

# Final Technical Report

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Grant 20\*1793 Fermented Beverage Lab at Michigan State University

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## Goals and Objectives

The state of Michigan is one of the leading states in fermented beverage production. Michigan is in the top 10 nationwide for breweries per capita (4.5 breweries per capita) [1]. Vineyard acreage in Michigan has doubled over the past 10 years to 13,700 acreage of vineyards, which makes it the 4<sup>th</sup> largest grape-growing state. [2]. There are 53 Michigan distilleries, which is up from 29 in 2015 [3]. Michigan is #1 in the US in hops production outside of the Pacific Northwest which expanded by 153% in Michigan from 2015-2017 to 810 acres [4]. Michigan is a leading producer in fruits such as apples and cherries – which are also used in fermented beverages.

In order to compete with national brands, Michigan products need to be of the highest quality and consistency. Quality control and quality assurance rely on data collection. However, sophisticated data collection is lacking due to expensive technology, as well as dedicated trained personnel needed to perform key analyzes. **The goal of this project was to support new equipment and maintenance to create an analysis lab to bridge the gap between growers, producers, and important data collection.** In addition, it was intended to complete grain quality analysis on wheat samples grown by another MSU researcher.

Specific goals are outlined below.

- 1) Identify key analyses for quality assurance in Michigan fermented beverage industry
- 2) Select and order appropriate equipment to enhance lab capabilities
- 3) Identify and order supporting supplies for analyses
- 4) Use equipment and supplies to run and validate methods of analysis
- 5) Create a cost basis for each analysis. Create and submit with approval, costs for each analysis. Create fee for service account within MSU accounting.
- 6) Create an online location for customers to request analyses and review costs
- 7) Perform several analyses on Wheat crop for MSU researcher

## Results, Conclusions and Outcomes

The setup of the fermented beverage lab was successful. All equipment purchased has been installed and set up for use in research or industry analysis. In addition, the MSU Malting Barley Quality Lab website is updated with the key analyses offerings. There is also a form to file out to submit samples and contact information if needed. The link to the website can be found here: [https://www.canr.msu.edu/malting\\_barley/lab](https://www.canr.msu.edu/malting_barley/lab)

The wheat analysis was not completed due to problems with wheat cropping.

## Timeline

Grant Effective Dates: April 1, 2020 – July 31, 2021

## Work Accomplished / Methods

Equipment costing over \$5,000 was labeled as equipment while anything less than \$5,000 was labeled as supplies. Equipment purchased and installed via this grant include: a mash bath, a GC headspace sampler, and a friability meter. Details on the importance and use of each piece of equipment is described below.

The mash bath is an electronic programmable water bath with 12 stainless steel beakers with stirrers attached. The temperature of the water and the contents of the beaker are programmable via electronic controls. The mash bath is necessary to produce a liquid wort from a grain sample. The mash bath is required in sample preparation to complete many malt analyses including extract, FAN, soluble protein, color, DP power and more.

The GC headspace sampler was partially funded by this grant with the rest, along with an ECD detector, being funded by a proceeding grant. A headspace sampler is an alternative sampling technique for gas chromatography. In normal liquid auto injecting, a liquid sample is taken from a 1.5 mL vial and injected into the GC. With headspace, a 10-20 mL vial is partially filled with the liquid to be tested. The sampler heats and shakes the vial then eventually withdraws a sample of the gas above the liquid sample, aka the headspace. The headspace is where many volatiles are found in fermented beverages. This sampling technique, accompanied with an ECD detector, allows for quantification of compounds, such as diacetyl, found in very small concentration in fermented beverage samples.

Friability refers to a material's ability to be broken down. In malting, friability is a measure of the grains hardness. A friable grain is crushed easily into several separate parts, which is desirable in brewing as an indication of a well-handled and dried malt. Moreover, friability is a quick and easy method of determining malting effectiveness. The friabilimeter purchased is the only friabilimeter on the market that is designed for malting grains for brewing and distilling. The friabilimeter tests grains by pressing them at constant pressure against wire meshes and measuring the amount passing through [5].

Pictures of the equipment can be seen on page 5 and 6 in the Appendix.

Supporting supplies, reagents and smaller pieces of equipment were also purchased with grant funds. The lab now has numerous research capabilities and research projects are in currently in process.

## Communication Activities, Accomplishments and Impacts.

### Communication Activities

- Virtual webinar tour of the lab
- The Michigan Craft Beverage Council toured the lab
- Michigan Brewer's Guild Conference 2022
- Hop Growers meeting 2022
- Michigan Brewer's Guild Conference 2023

### Accomplishments

- Several samples have been ran for industry members including spirits for glycerol content, wine for several HPLC measurements and repeated customers for ABV content
- Subsequent grant research is being conducted using the equipment, methods and procedures developed via this grant.

### Impacts

- The analysis lab as provided the opportunity to work closer with several research groups at MSU including the barley and small grains for brewing and distilling group and the hops research group
- The analysis lab has provided more education and training to undergraduate students at Michigan State University. This allows higher trained individuals to enter to the growing craft beverage industry in Michigan.

## Budget Narrative

The project conducted was consistent with the budget proposed by the principal investigator and approved by the State of Michigan. No matching funds or additional sources of funding were sought, nor contributed to the work described herein.

## Appendix

### References

[1] Culham, Devin. (2019, January 4). *New report ranks Michigan as one of the states with the most breweries per capita.* [www.metrotimes.com](http://www.metrotimes.com)

[2] Michigan Craft Beverage Council. *Fast Facts.* [www.michiganwines.com](http://www.michiganwines.com)

[3] Pure Michigan. *Distilleries, The spirits of Pure Michigan.* [www.michigan.org](http://www.michigan.org)

[4] Allen, Robert. (2019, February 14). *Michigan grows to No. 1 in hops production outside Pacific Northwest.* [www.freep.com](http://www.freep.com)

[5] Thomas, Keith. *Friability. Craft Beer and Brewing.*  
<https://beerandbrewing.com/dictionary/8HQHnBUUsh/>

## Pictures of Equipment



**Figure 1: Mash bath**



**Figure 2: GC auto sampler**



**Figure 3: Friabilitimeter**