DIFFERENT YIELD REGULATION STRATEGIES IN SEMI-MINIMAL-PRUNED HEDGE (SMPH) AND IMPACT ON BUNCH ARCHITECTURE

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Abstract:

Context and purpose of the study - Yields in the novel viticulture training system Semi-Minimal-Pruned Hedge (SMPH) are generally higher compared to the traditional Vertical Shoot Positioning (VSP). Excessive yields have a negative impact on the vine and wine quality, which can result in substantial losses in yield in subsequent vintages (alternate bearing) or penalties in fruit quality. Therefore yield regulation is essential. The bunch architecture in SMPH differs from VSP. Generally there is a higher amount but smaller bunches with lower single berry weights in SMPH compared to VSP. By means of different yield-regulating measures, i.e. biochemical thinning concepts, harvester thinning and Darwin-rotor (Fruit Tec Maschinenbau, Markdorf, Germany) the bunch architecture in SMPH is altered. A loose bunch architecture minimizes the risk of bunch rot and improves grape health. The aim of the study was to investigate the impact of different yield regulation strategies in SMPH on the bunch architecture.

Material and methods - Under field conditions, three different thinning methods were tested on the two fungus-resistant grape varieties Rondo, Regent, and additionally Riesling at Geisenheim, Germany (49°59´20" N; 7°55´56 " E). Both biochemical and mechanical thinning concepts were pursued. The biochemical grape thinning treatment was applied during flowering with the plant growth regulator gibberellic acid (Gibb3; Plantan GmbH, Buchholz, Germany). The mechanical thinning was performed using a harvester at berry pea size stage of fruit development and the Darwin-rotor, which was originally developed for horticultural crops and commonly used for mechanical blossom thinning by horizontally rotating strings. In the vineyard it has been used for thinning young canes a week after budburst (E-L-scale: 9). The three thinning treatments were compared to non-treated VSP and SMPH control and bunch architecture has been investigated.

Results - Lower bunch weight, berry weight and rachis weight were detected in all SMPH treatments compared to VSP. Statistically significant lower bunch weight was detected for SMPH using harvester thinning compared to SMPH thinning with gibberellic acid, thinning with Darwin-rotor and a non-treated SMPH control. No differences in rachis weight were observed between the SMPH treatments. Our results indicate a looser bunch architecture using a harvester and gibberellic acid for yield regulation compared to a non-treated SMPH control. Whereas thinning with the Darwin-rotor resulted in an increase of berry diameter and bunch weight hence more compact bunches.

Keywords:Semi-Minimal-Pruned Hedge (SMPH), yield regulation, thinning, bunch architecture, Darwin-rotor, gibberellic acid.

1. Introduction.

YIELD REGULATION STRATEGIES IN SEMI-MINIMAL-PRUNED HEDGE (SMPH) AND IMPACT ON BUNCH ARCHITECTURE

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INTRODUCTION AND AIM

- Excessive yields in the novel training system Semi-Minimal-Pruned Hedge (SMPH) have a negative impact on the vine and wine quality.
- By means of yield-regulating measures the velocity of ripening and sensory quality is improved.
- The aim of the study was to investigate the impact of different yield regulation strategies in SMPH on the bunch architecture of fungus-resistant grape varieties (PIWI) and *Vitis vinifera*.
- Additionally, through the reduced use of pesticides in fungus-resistant grape varieties, and in combination with SMPH, an ecofriendly and economically optimized cultivation concept in viticulture should be evolved.

MATERIAL AND METHODS

- PIWI: Rondo & Regent, *Vitis vinifera*: Riesling
- Three thinning strategies were applied:

1. Cane-thinning (SMPH Darwin) throughout complete canopy with the Darwin-rotor (Fruit Tec; E-L-scale: 9).
2. Biochemical bunch-thinning (SMPH Gibb) with the plant growth regulator gibberellic acid (50 ppm Gibb 3, Plantan GmbH; E-L-scale: 21).
3. Mechanical bunch-thinning (SMPH HT) in two intensities (light & intensive) using a harvester (ERO, E-L-scale: 31).

- n=4, six bunches each field replicate.
- Investigated parameters: Bunch weight, single berry weight, berries per bunch, rachis to bunch weight-ratio and berry diameter.
- The percentage of different berry diameter classes per bunch were determined by manual sieving.

