ALTERNATIVE FUELS FOR EVAPORATORS *reprinted from Farming, the Journal of Northeast Agriculture August, 2009*

With the high probability of increasing energy costs in the future, maple producers should be aware of new ways to improve efficiency in the sugaring process. Three fuels for running the evaporator that were not mentioned in last month's column about energy efficiency are wood chips, wood pellets and used vegetable oil. The use of each, once the evaporator or arch is properly adapted, could provide long term savings and/or convenience compared to burning oil, or even cordwood. All three fuels have the capability of automatic feed into the firebox, much like oil, and the added advantage of freeing the sugarmaker from purchasing a foreign and non-renewable energy source.

Wood pellets, which are becoming popular as a residential heating fuel, are dry compressed sawdust, made either as a byproduct of the lumber industry from waste, or more expensively from raw wood. They are sold to homeowners in bags but can be purchased un-bagged from mills at considerable savings—although regional supply may be tight in the winter. Because pellets are dry, the extractable heat is high (about 20 lbs of pellets equal the Btu's of a gallon of fuel oil), which makes burning them very efficient. In 2009, Nick and Garth Atherton, who work for Maple Pro in St. Albans, VT, tested a prototype of a wood pellet burner developed by CDL and installed in a high efficiency "Intens-O-Fire" firewood arch. Pellets were dumped by hand into a hopper, where they were fed through a pipe containing a small diameter auger to an 18" x 24" "pot" in the firebox. The auger speed, and therefore the rate of fuel consumption, was controlled by the operator. The Athertons estimated that they were burning 440 lbs of pellets per hour and making 32 gallons/hr with 11% concentrate. This rate of fuel consumption, 13.75 lbs pellets/gallon syrup, amounted to about 90 cents (US) in pellets per gallon of syrup made. Because the flame produced by the pellet burner is horizontal, very similar to an oil burner flame, the CDL engineers are developing an add-on unit to replace an oil burner in an arch, which they hope to market in the near future. A standard wood burning arch would be considerably more difficult to adapt to burn pellets.

Wood chips are a cheaper alternative to wood pellets; they are readily available but have high moisture content. In order to extract high heat from chips, pressurized air must be pumped into the firebox, creating turbulence that ignites the gasses given off by the hot, moist wood. After burning 1300 gallons of very expensive oil in 2008 for his 6000 tap operation, Lee Davis of Underhill, VT converted his arch to burn wood chips for the 2009 season. During the summer he bought 40 tons of "mill run" chips for $30/ton, chips that were cleaner and more uniform than the chips that large utilities might burn, and transported them to a newly constructed shelter at his sugarhouse. He completely reconstructed the arch, spending thousands of dollars and many hours on modifications that included raising it by a foot to accommodate a large space for the gasses to fully ignite under the pans. The enlarged firebox, now lined with brick, was supplied with air from both underneath the grate and from the top and supplied with chips from a large auger system. Chips were fed from a hopper outside the sugarhouse that was filled with a bucket loader. In 2009, Lee made 3500 gallons of syrup from 7500 taps. He burned an estimated 30 tons of chips, at a cost of 26 cents per gallon of syrup, not including the cost of transporting the chips to his sugarhouse. While this cost is not directly comparable to pellets, due to the Lee's use of high efficiency pans and steam recovery device, it is a remarkable example of just how inexpensive fuel for the evaporator can be.

The third alternative fuel, used vegetable oil (UVO), also known as "yellow grease," is produced in great quantity by the fast food industry. It currently has many uses, including powering agricultural combines,

as well as road vehicles. Sugarmakers have an advantage over other potential UVO users in that there is lower demand for it in the winter, since it is harder to keep UVO as a liquid in the cold. Straight from a restaurant, UVO may contain water and other contaminants, which must be filtered and settled out before it can be burned in an evaporator. Some companies are now in business to supply UVO to consumers, in which case the oil will be cleaned and ready to burn. Even if purchased, UVO will probably always be cheaper than #2 fuel oil. Since 2007 when he installed the necessary infrastructure, Dan Crocker of Putney, VT has successfully used UVO in his 24,000 tap operation, both as a fuel for his Thunderbolt evaporator and for his generator. While he is set up to take a tanker load of fuel which he stores in an insulated tank, smaller operations could obtain oil, perhaps from a restaurant that buys their wholesale syrup, and store it in the sugarhouse, where it could be kept warm more easily. In order to properly atomize in an oil burner, UVO must be further heated to around 210 degrees before it hits the oil gun. Excess hot water produced in an evaporator could provide some of the energy needed to heat the UVO.

Further information about conversion of a maple operation to use one of these fuels can be found in the publication http://www.uvm.edu/~pmrc/Combustion.pdf. Talking to producers who have experience making such a conversion would also be very helpful. While the labor and expense of switching to one of these fuels may make the payback time seem very lengthy, sugarmakers who do this will have the added advantage of being able to tell their customers that their natural product is made using "green" technology—which might benefit sales quite a bit.

Chips arriving by an auger system in Lee Davis's evaporator become an inferno in the firebox.