Greenhouses Heated With Waste Oil A True Story

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An alternative fuel source-used crankcase oil-has provided heat for three seasons at a forest tree nursery in northern Idaho. This environmentally safe system has proved economically sound as well, with fuel savings paying for the cost of the equipment in 2 1/2 years. Tree Planters' Notes 44(4): 146-148;1993

Waste oil has been used as an effective fuel for heating greenhouses where reforestation seedlings are produced. The EPA has stated that an environmentally safe way to dispose of used crankcase oil is to burn it in a certified burner. The heat energy released during that combustion can provide sufficient energy to heat greenhouses. A burner box inside a large tank of water can produce, store, and transfer many thousands of British thermal units of heat (BTU's) to extraction radiators. This system has been operated for three production seasons in a fairly extreme northern climate and has proved itself to be environmentally safe and economically sound. This same system can be converted to burn other fuels.

This description of our waste-oil burner system for heating our greenhouse does not present data of a scientific nature. Rather, the evidence that our heating system works is purely anecdotal, in other words it does work for us and works very well in our setting. The measure of BTU output, the insulation factor of the various greenhouses, the quality of fuel being burned, and many other factors would and could vary to change the overall efficiency of this system. As in other aspects of greenhouse production, the solution should fit the problem, but the problem is different in each unique setting. We hope that this solution to our particular problem will provide assurance that such a basic idea can be modified to provide an efficient and environmentally sound source of heat energy.

Geographic Considerations

North Woods Nursery, Inc., is located in a forested area of northern Idaho that can best be described as remote and isolated. At almost 47/ N latitude, Elk River is located in a snow belt with cold, snowy winters. First snow falls in late October and remains on the ground until mid-April. Greenhouses at North Woods Nursery are in operation from March to mid December. It is more than 20 miles (32.2 km) to a natural gas pipeline. Propane is available from suppliers over 50 miles (80.5 km) away but it is expensive and requires bulky storage tanks that need costly maintenance calls.

History of Conversion to Nontraditional Fuels

In 1989, we decided to switch from expensive propane to a wood-burning system. We found a stove system that seemed to meet our needs in Turbo Burn of Spokane, Washington, and had it installed during the summer. We operated it through January of 1990 using slab wood as the only fuel. The system was successful in maintaining temperatures above freezing in five 108- x 30-foot (32.9- x 9.1-m) double-poly houses, approximately 16,200 square feet (1,506.6 m^2), when outside temperatures fell to -40 /F (-40 /C). Wood proved to be adequate as a fuel source, but the labor required to feed the fire was the primary motivation in the decision to convert to a waste-oil burner for the spring crop of 1990. We have used waste oil as the heat fuel source for our greenhouses since that time.

How the System Works

The system consists of a burner box located inside a large metal tank that holds 1,500 gallons (5,670 liters) of water. A fire inside the box heats the water to nearly boiling. This is not a pressurized system, so water temperatures do not exceed 212 /F (100 /C). A network of pipes connects the hot water tank to radiators located in the greenhouses. Pumps controlled by thermostats circulate the water through this system. At the radiators, large fan jets (left over from the old propane burners) pull air through the radiators and conduct the warmed air under the growing benches in poly tubes. The cooled water is pumped back to the storage tank where it is reheated (figure 1).

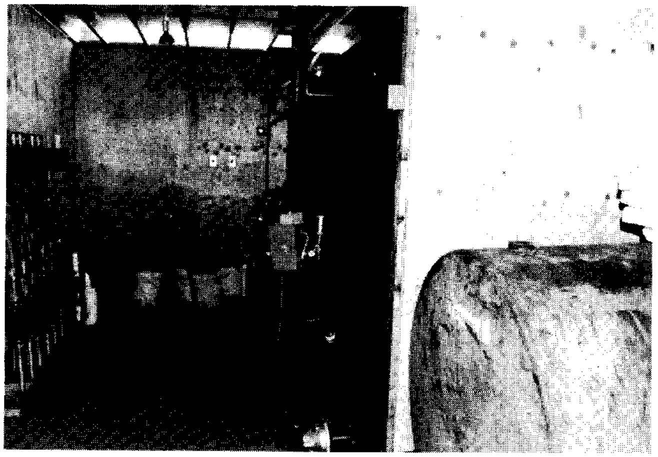

Figure 1—*Interior of barn showing burner box, oil drum, and tubing that transports hot air to 6 greenhouses.*

How Well It Works

In planning the system, we paid close attention to anticipating and avoiding problems before they occurred. This proactive philosophy has probably saved hours of headaches. Insulating all areas where heat could be lost has made the system fairly efficient. The building that houses the burner and water storage tank has 18-inch-thick walls. Roof and walls are both filled with "blown in" insulation material (figure 2).

