International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 10 Oct 2021, pp: 174-177 www.ijaem.net ISSN: 2395-5252

Study of heating an agricultural greenhouse by using geothermal energy (experimental analysis)

Rohitash Singh* Avinash Kumar Sharma**
**Department of Physics Hindu College Moradabad ** Asst. Teacher SLMD HSS, Harirampur, Aligarh*

Submitted: 25-09-2021 Revised: 01-10-2021 Accepted: 05-10-2021

Keywords: Agricultural greenhouse - Geothermal water - Crop production - Solar greenhouse.

I. INTRODUCTION

Geothermal reservoirs of low to moderate temperature are used for heating homes, offices and greenhouses, aquaculture and food-processing plants and other applications. These applications provide a savings in energy costs to the consumer and produce only a very small percentage of the air pollutants emitted by burning fossil fuels. Geothermal energy is not depending on climatic conditions. It allows to create an energy supplying structure from local resources.

Fig (1) Crop Production by using Green House (Site 1)

Since there are no expenses for fuels, geothermal energy is not directly depending upon the conditions of the international energy markets. Because of its special character, geothermal energy is an appropriate source for power generation, heat supply, cooling, energy storage, agricultural uses, fish farming, and desalination of water, development of balneological applications for bath and health purposes. Geothermal energy involves the lowest specific investment cost for gas reduction in comparison to other renewable energy sources. Geothermal energy is available for the consumer anytime, whenever there is need for it 24 hours a day irrespective of the time of the day or night, independent of weather and climate. Geothermal energy is base-load energy. It offers

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 10 Oct 2021, pp: 174-177 www.ijaem.net ISSN: 2395-5252

the basis for a general energy supply from renewable sources. Anybody who is heading towards an overall application of renewable cannot pass geothermal energy. Those are the reasons why geothermal energy is one of the sustainable energy sources most widely used on earth. The aim of our research in Northern India is to use geothermal energy sources for greenhouse heating to develop plants for crop production at lower temperatures and to improve the efficiency of this heating system.

II. GREENHOUSE HEATING

It is very important to determine the flow rate needed for irrigation in an oases during the heating period in order to calculate the appropriate area of the greenhouse project and to avoid water disequilibrium between heating and irrigation purposes. Theoretically, the greenhouses can exploit the maximum flow rate from the well, but for better use and optimization of geothermal resources without any losses of using a model for calculation of peak loading. It is necessary to calculate the total heat loss from the greenhouse in order to determine its heat demand from the geothermal water. The inside air temperature (Fig. 3and4) is the internal temperature of the greenhouse. It can be called the reference temperature that is required by the crop during the night to ensure favorable conditions for its growth. The temperature value used is the minimum temperature desired to be maintained inside greenhouse during the heating period. This value is chosen as the most favorable temperature for a crop during the night.

III. DESCRIPTION OF THE EXPERIMENTED GREENHOUSE

The greenhouse (Fig. 2), is located in North India . Climatic conditions in the region are characterized by low and high ambient temperatures during winter and summer, respectively. The absolute minimum during winter is close to -4 °C, while the mean minimum is close to 4 °C. During the summer period the absolute maximum is close to 43 °C.

Fig. 2: Arrangement of green House

IV. EXPERIMENTAL RESULTS (ONLY GRAPHICAL REPRESENTATION)

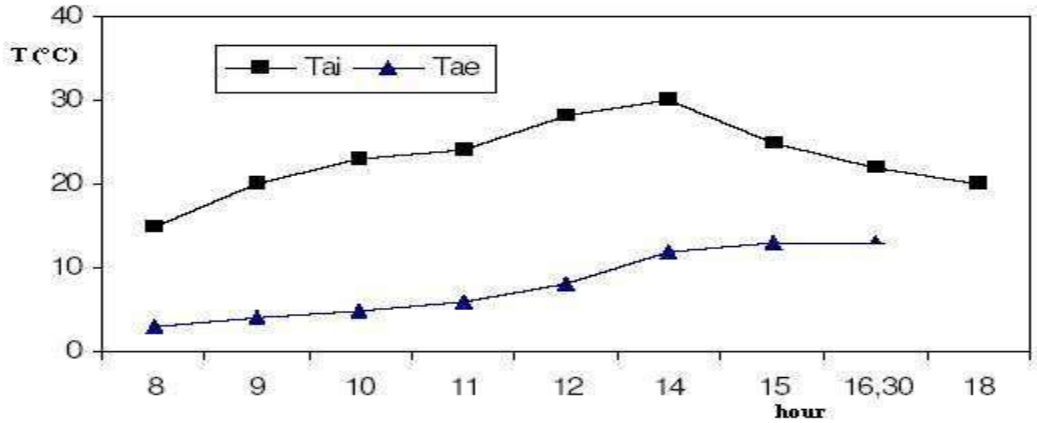

Fig. 3: Comparison between temperatures of outside air and inside in heated greenhouse

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 10 Oct 2021, pp: 174-177 www.ijaem.net ISSN: 2395-5252

