

Exploring Xynisteri and Maratheftiko for use in the Australian wine industry

By Alexander Willem Copper



The suitability of the Cypriot grape varieties Xynisteri and Maratheftiko to the Australian viticultural and oenological landscape, and the consumer feedback to the wines, have been revealed in the first detailed study of its kind.

INTRODUCTION

The changing climate globally is well documented and the impacts on agriculture will continue to be a challenge into the future. This research project studied the purported drought-tolerant, indigenous Cypriot grape varieties Xynisteri and Maratheftiko for their suitability to viticulture and oenology in Australia and the Australian consumer response to wines made from these varieties. When the project commenced, much of the knowledge regarding these Cypriot varieties was largely anecdotal. Since 2017, there has been increased interest in these varieties both from this project and with researchers in Cyprus. The research has provided new knowledge on several aspects, including the chemical composition and sensory attributes of the wines made from these varieties. Consumers have demonstrated a liking for the wines and in some cases preferred these wines to wine made from more common varieties such as Shiraz, Pinot Gris and Chardonnay. Xynisteri and Maratheftiko growing in non-irrigated vineyards in Cyprus have been bench marked against Shiraz and Sauvignon Blanc for the first time. Irrigation trials in Australia and Cyprus compared the vine growth response to different irrigation regimes and highlighted that the Cypriot varieties were better suited to heat and drought stress and that Xynisteri, in particular, was able to produce large above and below ground biomass under all irrigation conditions.

SENSORY, CHEMICAL AND CONSUMER ANALYSIS

The sensory, chemical and consumer study of the wines made from the indigenous Cypriot grape varieties Xynisteri and Maratheftiko was the first detailed study of its kind. Xynisteri was described sensorially as citrus, herbaceous, dried fruit, savoury, apple, pear, grassy with a full length of fruit and non-fruit flavours in the after taste (Copper *et al.* 2019). Chemical analysis supported sensory

analysis with aroma compounds of ethyl propanoate (fruity), 2-phenylethanol (honey), ethyl-3-methylbutanoate (fruity), ethyl acetate (acetone), ethyl-2-methylpropanoate (sweet), 3-methylbutanol & 2-methylbutanol (solvent), hexanoic acid (leafy, woody), ethyl octanoate (pear, pineapple), hexanoic acid (leafy, woody) and ethyl butanoate (lactate) identified in wines and have been associated with wine quality.

Wines made from the Cypriot red variety Maratheftiko compared favourably with common European varieties and less common Greek varieties, being described sensorially as dried fruit, jammy, confectionery, sweet, chocolate, herbaceous, woody, with full length of fruit flavours in the after taste. The Cypriot wines were also assessed to have aroma compounds that contributed to the above attributes, that is: strawberry, sweet, fruity, banana, cherry, pear, woody/leafy and butter.

It is also worth noting that there were only a small number of wine samples available for this preliminary study. It was therefore difficult to make in-depth comparisons with the more common European varieties. However, when these quality parameters and the consumer data generated in this study are considered, we can speculate that the wines made from Cypriot varieties are comparable to common Australian wines and potentially similar to other quality European wines made from varying grape varieties and likely to meet strong consumer acceptance.

Initial sensory analysis followed by the formal sensory and consumer trials highlighted that the Cypriot wines had characteristics similar to more common Australian wines. In particular, Xynisteri had flavour and aroma characteristics reminiscent of wines such as Pinot Gris and unwooded Chardonnay. This indicated that thiol analysis of the Cypriot wines would be beneficial to determine the concentration of three thiols (Copper *et al.* 2021): 4-methyl-4-sulfanylpentan-2-one (4MSP), which has an aroma of 'boxwood'

and 'cat urine' at high concentration; 3-sulfanylhexas-1-ol (3SH), which has been described as having a 'grapefruit/tropical fruit' aroma; and 3-sulfanylhexasyl acetate (3SHA), described as having an aroma of 'passionfruit'. Additionally, two other potent thiols were measured including benzyl mercaptan (BM), which has an aroma of 'smoke and meat', and furfuryl thiol (FFT), described as having a 'roasted coffee' like aroma. The thiol levels in these wines were comparable to those found in popular Australian wines such as Chardonnay and

IN BRIEF

■ In the first detailed study of its kind, the sensory, chemical and consumer aspects of wines made from the indigenous Cypriot grape varieties Xynisteri and Maratheftiko was undertaken.

■ The study demonstrated the varieties were well adapted to a hot climate, particularly Xynisteri.

