Enhancement of Mediterranean Greenhouses facilities: Heat Power Pump assessment for Bedding Plant Production by Coaxial Basal Heating

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**Abstract.** Protected horticulture is a highly energy-consuming sector where optimizing energy use and cost for heating facilities is strategic to achieve high environmental and economic sustainability of productions. The project's main aim was to evaluate the use of a heat pump (HP) for basal heating as an alternative technology for the production of bedding plants. As matter of fact, bedding plant production for the early spring market is usually characterized by high energy input, as plants are grown in greenhouse condition by maintaining a minimum temperature of at least 15 °C. The experimental trial took place in a greenhouse placed at the CREA Research Centre for Horticulture and Floriculture (Pescia, Italy). The greenhouse consisted of a supporting structure made of galvanized iron, roofing in polycarbonate slabs, and walls of polyethylene sheets equipped with a fully automatized opening system, equipped with twelve concrete benches. The benches were isolated from the ground with polystyrene and a substrate of volcanic lapilli. Then 8 benches were provided with a basal heating system based on four couples of coaxial pipes circulating warm water, while four of them were not heated. Cuttings of Impatiens Walleriana ‘Buddha F1 Carmine’ were transplanted in 1.2 L pots and subsequently grown by comparing a basal heating of 16 °C with no basal heating conditions, for a total of 960 potted plants. According to requirements, all the plants underwent the same agronomic cares (fertigation and pest control) and by maintaining the greenhouse temperature of 5 °C. The microclimatic conditions and the energy consumption were acquired. The experimental results show that the heat pump ensures suitable thermal conditions for such cultivation in the winter period, confirming the possibility of using a conventional heat pump in horticulture as a simple installation in an existing Mediterranean greenhouse. Furthermore, based on the fossil fuel efficiency, the HP installation shall be also evaluated taking into account the used energy source: in greenhouse production systems, even though heat pumps are more efficient than other heating sources, their use shall undergo accurate analysis to assess the resulting economic and environmental benefits.