AGRICULTURE & AQUACULTURE CASCADING THE GEOTHERMAL WAY

John W. Lund
Research Associate

INTRODUCTION

The Liskey Farms, Inc. greenhouses, located about 10 miles south of Klamath Falls, are back in operation. The main greenhouses, originally built in 1978 to raise trees for reforestation (see Laskin, 1978), were idle in the late 1980's. In 1990 they were cleaned up and put back into operation growing bedding plants and perennials this time, with the first crop sold in May of 1991.

The original geothermal resource was once considered a nuisance to Jack Liskey, the ranch owner. It was later used for house heating and, after cooling in surface ponds, for stock watering and crop irrigation on the 120-ha (300-acre) ranch. It has also been used for cooking cull potatoes for cattle feed and for frost protection of crops. However, neither of these ideas worked well. Presently, it is still used for space heating, for washing equipment, and mixing with chopped hay to soften it for feeding calves. At peak use, the approximately 0.6 ha (1.5 acre) greenhouses use 1500 L/min (400 gpm) and the waste water is then supplied to tropical fish ponds, and finally cooled and used to water cattle.

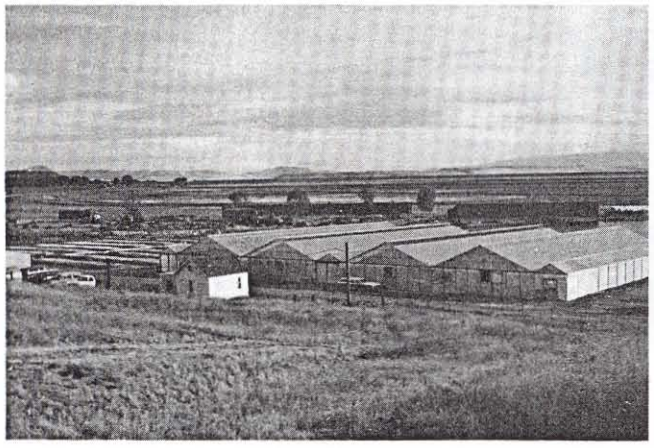

Figure 1. Greenhouses with fish ponds on the left.

There are six geothermal wells on the ranch ranging from 93° C to 27° C (199° F to 80° F). Some are very close together, but have different chemical composition, suggesting they tap different aquifers. The main well used for the greenhouse heating is 90 m (300 ft) deep with a water surface 12 m (40 ft) below the ground. It can produce as much as 3780 L/min (1000 gpm) of 90° C (195° F) water with only a 6 m (20-ft) draw-down. The water is pumped up to a tank (salvaged from a tank car) buried atop a hill overlooking the greenhouses. A rod connected to an internal float protrudes above ground from the tank, to visually indicate the water level in the 37.8-m^3 (10,000-gallon) capacity tank. A float switch activates the well pump to charge the tank when the water level drops to a preset point. An emergency generator in the pump house is capable of driving the pump during power failure.

Water from the tank flows by gravity to the greenhouses, arriving with about a 9-m (30-ft) head and a temperature between 82° and 85° C (180° and 185° F). Depending on the outside temperature, the water leaves the greenhouses between 74° to 85° C (165° to 180° F).

GREENHOUSES

The greenhouse complex was designed by Balzhiser and Colvin Engineering, Inc. of Eugene, Oregon. The main complex consists of four houses 13 m by 46 m (42 ft by 150 ft) provided with three 4.5-m (15-foot) wide breezeways. Each house has 3-m (10-ft) high walls and a center peak that rises to 6.5 m (21 ft). They are all covered with a single layer of plastic. The outside walls can be rolled up for additional ventilation and each house can be isolated by an interior curtain.

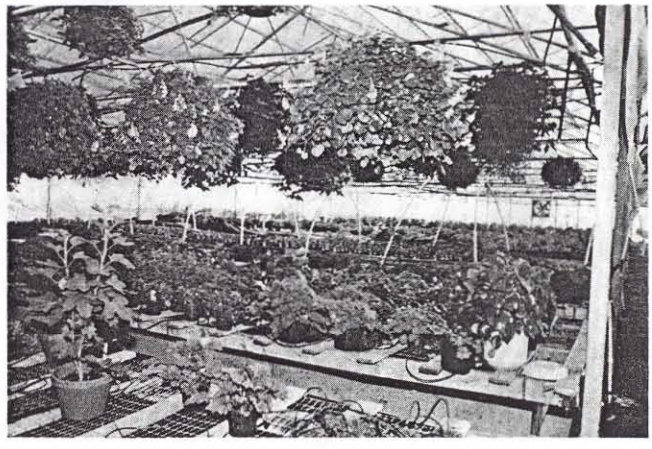

Figure 2. Interior of the greenhouses.

Nineteen tables, each 1.8 m by 12.5 m (6 ft by 41 ft), run the width of each house. Trays of plants are placed on each table and watered by a drip irrigation system. Heating is provided by finned tube pipes below each bench. A metal shield is placed over each heating tube to better distribute the heat under the benches. Additional heating is provided by finned tube pipes around the perimeter of the houses and just

below the eves. The eve heating system was original designed to take care of snow and ice buildup at these low points, but this was found not to be a problem.

