MASSON RADIUM SPRINGS FARM

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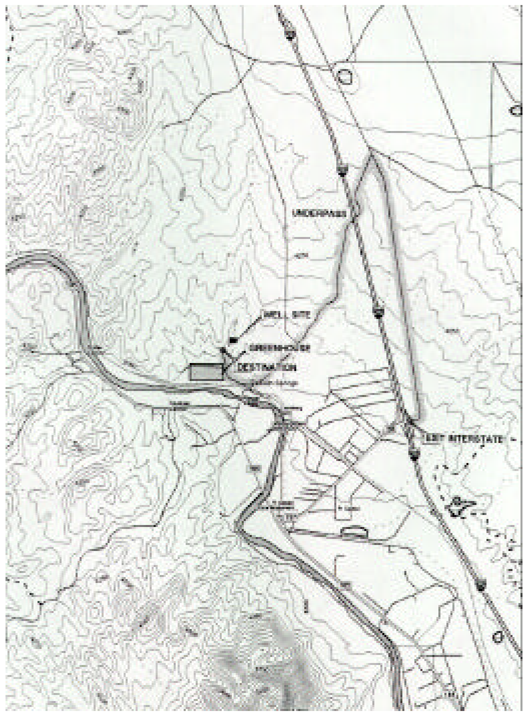

Figure 1. Location map of the Masson Greenhouses (Witcher, 2001).

INTRODUCTION

The Masson Radium Springs Farm geothermal greenhouses are located on private land in southern New Mexico 15 miles north of Las Cruces and just west of Interstate 25 near the east bank of the Rio Grande adjacent the Federal Radium Springs KGRA (Figure 1). The operation started in 1987 with four acres of geothermally-heated greenhouses (Whittier, et al., 1991). Prior to startup at Radium Springs, Masson was one of the first clients in the SWTDI/NMSU business incubator and research Geothermal Facility. Masson selected New Mexico and the Radium Springs area to take advantage of the sunshine, ease of climate control because of the dry desert air, a willing and trainable work force, and geothermal heat. Today, the greenhouses employ 110 people, and cover 16 acres in two major modules, each with shipping and warehousing buildings attached (Photo 1). The Masson Radium Springs Farm is the production facility for Alex R. Masson, Inc. of Linwood, Kansas which handles distribution, marketing, and sales of wholesale potted flowering and tropical plants. The markets cover southern Arizona, New Mexico, west Texas, and the mid-west, and the products are sold under the registered trade name of Sunflower Sue (http://www.sunflowersue.com/). The Masson Radium Springs Farm geothermal greenhouses are used to produce more than 30 groups of potted plant products including season products such as poinsettias.

GEOLOGY AND HYDROGEOLOGY

The Radium Springs geothermal system is one the largest in the southern Rio Grande rift and the main thermal anomaly extends northward from Radium Springs nearly 10 miles over a 3-mile wide swath. The Radium Springs geothermal system is confined to a late-Tertiary horst block bound on the east by a major Pleistocene normal fault, and on the west by several smaller late Tertiary and Quaternary faults (Seager, 1975). However, the pre-Tertiary bedrock or reservoir host in the horst is dominated by large-scale Laramide reverse faults and associated folds, and minor thrust

 

Photo 1. Two views of the greenhouses.

faults in Precambrian granite and Paleozoic limestones. These deformed rocks are apart of the frontal convergence zone of a very large basement-cored and northwest-trending Laramide uplift that has since been sliced apart by north-striking Tertiary rift normal faults (Seager, et al., 1986). The Laramide compressional deformation of Precambrian and Paleozoic rocks with an overprinting of extensional faults forms a favorable host for the deep or parent reservoir at Radium Springs and northward in the subsurface to San Diego Mountain. The deep reservoir is confined by up to 1,000 feet of altered andesitic volcanic mud flows (lahars), and muddy gravely sand and muddy andesitic boulder conglomerate of Eocene age called the Palm Park Formation (Seager, 1975).

At Radium Hot Springs, a low angle, north-dipping rhyolite dike acts as the conduit or "hydrogeologic discharge window" out of the deep Precambrian-Paleozoic reservoir for thermal water flow to the surface across the Palm Park aquitard (Witcher, 1988 and 2001). Because the shallow rhyolite dike of probable Oligocene age is also highly fractured, it forms a shallow outflow plume reservoir at Radium Springs that ultimately discharges thermal water into the near surface river gravels and sands of the Rio Grande.