■ Vineyard and potted vine trials were undertaken in Cyprus and Australia to evaluate the effect of full, deficit and no irrigation regimes on the vine growth of the two varieties.

■ Sensory analysis and consumer trials highlighted that the Cypriot wines had characteristics similar to wines more commonly made in Australia.

■ Trial plantings of Xynisteri and Maratheftiko are currently being established in the Barossa Valley and Clare Valley and will form the basis of future research projects into these varieties when grown under Australian conditions.



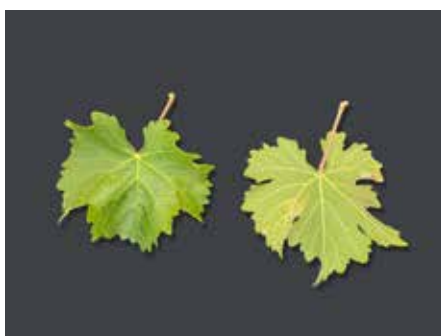
Maratheftiko



Shiraz



Xynisteri



Sauvignon Blanc

Maratheftiko, Xynisteri, Shiraz and Sauvignon Blanc leaves at the end of the irrigation trial. Images matched to the same scale for size comparison.

Sauvignon Blanc. These varietal thiols are important compounds in certain varieties when 'fruity', 'tropical' and 'citrus' aromas are desired. The thiols that were detected in all the Cypriot white wines were above threshold levels; however, the Australian Pinot Gris

and Chardonnay had better correlation with the desirable thiol 3SHA and its 'passionfruit/tropical' characteristics. One explanation for this could be the age difference of the wines. Apart from one Xynisteri, which was aged in oak for six months, the remaining Xynisteri

wines were at least six months older than the Australian wines, having been bottled in late 2016 or early 2017. Alternatively, this may also be attributable to masking/suppression and synergistic effects as has been shown previously in Chenin Blanc and in red wine. Winemaking practices that affect thiols, such as the handling of the grapes prior to fermentation, could be applied to these varieties to be able to meet the desired wine style, whether it be to enhance or reduce these characteristics. While this study was a preliminary investigation, it highlights the importance of thiols in white wines. However, their role in red wines is not well understood and requires further research.

VINE PERFORMANCE

The vine performance study (Copper *et al.* 2020) determined that Maratheftiko and, in particular, Xynisteri were well adapted to a hot climate, continuing to perform well as the climate becomes hotter. Xynisteri and Maratheftiko achieved budburst earlier and reached harvest maturity later than Shiraz and Sauvignon Blanc, which could be advantageous for reducing harvest compression in hot climates and for promoting better wine quality.



Trial plantings of Maratheftiko and Xynisteri in a vineyard in the Barossa Valley planted 10 weeks prior to these photos being taken. The vines are now 18 months old.

Xynisteri had the greatest stomatal density, more shoots, more leaves, bigger bunches, higher yields, the highest leaf water potential at harvest and stomatal conductance equal to Maratheftiko, while both had greater stomatal conductance than Shiraz and Sauvignon Blanc. Maratheftiko had the longest shoots and the largest shoot diameter, as well as the greatest chlorophyll content out of all four varieties. Xynisteri and Maratheftiko were classed as moderate to high vigour varieties. The higher yields and vigorous growth without irrigation of these Cypriot varieties indicate that they have potential to outperform other varieties in hot viticulture regions.

The purpose of this study was to provide a baseline understanding of the performance of Xynisteri and Maratheftiko compared to each other and to Shiraz and Sauvignon Blanc. It highlighted several positive aspects of Xynisteri and Maratheftiko performance which warrant further investigation for their use in hot, dry climates elsewhere and in comparison with other drought-tolerant winegrape varieties.

IRRIGATION TRIALS

The irrigation trial comprised three parts and occurred both in Cyprus and Australia (Copper *et al.* 2022). The first part was a field trial in a Cypriot vineyard which compared the performance, yields and composition of Xynisteri under full, deficit and no irrigation regimes for 107 days. No significant differences between physiological measures at fruit set and harvest were found when comparing the three irrigation regimes. Must composition analysis of the harvested fruit revealed fructose to be lowest in the full irrigation group compared to deficit and non-irrigated treatments. Fructose production is favoured in warmer conditions and can be an indication of over ripeness and higher potential alcohol. The full irrigation regime may have had a role in reducing the amount of fructose produced.

