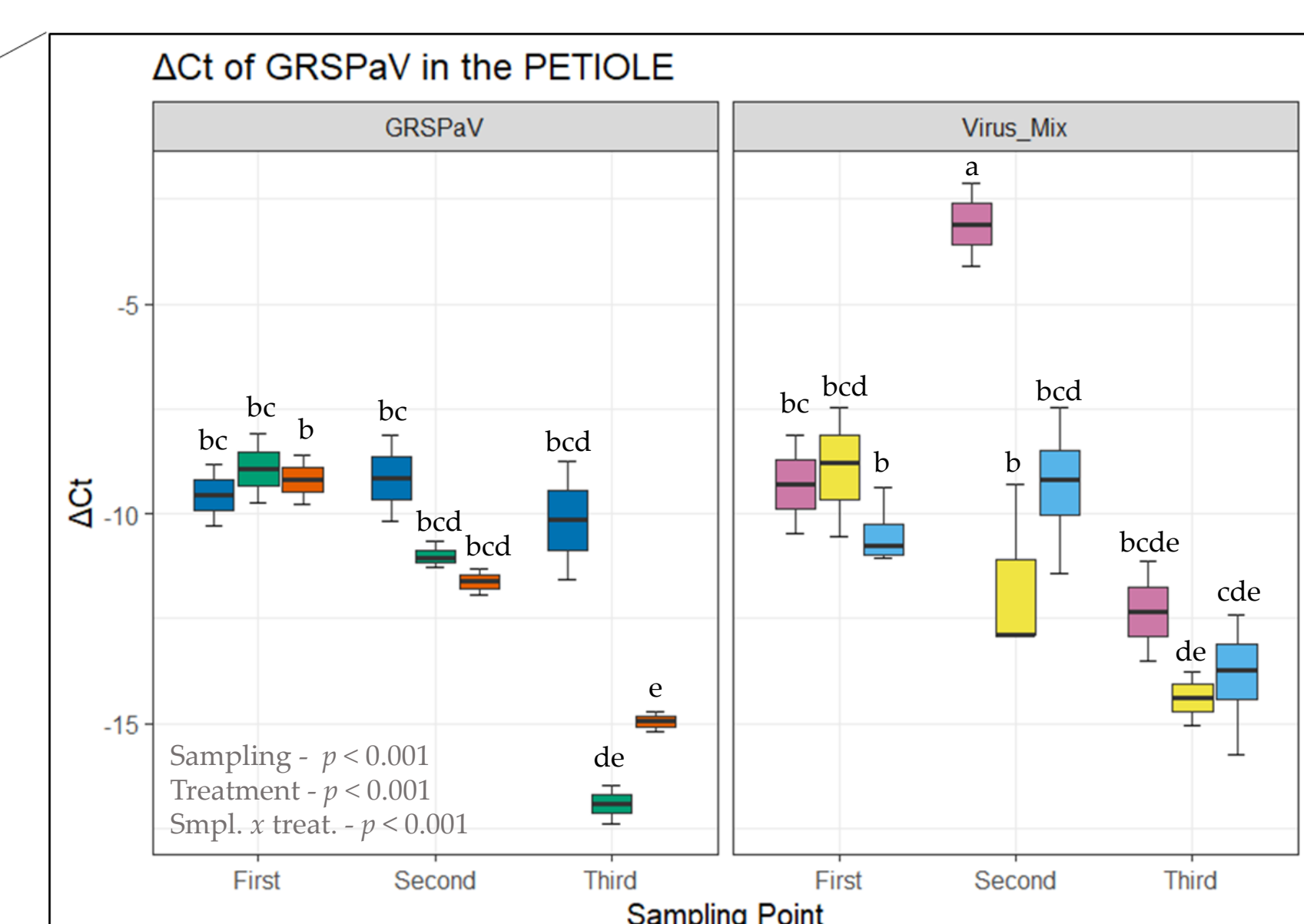
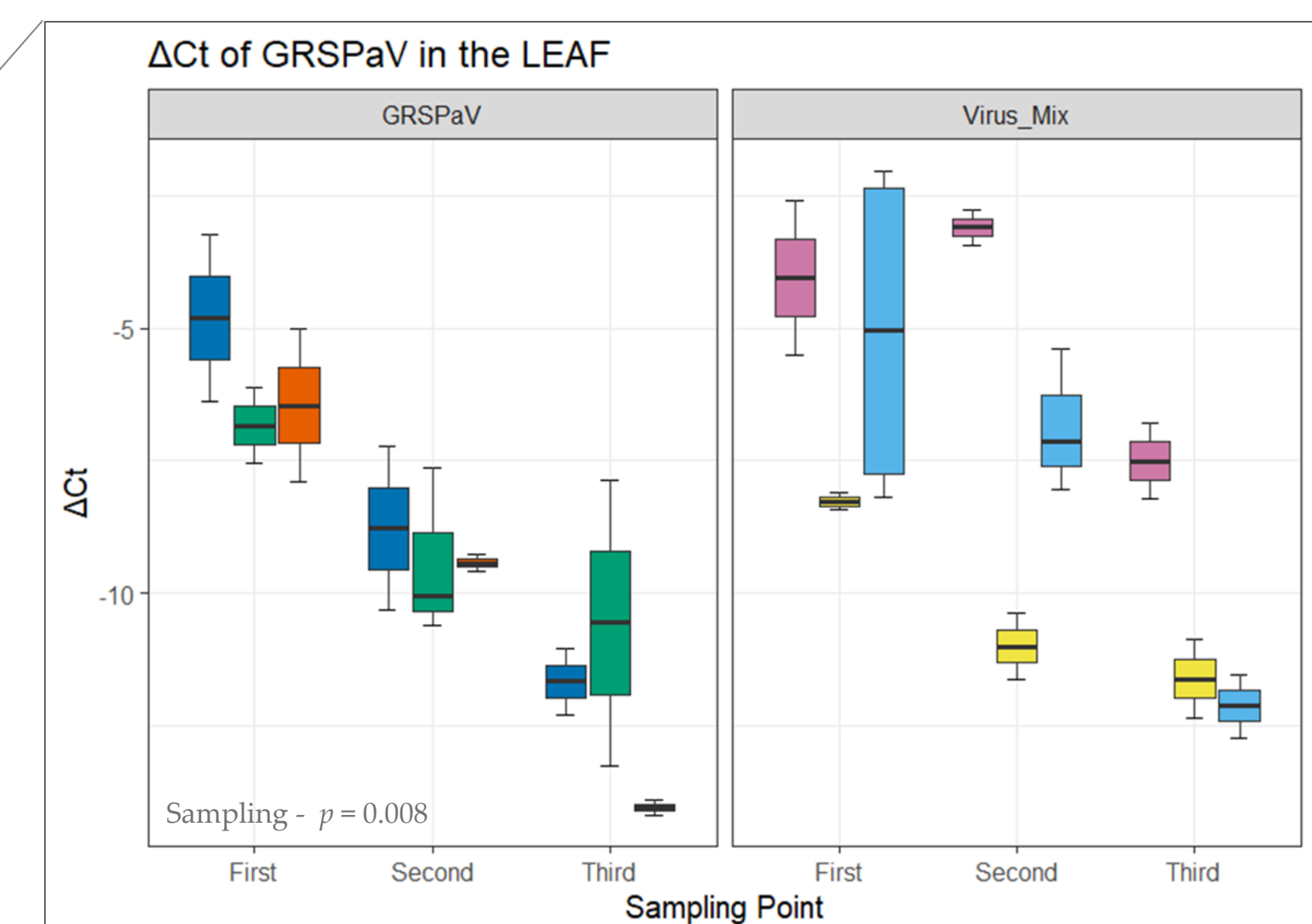
