Extended Practice Abstract Nº 20

Shading nets to counteract multiple summer stresses

Challenge

Multiple summer stresses for grapevines arise from the simultaneous occurrence of adverse environmental conditions such as heatwaves, excessive solar radiation and water scarcity, which can significantly impact vine health and grape quality.

Solution

The use of anti-hail nets installed in the 'apron' configuration not only offers direct defence against hail, but also helps safeguard grapevines from multiple summer stresses. By modifying the microclimate around the vines, these nets can improve growing conditions throughout the plants' development cycle, particularly during the critical ripening phase. Nets protect leaves and clusters from thermal and radiation stress, as well as reduce transpiration during drought periods. The reduction of multiple summer stresses ensured by using anti-hail nets allows winegrowers to meet their production targets while stabilising yields and maintaining high quality standards.

Benefits

Besides mechanical protection from hail, as a shading net, anti-hail nets alter the energy balance of the vine canopy, reducing incoming solar radiation, mitigating heat stress and lowering transpiration rates.

The following four different anti-hail nets, differing in shading percentage and colour, were tested and compared to a non-shaded control (CON):

- Light green (LGR) – 8% shading
- Black (BLK) – 26% shading
- Dark green (DGR) – 19% shading
- White (WHT) – 30% shading

The trial was conducted in a Chardonnay vineyard in Adro (Brescia, Italy) (Figure 1).

The nets act directly on the canopy microclimate, reducing incident radiation according to the specific characteristics of the fabric (Figure 2). This leads to a significant decrease in berry temperature in the shaded treatments. Specifically, temperatures exceeding 41°C are rare under the nets, whereas in the control, these temperatures occur approximately 22% of the total time.

Applicability box

Theme

Adaptive management
Climate change adaptation
Water-use efficiency

Context

This solution could be applied to all viticultural contexts where vines are trained with vertical shoot position systems.

Application time

All year

Required implementation time

The installation can be performed in a few hours without any structural modifications to the current vineyard.

Period of impact

The net acts on the effects of environmental conditions throughout the whole vine development cycle, particularly during the ripening phase. The solution has an immediate impact.

Equipment

The system consists of nets and support structures (frames) designed to be mounted on vineyard poles.

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Additionally, a higher frequency of temperatures below 30°C is observed under the nets (Figure 3).
In terms of physiological response, a reduction in transpiration is also observed (up to 57% compared to the control), which can be beneficial under water deficit conditions by promoting a more conservative water-use strategy in the plant (Figure 4). This effect is consistent across all shaded treatments, apart from the white net. It is hypothesised that the colour of the white net may promote radiation refraction phenomena within the canopy, potentially explaining this different behaviour.

In terms of grape quality, the nets show a clear effect on sugar accumulation. When normalised by yield, the shaded treatments display a reduction in sugar accumulation ranging from 10% to 40% compared to the control, while no significant effects are observed on other parameters (Figures 5 and 6). One aspect to consider is the slight decrease in fertility induced by the shading nets (with a reduction in the number of grape clusters), which could potentially be mitigated by delaying the onset of canopy coverage.

In general terms, the reduction of adverse environmental conditions promotes a more consistent progression of development and ripening, with positive impacts on the final product. From a management perspective, the timing of canopy coverage appears to be crucial to ensuring an optimal level of vine fertility. In conclusion, the potential multifunctionality of anti-hail nets is confirmed, making them an interesting and promising tool for mitigating climate-related challenges.

Practical recommendation

The installation of the shading net is very simple.
The support structure consists of two main elements to be installed on the end posts of each row. These elements are designed to maintain tension on the upper and lower wires to which the net is applied.
Secondary support elements are mounted at equal intervals (4–5 posts) along the row.
The supporting structures are made of stainless steel and allow the ‘apron’ to be opened using a practical spring system, exposing the cluster zone and enabling vineyard operations.
The structure allows machinery to be operated even when in the open position.
Once the support structure is installed, the nets are then placed along the support wires on both sides of the row. The nets are supplied in rolls, which are unrolled as they are attached to the support cables using plastic connectors.
The system is ready to work as soon as it has been assembled. The apron can be opened or closed depending on the grapevine’s phenological stage and the management strategy adopted by the grower.