The second part of the trial involved potted vines in Cyprus (in 2019) of two suspected Xynisteri clones (XM and XK) and Sauvignon Blanc (SBC) under three different irrigation regimes over 67 days. The third part was a potted trial of Xynisteri (XP), Maratheftiko (MP), Sauvignon Blanc (SBA) and Shiraz (SZ) in Australia (in 2020-21) over 74 days. In 2019, physiological measurements were taken at flowering. XM and XK had longer shoots and internode length than SBC as well as a greater shoot diameter. XK also had longer shoots than XM. This high vigour growth can have an impact on the canopy density and the exposure of fruit to sunlight and the resultant wine composition.

In 2020-21, the potted vine trial consisted of XP, MP, SBA and SZ. Physiological measurements at flowering showed XP, MP and SZ had longer shoots than SBA. SZ had the most leaves per shoot and MP the least. XP and MP had the largest shoot diameter and MP had the longest internode length with SBA the shortest. This is consistent with the data from Copper *et al.* (2020) where Xynisteri had the longest shoots and the largest shoot diameter and Maratheftiko had the least leaves per shoot and longest internode length.

The results for water potential in 2020-21 were not conclusive, yet the results for 2019 were similar to those reported by Copper *et al.* (2020) who demonstrated that Xynisteri had higher stem water potential than Maratheftiko and Shiraz, while Sauvignon Blanc had the lowest stem water potential. Water potential is widely used as an indicator of plant water status for irrigation management purposes. However, water potential measurements respond not only to water shortage but also to other factors including cultivar, environment, soil type and

the relationships between canopy and root system. Modifications of the ratio of root-to-leaf area can induce changes in the relationship between transpiration, water potential and soil water content. This could help to explain the inconsistencies seen with the results particularly in 2020-21. The cultivar and root structure differences for Xynisteri may be an explanation for why the water potential measurements were not significant until the end of the testing period after 74 days of water stress.

In 2019, XM and XK had higher stomatal conductance than SBC. In 2020-21 XP had higher stomatal conductance and SZ had the lowest in the early stages of testing, with SBA being the lowest in the later stages of development. Previous research has demonstrated that Xynisteri and Maratheftiko had greater stomatal conductance than Shiraz and Sauvignon Blanc in a vineyard trial (Copper *et al.* 2020). Both trials also indicated that all the varieties had a reduction in stomatal conductance over time but at differing rates. Tzortzakis *et al.* (2020), studying Xynisteri and Chardonnay, showed similar results for Xynisteri but saw that stomatal conductance for Chardonnay was relatively constant throughout their testing period. They concluded that this was a possible mechanism whereby Xynisteri responds to drought stress by improved stomata conductance regulation.

Readings from a soil plant analysis development (SPAD) meter were used for indicative leaf chlorophyll content. Both XM and XK had higher chlorophyll content when compared to SBC throughout the testing period in 2019. Chlorophyll content for all three varieties remained constant throughout the testing period. In 2020-21 chlorophyll content



WHITCO
AUSTRALIAN BUILT

SUPERIOR HEDGING SYSTEMS
The extra edge in productivity and canopy management

- Affordable modular system - add as you go
- Available in four lengths and multiple configurations
- Medium or heavy duty
- Robust construction, low maintenance
- Easy mounting to tractor with hydraulic masts
- Versatile - use for pruning or trimming
- Suitable for hedging olives, orchards and hedges

HEDGER BAR SYSTEMS • MASTS AND MOUNTING SYSTEMS
Designed and manufactured in Australia by ACJ Engineering
Call 0403 654 390 for a colour brochure

WHITCO
Vineyard Pruning Equipment

To find your nearest dealer, visit
www.whitcovequip.com.au



A Maratheftiko vine (left) and Xynisteri vine (right) in a trial vineyard in the Barossa Valley.

for XP and MP had the highest levels for all three irrigation regimes at every testing period. Conversely, SBA and SZ were the lowest for all three irrigation regimes and testing period. Overall, all four varieties increased their chlorophyll content over the testing period. XP and MP, in particular, increased their chlorophyll content with deficit and minimal irrigation. This, again, concurs with results seen by Copper *et al.* (2020) where Xynisteri and Maratheftiko had higher chlorophyll content than Shiraz and Sauvignon Blanc. However, they identified that in a vineyard, Maratheftiko had higher chlorophyll content than Xynisteri, which was not the case with the potted trials.