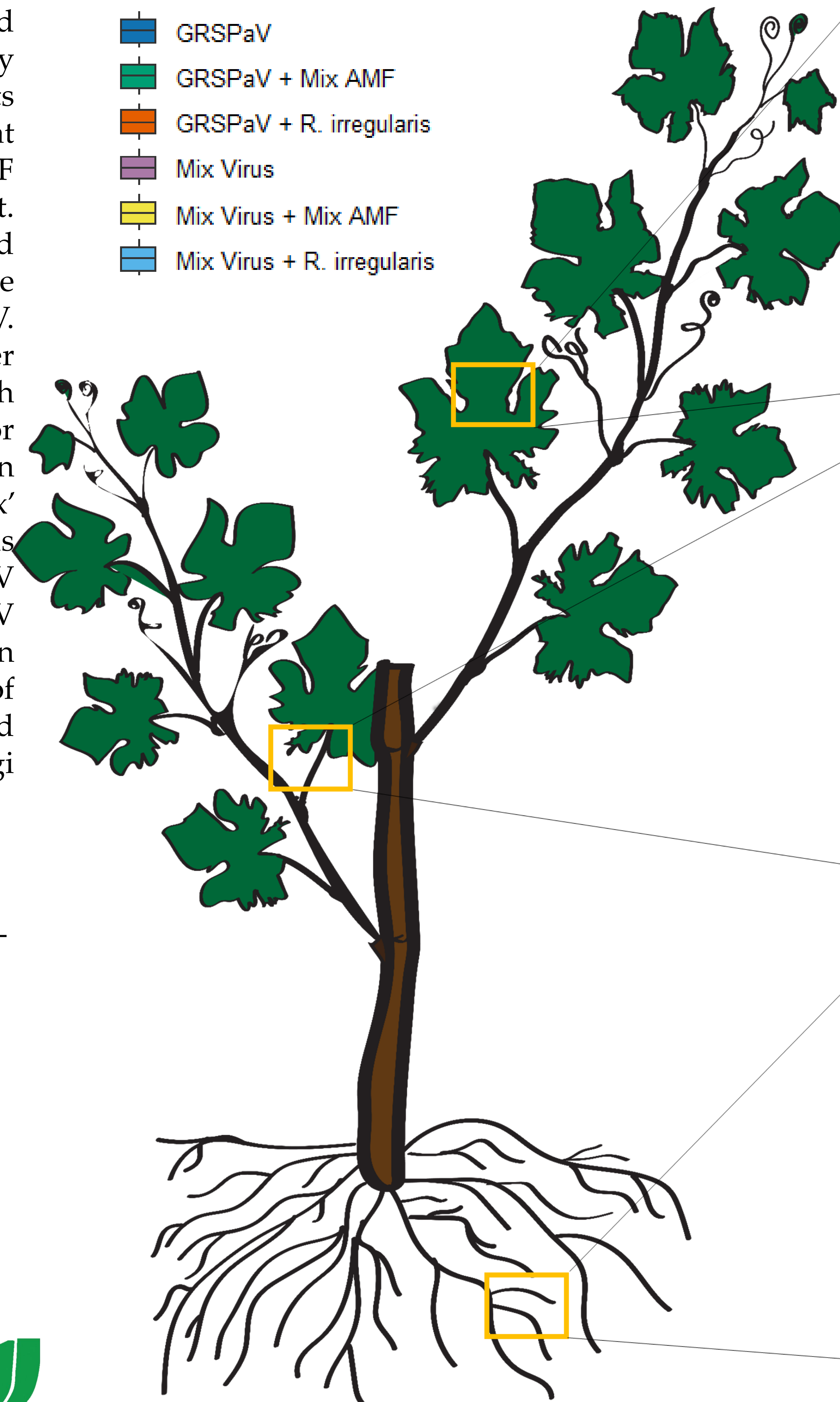


