USING GEOTHERMAL HEAT PUMPS IN A PROPAGATION NURSERY

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The term "geothermal" could perhaps be misleading if one thinks of geothermal as meaning hot water out of the ground. Our water comes from the ground at 52°F and is used successfully with heat pumps for propagation of cuttings in heated soil beds. No benches are involved, and we do not heat the air.

In our main propagation greenhouse, the heated soil block is 14,000 sq. ft. with an unheated 15 to 20 ft. perimeter to reduce heat loss to the outside.

We use a low temperature (80° to 90°F) system. Water is circulated in the beds through ½ in. PVC pipe placed approximately 4 in. apart and buried 1 to 2 in. beneath the surface.

In order to distribute the heat evenly, we plumbed the system to force the water to travel the same distance for all the beds, whether it be the first bed or the farthest one at the end of the house.

Beds are plumbed in sets of two. The warm input line feeds each set through the manifold of its first bed, and the water is returned through the second bed.

The return water from all beds flows into a 3 in. cold return pipe, picking up water from the outputs of each additional set of beds as it continues away from the pump. When it receives the cold water from the farthest bed, it makes a "U" turn and flows directly back to the pump.

Oregon offers an energy-saving tax incentive which requires, for a geothermal installation, a heat pump with a COP (Coefficient of Performance) of 3. The 3 COP = the ratio of heating produced from 1 BTU of energy. Thus, it must be three times more efficient than conventional electric heat.

To locate a heat pump to meet this COP requirement, we made an extensive research and located the Hydron, manufactured in Michigan, for this new installation. Our former five 5-hp heat pumps were satisfactory, but they were no longer manufactured.

We have been using water-to-water geothermal heat pumps for several years. For us, the advantage of the water to water type over the air type heat pump is evident since our well water is 52°F year round, regardless of outside air temperature. Obviously, 52°F water could have more heat than 20°F air temperature.

We were already using our irrigation pumps to supply water to our former heat pumps. The two uses are compatible since usually we do not irrigate and heat at the same time.

To receive maximum use of the electricity required for pumping, we decided to use the well water twice. After the 52°F water goes through this heat pump, it is exhausted at approximately 44°F. This chilled water is then sent through the Hydron heat pump which extracts an additional 8°F approximately. The efficiency, even with this chilled water still exceeds a COP of 3.

How do we get rid of this much exhausted water? We already had an oversized rock-filled drainfield to care for the water which drained from our large greenhouses, several of which are 200 ft. long. This chilled water is exhausted into that. This means, actually, that we are only taking the water out of one place in the ground and putting it back in at another location.

To help you compare costs:

A COP of 3 produces 3 BTU's of heating from 1 BTU of electric energy input.

Resistance electric heat	= 3420 BTU's per KWH
Oil	= 105,000 BTU's per gallon, figuring approximately 75% boiler efficiency
105,000 BTU's	= 30.77 KWH.
At 5¢ per KWH	= $1.54
Heat pump with COP of 3 (3 BTU's of heating from 1 BTU of electric energy)	= 52.4 cents
Plus electricity to pump the well water, approximately 20%	= 62.4 cents

This is the equivalent of paying 62.4 cents per gallon for oil.

At the time we installed our heat pumps, electricity was less than 3¢ per KWH. But even with its costing about 5¢ now, we figure we are still saving about one-third as compared to heating with diesel oil.

Whether a heat pump would be practical for you would depend upon the cost of electricty and how efficient your boiler was.

If you are changing from an existing hot water system it is easy to see that you would need to greatly increase your heating area (pipes or heat exchangers) to compensate for the lower water temperature.

You must also calculate the initial cost of a heat pump. But considering today's high heating costs, we have found that a heat pump can pay for itself within a few years.

VIRUS ERADICATION THROUGH IN VITRO TECHNIQUES

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Abstract. *In vitro* heat therapy was successfully used in combination with shoot-tip culture to generate grapevine fanleaf virus-free *Vitis vinifera* 'Ranny Vira' but not grapevine leafroll-free *V. vinifera* 'Schuyler' or *V. piasezkii.* A combination of shoot tip culture and *in vitro* chemotherapy with either DHPA or vidarabine was ineffective in generating grapevine leafroll-free *V. vinifera* 'Limberger' while ribavirin appears more promising.

INTRODUCTION

Two important diseases of grapevines are grapevine fanleaf (GFL) and grapevine leafroll (GLR). Both have inflicted serious economic losses to the grape-growing industry. Consequently all new introductions of grapevines into Canada are indexed for these diseases at Saanichton as part of the national plant quarantine program.

New introductions found to be infected need to be cleaned up before they are released for commercial propagation. The conventional treatment consists of growing the infected plants in a heat therapy chamber, where they are subjected to a continuous heat treatment at 38°C. After 100 days 2 cm shoots are removed and grafted onto the appropriate virus-free woody indicator. The grafted indicator plants are then monitored for symptom expression. Only some 48% of the tips generated by this method are free of grapevine fanleaf virus (GFLV). With GLR the success rate is lower. At least part of the reason for the fact that the proportion of pathogen-free tips is relatively low may be that only large shoot tips can be taken from the heat-treated grapevines for grafting onto the woody indicators.

A simple solution to this aspect of the problem lies in combining heat therapy with tissue culture. Much smaller shoot tips can be excised from grapevine tissue cultures heat treated *in vitro* than from conventionally heat-treated plants,