المـركـز الوطنـي لأبحـاث وتطوير الزراعة المستدامة
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Effect of dry spots on the pad wall on cooling-water use efficiency

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Background

Evaporative cooling works well to reduce the inside greenhouse temperature in regions with a low outside humidity. As this is the case in the central part of Saudi Arabia, many greenhouses rely on pad and fan system for cooling. However, the water consumption associated is high and as water is scarce, all effort should be made to ensure efficiency of the pad wall during the growing season. In connection, to get an efficient pad wall cooling, it is important to have an equal distribution of water and to prevent dry spots.

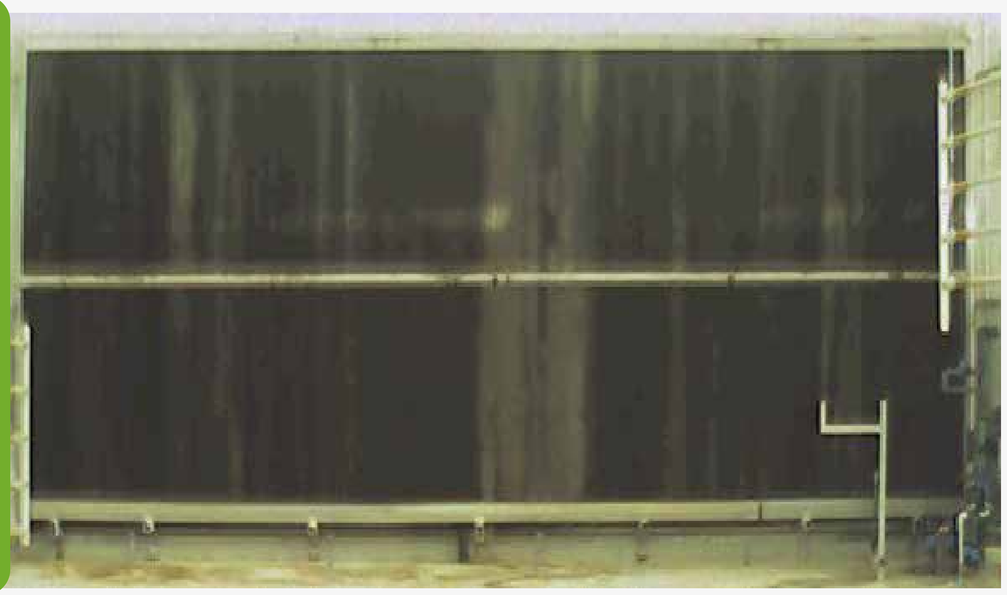
Objective

Study the effect of dry spots on the pad wall on water consumption and cooling efficiency.

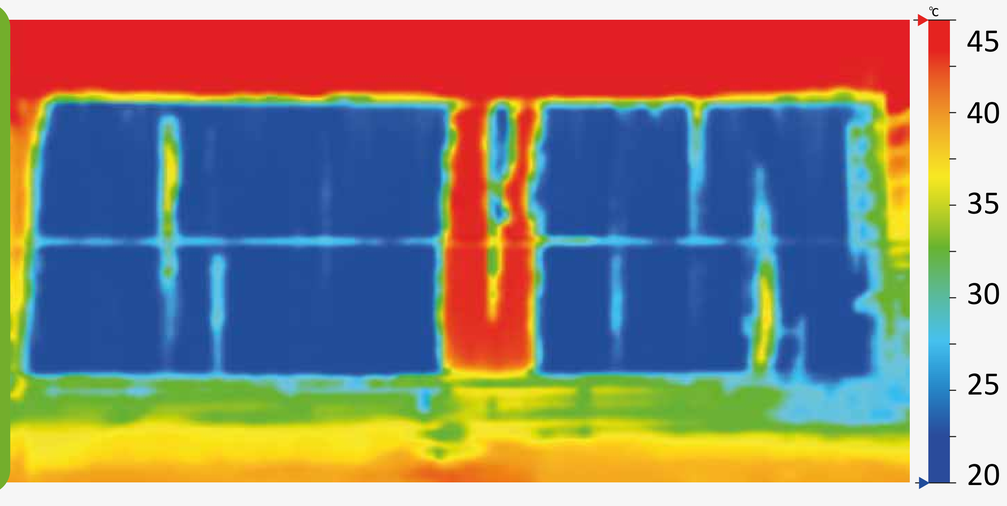
Methods

When a part (spot) of the pad wall is not wetted, it will prevent cooling follow, either heat the greenhouse, resulting in a higher amount of ventilation in order to keep the greenhouse cooled. In this respect, an excel simulation model was developed to calculates how much additional heat is dragged into the greenhouse through a non-wetted part of the pad wall. Thus, the model calculates the temperature decrement of the outside air when dragged through a wetted pad wall, as function of the outside temperature and humidity, the model calculates the amount of ventilation needed.

