

Alternative Sap Chilling Methods

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I have a new addiction, collecting window air conditioners. While maple producers typically collect old maple syrup containers, chainsaws, or antique maple equipment, I have been on the hunt for good deals on working air conditioners. You may think this is an odd obsession for a guy who lives and sugars in Lake Placid, NY, a place notoriously cold and rarely hits 80 degrees in the height of summer. So why the obsession with window air conditioners? Efficiency during the maple season and syrup quality.

Let me back up. As spring temperatures rise, microbial growth increases rapidly in sap collection systems. This growth degrades sap quality and can lead to spoilage. Poor-quality sap yields poor-quality syrup or sometimes must be discarded. Poor-quality sap complicates syrup production by clogging filters, plugging reverse osmosis (RO) membranes, and increasing foaming in the evaporator. Chilling sap helps preserve quality, enabling producers to store sap longer and process it when convenient. This flexibility is especially helpful for part-time producers and those managing large operations. Chilling also enables longer, more efficient boils. By chilling sap and boiling less often, I reduced the number of times I boiled by 40% this past season saving

over 24 hours in post boil cleanup.

Maple producers are starting to incorporate sap chilling into their production systems. Previously there was little information for producers to reference on sap chilling techniques. The Cornell Maple Program just published two new sap chilling documents on our www.CornellMaple.com website. The first document is overview on chilling sap and covers different chilling techniques and how to size a chilling unit.

Previously, most maple producers who were chilling sap were utilizing used milk tanks with direct refrigerant compressors. Refrigeration is efficient and effective but requires a specialist to connect and service. Additionally, older milk tanks may have leaking valves, compressors that no longer work, or use refrigerant no longer available. All issues I ran into when trying to get an old milk tank hooked up but ended up deciding it was not financially worth it.

Less utilized in the maple industry is chilling maple sap with glycol chiller. Glycol chillers are commonly used by many industries from manufacturing and food production to the brewing industry. Glycol chillers utilize a refrigerant system and a chilling coil to cool down a solution of glycol that can be

pumped in a loop to a heat exchanger or chilling plate and back to the chiller. As the chilled glycol passes through a chilling plate or heat exchanger, it removes heat from the solution in which the chilling plate is immersed. Glycol chillers do utilize refrigerant and a compressor, but the refrigeration components are completely contained within the unit and do not require a specialist to connect. Pumping chilled glycol from the chiller to a chilling plate or heat exchanger requires only minimal plumbing skills. Although slightly less efficient at chilling than a direct refrigeration system, glycol chillers are a more cost-effective way to chill maple sap due to a combination of lower upfront costs and ease of set up and long-term maintenance.

Instead of refrigerant, glycol can be pumped through the cooling plate in the wall of a used milk tank. The use of glycol chilling also provides flexibility such as adapting existing sap tanks into chilling tanks or in line sap chilling through a heat exchanger.

Thanks to funding from the Northern NY Agriculture Development Program we tested the use of a glycol chiller at the Cornell University Uihlein Maple research Forest during the 2025 maple season.

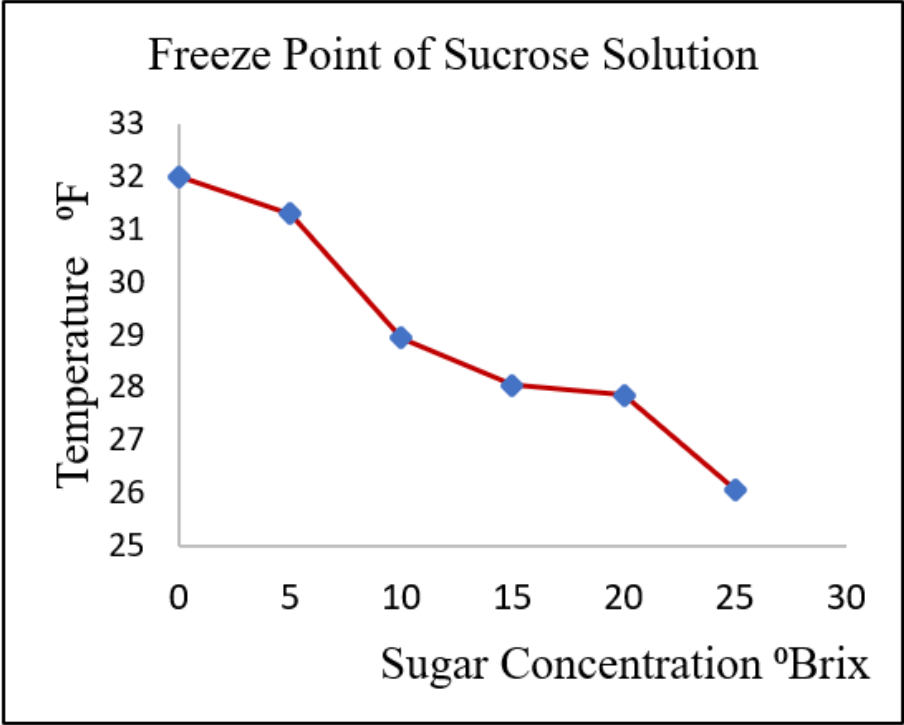
Overall, we were thrilled with the effectiveness of chilling maple sap with a glycol chiller and we plan to continue use for future production seasons. Details on glycol chiller performance, glycol selection, and sizing a unit available in the new sap chilling document.

