

## Thermal Evaluation of a Greenhouse in a Remote High Altitude Area of Nepal

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### Abstract

*Remote communities in the high altitude areas of Nepal suffer both chronic and acute malnutrition. This is due to a shortage of arable land and a harsh climate. For seven months of the year, the harvesting of fresh vegetables is almost impossible. Greenhouse technology, if appropriate for the location and its community, can extend the growing season considerably. Experience in the Ladakh region of India indicates that year-round cropping is possible in greenhouses in cold mountainous areas. A simple 50-m<sup>2</sup> greenhouse has been constructed in Simikot, the main town of Humla, northwest Nepal. This paper describes the evaluation of the thermal performance of that greenhouse. Both measurement and simulation were used in the evaluation. Measurements during the winter of 2006-7 indicate that the existing design is capable of producing adequate growing conditions for some vegetable crops, but that improvements are required if crops like tomatoes are to be grown successfully. Options to improve the thermal performance of the greenhouse have been investigated by simulation. Improvements to the building envelope such as wall insulation, double-glazing and using a thermal screen were simulated with a validated TRNSYS model. The impact of the addition of nighttime heat from internal passive solar water collectors was also predicted. The simulations indicate that the passive solar water collectors would raise the average greenhouse air temperature by 2.5°C and the overnight air temperature would increase by 4.0°C. When used in combination, overnight temperatures are predicted to be almost 7°C higher.*

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