TERROIR ASPECTS OF HARVEST TIMING IN A COOL CLIMATE WINE REGION: PHYSIOLOGY, BERRY SKIN PHENOLIC COMPOSITION AND WINE QUALITY•

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1. INTRODUCTION

Grape and wine quality are determined by many factors including cultivar, environmental conditions where the grapevine is grown and the impacts of human activities. Mild and moderate water stress have a favorable impact on wine quality, therefore water deficit is a major component of the so-called 'terroir effect' (van Leeuwen, Seguin, 2006; Zsófi *et al*., 2009). Water deficit results in increased concentration of phenolics and anthocyanins in grape berries partly due to the larger relative skin mass in the berries (Roby, Matthews, 2004) and transcriptional upregulation of anthocyanin biosynthesis in the grape berry skins (Castellarin *et al*., 2007). Fruit sugar concentration is also influenced by the level of water supply. Severe water deficit results in low sugar concentration as a result of restricted carbon assimilation (Santesteban, Royo, 2005), however, under field conditions, moderate water deficit often, but not always, increases sugar accumulation. The changes of grape quality parameters during ripening are largely depending on the *terroir* effect. In addition, the concentration and the composition of these substances have a great impact on wine quality and style. Therefore, choosing the proper harvest time is essential for winemakers in order to achieve the desired quality and style. The present study shows some preliminary results of the effect of harvest timing on berry skin phenolic concentration and wine style of the 'Kékfrankos' at two sites with different water supply.

2. MATERIALS AND METHODS

The experiment was carried out in the Eger Wine district, Hungary in 2009. Measurements were taken in two commercial vineyards with different water supply, slope and aspect (Eger-Kőlyuktető, E-KT – non-stressed, flat vineyard and Eger-Nagyeged hill, E-NH – water

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stressed, steep slope vineyard. The 'Kékfrankos' (*Vitis vinifera* L.) vines at both vineyards were umbrella trained, with south-north row orientation with 3x1.2m row and vine spacing, at the same pruning level on 'Teleki 5C' (*V. berlandieri* x *V. riparia*) rootstocks.

Pre-dawn (Ψ_p) and midday (Ψ_m) water potential were monitored with a Scholander-pressure chamber. *In situ* gas-exchange parameters were measured with a Ciras-1 portable infrared gas analyser (PP Systems, UK).

Quality parameters were determined according to the Hungarian Standards. Experimental wines were made on microvinification scale. Sensory evaluation was carried out with a panel of six tasters giving points from 0 to 5 to each sensory parameter.

3. RESULTS AND DISCUSSION

As a result of steep slope aspect and low soil water holding capacity, mild water deficit occurred at Eger–Nagyeged hill. At the hilly site pre-dawn water potential and gas exchange parameters (data not shown) were lower than at the flat vineyard. Stomatal conductance indicated mild to moderate water stress, especially during the ripening period. In contrast, no water deficit was detected at Eger-Kőlyuktető. Sugar concentration was increasing during the ripening at both sites having higher values at the water stressed vineyard. No significant decrease was observed in titratable acidity from the 2nd harvest at both sites (data not shown). Total polyphenol, catechin and anthocyanin concentration of the berry skin was increasing significantly at Eger-Nagyeged hill until the last harvest date. In contrast, no changes were found in these parameters in the case of the non-stressed site (fig. 1). As a result the correlation was also different between the concentration of the primary parameters and phenolics at the two sites (i.e. anthocyanins vs. sugar: Eger-Kőlyuktető R^2=0.17; Eger-Nagyeged hill R^2= 0.96).

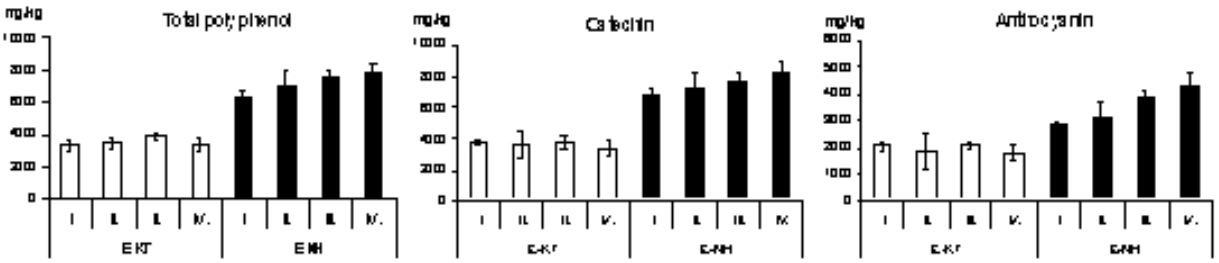
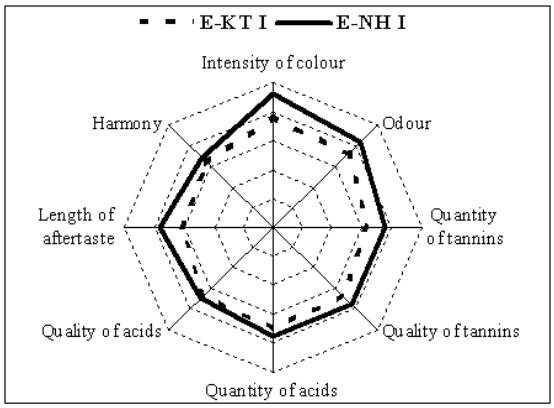
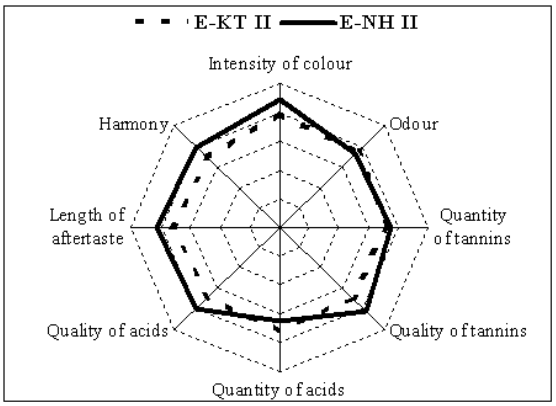