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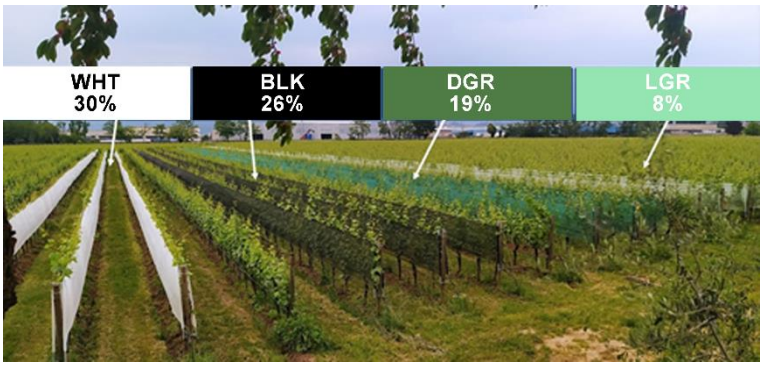

Figure 1. The trial demonstration vineyard, with the four nets and shading levels

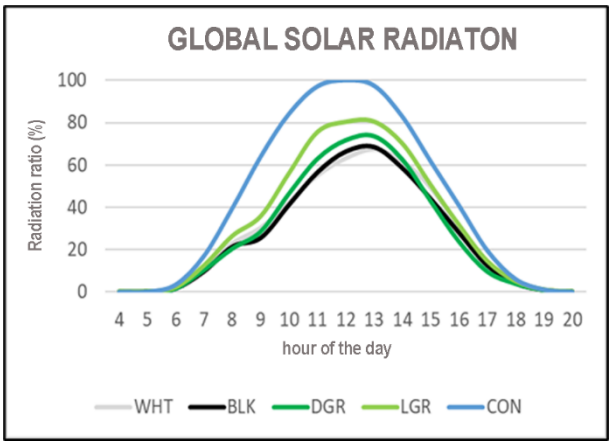

Figure 2. Global solar radiation measured within the canopy, expressed as a percentage relative to the maximum value

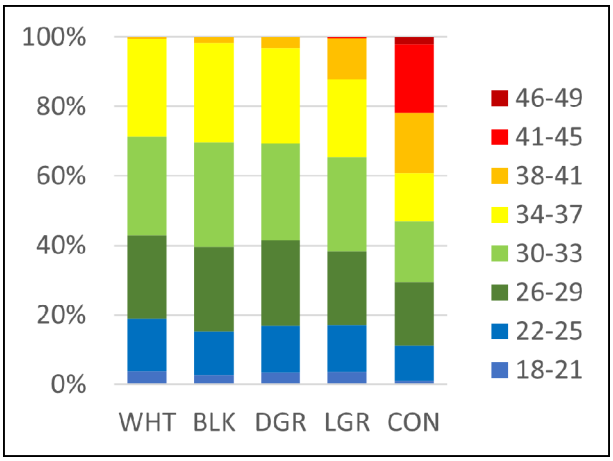

Figure 3. Frequency of daytime berry temperature intervals (in °C) across the different treatments

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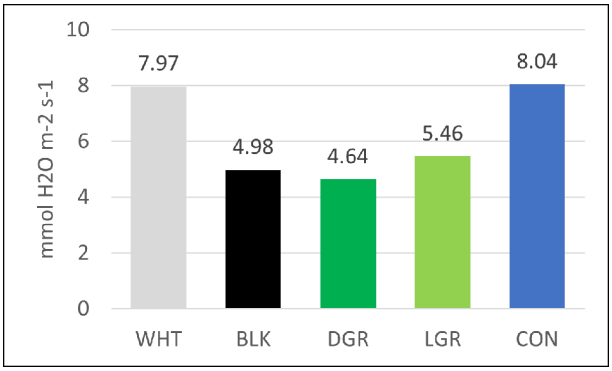

Figure 4. Transpiration values across the different treatments measured on a summer day

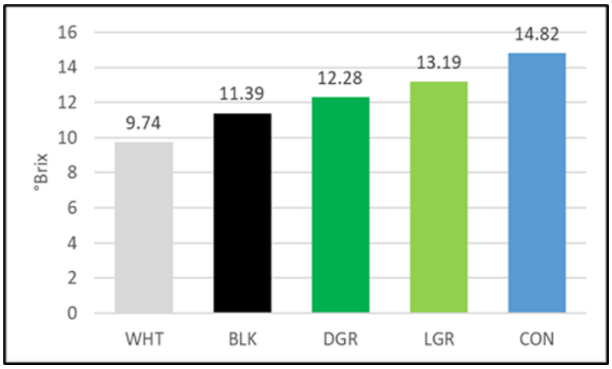

Figure 5. Sugar content values normalised by yield; the shaded treatments show a reduction in sugar accumulation ranging from 10% to 40% compared to the control.