The pipes that connect the storage tank to the greenhouses and back are buried 2 feet (.6 m) underground and housed in 12 inches (.3 m) of rigid foam insulation. The loop of pipe that connects the storage tank to the radiator and back is a continuous polybutyl pipe with all its fittings above ground. The oil tanks are housed adjacent to the burner in insulated rooms,

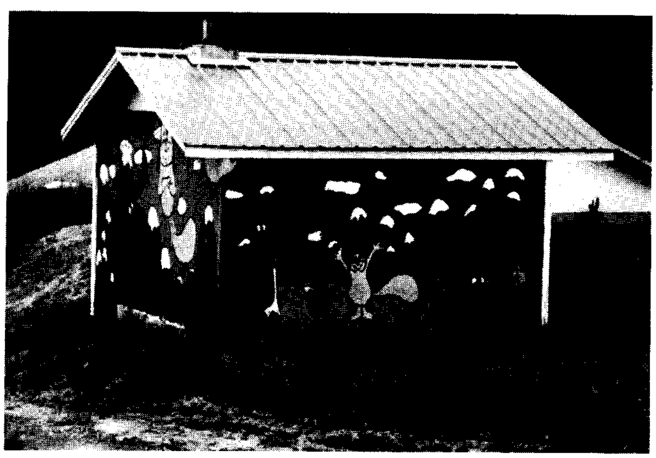

Figure 2—*Exterior of barn.*

to help keep the oil warm enough to flow efficiently and add more protection from cold temperatures to the burner room.

The first radiators that we installed in the system were used truck radiators. Although they proved adequate, we have since replaced them with more efficient heat exchange units that have four copper coil; and a much larger exposed area to extract the heat.

Handling, Safety, and Environmental Considerations of the Fuel

At this time, the only EPA-recognized way to dispose of waste oil is to incinerate it in a certified burner. The source of fuel for our burner has been used crankcase oil from farms and logging companies in our area. The fuel arrives at the nursery in 50-gallon (189.3-liter) drums and is pumped into the larger storage tanks adjacent to the burner. The ground immediately adjacent to the building is lined with a vinyl sheet in the case a serious spill needs to be removed. The rest of the area is lawn grass. The grass and soil organisms can successfully breakdown minor spills. The residue left after combustion is essentially inert, and its quantity and composition depend on the first use of the oil. We save this residue in a coffee can and take it to the nearby landfill once year on their household toxic chemical disposal day.

General Maintenance

We added a special anticorrosion chemical to the water storage tank as recommended by the dealer and covered exposed pipes and pumps with heat tapes f very cold temperatures. To prevent freezing damage, we remove and store the radiators when they are no in use in the winter.

Side Benefits

The storage tank is also fitted with a coil of copper pipe through which fresh water circulates. The resulting hot water at 170 /F (76.7 /C) is used to sterilize the trays.

Payback and Tax Benefits

At this time we are exploring the tax benefits and special loan opportunities that are available for individuals and businesses that are pioneering alternate energy technologies. We recovered the cost of the burner, pipe, and labor to install this entire system in 2½ years by saving on the cost of propane fuel.

Should You Convert to This System?

The primary motivation to convert to this system could well be economic, but the environmental benefits are also great. Safe disposal of a large quality of waste oil can have a very positive impact on the environment. Some states do monitor burner sites and ask that operators test their fuel source on a regular basis. This minor requirement does not overshadow the major benefits of such a system.

Summary

Heating greenhouses with waste oil as a fuel appears to be a feasible solution to two problems: first, finding an inexpensive fuel source that is readily available, and second, using an environmentally safe and approved method to dispose of a potentially harmful product. The technology to convert to this system is available and new higher output burners and more efficient equipment are on the horizon.