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Telomere length as a genomic biomarker of well-being in grapevines: a two-year study in Aglianico grapevine.

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Molecular biomarkers are increasingly used in agriculture to provide objective indicators of plant health and responses to environmental stress. In grapevine (*Vitis vinifera* L.), genomic biomarkers are particularly valuable as they integrate physiological and environmental information. Among these, telomere length has emerged as a rapid and cost-effective biomarker, already applied in several plant and animal systems.

Telomeres are repetitive DNA sequences located at chromosome ends that preserve genomic stability and are known to respond dynamically to aging and stress conditions. In this study, telomere length was quantified by quantitative real-time PCR (qPCR), using a grapevine-specific single-copy reference gene to ensure reliable measurements.

The protocol was applied to Aglianico grapevines subjected to different water regimes (irrigated and non-irrigated) under identical soil conditions in a high-quality wine production area of southern Italy (Taurasi DOCG area, Tenuta Donna Elvira, Montemiletto, AV). Results obtained over two consecutive growing seasons allowed evaluation of telomere length dynamics across years. Consistent differences associated with water regime were observed between seasons, supporting telomere length as a sensitive indicator of vine well-being and environmental pressure.

These findings strengthen the potential of telomere length as a genomic biomarker for long-term monitoring of grapevine health under climate-related stress conditions.