The geothermal water at Radium Springs is a sodium chloride type with total dissolved solids (TDS) between 3,600 and 3,700 mg/L (Witcher, 1995 and 2001). Because of the high chloride content between 1,500 and 1,700 mg/L, chemical corrosion becomes an issue, requiring titanium alloys to be used in the heat exchangers.

Currently, three wells, drilled on private land, are online for production purposes. A fourth well, Masson 36 well, is on a Federal BLM lease held by Masson and has not gone into production due in part to the costly requirements of installing and maintaining energy meters for production monitoring to determine royalties. The Masson 36 well is probably capable of producing more than 1,500 gpm of 210ºF (Witcher, 2001) (see vol. 22, no. 4 - December 2001 - issue of the *GHC Quarterly Bulletin* for details on this latter well).

Pump and recovery tests of a shallow (<250 ft depth) Masson geothermal well in the fractured rhyolite dike reservoir indicates a transmissivity of about 45,000 gpd/ft (Gross, 1986). Pump testing also shows that the shallow reservoir has some hydraulic connection to the near surface cold fresh water aquifer. Quantitative properties of the deep reservoir are not known at this time. However, this reservoir is isolated from near surface cold aquifers by up to 1,000 ft of clayey aquitard (Palm Park Formation) and probably has significant solution permeability in addition to fracture permeability.

Besides the geothermal resource, the site also has a cold near surface aquifer that is used for irrigation. This aquifer is recharged from the nearby Rio Grande and consists of fluvial sands and gravels. Because of the requirements of irrigation with many crops grown in the greenhouses, a reverse osmosis unit is used to tailor the freshwater quality to specific needs.

GREENHOUSE GEOTHERMAL HEATING

The Masson greenhouse facility consists of 16 acres of single wall fiberglass sides with double-poly roofs. Daytime and summer cooling is provided with evaporative pads and fans. The heating and cooling of the greenhouse environment is monitored and controlled by computer.

The greenhouse space is heated by geothermal energy from three wells that are located on private land. Masson 32 and 33 are shallow wells less than 350 ft depth in the rhyolite dike reservoir and produce 165ºF water. Masson 36 was drilled during the last year to 800 ft depth and produces at 199ºF water from the deep reservoir. Flows vary from 430 gpm in summer to 720 gpm in winter for Masson 32 and 33 , and 750 gpm in winter for Masson 36. The water is stored in a newly construct 167,000 gallon storage tank that is used mainly for night-time heating (Photo 2) , and then fed thru two large titanium plate heat exchangers (Photos 3 and 4). The geothermal water that is cooled to 110 to 130ºF is then injected back into the shallow rhyolite reservoir with three shallow (<250 ft depth) injection wells at a location on the outflow plume down hydraulic gradient from the production wells.

In general, two types of heating arrangements are done in the greenhouses. In the older greenhouses, plotted plants are placed on benches underlain with finned tubing, black plastic and iron pipe for heating. In the older greenhouses, the finned tubing and piping is also run along the

Photo 2. ***The 167,000-gallon storage tank.***

Photo 3. ***The two new plate heat exchangers.***

Photo 4. ***The existing plate heat exchanger (Jim Witcher).***

base of the greenhouse walls for heating. The most of the newer greenhouses use floor heating and the potted plants are placed directly on the concrete floor. In addition to heating, this arrangement conserves irrigation water and fertilizers by avoiding runoff and promoting recycling. Polybutylene tubing is embedded in the concrete floor for heating.

Maximum installed geothermal heating capacity is 44.1 x 10^6 Btu/hr (12.9 MWt). Maximum annual energy use is probably around 76.8 x 10^9 Btu for a minimum capacity factor of about 0.20. Annual energy use per acre is assumed to be between 4.2 and 4.8 x 10^9 Btu/acre/yr based upon the energy use of the SWTDI/NMSU Geothermal Greenhouse Facility in Las Cruces.

CONCLUSION

In addition to lowering overall energy costs, the Radium Springs geothermal resource gives Masson several advantages in production that has enabled the company to be less dependent upon other growers. For example, the company is able to grow its own stock plants that would normally be purchased from a plant specialist. Because of the economical geothermal heat, the company is able to be it's own supplier for starter plant material, such as unrooted chrysanthemum cuttings, for final grow out at Radium Springs. With this approach, plants are more readily adapted to the environment and production schedules can be reduced and product quality improved.

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