Final Plain Language Research Summary - AgriScience Grape & Wine Cluster 2018-2023

Activity: *Improving sparkling and still wine quality: preventing high volatile acidity, honey off-flavour and other faults that reduce wine quality through natural Canadian indigenous yeast isolates*

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Introduction

In wines, a limited amount of "sweet/honey" flavour contributes to the complexity of wine, but at high levels, is considered a fault (Campo et al. 2012). It has been observed by sparkling producers in Canada Ontario that sparkling wines in Ontario produced with Pinot noir grapes (susceptible to sour rot) can have an obvious "sweet/honey" flavour. With sparkling wine production on the rise across Ontario, it is critical that this issue is addressed. Two specific aroma compounds identified in wine that cause this "sweet/honey" off-flavour are Ethylphenyl acetate (EPhA) and Phenylacetic acid PhAA (Campo et al. 2012). Both compounds were reported to contribute to "sweet/honey" off-flavour in wines made from grapes that contain some sour rot (Campo et al. 2012). It is unclear as to when these problem compounds originate, and the direct linkage to sour rot development in grapes. It could be that the grapes have high levels of the precursor, and the sour rot microbial complex acts on the precursor contributing to the "sweet/honey" off-flavour when sour rot develops in the fruit. Alternatively, commercial yeast could be forming these compounds during fermentation when acetic acid levels are high in the starting must (such as when sour rot grapes are present) through esterification reactions with other fermentation metabolites.

PhAA is a plant-growth regulator so it could possibly be produced in grapes susceptible to sour rot as a growth response to an alteration of the surface of the grapes. No studies to analyze the grapes before, and after, sour rot to measure the precursor PhAA and the metabolite EpHA have been carried out. We hypothesize that these compounds are high in grapes as they begin to break down internally from sour rot, and then are transferred to the must and ultimately the wine. Studies have not been carried out on Ontario varieties in Canada prone to sour rot used in red table wines and sparkling wines (Pinot noir). Consumer threshold levels have been identified in wines made from the Portuguese red grape variety Trincaderia. However, the "sweet/honey" off- flavour also appears to be increased by the common nitrogen additive Diammonium phosphate (DAP) during fermentation and lees aging. It is essential we test grapes harvested for sparkling wine that are known to be susceptible to sour rot, for the precursor and the metabolite (Torrea et al. 2011, Campo et al. 2012). The thin-skinned Pinot

noir is particularly susceptible to sour rot, widely planted across Canada and in Ontario and used in sparkling wine production.

One way to improve quality and further provide a sense of regional identity to Canadian wine is through the use of locally isolated yeast. Inglis has been characterizing a natural yeast isolated from the skin of local Icewine grapes in Ontario, CN1. Although the yeast was not a sufficiently strong yeast to ferment above 9% v/v ethanol in Icewine, it has proven beneficial for appassimento wine production in that it is a low producer of the oxidative compounds acetic acid, ethyl acetate and acetaldehyde while also offering a favorable, unique flavor profile to the wines and over 16%v/v ethanol. This project has the opportunity to fully characterize the commercial potential of locally isolated yeasts, one of which is already known to produce lower levels of acetic acid, acetaldehyde and ethyl acetate during fermentation. This yeast also appears to consume large quantities of acetic acid during the fermentation, and may further reduce the formation of "sweet/honey" off-flavour. Applications of this yeast may extend beyond appassimento wine production to still red wine production, sparkling base wine production and a specific application to reduce negative impacts from a percentage of sour rot fruit on overall wine quality.

Objectives

The overall objectives of this project are to identify if two "sweet/honey" off-flavours from ethyl phenylacetate (EPhA) and phenylacetic acid (PhAA) are present in Pinot noir grapes because of sour rot infection, as well as in sparkling and still wines fermented from those grapes. Test consumer acceptance of the compounds in red and sparkling wines, and test if natural indigenous yeast isolates from Canadian vineyards can remove the compounds along with acetic acid. Furthermore, an indigenous yeast isolated from an Ontario vineyard will be trialed for commercial scale red wine production.

- Quantify EPhA, PhAA, ethyl acetate and acetic acid levels from clean and sour rot infected fruit in grapes prior to harvest to measure baseline values of taint and precursor compounds in grapes. Produce
- Pinot noir sparkling and still red wines with varying amounts of sour rot to determine if the taint compounds EPhA, PhAA, ethyl acetate and acetic acid are present.
- Determine the potential of the indigenous yeast isolated from Ontario to reduce acetic acid, EPhA and PhAA in sparkling and still red wines.
- Establish the consumer detection and the consumer rejection threshold levels of EPhA and PhAA associated with "sweet/honey" off-flavour in Pinot noir sparkling and still red wines to determine at what concentrations the compounds affect wine quality.
- Differentiate and describe sparkling wines made from grapes with varying sour rot levels fermented with a standard commercial yeast versus the Brock isolated yeast.

- Assess the commercial application of the Brock isolated yeast CN1 for fermenting appassimento wines

Methodology

Both still red wines and sparkling wines were made in 2019 and 2020 as per previous reports. Still wines from 2019 and 2020 were already analysed for the standard juice and wine chemical analysis including acetic acid and ethyl acetate following standard procedures of enzyme kit (Megazyme) for acetic acid and GC FID for ethyl acetate. The 2020 sparkling wines were disgorged in June 2022 and laboratory analysis of these wines were completed in 2022-2023. The two "off-flavour" compounds EPhA and PhAA were measured in the sparkling wines after disgorging using the GC MS method developed in prior years. Sensory analyses of the sparkling wines has not been completed yet due to COVID-19 restrictions and challenges associated with COVID, as it was dependent upon the health and safety guidelines of the Brock University Research Ethics Committee.

Commercial fermentations of Cabernet franc appassimento wine were trialed with the active dry culture of the CN1 yeast at Pilitteri winery whereas paste formulations of CN1 were also completed with Cabernet franc, Merlot and Corvina appassimento juice in the fall of 2021. All wine replicates were placed into individual barrels for aging at the winery (24 in total) in 2022. After one year in barrel, sufficient wine from each treatment (10L) was transferred to CCOVI for bottling in 2023 and future study. Wines were sulfited, bottled and all chemical analysis of the wines was completed in 2023. No sensory evaluation of the wines was performed as it was not scheduled within this project and there was insufficient time after bottling was completed.