## RESULTS AND DISCUSSION

In all tissue types, virus titer slowly decreased along the temporal dimension regardless of mycorrhizal inoculum or virus combination. Since sampling points were positioned through late spring and first half of summer, this steady decline was expected (Gambino et al., 2012). Treatments without mycorrhizal fungi had higher virus concentration that varied with sampling point and tissue type. The least AMF influence on GRSPaV concentration was observed for the root. The most significant decrease of virus accumulation was found in petiole and leaf tissue, especially seen in treatment where GRSPaV was in combination with GLRaV-3 and GPGV. Grapevine infected with 'virus mix' had significantly greater leaf GRSPaV concentration than plants infected solely with GRSPaV that received AMF inoculum – either *R. irregularis* or 'AMF mix'. Similarly, GRSPaV concentration decreased in petiole of 'virus mix' treated grapevine that received 'AMF mix' in contrast to grapevine that harbors same virus status, but was uninoculated. In summary, AMF influence on GRSPaV variability through time builds upon general trends of GRSPaV seasonality, further lowering naturally present decrease in virus titer through summer months. Similarly, overall impact of AMF on spatial distribution of GRSPaV is present in reduced accumulation in leaf tissue, with mixture of mycorrhizal fungi prevailing over one-species inoculum.

**Treatment**

- GRSPaV
- GRSPaV + Mix AMF
- GRSPaV + *R. irregularis*
- Mix Virus
- Mix Virus + Mix AMF
- Mix Virus + *R. irregularis*



## REFERENCES

- Gambino, G., Cuozzo, D., Fasoli, M., Pagliarani, C., Vitali, M., Boccacci, P., Pezzotti, M., & Mannini, F. (2012). Co-evolution between Grapevine rupestris stem pitting-associated virus and *Vitis vinifera* L. leads to decreased defence responses and increased transcription of genes related to photosynthesis. *Journal of Experimental Botany*, 63(16), 5919–5933. <https://doi.org/10.1093/jxb/ers244>
- Gambino, G., Minuto, M., Boccacci, P., Perrone, I., Vallania, R., & Gribaudo, I. (2011). Characterization of expression dynamics of WOX homeodomain transcription factors during somatic embryogenesis in *Vitis vinifera*. *Journal of Experimental Botany*, 62(3), 1089–1101. <https://doi.org/10.1093/jxb/ERQ349>
- Hu, G., Dong, Y., Zhu, H., Zhang, Z., Fan, X., & Ren, F. (2018). Detection and distribution of Grapevine rupestris stem pitting-associated virus in grapevine. *Scientia Horticulturae*, 239, 64–69. <https://doi.org/10.1016/j.scienta.2018.05.028>
- Miozzi, L., Vaira, A. M., Catoni, M., Fiorilli, V., Accotto, G. P., & Lanfranco, L. (2019). Arbuscular Mycorrhizal Symbiosis: Plant Friend or Foe in the Fight Against Viruses? *Frontiers in Microbiology*, 10(JUN). <https://doi.org/10.3389/FMICB.2019.01238>