Heat Transfer Coefficients of Layers of Greenhouse Thermal Screens

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Abstract: The total energy saving effect of different types of greenhouse thermal/shade screens was determined by measuring and calculating the overall heat transfer coefficients (U-values) for single and several layers of screens. The measurements were carried out using the hot box method, and the calculations were performed according to the ISO Standard 15099. The goal was to examine different types of materials with a wide range of thermal radiation properties used for thermal screens in combination with a dehumidification system in order to improve greenhouse insulation. The experimental results were in good agreement with the calculated heat transfer coefficients. It was shown that a high amount of infra-red (IR) radiation can be blocked by the greenhouse covering material in combination with moveable thermal screens. The aluminum foil screen could be replaced by transparent screens, depending on shading requirements. The results indicated that using a single layer, the U-value was reduced by approximately 70% compared to covering material alone, while the contributions of additional screen layers containing aluminum foil strips could reduce the U-value by approximately 90%. It was shown that three screen layers are sufficient for effective insulation.

Keywords: greenhouse insulation, heat loss, thermal screens, U-value

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