RESULTS

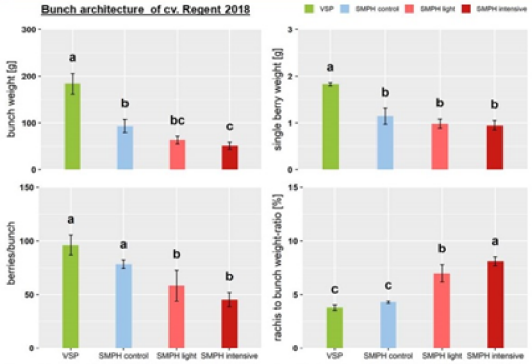

Figure 1: Impact of bunch-thinning using a harvester on bunch architecture of cv. Regent (vintage 2018). Compared are lightly (SMPH light) and intensively (SMPH intensive) thinned bunches of SMPH to a non-treated SMPH control and Vertical Shoot Positioning (VSP). Different letters between the treatments indicate statistically significant differences.

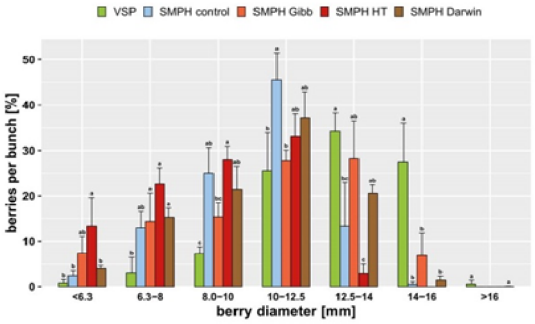

Figure 3: Percentage of berries per bunch in order to their berry diameters in millimetre. Compared are the treatments cane-thinning with Darwin-rotor (SMPH Darwin), biochemical-thinning with application of gibberellic acid (SMPH Gibb) and bunch-thinning using a harvester (SMPH HT) to a non-treated SMPH control and Vertical Shoot Positioning (VSP). Different letters between the treatments of each berry diameter class indicate statistically significant differences.

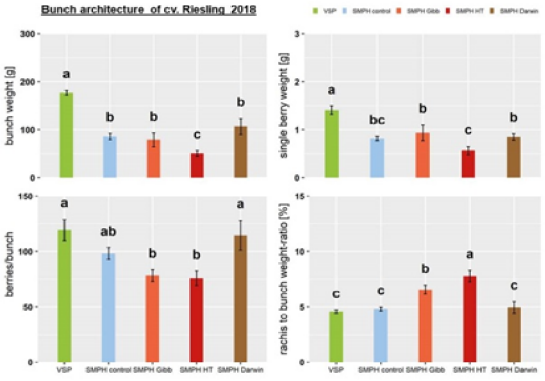

Figure 2: Impact of different thinning strategies in SMPH on bunch architecture of cv. Riesling (vintage 2018). Compared are the treatments cane-thinning with Darwin-rotor (SMPH Darwin), biochemical-thinning with application of gibberellic acid (SMPH Gibb) and bunch-thinning using a harvester (SMPH HT) to a non-treated SMPH control and Vertical Shoot Positioning (VSP). Different letters between the treatments indicate statistically significant differences.

Results Rondo and Regent

Thinning using a harvester:

- Lower bunch weight, single berry weight and berries per bunch compared to a non-treated SMPH control and VSP.
- Statistically significant higher rachis to bunch weight-ratio with light and intensive thinning intensity compared to a non-treated SMPH control and VSP.

Results Riesling

Thinning with Darwin-rotor:

- Increase in bunch weight and berries per bunch.
- No differences in single berry weight and rachis to bunch weight-ratio compared to a non-treated SMPH control detected.

Thinning using a harvester:

- Statistically significant lower bunch weight and single berry weight compared to a non-treated SMPH control.
- Higher rachis to bunch weight-ratio compared to a non-treated SMPH control and VSP.
- Decrease in single berry weight and berry diameter.

Thinning with gibberellic acid:

- Statistically significant higher rachis to bunch weight-ratio compared to a non-treated SMPH control.
- Increase in single berry weight and berry diameter.

Conclusion

- Generally there is a higher amount but smaller bunches with lower single berry weights in SMPH compared to VSP.
- Thinning using a harvester or gibberellic acid improves bunch architecture and minimizes bunch rot risk by leading to less compact bunches.
- Cane-thinning using the Darwin-rotor results in higher bunch weights and does not improve bunch architecture regarding bunch rot compared to a non-treated control.
- The applied thinning concepts alter the bunch architecture. Therefore, if yield-regulating measures are considered, climatic conditions at the vineyard site, grape variety and the production target should be taken into account.

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