THE EFFECTS OF CANE GIRDLING ON BERRY TEXTURE PROPERTIES AND THE CONCENTRATION OF SOME AROMA COMPOUNDS IN THREE TABLE GRAPE CULTIVARS

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Abstract:

Context and purpose of the study - The marketability of the table grapes is highly influenced by the consumer demand; therefore the market value of the table grapes is mainly characterized by its berry size, colour, taste and texture. Girdling could cause accumulation of several components in plants above the ringing of the phloem including clusters and resulting improved maturity. The aim of the experiments was to examine the effect of girdling on berry texture characteristics and aroma concentration.

Material and methods - Three table-grape cultivars (Melinda, Pölöskei muskotály, Árkádia) were selected for the experiments, which were carried in Mátra Wine region, Hungary in 2017. The girdling was conducted at the beginning of the ripening. Sugar concentration, pH and acidity were measured by a WineScan instrument (Foss, Hilleroed, Denmark). Basic texture parameters, such as berry hardness (BH), berry skin thickness (S_{psk}) skin hardness (F_{sk}) etc. were scanned with a TA.XT Plus Texture Analyser (Stable Micro Systems, London, UK). Some aroma compounds of the must samples were also investigated by GC-MS (Agilent, Palo Alto, USA).

Results - The gridled samples presented higher average berry weight, sugar concentration and titratable acidity compared to the control. Berry hardness of the girdled treatment was higher compared to the non-treated vines. However, berries of girdled vines had lower skin hardness, probably due to the accelerated maturity. Furthermore, girdling resulted in thicker skins in the case of Melinda and Árkádia cultivars. In addition, the concentration of the measured aroma compounds (linalool, citronellol, geraniol) was higher in the treated berries compared to the control ones.

Keywords: Cane girdling, Berry texture, Aroma compounds

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1. Introduction.

The effects of cane girdling on berry texture properties in three table grape cultivars

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Introduction and objective

The marketability of the table grapes is highly influenced by the consumer demand; therefore the market value of the table grapes is mainly characterized by its berry size, colour, taste and texture. Girdling accumulates of several components in plants above the ringing of the phloem including clusters and resulting improved maturity. The main objective of this study is to examine the effect of girdling on grape berry texture parameters and the concentrations of some aroma compounds under cool climate conditions (Mátra, Hungary).

		Árkádia	Melinda	Pölöskei
Sugar (g/l)	C	163,40	240,30	244,00
	G	202,10	255,80	269,80
Significance		***	ns	****
Acidity (g/l)	C	2,77	7,40	2,53
	G	3,73	8,80	3,56
Significance		****	***	**

C: Control, G: Girdled, *, **, ***, indicate significance at p<0.05, **** indicates significance at p<0.0001, ns= not significant

Table 1. *Sugar concentration and titratable acidity of the grape juices.*

Pölöskei muskotály	Linalool	Citronellol	Geraniol
C	15,87	3,6167	0,6667
G	18,53	3,7667	0,9333
Significance	*	ns	ns

C: Control, G: Girdled, * indicate significance at p<0.05, ns= not significant

Table2. Some *aroma compounds(µg/l) of Pölöskei muskotály cultivar*

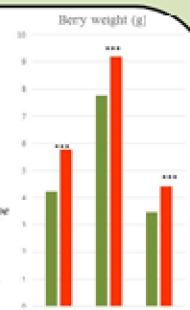

Figure 3. *Berry weight of the girdled and control berries*

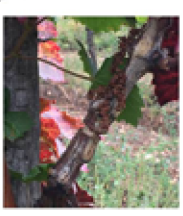

Figure 1. *Girdling on the cane (photo: Tóth, A.M.).*

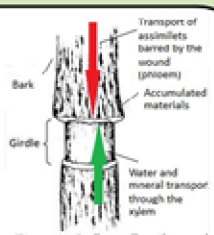

Figure 2. *Girdling effect (figure after Taiz and Zeiger. 2002.)*

The method of the girdling means removing a small part of the phloem (3-6 mm) from a woody plant (it could be trunk, bunch, shoot) (Fig. 1). Usually it is taken by a special girdling tool which doesn't harm the xylem of the plant. The wound on the phloem behaves as physical barrier on the way of assimilates and hormones from leaves to roots, consequently induced the accumulation of them; meanwhile the water and minerals could be transported freely from roots to leaves (Fig. 2).

