NGWB Grant Final Report (FY24-25)

Contract Number #18-13-505 - Glacial Till – Wine Filtration Research

Grant Amount $5,800

Contact Information

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Issue of Interest

The focus of this research was to objectively analyze filtration methods and winemaking practices utilized across Nebraska Wineries in order to understand the benefits and drawbacks of each, with the goal of ensuring quality, shelf-stable wine is being produced. Samples from some participating wineries were tested allowing for an overview of current practices and their quality.

This research gave insight to winemakers on what methods they could invest in, and areas throughout the stage of production to be attentive in order to avoid potential flaws in their products.

Approach to Problem

Filtration research was started by fermenting approximately 5000 gallons of cider, to be separated into three different batches for filtration. This allowed the same initial conditions for each batch in order to accurately compare the results of filtration.

Separate filtration methods were then performed, utilizing CrossFlow, Centrifuge, and Plate Filter technologies, measuring Dissolved Oxygen (DO), Dissolved Carbon Dioxide (DCO_2), and Turbidity both before and after each method. Loss amounts were also recorded to compare.

Dissolved Gasses were measured, with a focus on Dissolved Oxygen, because when carried throughout the winemaking process, it can lead to spoilage, oxidation, or

refermentation of the wine. Turbidity was measured as a way to observe the effectiveness of the different filtration methods.

After the 2024 harvest was completed, with the goal of testing recently bottled wines, wineries were contacted to send in samples of their product in order to test how well each winery was treating their product.

A total of four wineries participated, delivering at least two samples of wine, and Glacial Till supplied a wide range of samples to supplement the study.

All of the same tests were performed on the bottled samples, with the addition of Free SO_2 testing, to quantify how much oxygen may have reacted with any Potassium Metabisulfite (KMBS) added to the wine.

All lab testing and in-line testing was performed at Glacial Till's production facility by Jack Krejci.

Goals/Achievement of Goals

The goal of this study was to better understand how filtration influences Nebraska Wine quality, and investigate potential problems and solutions throughout the winemaking process to share with Nebraska Winemakers.

This research was presented at the 2025 NWGGA conference, and several winemakers commented on the benefit of this information, with an interest in applying it.

Results, Conclusions, Lessons Learned

For a more in depth understanding of current practices in Nebraska wineries, more samples should be obtained, this study only received 2-4 samples from four Nebraska wineries.

Results:

Figure 1

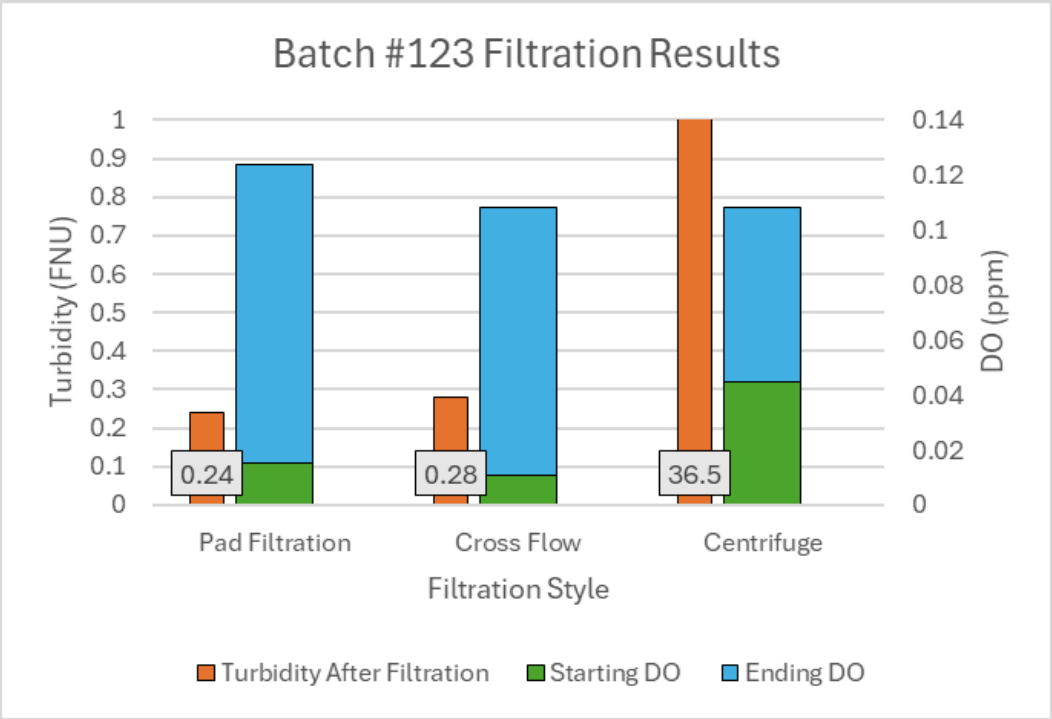

Figure 1 shows the amount of DO prior to filtration (green) and the amount of DO post filtration (blue), along with the ending turbidity of each method. Initial turbidity amounts exceeded machine limits.

