

Effect Of Shading In Evaporatively Cooled Greenhouses In The Mediterranean Region

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Abstract : Greenhouse ventilation is an effective way to remove the extra heat from the greenhouse through air exchange between inside and outside when outside air temperature is lower. However, in the Mediterranean areas during summer, most of the day, the outside air temperature reaches values above 25 C; and natural ventilation can not remove the excess heat outside the greenhouse. Shade screens and whitewash are major existing measures used to reduce the greenhouse air temperature during summer by reducing the solar radiation entering the greenhouse. However, the greenhouse air temperature is reduced with a cost in radiation reduction. In addition, due to high air temperature values outside the greenhouse, generally, these systems are not sufficient for extracting the excess energy during sunny summer days and therefore, other cooling methods, such as forced ventilation combined with evaporative cooling, are needed. Evaporative cooling by means of pad and fan or fog systems is a common technique to reduce sensible heat load by increasing the latent heat fraction of dissipated energy. In most of the cases, the greenhouse growers, when all the above systems are available, apply both shading and evaporative cooling. If a movable screen is available, then the screen is usually activated when a certain radiation level is reached. It is not clear whether the shading screens should be used over the growth cycle or only during the most sensitive stages when the crops had a low leaf area and the canopy transpiration rate cannot significantly contribute to the greenhouse cooling. Furthermore, it is not clear which is the optimum radiation level that screen must be activated. This work aims to present the microclimate and cucumber crop physiological response and yield observed in two greenhouse compartments equipped with a pad and fan evaporative cooling system and a thermal/shading screen that is activated at different radiation levels: when the outside solar radiation reaches 700 or 900 W/m². The greenhouse is located in Velestino, in Central Greece and the measurements are performed during the spring -summer period with the outside air temperature during summer reaching values up to 42C.

Keywords : microclimate, shading, screen, pad and fan, cooling

Conference Title : ICAABE 2024 : International Conference on Advanced Agricultural and Biosystems Engineering

Conference Location : Dublin, Ireland

Conference Dates : August 29-30, 2024