Materials and methods

Three table-grape cultivars (Melinda, Pölöskei muskotály, Árkádia) were selected for the experiments in 2017, in Mátra Wine region, Hungary. The girdling was conducted at the beginning of the ripening. Sugar concentration, pH and acidity were measured by a WineScan instrument (Foss, Hillerood, Denmark). Texture properties of the berry (berry hardness - BH, gumminess - BG, springiness - BS, chewiness - BCh, resilience - BR), berry skin thickness (S_{sk}) and skin hardness (F_{sk}) were scanned with a TA.XT plus texture analyser (SMS, London, UK) according to Letaief *et al.* (2008). Some aroma compounds of the must samples were also investigated by GC-MS (Agilent, Palo Alto, USA). Statistical analysis was conducted by Graph Pad Prism software 6 (GraphPad Software Inc., La Jolla, CA, USA).

Results and discussion

The girdled samples presented higher average berry weight (Fig. 3), sugar concentration and but lower acidity as it was described earlier (Soltekin *et al.* 2016) (Tab. 1). **Berry hardness** of the girdled treatment was higher compared to the control (Fig. 4), probably due to the increased berry size (Rolle *et al.* 2015; Zsófi *et al.* 2015). The **whole berry texture parameters such** as cohesiveness (BCo), gumminess (BG), springiness (BS), chewiness (BCh) and resilience (BR) values were significantly higher in case of Melinda cultivar (Tab. 3). However, berries of girdled vines had lower **skin hardness**, assumingly due to the accelerated maturity (Tab. 3) (Rio Segade *et al.* 2011). Furthermore, girdling resulted in thicker skins in Melinda and Árkádia cultivars (Fig. 5). In addition, the concentration of linalool aroma compound was significantly higher in the treated berries compared to the control ones (Tab. 2).

		BCo	BG (mN)	BS (mm)	BCh (mJ)	BR	F_{sk} (mN)
Árkádia	C	0.5507	523.4	3.676	1939	0.2634	460.5
	G	0.4826	518.7	3.840	1992	0.2681	418.6
Significance		****	ns	**	ns	ns	**
Melinda	C	0.3762	640.8	3.883	2498	0.1604	410.8
	G	0.4041	750.6	4.030	3034	0.1828	391.4
Significance		*	***	*	****	**	ns
Pölöskei mu.	C	0.5427	443.3	3.413	1517	0.2449	556.6
	G	0.5272	477.7	3.426	1630	0.2306	530.3
Significance		ns	**	ns	*	*	ns

C: Control, G: Girdled, *, **, ***, indicate significance at p<0.05, **** indicates significance at p<0.0001; ns= not significant

Table 3. *Berry texture parameters and skin hardness (F_{sk})*

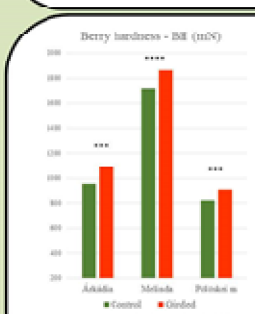

Figure 4. *Berry hardness (BH) of the girdled and control berries*

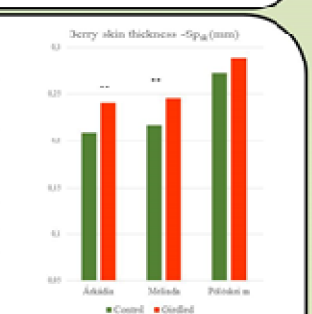

Figure 5. *Berry skin thickness (S_{psk}) of the girdled and control berries*

Conclusion

In summary, girdling had a positive effect on **berry quality parameters** and **mechanical properties** and **some aroma** compounds. It resulted in an accelerated ripening with harder berries and thicker skin. However the variety must be always considered in terms of the timing of the girdling and optimal harvest time.

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