A pad wall at Estidamah research

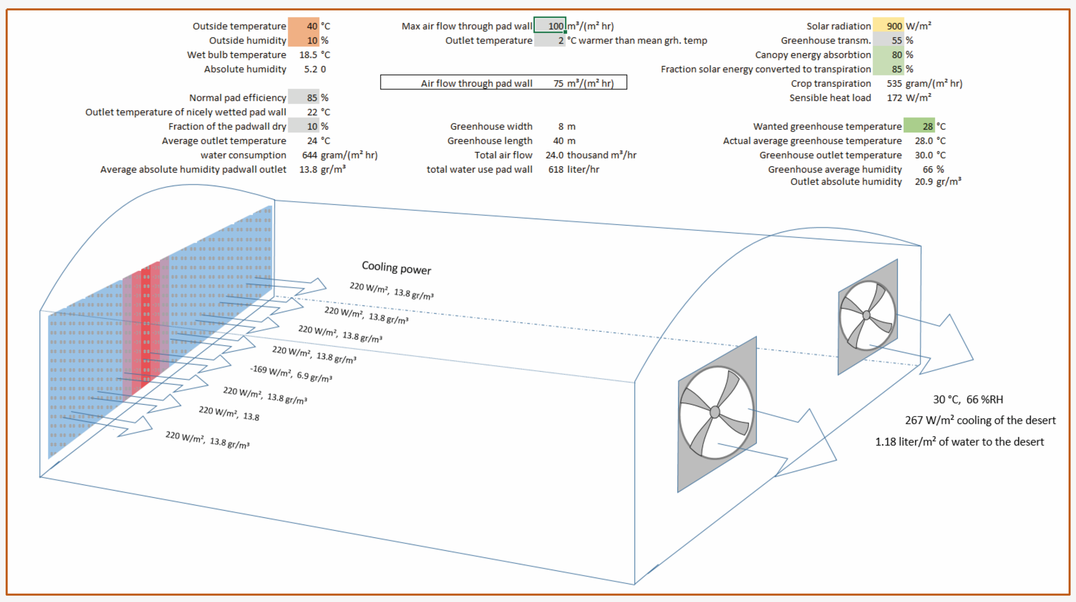


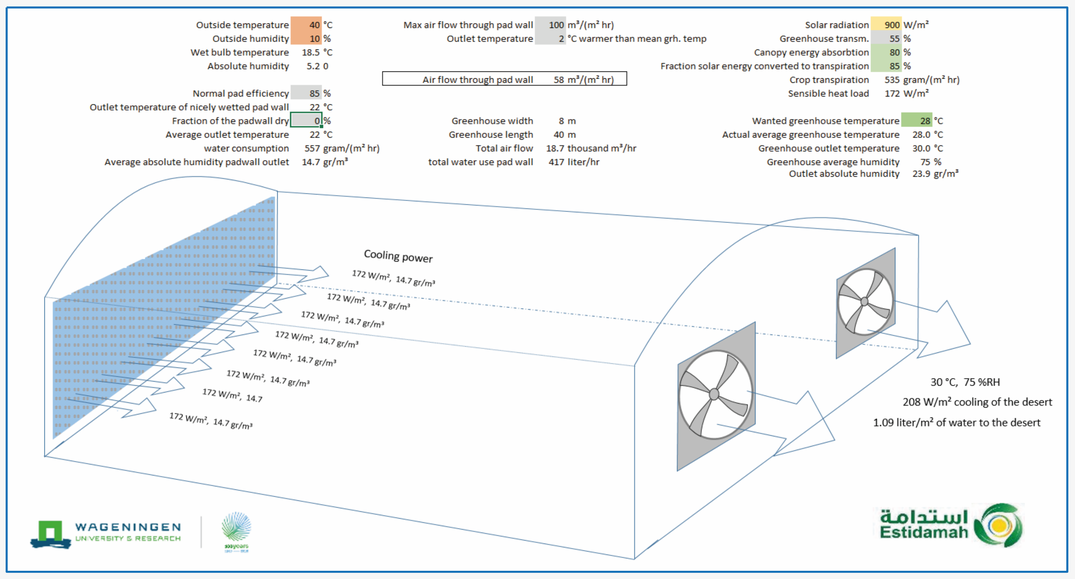
Thermal image for the pad wall



Results

The model output of two cases as follow:





When %10 of the pad wall is not wet, the water consumption in %50 more (618 liter/(m² hr) compared to 417 liter/(m² hr)). This is caused by the fact the dry spot adds 169 W/m² to the heat load of the greenhouse. Thus, fans run faster (75 m³ /(m² hr) instead of 58 m³/(m² hr)) in order to keep appropriate cold air, which increase the mount of cooling water.

Conclusion

- Clogging parts of the water supply pipe of the pad wall system results in a substantial amount of extra cooling needed, and therefore a substantial amount of extra water.
- Therefore, the sprinkling supply line of the pad wall needs to be well maintained.
- The model can also be used to show that the water consumption goes up more than linear when the setpoint for the greenhouse air is lowered.

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