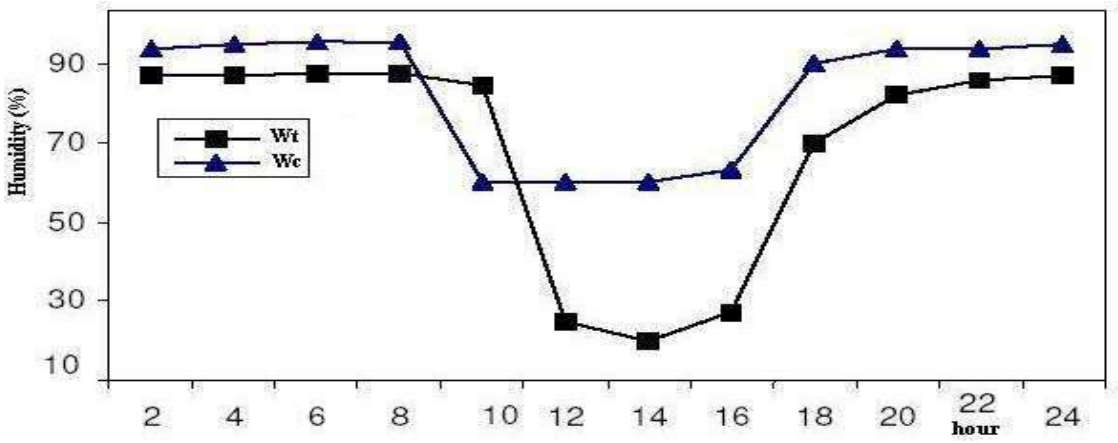

Fig. 4: Relative humidity: heating greenhouse (WC) and controlled greenhouse (WT)

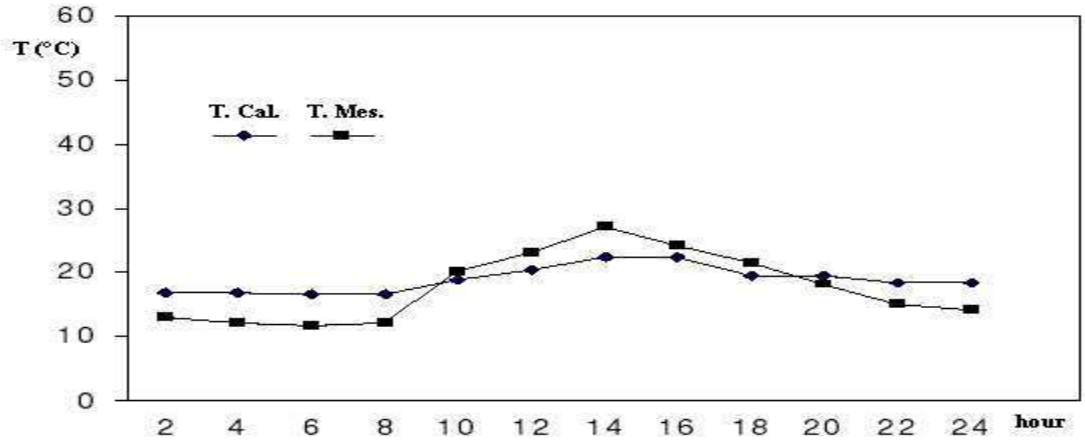

Fig. 5: Measured and calculate temperature at type day of January

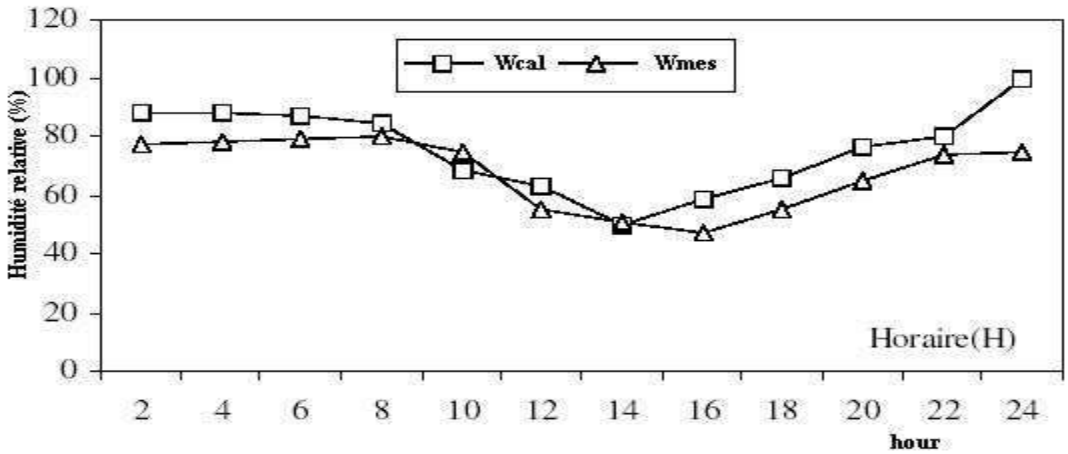

Fig. 6: Calculate and measured of relative humidity at a type day of February

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 10 Oct 2021, pp: 174-177 www.ijaem.net ISSN: 2395-5252

V. CONCLUSION

This research work concern the development of greenhouses heated by geothermal water in the India for producing commercial out-of-season vegetables and fruits (tomatoes,melons,...). The experimental results (Fig. 5, 6) obtained are satisfying to develop this technique in the near future for supply population in these regions where the geothermal water, clean and free energy, exists on abundance.

REFERENCES

[1]. K. Popovsky, 'Application Directe de l'Energie Géothermique en Agriculture, en Aquaculture et dans l'Industrie Alimentaire', Yougoslavie CNRE, Article N° 4, FAO/CNRE, pp. 353 – 367, 2007.

[2]. T. Boulard, E. Rarafnjohany and S. Baille, 'Heat and Water Vapor Transfer in a Greenhouse with an Underground Heat Storage System - Part 1: Experimental Results, Agricultural and Forest Meteorology', Vol. 175, pp. 175 – 184, 2009-10.

[3]. C. Souter, 'Use of Geothermal Energy for Agricultural Purposes', Proceeding of the National Conf. on Geothermal Energy, pp. 148 – 158, 1999.

[4]. A. Clot, 1977, 'La Géothermie Basse Energie', La Recherche, Vol. 8, N°76, p. 219, 1987.

[5]. D. Block, Solar Desalination of Water, FSECRR- 14-89, Florida Solar Energy Center, Cape Canaveral, February 1989.