

Introduction

As a consequence of climate change, summers are experiencing heightened temperatures and increasingly frequent heatwaves. Within this context, grapes are subjected to elevated temperatures, leading to imbalanced ripening characterized by excessive sugar content, very low acidity, inadequate phenolic maturity, and increased susceptibility to sunburn damage.

Shading nets are commonly used to protect crops from intense sunlight in fruit cultivation, but their adoption in viticulture is less widespread. Furthermore, there is limited understanding of the effects of shading nets on wine grape quality¹.

This study investigates the impact of two kinds of shading nets on the productivity and quality of Sangiovese grapes cultivated in Montalcino, Tuscany (Italy), with two different shading capacities (SC).



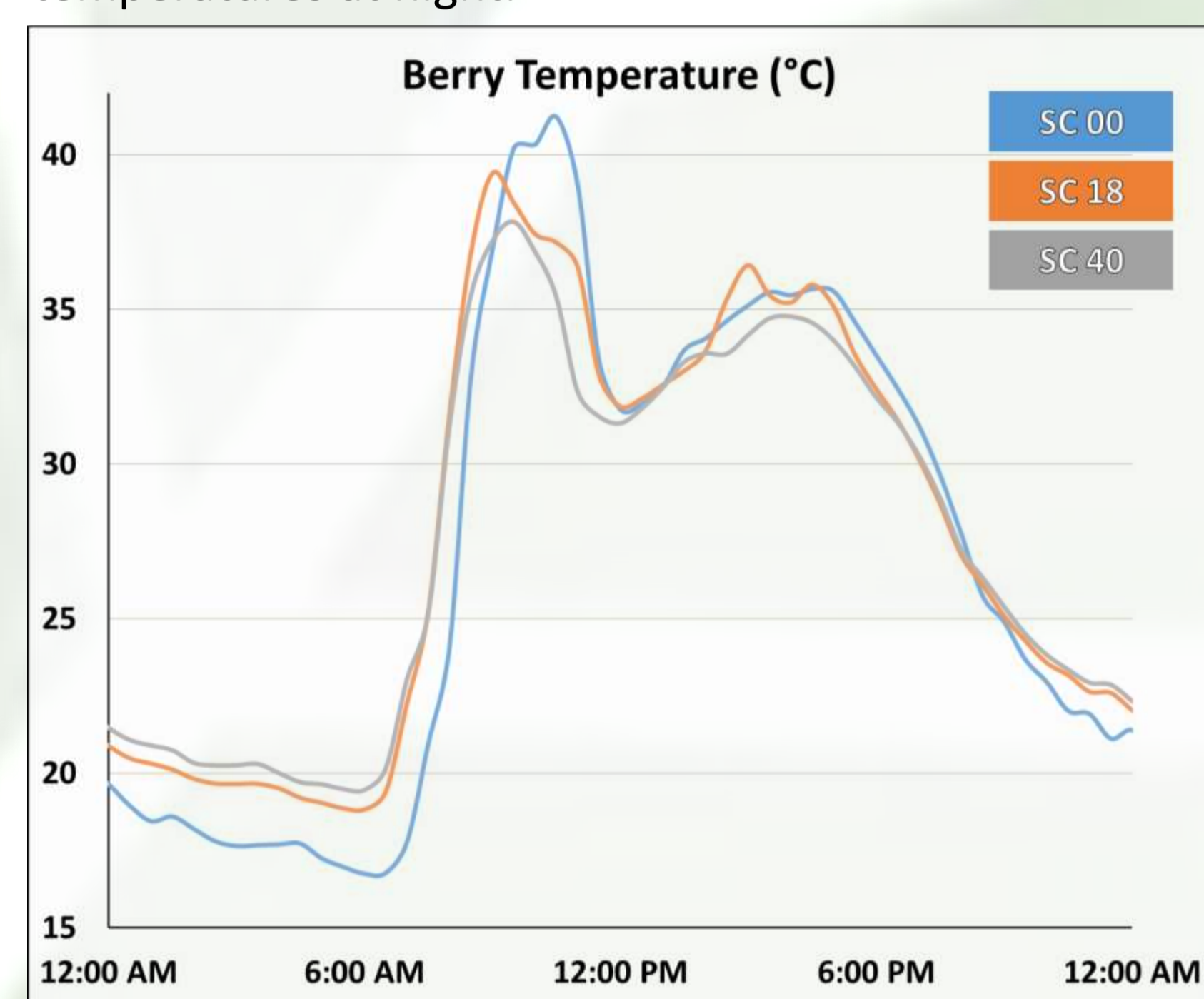
Methods

The study was conducted in 2023, at the Biondi Santi farm in Montalcino (SI). Vine rows, oriented in the NNE/SSE direction on terraced land, were covered with nets with 18% (SC 18) and 40% (SC 40) shading capacity, shortly after fruit set (when berries were the size of peas, BBCH 73-75) and remained until harvest. A control row was left uncovered (SC 00). The tests were replicated three times. Berry temperature was monitored using thermocouples connected to a data logger.

At harvest, yield characteristics were assessed by measuring the average production per plant, cluster weight, and berry weight. Musts were chemically analyzed for sugars, total acidity, and pH using official OIV methods. Total anthocyanins content were determined by spectrophotometry². Organic acids³, polyphenol profiles⁴, and carotenoid profiles (at BBCH 79-81)⁵ were determined by HPLC-DAD.

