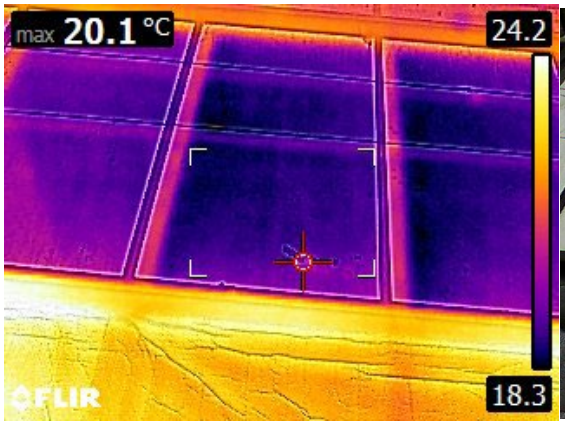
Article 2: Greenhouse material comparison: glass vs single skin plastic vs twin skin plastic

The three most common forms of greenhouse materials are glass, single skin plastic and twin skin plastic. During the thermal imaging study, all three were looked at to understand the insulating properties for each of these materials.

Glass

Figure 4 shows the thermal imaging pictures of glass. Key things to notice are the moderate temperature difference between the inside (top) and outside (middle). This shows a good level of insulation through the glass.

The main losses occur through the gaps in the glass segments. These gaps are the same temperature as the inside glass (lower), indicating that there is a significant amount of infiltration heat loss occurring from the gaps. This is where most of the heat loss occurs in glass.



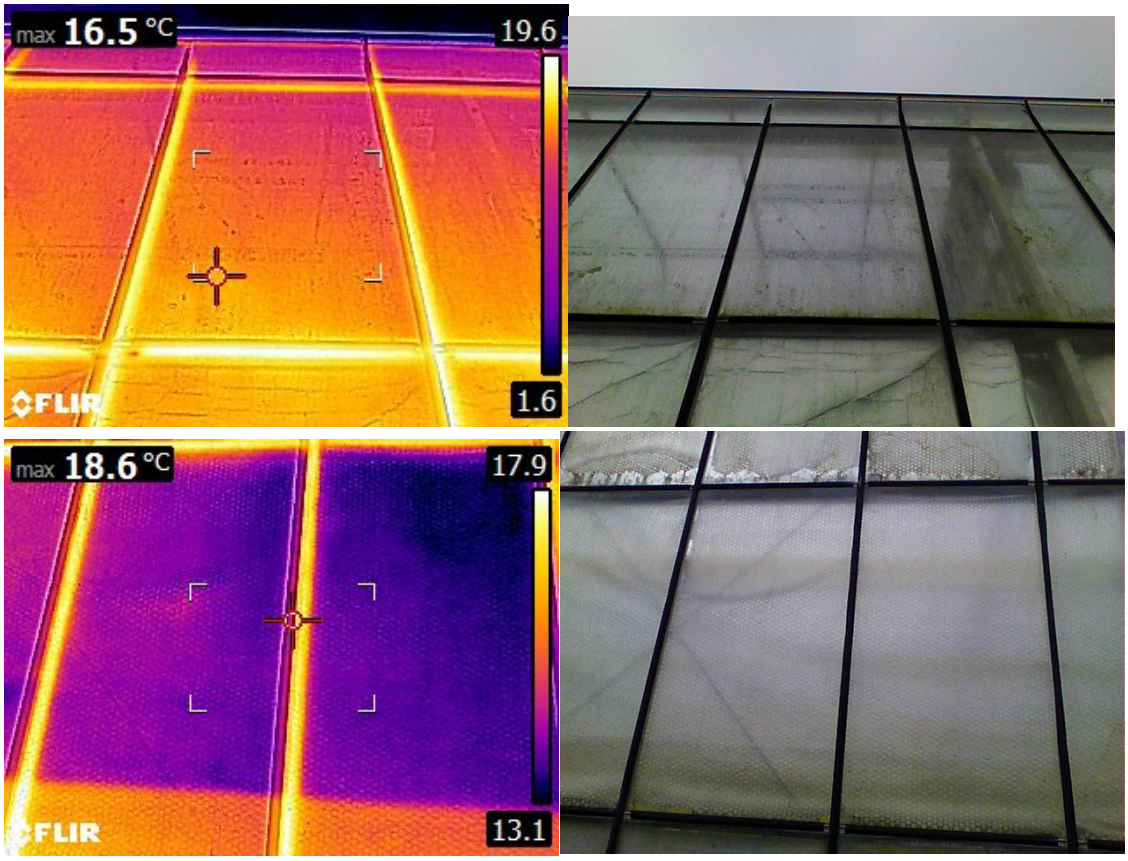
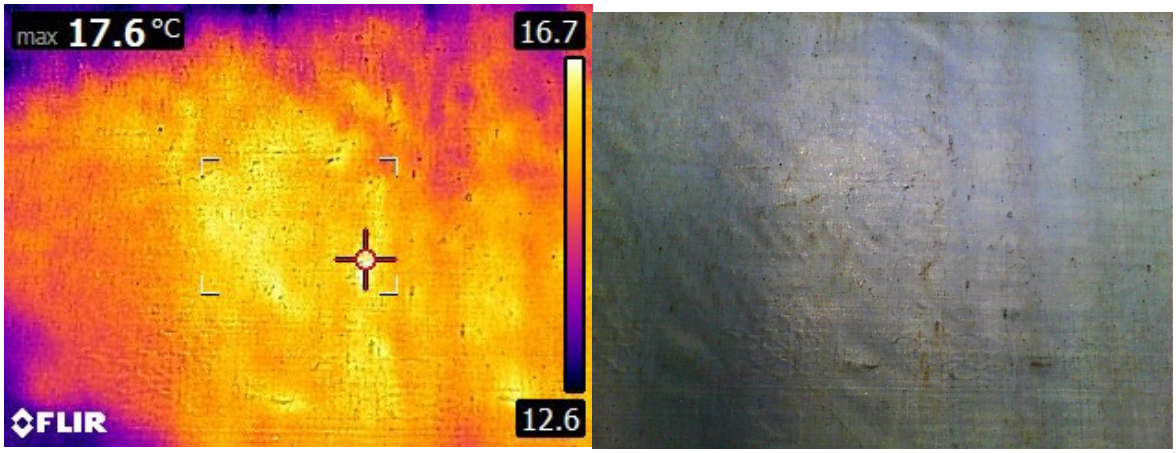