From Figure 1 a clear comparison of filtration effectiveness can be seen, with CrossFlow and Pad Filtration both being effective methods, producing good clarity (below 0.5 FNU). Centrifuge did remove heavier particulates, but is not an effective method of filtration for packaging, but can be utilized as an initial mode of removing sediment/yeast/or lees.

Dissolved Oxygen also showed distinct differences through filtration methods that only partially aligned with our initial hypothesis. Each method ended up with close ending values of DO, with a slight preference to the Cross Flow method, followed by Centriguing, and ending with Pad Filtration. This was less drastic of a difference between methods than we expected to see, but it is encouraging that no method had noticeably poor results.

Important note is that the bottom portion, or “end”, of the large fermented batch of cider went toward the Centrifuge portion of the study, which is where we believe a larger initial DO measurement originates. With a higher proportion of lees to cider, there is a greater chance that more Oxygen was attached and trapped in the lees. It also had

more time to absorb any oxygen that was present in the tank after sitting multiple days with considerable head space.

Figure 2

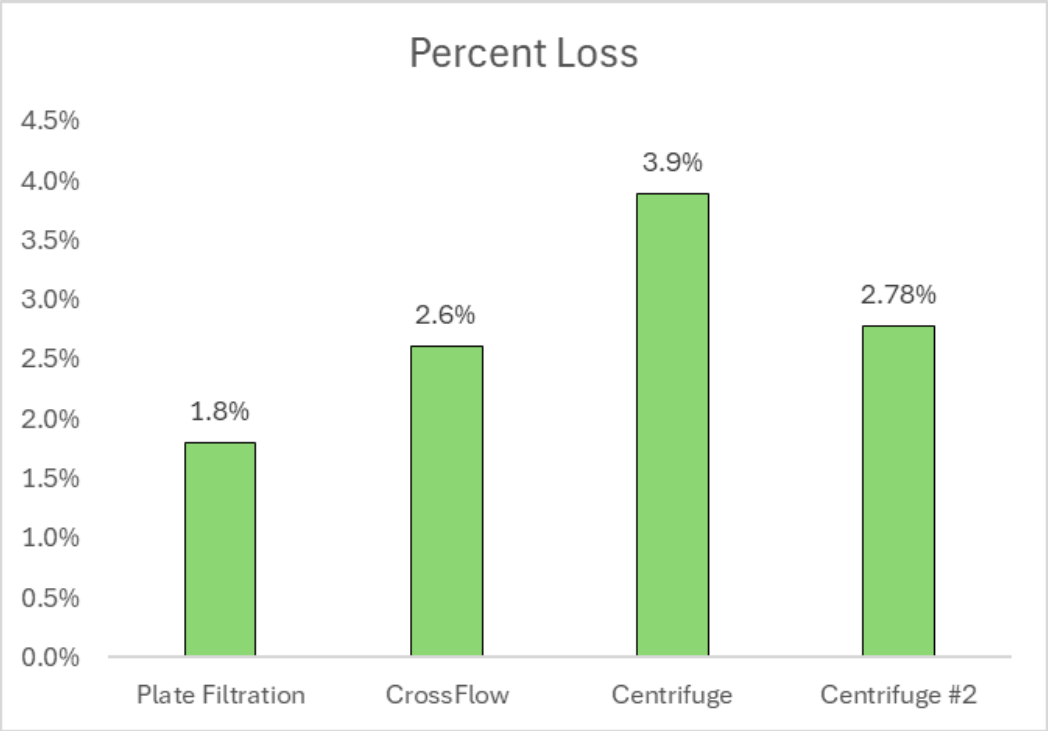

Figure 2 shows the amount of loss recorded through each method. To verify the results of the initial Centrifuge, a second operation was performed on a separate batch of cider.