So why air conditioners? Purchasing a glycol chiller can still be expensive. Instead, I am building glycol chillers out of a window AC unit and a picnic cooler. The picnic cooler is filled with glycol water solution and then the front cooling coil of the air conditioner is inserted into the glycol solution to chill the glycol. This chilled glycol is then pumped through whatever cooling plate is used for chilling sap. This process does require rewiring a new thermostat to the AC unit to be able to chill to a lower temperature. The amount of parts and materials is minimal. Purchasing a new 7,000 BTUs/hr. glycol chiller costs around \$3,500. To build a similar size unit from an AC unit and a picnic cooler costs around \$135-\$500 depending on if purchasing a new AC unit or buying used. You may even have an unused AC unit laying around. Want a good deal on an AC unit? Look in the fall or winter. I found a great deal last November and the next day I found a free picnic cooler along the side of road. Score. I have built a few chillers now.

During the 2025 maple season we utilized two of the DIY sap chillers to connect to a milk tank. Many milk tanks have two separate cooling plates with their own supply and return lines. I hooked one of the chilling units to each chilling plate. Having two smaller chillers provided similar size chilling capacity as the \$6,000 purchased chiller. Wi-Fi outlets and Wi-Fi connected thermostats allowed for remote operation and monitoring. The DIY chillers performed well and were able to chill 22 °Brix concentrate to the set point of 29 °F. Higher brix sap can be chilled to a

lower temp without freezing (Figure 1). We hope to continue utilizing the chillers next maple season.

Figure 1. Freezing point of sucrose water solutions at different concentrations.



Note that this is pure water and sucrose without minerals or other compounds.

Data from: Jayawardena, Erandya, Vanniarachchi, M.P.G, & Wansapala, Jagath. (2017). Freezing point depression of different Sucrose solutions and coconut water. Journal of Food Science and Nutrition. 2. 68-71.

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If you want to build your own glycol chiller, our second new document covers step by step how to build your own chiller. The document is called “Do it Yourself Maple Sap Chiller” and is available on www.CornellMaple.com. We also have a video available on the Cornell Maple Program YouTube page

The following table provides a quick reference for the BTU/h rating needed for chilling different volumes of concentrated sap.

Table 1: Approximate chiller rating (BTU/h) needed per volume of sap.

Gallons Sap¹	BTU/h Chiller²
100	2,200
250	5,500
500	10,900
750	16,300
1,000	21,700
1,250	27,100
1,500	32,500

¹Assumes the sap has a sugar content of 2 °Brix and a density of 8.39 lb/gal.

²Calculated using a change in sap temperature of 30 °F over 12 hours. Chiller rating is rounded up to the nearest 100 BTU/h.

If you have questions about chilling sap, sizing a glycol chiller, or building your own chiller, get in contact. Adam-Wild@cornell.edu (518) 523-9337.

Thank you to the Northern NY Agriculture Development Program for funding

the work, the Upper Hudson Maple Producers Association for donating a milk tank for connecting the glycol chillers to, and than you to Kara Lynn Dunn, Ailis Clyne, and Aaron Wightman for reviewing the chilling documents.



Image 1: DIY glycol chiller connected to a 1,500 gallon tank for testing at the Uihlein Forest

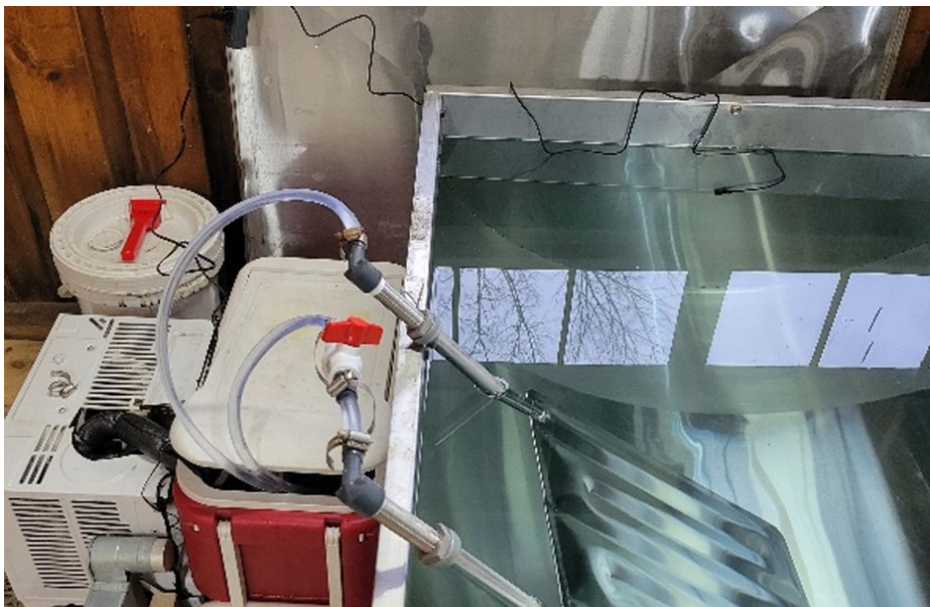


Image 2: DIY glycol chiller connected to a chilling plate in a small maple sap tank.