This indicates that both Xynisteri and Maratheftiko are able to maintain or, in some cases, increase their chlorophyll content across a growing season and are able to do this more efficiently than Chardonnay, Sauvignon Blanc and Shiraz. Higher chlorophyll content in leaves has been associated with an increase in aboveground biomass. This may be the reason XM, XK, XP and MP developed higher biomass than SBC, SBA and SZ. Xynisteri, in particular, demonstrated high chlorophyll content, large aboveground biomass and large root biomass.

In 2019, XK and XM produced greater end-of-season root, trunk and shoot mass than SBC under all irrigation regimes and XK had greater root, trunk and shoot mass than XM with full irrigation. In 2020-21, XP had the highest root, shoot and leaf mass followed by MP, SBA and SZ. SZ had the lowest root, shoot and leaf mass at all irrigation levels except in the case of shoot mass with minimal irrigation where it was not statistically different to that of MP and SBA had the lowest mass. In both seasons, root mass for Xynisteri was greater than the shoot and leaf mass (above ground biomass), while Maratheftiko, Shiraz

and Sauvignon Blanc had similar root and aboveground biomass ratios.

In 2019, XK and XM had greater stomatal density than SBC. The Xynisteri stomatal density was also similar to the findings of Copper *et al.* (2020), along with XP having the highest stomatal density, followed by MP, SZ and SBA in 2020-21. There was, however, some difference between the two seasons. The 2019 testing period had a mean temperature of 24°C while the 2020-21 growing season had a mean temperature of 21°C. Stomatal density is correlated with temperature and can be as much as 1.4 times greater in warm temperatures when compared to cooler temperatures. This could help explain the differences seen between 2019 and 2020-21 for Xynisteri with the warmer season producing higher stomatal densities.

SUMMARY

This research has identified the potential of the indigenous Cypriot grape varieties to tolerate drought stress. Xynisteri, in particular, has shown itself to be more able to cope with drought stress than the more commonly cultivated varieties of Sauvignon Blanc, Shiraz and Chardonnay. In regions where irrigation is used to supplement rainfall, this could result in a reduction of the irrigation required and warrants further investigation with vineyard trials.

Overall, the biomass of Xynisteri above and below ground were far greater than all the other varieties investigated and with all irrigation regimes. The role of the extensive root structure of Xynisteri is one area that is an exciting outcome of this research and warrants further investigation. Although to date root biomass data for Xynisteri only exists for potted vines, field-grown vines could better explain the role of the roots in drought tolerance in the future. Vineyard trials are

currently being established in the Barossa Valley and Clare Valley and they will form the basis of future research projects for Xynisteri and Maratheftiko grown under Australian conditions. Analysis of the fruit and wine from these vineyards is expected in the next two to three years and will give greater guidance on the potential use of these varieties in commercial vineyards.

ACKNOWLEDGEMENTS

This project was supported through a University of Adelaide scholarship and funding from Wine Australia. Wine Australia is supported by Australian grapegrowers and winemakers with matched funds from the Australian Government.

REFERENCES

- Copper, A. W.; Johnson, T.E.; Danner, L.; Bastian, S.E.P. and Collins, C. (2019) Preliminary sensory and chemical profiling of Cypriot wines made from indigenous grape varieties Xynisteri, Maratheftiko and Giannoudhi and acceptability to Australian consumers. *OENO One* 53(2):229-248.
- Copper, A.W.; Collins, C.; Bastian, S.E.P.; Johnson, T.E.; Koundouras, S.; Karaolis, C. and Savvides, S. (2020) Vine performance benchmarking of indigenous Cypriot grape varieties Xynisteri and Maratheftiko. *OENO One* 54(4):935-954.
- Copper, A.W.; Collins, C.; Bastian, S.E.P.; Johnson, T.E. and Capone, D.L. (2021) Preliminary investigation of potent thiols in Cypriot wines made from indigenous grape varieties Xynisteri, Maratheftiko and Giannoudhi. *OENO One* 55(1):223-234.
- Copper, A.W.; Koundouras, S.; Bastian, S.E.P.; Johnson, T.E. and Collins, C. (2022) Assessing the growth response of *Vitis vinifera* L. cv. Xynisteri, Maratheftiko, Shiraz and Sauvignon Blanc to different irrigation regimes. Preprint DOI: 10.21203/rs.3.rs-1229873/v1
- Tzortzakos, N.; Chrysargyris, A. and Aziz, A. (2020) Adaptive response of a native Mediterranean grapevine cultivar upon short-term exposure to drought and heat stress in the context of climate change. *Agronomy* 10(2):249-261. **WVJ**