

Fruit set rate clonal variation explains yield differences at harvest in Malbec

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Abstract (250 words)

Malbec is Argentina's flagship variety, and it is internationally recognized for producing high-quality red wines. Fruit set rate is a major component in grapevine yield determination, and it is the outcome of multiple genetic and environmental interacting variables. Here, we characterized the reproductive performance of 25 Malbec clones grown under homogeneous conditions in a 23-years old experimental plot. We measured traits near flowering (like the number of flowers per inflorescence) and at harvest (including the number of berries per cluster and berry weight), during two consecutive seasons (2022 and 2023). After combining image-based systems to assist in the phenotyping with univariate and multivariate approaches for statistical analyses, we identified a wide range of clonal variation. For example, fruit set rate varied from 13.1 to 65.8% (avg. 38.4%) and from 9.8 to 50.0% (avg. 32.1%) in 2022 and 2023, respectively. A hierarchical clustering on principal components analysis identified three clonal groups of phenotypic similarity, consistent between seasons. Interestingly, two of these groups presented a similar number of flowers per inflorescence but markedly different fruit set rates. Consequently, clones from these two groups produced a significantly different number of berries per cluster. The in-depth analysis of clones assigned to these contrasting groups, for traits like pollen viability and flower morphology, allowed exploring the potential causes of the observed differences. We found that fruit set rate variation has multiple causes in Malbec, associated to anomalous flower development and functionality, which could ultimately impact on clonal yield differences at harvest.

Keywords: intra-varietal variation, reproductive performance, image-assisted phenotyping, flower development