

Effect of Single- and Double-layer Polyolefin on the Microclimate of Thermal Screened Greenhouses for Strawberry (Seolhyang sp.) Cultivation

Hyun-Woo Lee^{1,2*}, Timothy D. Akpenpuun^{2,3}, Wook Ho Na², Qazeem O. Ogunlowo^{1,4},
Anis Rabi¹, Misbaudeen Aderemi Adesanya¹, Hyeon Tae Kim⁵

¹Department of Agricultural Civil Engineering, College of Agricultural & Life Sciences, Kyungpook National University, Daegu 41566, Korea

²Smart Agriculture Innovation Center, Kyungpook National University, Daegu 41566, Korea

³Department of Agricultural and Biosystems Engineering, University of Ilorin, PMB 1515, Ilorin, Nigeria

⁴Federal College of Agriculture, Moor Plantation, PMB 5029, Ibadan, Nigeria

⁵Department of Bio-Industrial Machinery Engineering, Gyeongsang National University. (Institute of Agricultural and Life Sciences), Jinju 52828, Korea

Strawberry cultivation highly depends on environmental factors. Two gothic greenhouses with different glazing material-thermal screen configurations (single layer (SLGH) and double layer (DLGH)) were used for strawberry cultivation. The research assesses the impact of glazing material-thermal screen configurations on temperature, relative humidity (RH), vapor pressure deficit (VPD), and solar radiation (SR), and the subsequent effect on strawberry yield in both greenhouses. Strawberries were planted on five benches, with 660 stands per greenhouse. Daily environmental parameters were recorded. The mean daytime air temperature, RH, VPD, and SR were $2.5^{\circ}\text{C} \pm 15.7^{\circ}\text{C}$, $10.7\% \pm 63.1\%$, $0.3 \pm 0.8 \text{ kPa}$, and $101.8 \pm 151.9 \text{ Wm}^{-2}$, respectively, for SLGH, and $2.5^{\circ}\text{C} \pm 15.9^{\circ}\text{C}$, $10.3\% \pm 66.1\%$, $0.3 \pm 0.8 \text{ kPa}$, and $111.5 \pm 160.9 \text{ Wm}^{-2}$, respectively, for DLGH. However, the mean night air temperature, RH, and VPD were $2.6^{\circ}\text{C} \pm 10.2^{\circ}\text{C}$, $5.1\% \pm 86.7\%$, and $0.1 \pm 0.2 \text{ kPa}$, respectively, for SLGH, and $2.7^{\circ}\text{C} \pm 10.3^{\circ}\text{C}$, $3.0\% \pm 92.8\%$, and $0.0 \pm 0.1 \text{ kPa}$, respectively, for DLGH. Comparing the SLGH and DLGH, VPD, and SR were significantly different during the day, whereas RH and VPD were significantly different at night ($p < 0.01$). Tukey's HSD test further showed that RH, VPD, and SR were significantly different ($p < 0.01$). The yield in the SLGH was 3.2% greater than that in the DLGH and can be attributed to the higher daytime VPD and a lower RH achieved in SLGH at night. The environmental parameters had significant interaction on yield with a resultant R^2 value of 0.89 and 0.79 for SLGH and DLGH, respectively. The study established that the configuration of glazing material and thermal screen influence greenhouse microclimate and strawberry yield.

This research was supported by the Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry and Fisheries (IPET) through the Agriculture, Food, and Rural Affairs Research Center Support Program Funded by the Ministry of Agriculture, Food and Rural Affairs (MAFRA) (717001-7).

*Corresponding author, E-mail: whlee@knu.ac.kr