

The Impact of a Sustainable Solar Heating System on the Growth of Strawberry Plants in an Agricultural Greenhouse

Authors : Ilham Ihoume, Rachid Tadili, Nora Arbaoui

Abstract : The use of solar energy is a crucial tactic in the agricultural industry's plan to decrease greenhouse gas emissions. This clean source of energy can greatly lower the sector's carbon footprint and make a significant impact in the fight against climate change. In this regard, this study examines the effects of a solar-based heating system, in a north-south oriented agricultural greenhouse on the development of strawberry plants during winter. This system relies on the circulation of water as a heat transfer fluid in a closed circuit installed on the greenhouse roof to store heat during the day and release it inside at night. A comparative experimental study was conducted in two greenhouses, one experimental with the solar heating system and the other for control without any heating system. Both greenhouses are located on the terrace of the Solar Energy and Environment Laboratory of the Mohammed V University in Rabat, Morocco. The developed heating system consists of a copper coil inserted in double glazing and placed on the roof of the greenhouse, a water pump circulator, a battery, and a photovoltaic solar panel to power the electrical components. This inexpensive and environmentally friendly system allows the greenhouse to be heated during the winter and improves its microclimate system. This improvement resulted in an increase in the air temperature inside the experimental greenhouse by 6 °C and 8 °C, and a reduction in its relative humidity by 23% and 35% compared to the control greenhouse and the ambient air, respectively, throughout the winter. For the agronomic performance, it was observed that the production was 17 days earlier than in the control greenhouse.

Keywords : sustainability, thermal energy storage, solar energy, agriculture greenhouse

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