Figure 1: Picture of inside glass temperature (top), outside temperature (middle) and infiltration (lower)

Single skin plastic

The single skin plastic walls have the largest amount of heat lost through the walls compared to glass and twin skin plastic test cases. The single skin has a higher heat transfer coefficient meaning more heat will be conducted through the skin and out into the surrounding environment. Figure 5 shows that the reading from the thermal imaging camera of the outside of the greenhouse is warmer than what is being displayed on the inside of the greenhouse. This is unusual but demonstrates the poor insulating properties of single skin plastic compared to other materials.



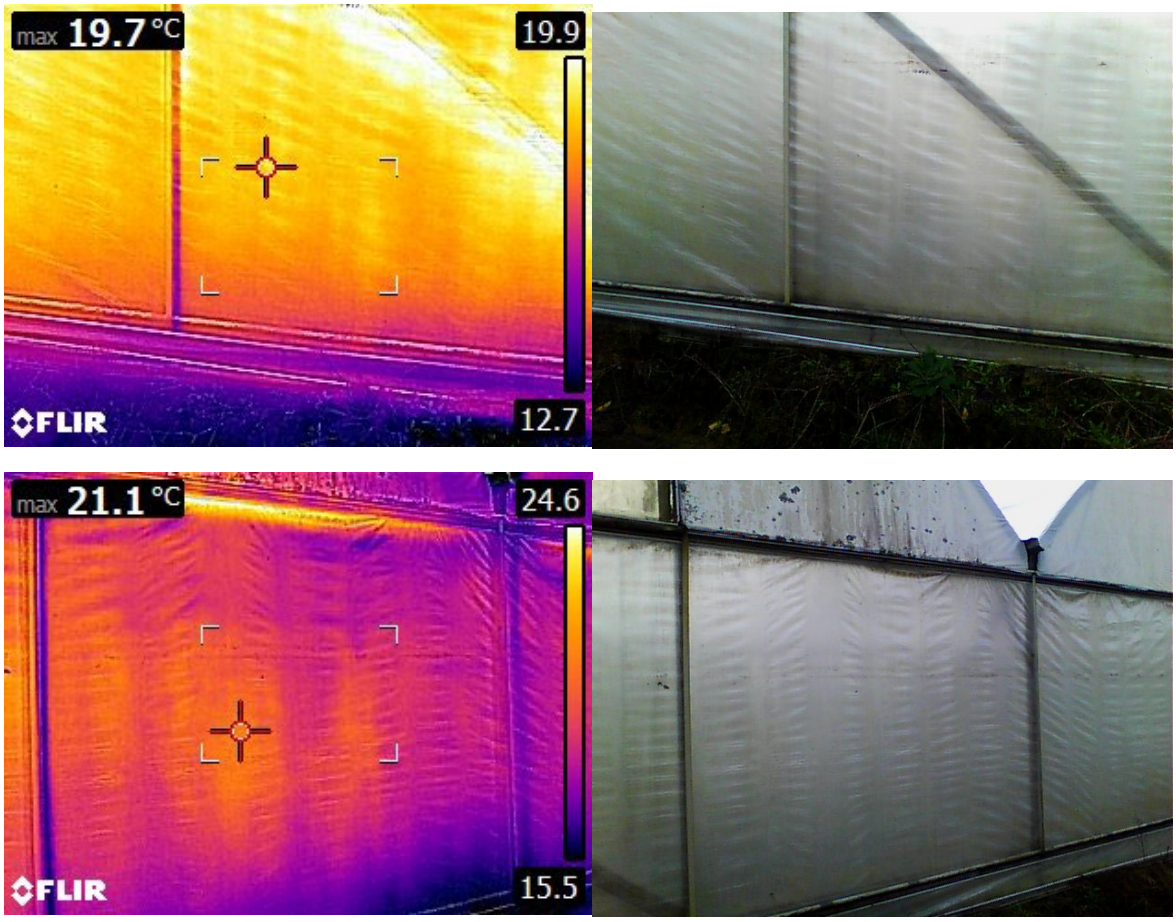


Figure 2: Inside of the single skin greenhouse wall temperature (top picture) vs the outside of the single skin wall temperature (middle and bottom pictures)

Twin skin plastic

The pictures in Figure 6 show the large temperature difference created by twin skin plastic walls. The twin skin walls create the largest temperature difference between the outside and inside walls. This indicates that they have the largest heat retention amongst the different types of materials.

The air trapped between the twin skin material creates an additional insulation layer, reducing the conductivity potential of the material and retaining the heat within the greenhouse. This is consistent with the theoretical models showing that twin skin is the best type of material for heat retention. The theoretical heat loss of different skin materials is shown in Figure 7.

