

NEW GREENHOUSES IN KLAMATH FALLS

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A state-of-the-art 50,000-sq ft greenhouse, heated by geothermal energy, was recently put into operation in Klamath Falls, Oregon (Figure 1). The greenhouse, which uses technology that has long helped Canada dominate the market for tree seedlings is operated by IFA Nurseries, Inc., based in Canby, Oregon. The facility can raise about two million seedlings of ponderosa pine, Douglas fir, hemlock and other species, depending upon the demand of customers. Eventually, they plan to have four greenhouses in operation, producing about eight million seedlings a year. A second greenhouse is currently under construction and will be ready for use this fall (Figure 2).



Figure 1. *50,000-sq ft greenhouse currently in operation.*



Figure 2. *The second greenhouse under construction.*

The operation was located in Klamath Falls to take advantage of the geothermal heat available from the city's district heating system. To attract the business, the city of Klamath Falls extended their hot water pipeline from the downtown to the greenhouse, located on the edge of town near the South 6th street overpass and city maintenance yard. The heated water is provided from the supply side of the district heating system (see Brown, 1999) at 180°F, and the spent water is then piped to the return side of the district heating loop. A plate heat exchanger (Figure 3) transfers the heat to a secondary loop using a water-glycol mixture (Figure 4). This loop then provides heat to a series of under-bench fan coils and hot air plastic distribution tubes (Figure 5). IFA pays the city for the heat at a rate somewhat less than the corresponding natural gas rate, which does not fluctuate with the market.



Figure 3. *The main plate heat exchanger.*

The seedlings, growing in long rows of Styrofoam containers (Figure 6), are watered by long wands that slide across the ceiling. A computer controls the heat supply, watering, lights and ventilation through opening and closing perimeter curtains and vents in the roof. Controlled lighting and uniform temperatures help the growth rate, as what normally would take a year to grow in normal light, grows in six months in this controlled environment. In addition, seedlings grown indoors in containers usually survive transplanting better than those from outdoor nurseries; where, they are uprooted for shipping. Typically, about 98 percent of the seedlings grown in the nursery's Styrofoam containers survive transplant. The customers include Boise, Sierra Pacific and Roseburg Forest Products, for planting in California, Oregon, Nevada and Idaho.



Figure 4. *Secondary distribution system being installed for the new greenhouse.*



Figure 5. *Under-bench heating system.*

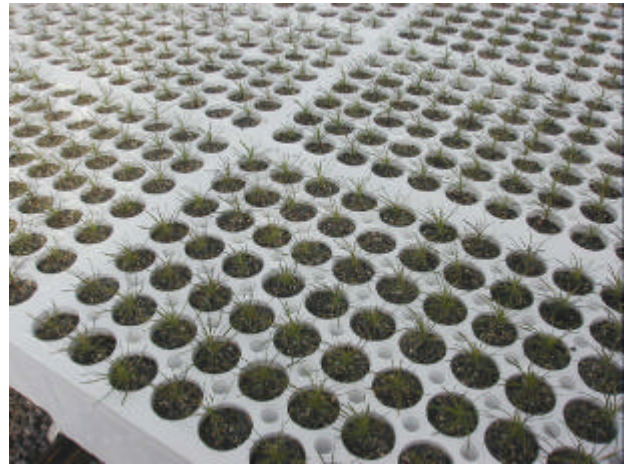


Figure 6. *Tree seedlings in Styrofoam containers*

ACKNOWLEDGMENTS

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REFERENCES

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