Environmental – genotype interactions and the physiological processes determining fruitfulness and yield in grapevines from hot and cool climates

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Abstract

Yield instability is estimated to cost the Australian Wine Industry more than $200 million annually. Thus the prediction of yield potential and the management of yield is of utmost importance. Experimentation investigated the effect of environmental conditions on fruitfulness and yield. The major objective being to provide a sound scientific base for understanding the environmental factors, genes and physiological processes that determine yield as a necessary first step toward developing more cost effective ways to predict and regulate yield.

Yield potential depends on the transition of apices to a floral state and their subsequent differentiation in developing latent grapevine buds. Traditional approaches to studying the effects of environment and management on initiation and differentiation are limited by technical difficulties associated with quantitative measurement of developing buds and natural variation across bud populations within grapevines. Experimentation reported here combines traditional physiological and anatomical approaches with current molecular tools to improve our understanding of the variables that drive fruitfulness and yield development in grapevines. Two controlled environments of 30°C/30°C day/night (hot) and 15°C/15°C day/night (cool) resulted in up-regulation of the VvTFL gene at node position 2 in the warmer environment at a time that would coincide with the period of veraison in the field when there would be active differentiation of inflorescence primordia in the latent bud. This particular gene is thought to be implicated in the suppression of apical dominance.

The levels of three genes VvTFL, VvFL and VvFT, known to be associated with flowering in grapevine, varied with the stage of ontogeny and node position of the latent bud in field grown vines from hot and cool locations.