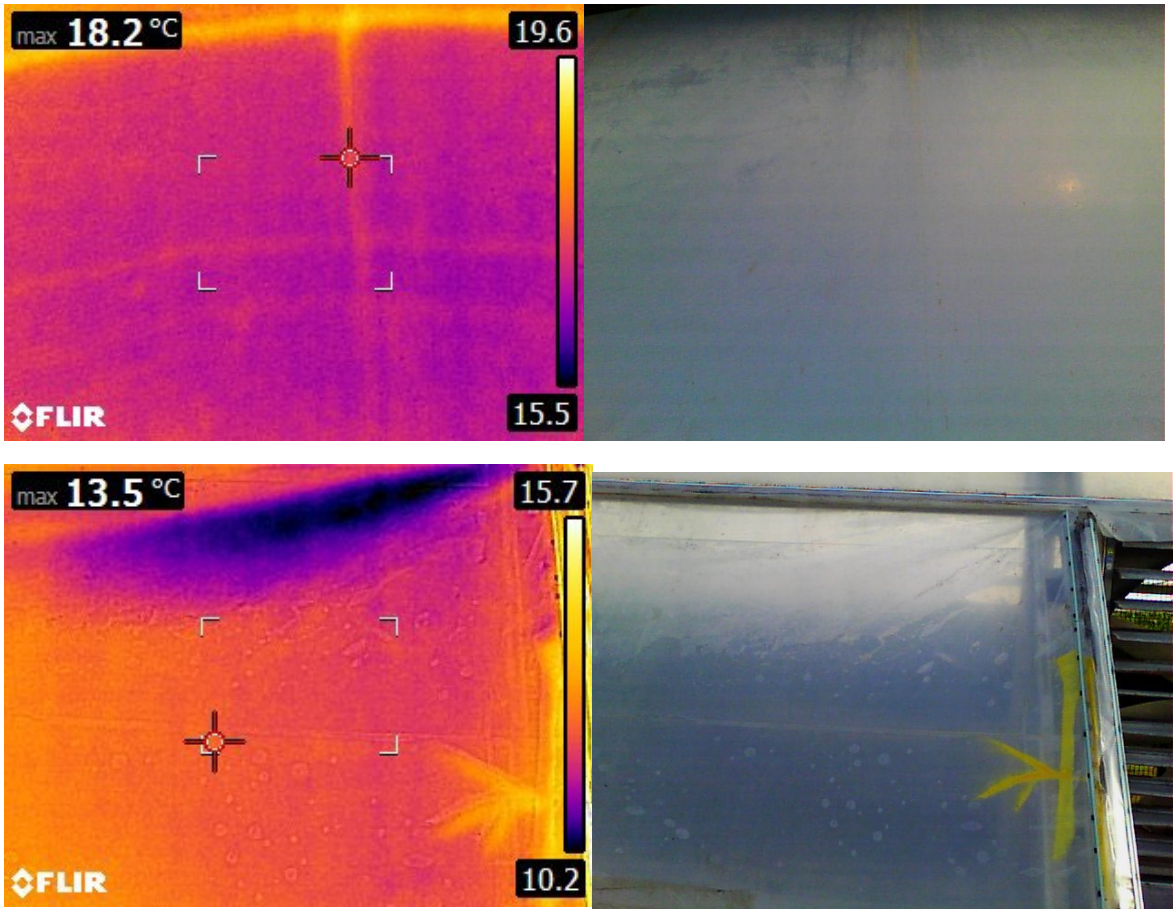


Figure 3: Inside twin skin temperature (top picture) vs the outside twin skin temperature (bottom picture)

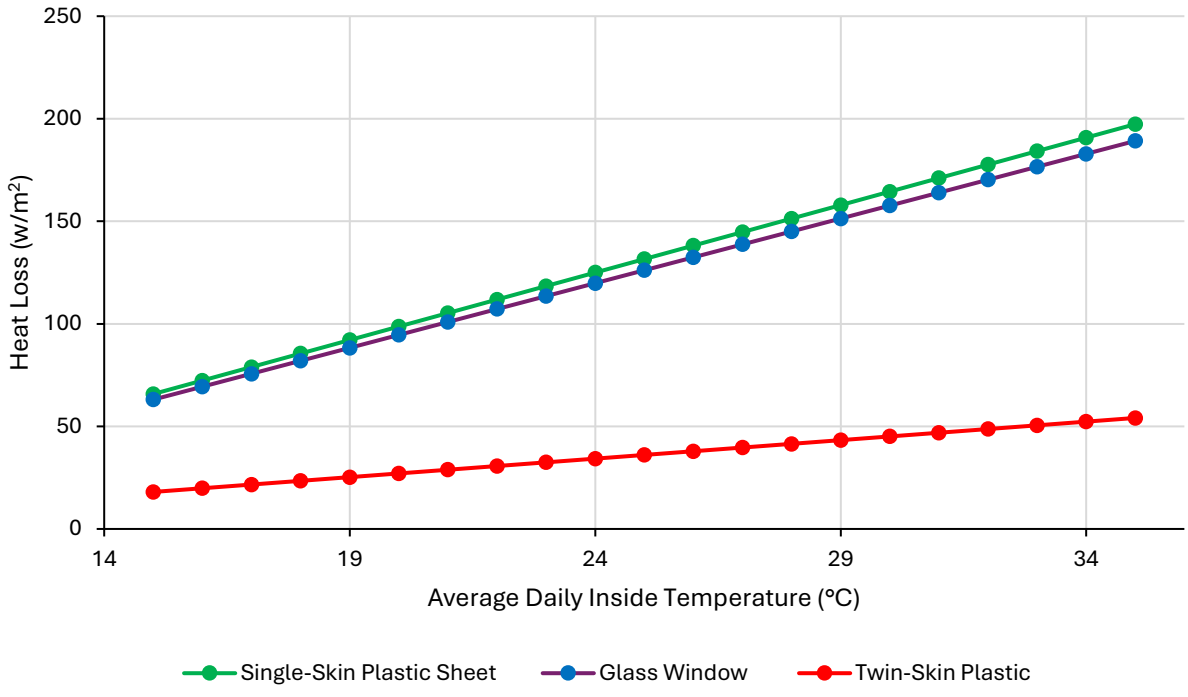


Figure 4: Graph showing the amount of heat loss (w/m^2) for different types of greenhouse materials