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Contents

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Foreword

Review: Peroxidase: a multifunctional enzyme in grapevines

Alfonso Ros Barceló, Federico Pomar, Matías López-Serrano and María Angeles Pedreño 577–591

This is a review of the now considerable depth of knowledge of the role of Class III peroxidases in higher plants, with a specific emphasis on work on this enzyme group in grapevines. The authors present interesting recent findings regarding the possible role of peroxidases in plant disease resistance.

Review: New insights into grapevine flowering

Paul K. Boss, Elise J. Buckeridge, Andrew Poole and Mark R. Thomas 593–606

Recent progress on understanding the molecular basis of flowering in grapevines is reviewed here. This process is particularly complex and interesting, and the work described provides an excellent example of how molecular-genetic research in *Arabidopsis* can be applied to other plants.

A ten-year study on the physiology of two Spanish grapevine cultivars under field conditions: effects of water availability from leaf photosynthesis to grape yield and quality

Hipólito Medrano, José M. Escalona, Josep Cifre, Josefina Bota and Jaume Flexas 607–619

This paper examines long-term trends in the physiology of field-grown grapevines to the effects of drought. Correlations were drawn between water availability, canopy water loss, photosynthesis, and fruit yield and quality. Mechanisms of photosynthetic down-regulation under drought, including RuBP regeneration and Rubisco activity, are also analysed.

Cloning and expression of two plasma membrane aquaporins expressed during the ripening of grape berry

Sarah Picaud, Frédéric Becq, Fabienne Dédaldéchamp, Agnès Ageorges and Serge Delrot 621–630

Aquaporins, which are presumed to participate in water accumulation accompanying massive sugar influx in grapes, are mainly expressed after veraison. These authors demonstrate that aquaporins may transport small solutes in addition to water, and describe for the first time mercury-sensitive inhibition of urea transport by a plant aquaporin.

Assessment of photoprotection mechanisms of grapevines at low temperature

Luke Hendrickson, Marilyn C. Ball, C. Barry Osmond, Robert T. Furbank and Wah Soon Chow 631–642

These authors studied the photosynthetic and photoprotective responses and mechanisms of grapevine leaves subjected to low temperatures and high light, compiling both field and laboratory studies. Under low temperature conditions where light-saturated photosynthetic electron transport rates were reduced, non-photochemical quenching increased while both calculated photorespiration and, particularly, the Mehler reaction decreased.

Whole-plant transpiration efficiency of Sultana grapevine grown under saline conditions is increased through the use of a Cl⁻-excluding rootstock

Mark R. Gibberd, Rob R. Walker and Anthony G. Condon 643–652

Gibberd *et al.* test the influence of salinity on transpiration efficiency, lamina gas exchange and carbon isotope discrimination in grapevine, grown either on their own roots or grafted onto a Cl⁻-excluding rootstock. Comparisons enabled interpretations of the relative importance of the effects of tissue ion concentrations on the reduction in photosynthesis observed for leaves of plants in a saline potting media.

Cover illustration: Grapes at or near harvest stage; 'Cabernet-Sauvignon', grown in many countries (left) and 'Ahmeur bou Ahmeur', commonly grown in North Africa and parts of the US (right). Images courtesy of Jean-Michel Boursiquot, ENTAV, France.

Partial rootzone drying: regulation of stomatal aperture and carbon assimilation in field-grown grapevines (*Vitis vinifera* cv. Moscatel)

Claudia R. de Souza, João P. Maroco, Tiago P. dos Santos, M. Lucília Rodrigues, Carlos M. Lopes, João S. Pereira and M. Manuela Chaves

653–662

The effect of a novel irrigation management strategy, partial root drying (PRD), on gas exchange, fluorescence and water use efficiency was evaluated in grapevines growing under field conditions. PRD watering enabled grapevine plants to maintain water status close to that achievable with full irrigation, but with a higher water use efficiency.

Partial rootzone drying: effects on growth and fruit quality of field-grown grapevines (*Vitis vinifera*)

Tiago P. dos Santos, Carlos M. Lopes, M. Lucília Rodrigues, Claudia R. de Souza, João P. Maroco, João S. Pereira, Jorge R. Silva and M. Manuela Chaves

663–671

This group assesses the effects of the partial rootzone drying (PRD) irrigation strategy on growth and fruit quality of field-grown grapevines. By regulating growth and water use, this irrigation system enabled equilibrated vegetative development, improving partitioning of photoassimilates to the fruit and providing an optimum environment for berry maturation.

Extension of a Farquhar model for limitations of leaf photosynthesis induced by light environment, phenology and leaf age in grapevines (*Vitis vinifera* L. cvv. White Riesling and Zinfandel)

Hans R. Schultz

673–687

Schultz presents a parameterization of the Farquhar model for photosynthesis applied to grapevines, and extends the model to covers sun–shade effects, and the effects of leaf age and phenological stage. He utilizes data from both laboratory and field experiments. Recent advances in studies of seasonality and/or limitations of gas exchange are included.

Regulation of canopy conductance and transpiration and their modelling in irrigated grapevines

Ping Lu, Isa A. M. Yunusa, Rob R. Walker and Warren J. Müller

689–698

The paper demonstrates strong stomatal control of canopy transpiration, and provides a robust model for grapevine water use. The authors present data on sap-flow measurements in grapevine using the Granier method, and they use the Penman-Monteith equation to model whole-canopy transpiration rates. Prediction of canopy conductance and transpiration was possible.

Modelling the seasonal dynamics of the soil water balance of vineyards

Eric Lebon, Vincent Dumas, Philippe Pieri and Hans R. Schultz

699–710

Water supply influences wine quality through its impact on the balance between vegetative and reproductive growth. Soil water balance of vineyards under water deficit was modeled using field and potted plant data. This model allows the simulation of soil evaporation after summer rain, as frequently encountered in vineyard regions of Europe.

The effect of leaf removal and canopy height on whole-vine gas exchange and fruit development of *Vitis vinifera* L. Sauvignon Blanc

Paul R. Petrie, Michael C. T. Trought, G. Stanley Howell and Graeme D. Buchan

711–717

Canopy topping and leaf removal are common grapevine management practices; it was previously believed that an increase in photosynthesis occurs when leaves are removed, but the extent of possible compensation for reduced leaf area is unknown. These authors study the underlying processes of summer pruning through a whole-vine approach

Short communication: Calcium-accumulating cells in the meristematic region of grapevine root apices

Richard Storey, R. Gareth Wyn Jones, Daniel P. Schachtman and Michael T. Treeby

719–727

This paper describes the novel Ca sequestering ability of idioblast cells in the grapevine root meristem to accumulate Ca. The authors suggest that idioblast cells might be involved in lowering apoplastic Ca^{2+} and thereby reducing Ca^{2+} uptake into meristematic cells, and also in releasing stored Ca^{2+} for cell wall formation in the root elongation zone.