Plate Filtration exceeded expectations for percent loss. This relies heavily on user error, but if done efficiently most of a product can be maintained. Both Cross Flow and Centrifuge Loss are due to machine determination, and are linked to the size of both of those machines. Smaller models should lead to less loss for the Cross Flow and the Centrifuge may have a higher efficiency with cleaner base product (Centrifuge #2) when compared to the bottoms of a tank (Centrifuge)

Figure 3

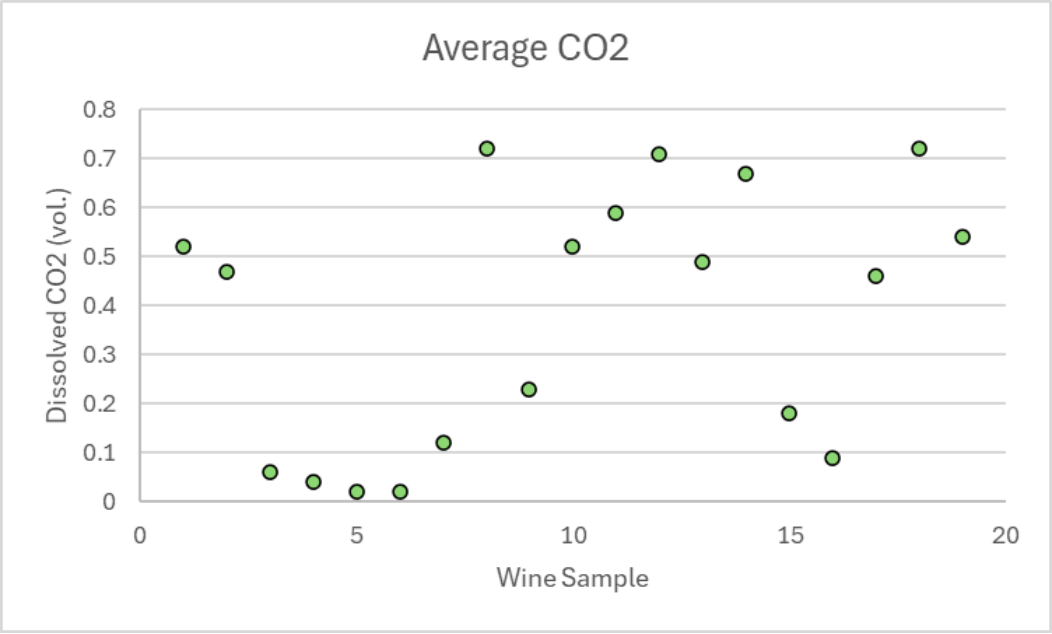

Figure 3 shows a scatter plot of the dissolved CO2 (vol.) found in each bottle.

Dissolved CO2, while not the most telling figure for Nebraska wine quality, is beneficial to know. All samples were considered ‘still wines’ with no intentional addition of CO_2. The role it plays is a competitor with DO within the headspace and in the wine itself.

Since no CO_2 was intentionally added, any presence of CO_2 is likely from sparging the bottles with CO_2, instead of Nitrogen gas, or mixing any last additions with CO_2 instead of a mixer or Nitrogen gas. Dissolved CO_2 can create an effervescence in the wine which can be perceived as a flaw in some wines or a positive in others.

Figure 4

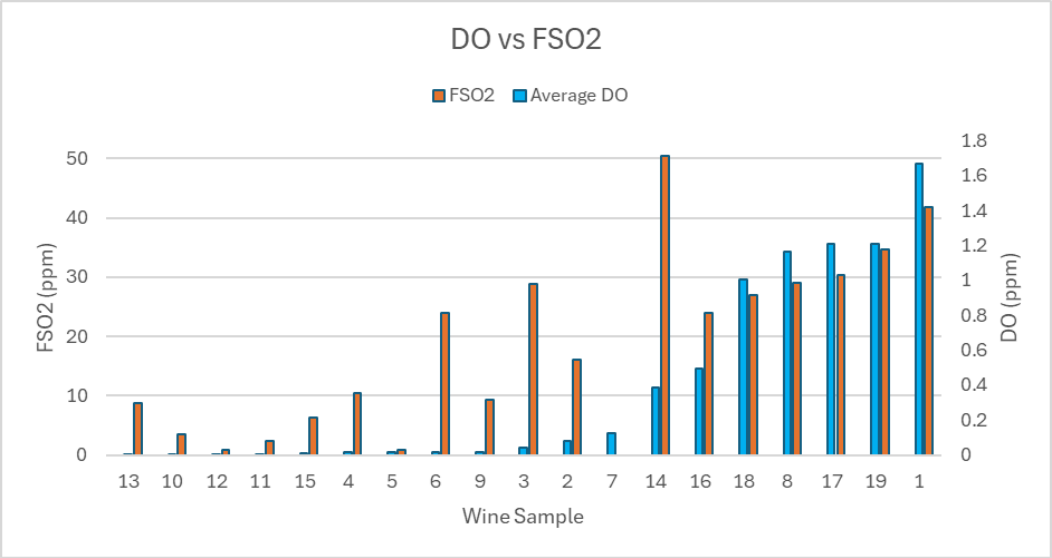

Figure 4 shows the trend of increasing DO. Wine samples 15,3, and 14-1 on the chart were all bottled 1-3 months prior to testing. Bottles 18 and 8, along with 17 and 1 are pairs of samples, where the same variety of wine was tested month(s) apart after bottling to see how sulfites are consumed in the bottle