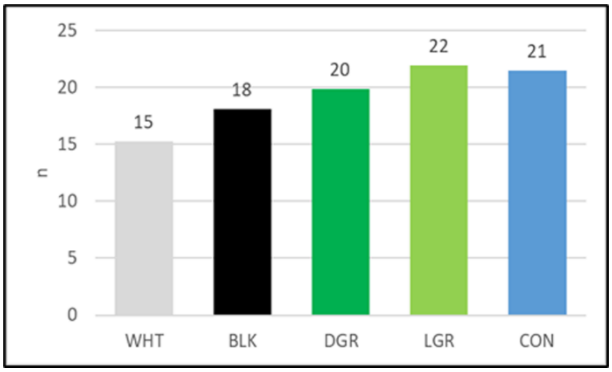

Figure 6. Number of clusters per plant; a slight decrease in fertility is observed in the shaded treatments, with a reduction in the number of clusters per plant.

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CLIMED-FRUIT

RESIL-VINE PROJECT – tools for adapting to climate change

Short description of the OG

The objective is to promote innovative agronomic practices in the wine sector that can increase vineyard resilience to extreme weather events such as late frosts, hail, heatwaves and prolonged droughts, which are becoming more frequent due to ongoing climate change. This range of practices helps vineyards adapt according to the diverse needs and situations within the complex winegrowing system in Lombardy.

Up to now, these practices were mostly applied at an experimental level, selecting the most promising based on their multifunctionality. They can address multiple needs and help achieve optimal grape quality and yield standards despite an increasingly variable climate.

Benefits

A set of tools to address environmental threats related to climate change:

Precision irrigation – Water saving and better vine physiological performance resulting from optimal water inputs.

Canopy management – Different canopy management approaches influence the vegetative production balance and result in differing vine performance, providing growers with a set of choices to pursue their specific production targets.

Training systems – The choice of training system is a long-term strategy that affects the vegetative production balance and results in differing vine performance, enabling growers to pursue their specific production targets.

Rootstock choice – The proper choice of rootstock allows the variety to express itself best in the specific environmental context analysed.

Anti-hail nets – Protect the grapevine against multiple summer stresses.

Stage of implementation

The two-year project has been completed, testing and demonstrating the different practices in the field.

Applicability box

Theme

Adaptive management
Climate change adaptation
Water-use efficiency

Duration

2 years

Partners involved

Università degli Studi di Milano
Farms involved: Ferghettina, Vezzoli, Bersi Serlini
Technical partners: Arrigoni (shading nets), Rivulis (irrigation systems)

Budget

€150,000

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Main achieved or expected results

The variable rate irrigation system enabled a 17% reduction in water consumption compared to standard management practices, ensuring more efficient water distribution and greater uniformity in both yield and quality parameters, particularly in areas with higher irrigation demands.
The anti-hail nets helped mitigate summer thermal stress by reducing berry temperature and leaf transpiration by up to 57%, with positive effects on grape quality.
The Geneva Double Curtain (GDC) and Sylvoz training systems showed higher yields compared to the Guyot system; in particular, GDC promoted a useful delay in ripening under especially warm climatic conditions.
The rootstock trials highlighted the good performance of the M series, particularly M4, in terms of water use efficiency and oenological quality.
Finally, increasing the canopy height improved the vegetative-reproductive balance and promoted a more balanced technological profile of the musts.
All the tools have been communicated and demonstrated at the regional level to winegrowers, agronomists, technicians and wine lovers, increasing the interest in such sustainable and innovative solutions.
The main end result is a manual on the adoption of the different adaptation tools.

Existing materials

All information is in Italian.

Videos

Project presentation video: https://www.youtube.com/watch?v=_uoS2D9vuI8

Adaptation strategy – training system: https://www.youtube.com/watch?v=ICV0gGPYKY0
Adaptation strategy – canopy management: https://www.youtube.com/watch?v=mtmklYzs72c
Adaptation strategy – precision irrigation: https://www.youtube.com/watch?v=mUWV4NrQhdQ
Adaptation strategy – anti-hail nets: https://www.youtube.com/watch?v=EegiO75m9aU
Final project meeting: https://www.youtube.com/watch?v=jb74iVOMJkk

Web links

First results presentation on VVQ magazine
https://vigneviniequalita.edagricole.it/featured/resilvine-i-primi-risultati/

Project manual
https://resilvine.altervista.org/manuale/

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