Results

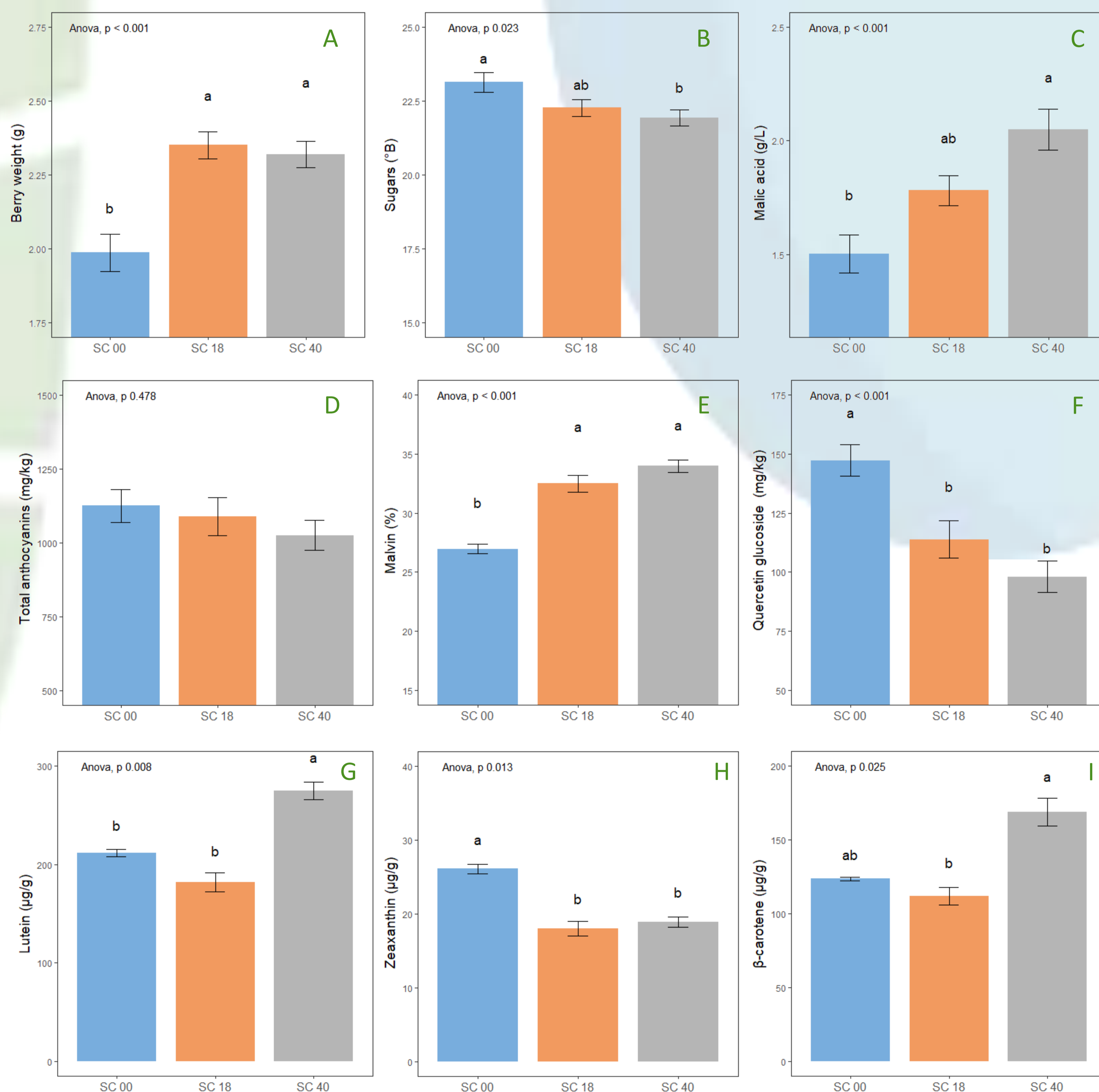
An intense heatwave in late August, reaching temperatures around 40°C, highlighted the efficacy of shading nets. The nets, especially SC 40, kept the berries cooler during peak temperatures (10:00 AM and 4:00 PM), although they maintained higher cluster temperatures at night.



The shaded vines produced about 20% more grapes; an increase attributed to a similar rise in the average berry weight (A).

Grapes from the vines covered by the nets had a lower sugar content (B), higher acidity as a result of increased malic acid concentration (C). Regarding polyphenol content, no significant differences were found in the levels of total anthocyanins attributable to the shading (D). However, higher percentages of malvin were found in the uncovered grapes (E), at the expense of cyanin content.

The solar ray protection slowed the accumulation of flavonols. At harvest, the concentrations of quercetin glucoside were approximately 30% lower in both the net-covered trials (F). The effect of shading was also evident in the carotenoid content. In the case of SC 40, particularly, the grapes had higher levels of lutein (G) and β-carotene (I), while the uncovered grapes had higher concentrations of zeaxanthin (H), a pigment related to abiotic stress⁶.



Conclusions

The results show that the effect of the nets on yield components and on grape chemical composition was proportional to the ratio of intercepted light and impacted all aspects of production.

Observing the analytical results, the nets induced a different maturation of the grapes. Specifically, they slowed down the accumulation of sugars while maintaining higher concentrations of malic acid, yet allowed for a good synthesis of colored substances. Moreover, by reducing the content of flavonols, shading appears to decrease the risk of phenolic matrix instability, which is a problematic challenge in Sangiovese wine production.

The increased concentration of carotenoids might positively impact the aromatic profile of the grapes at maturity and of the wines⁷.

Although many aspects remain to be overcome, such as the high cost of installation and management, and the lack of established experience, shading nets can ultimately be considered a useful tool for modifying the qualitative and quantitative parameters of production in order to mitigate the effects of climate extremes due to global warming.

References

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