Overall these results were unsurprising, if not encouraging. Largely, even after all of the DO has been consumed by sulfites, some sulfites remain. This is good in case the bottle “breathes” while being stored, or sitting on a shelf, as it allows for the continued barrier against Oxygen. We also have a better understanding of where DO is picked up, and for many cases we believe the biggest jump in DO is in packaging. This highlights the importance of purging bottles prior to filling, ensuring lines are blown out with CO_2 or Nitrogen

Figure 5

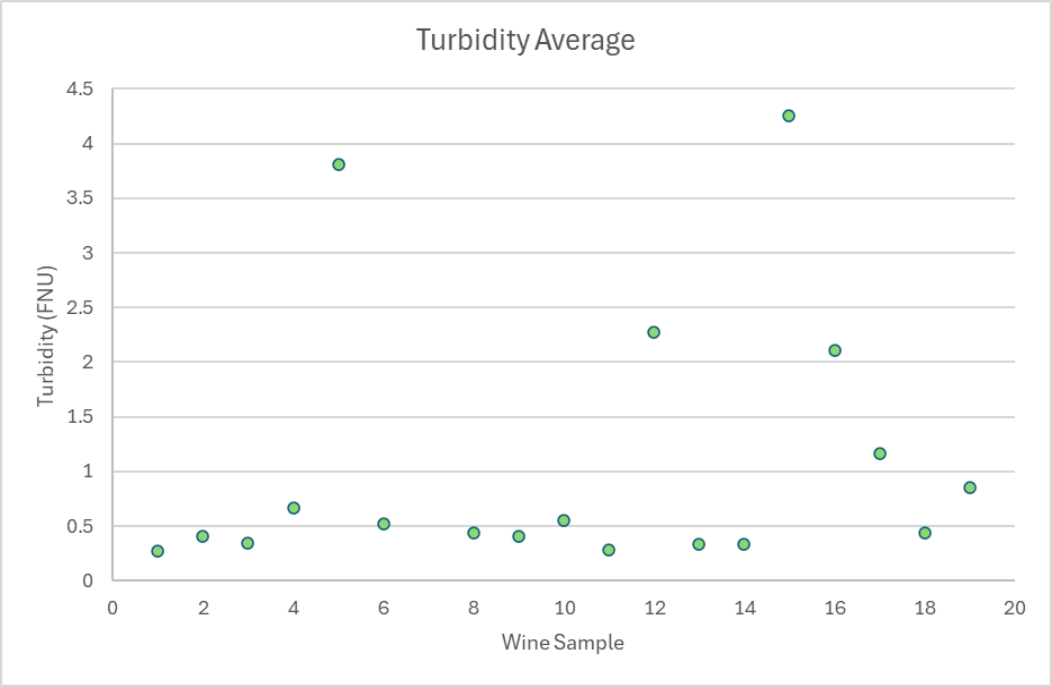

Figure 5 shows the measured turbidity of the wine samples, with sample #7 excluded with a recorded turbidity of 38.10 FNU.

Turbidity results were encouraging, with a median of 0.48 FNU. This is encouraging as it demonstrates that except for a few batches, most samples submitted were filtered well, and are also likely hot and cold stable.

At the conclusion of the project, a better understanding of winemaking practices and their influence on key measureables was obtained. Properly managing wine exposure to air, proper dosing amounts with sulfites, and effective filtration methods can all help increase the quality of wine by appearance and minimizing faults, along with improving expected shelf life of any wine produced.

Ultimately, winemaking practices are so unique to individual wineries that the way this information is used will be left to the winery. With a range of practices to accommodate any size winery, and the options they should keep in mind when expanding, improving Nebraska wine can be accessible to anyone.

Progress Achieved According to Outcome Measures

This research will aid Nebraska wineries when looking to invest in newer equipment, or develop a more strict quality assurance program.

With a higher commitment to quality wine production, wineries will be able to sell a more premium product that is also stable on the shelves for longer. With no set market research the goal is that this allows Nebraska Wine to stand out when compared to competitors or larger brands.

Financial Report

Filtration Testing	Description
$5,800.00	**Grant Funding**
-$3,000.00	Lab Testing, consisting of DO, DCO2, FSO2, and Turbidity
-$1,800.00	Chemicals, filter pads, yeast, nutrients, nitrogen gas
-$1,000.00	Operating Costs of Centrifuge and CrossFlow Systems
$0.00	Remaining Balance