Fig.1 - Changes of some phenolics during the ripening at the two sites.
Each bar represents the mean value of three replicates (±SE). Each replicate includes the skin extraction of 20 berries collected randomly from different bunches and blocks of the vineyards.

Wine phenolic composition and sensory characteristics (*quality and style*) were also changing during the ripening. Wine analysis has shown that the water stressed site has a greater phenolic potential for quality wine making. However, in the case of the last harvest, wine

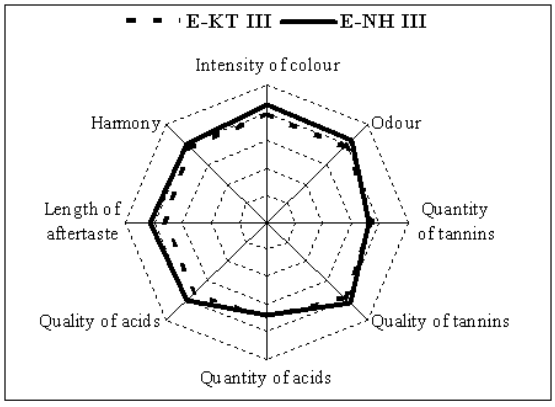
sensory characteristics were slightly better at the flat vineyard (smooth tannins and nice harmony) than at the hilly site (fig. 2).

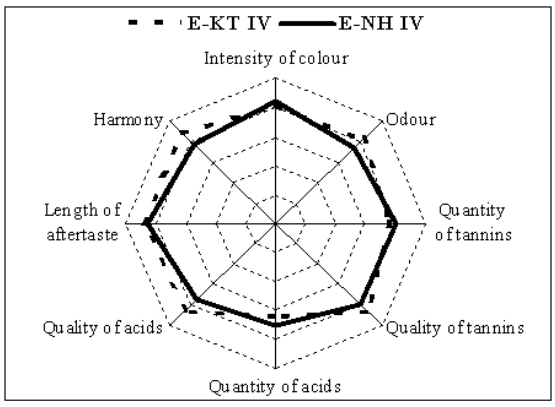




E-KT I: Fruity, mainly sour cherry on the nose. The palate shows harsh tannins and high acidity. It is a light-to-medium bodied wine with rich aftertaste.
E:NH I: A bit harsh tannins and acids. On the nose mainly fruity and jammy, with long aftertaste.

E-KT II: Medium-bodied wine, still tannic with vivid acidity.
E-NH II: Smoother, but firm tannins, vivid acidity. Complex wine, with fruity notes and long aftertaste.





E-KT III: Shows smoother tannins and acids. A characteristic flavour with parched fruits notes. Nice harmony.
E:NH III: Dry tannins and vivid acidity. Jammy nose. Complex wine with great aging potential.

E-KT IV: Smooth tannins, nice acids. Overriped fruits on the nose. Full-bodied wine, which has rich, long aftertaste with coffee notes.
E-NH IV: Tannic and high acidity. On the nose fruity with herbal notes, but with weak intensity. Full flavoured, full-bodied wine with great aging potential.

Fig. 2 - Sensory evaluation of the wines from the terroirs in different harvest dates.

4. CONCLUSION

Differences in grape ripening dynamics in the different sites resulted in different **optimal** harvest time at both sites. The altered correlation between the concentration of the primary parameters and phenolics at the two sites suggests that additional tools should be developed and applied to determine optimal ripeness. New methodologies would help not only to assess the quality of the grape, but wine style could also be predicted by harvest timing.

Abstract

Preliminary experiment of harvest timing was carried out in Eger wine district, Hungary in 2009. *In situ* physiological responses, berry quality parameters and wine quality of the Kékfrankos grapevine were studied at two growing sites (Eger-Kőlyuktető - non-stressed, flat vineyard, and Eger-Nagyeged hill – water stressed, steep slope vineyard). At the hilly site physiological responses indicated mild to moderate water stress, especially during the ripening period. In contrast, no water deficit was detected at Eger-Kőlyuktető. Sugar concentration was increasing during the ripening at both sites having higher values at the water stressed vineyard. Total polyphenol, catechin and anthocyanin concentration of the berry skin was increasing significantly at Eger-Nagyeged hill until the last harvest date. In contrast, no changes were found in these parameters in the case of the non-stressed site. Wine phenolic composition and sensorial characteristics (*quality and style*) were also changing during the ripening. Wine analysis has shown that the water stressed site has a greater phenolic potential for quality wine making. In conclusion, differences in grape ripening dynamic of the terroirs resulted in different optimal harvest time at both sites. The correlation was also different between the concentration of primary parameters and phenolics at the two sites. This suggests that new tools should be developed and applied to determine optimal ripeness. New methods would help not only to asses the quality of the grape, but wine style could also be predicted by harvest timing.

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