Evaporative Pad Evaluation

ROYAL HEINS[1]

The efficiency of a pad material (CEL-DEK*) donated to the W. D. Holley Plant Environmental Research Center was evaluated during the summer of 1974 (Fig. 1).

Materials and Methods

Two 35' x 41', east-west glass houses with two, ½ hp, 30" fans were employed for comparison. CEL-DEK* pads, 12 inches thick, were installed in one house (Hse A) and new aspen pads in the other (Hse B). The CEL-DEK* pads occupied 96 sq.ft. of area while the aspen pads occupied 82 sq. ft. Data included the wet bulb and dry bulb temperatures inside and outside the pad, air flow velocities through the pad, and air flow

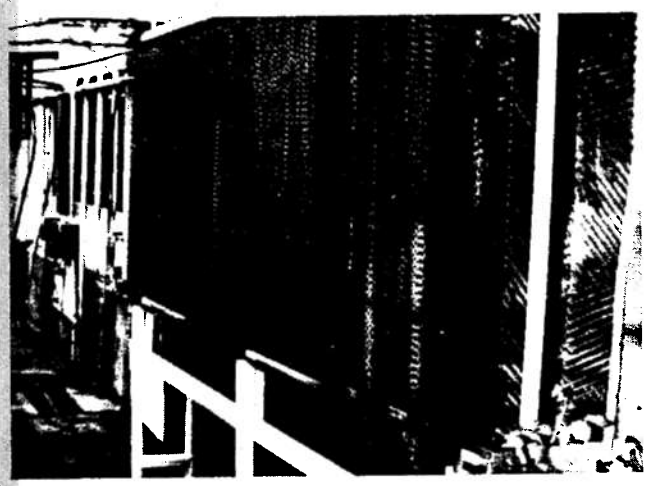

Fig. 1. CEL-DEK* pad installation using 12 x 12 x 48-inch sections.

Efficiency of the pads was determined by subtracting the wet bulb temperature from the dry bulb temperature outside the pad, and subtracting the resultant wet bulb depression (WBD) from the inside dry bulb temperature. This value (Δt) showed the difference between theoretical cooling and the actual cooling achieved. By subtracting Δt from the WBD and dividing by the WBD times 100, the efficiency was calculated.

Results

The aspen pads used were found to vary in thickness. The mean air flow rate through the pad varied from 36 feet per minute (fpm) in the thickest areas to 170 fpm in the thinnest (Table 1). A mean air flow rate of 100 fpm was calculated from all observations with an average efficiency of 91% (Table 2). The air flow rate through the CEL-DEK* pads was more uniform with an average velocity of 165 fpm. This was accompanied by a 97% average efficiency.

Two fans in Hse A moved 14,900 cubic feet per minute (cfm) while the fans in Hse B moved 13,700 cfm. The average total air flow through the aspen pads was calculated to be 8,200 cfm. The remaining 5,500 cfm that the fans were exhausting apparently came from infiltration through cracks in the greenhouse.

The CEL-DEK* pads had 14,500 cfm passing through them. Only 400 cfm came from infiltration.

No good data were obtained on temperatures the length of the houses, as entering cold air dropped to the floor and flowed along it until it rose to the fans and was exhausted. A baffle along the floor, perpendicular to the air flow, appeared to help keep the air at plant height.

Table 1. Measurements of air flow rates through varying thicknesses of aspen pad at a constant static pressure of 0.03 inches water.

Aspen Pad Thickness*	Air Velocity Measurements (fpm)	Mean (fpm)
Thin	148 to 194	170
Medium	58 to 140	103
Thick	28 to 50	36

*Subjective determination
Thin — Some direct sunlight able to pass through the pad
Medium — Some indirect light able to pass through the pad
Thick — No light able to pass through the pad

Table 2. Average values of nine observations taken over 3 days used in comparing the efficiency of the aspen and CEL-DEK* pads.

Measurement	Aspen Pads	CEL-DEK* Pads
Outside of pads		
Dry Bulb Temperature	81.6°	82.9°F
Wet Bulb Temperature	55.4°F	56.4°F
Fan side of pad		
Dry Bulb Temperature	57.9°F	57.4°F
Wet Bulb Temperature	56.4°F	56.7°F
Wet Bulb Depression	26.2°F	26.6°F
t	2.3°F*	1.0°F*
Efficiency	91%	97%

*Observation means are significantly different

Conclusions

On the basis of efficiency, there was a difference between the pads. The CEL-DEK* pads offered less resistance to air flow.

The CEL-DEK* pads used in this experiment were 12" thick, but according to manufacturer's specifications, a 6" pad would have been adequate. Specifications for CEL-DEK* pads show high efficiency at air velocities of 400 fpm. This compares to 150 fpm for aspen pads.

Using these specifications, one sq.ft. of CEL-DEK* pads could replace 2-2/3 sq.ft. of aspen pads. A four foot tall CEL-DEK* pad could replace a 10 or 11 foot tall aspen pad and still cool as efficiently.

The manufacturer claims the pads should last nine to ten years. However, considerable care would have to be exercised to prevent salt build up. The installation of a screening system to prevent clogging from weed seeds, etc. would also be needed.