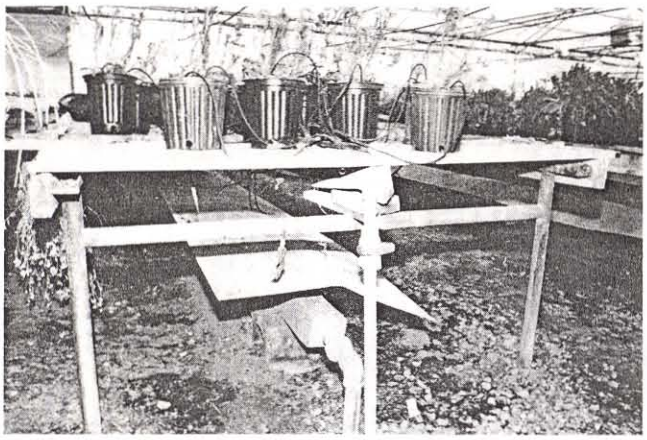

Figure 3. Under bench heating system.

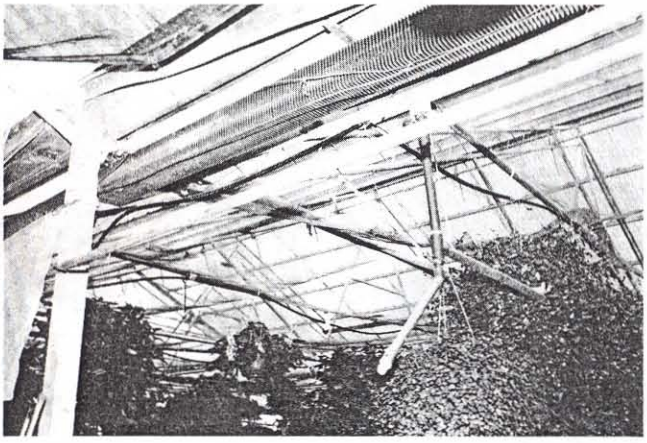

Figure 4. Eve heating system.

These greenhouses are used to raise bedding plants and perennials. Each season, running from early January to mid-July, 6000 flats of annuals, 1000 flats of perennials and 900 hanging baskets are produced. A total of 13 employees are used during the peak season, with only two part time people off season. This year they are in operation during December to provide poinsettias, cacti and dried flowers. All of the plants are sold in Klamath Falls.

In addition to the gabled greenhouses, a 61 m by 18 m (200 ft by 60 ft) double plastic covered arch greenhouse is used to grow about 8000 tomato plants each season.

Several unusual uses of geothermal water are being tried in the greenhouse. The first is a bathtub used to sterilize plastic flower pots. The pots are only emersed in the hot water, thus saving the time and cost of washing them. An old walk-in freezing is also being used with geothermal water. It has been modified for seed germination using the vapors from the near boiling hot water. They are also planning to use the hot water as a weed killer on the ground between the benches.

Figure 5. Sterilization bathtub.

Figure 6. Seed germination cabinet.

AQUACULTURE

The effluent from the greenhouse water is used to heat 37 shallow tropical fish ponds adjacent to the greenhouses. These ponds, approximately 30 m (100 ft) long and 4 m (13 ft) wide vary from 1 to 1.4 m (3 to 4.5 ft) deep. They are kept at a constant 23°C (74°F) temperature by thermostatically regulated solenoid valves. The ponds are unlined and are fed geothermal water from a header running between rows.

The ponds were originally used to raise Gambusia (mosquito fish), and were acquired about five years ago by the present owner. At the present time 85 varieties of cichlid fish which survive in hard water, are raised for pet stores in the San Francisco Bay area and Portland. Approximately 1000 fish 7.5 to 10 cm (3 to 4 inches) long, are shipped each week

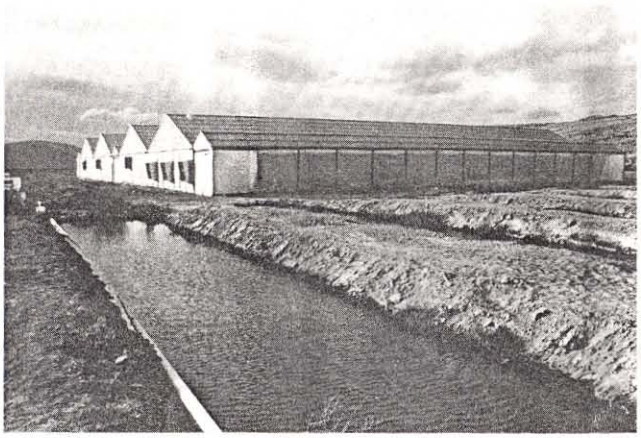

Figure 7. One of the 37 fish ponds.

Figure 8. Header pipe used to supply geothermal water to ponds.

from the local airport. The fish are harvested by traps placed in the ponds. The geothermal heat is a real advantage, as the greatest demand for the fish is during the winter months.

The outflow from the ponds is then cooled in a large storage pond and finally used for stock watering. Thus, this is a good example of maximizing the use of geothermal water by cascading.

ACKNOWLEDGEMENTS

I would like to thank Vicky Azcuenaga, greenhouse manager, and Ron Barnes, manager of the tropic fish ponds for providing information for this article.

REFERENCE

Laskin, Saul, 1978. "Klamath Greenhouses," Geo-Heat Center Quarterly Bulletin, Vol. 3, No. 4 (July), Klamath Falls, OR, pp. 4-7.