

## Performance of the aluminized screen use associated with systems in a greenhouse

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### Abstract

Aluminized screens, widely used in agriculture, represent a shading option in greenhouses. This study aimed to evaluate the performance of this material used with systems of mechanical ventilation, evaporative cooling and natural ventilation with or without anti-insect screen. The fixed shading increases the differences of temperature and relative humidity of air between the internal and external environments, and that increase may occur in the direction of rise or reduction of these variables.

*Key words: evaporative cooling, shading, ventilation*

### Introduction

Knowledge of the internal environment of greenhouses is important to achieve the comfort conditions of plants. High solar radiation values imply high thermal load inside these structures. Although the shading screens reduce the transmission of the total radiant energy, the effect of air temperature is complex and field measurements are essential for a better understanding of this system. It was expected to prove the hypothesis that the shading, by the use of the aluminized screen, associated with systems (such as natural ventilation, mechanical ventilation and evaporative cooling), allows the reduction of temperature and the increasing of the relative humidity of internal air. The objective was to compare temperature and relative humidity of air for each configuration of the greenhouse.

### Results and Discussion

The experiment was realized in a greenhouse (117 m<sup>2</sup>), at FEAGRI/UNICAMP, in 2014. Data of temperature and relative humidity of air were collected, at 45 points of the greenhouse, in 8 configurations with different systems, with and without aluminized screen (Image).

**Image.** Systems of the greenhouse: (a) mechanical ventilation (MV) (sides closed and two exhausters on) and evaporative cooling (EC); (b) natural ventilation (NV) (sides with anti-insect screen); (c) natural ventilation (NVo) (fully open sides).



The use of shading system, by the association of aluminized screen, increased the mean differences between the internal and external

environments in all treatments. However, only in the configuration with the fully closed greenhouse and both exhausters on (MV + S), this increase occurred in the direction of rising internal air temperature, as compared to the configuration without the screen (MV). On other systems, the internal air temperature was reduced, agreeing with the literature<sup>1</sup>, and the relative humidity increased, by the permanently use of aluminized screen during the experiment. With enough ventilation, the horizontal shading screens allow the reduction of air temperature due to shading<sup>2</sup>.

**Chart.** Daytime average (7am-6pm) of temperature (T), relative humidity (RH) and air velocity (V), for the external and internal environments and their differences.

Configuration	Te °C	Ti °C	ΔT °C	RHe %	RHi %	ΔRH %	Ve m s <sup>-1</sup>	Vi m s <sup>-1</sup>
MV	22.7	22.9	0.2	52	53	1	5.4	0.0
MV+S	19.8	20.2	0.4	66	66	0	9.2	0.2
EC	22.9	18.6	-4.3	56	87	31	9.5	0.1
EC+S	27.0	19.4	-7.6	37	84	47	7.1	0.0
NV	28.9	28.2	-0.7	45	48	3	11.7	1.2
NV+S	26.8	25.9	-0.9	60	65	5	8.3	0.7
NVo	27.0	26.3	-0.7	62	66	4	8.1	5.2
NVo+S	31.2	29.8	-1.4	51	57	6	6.1	4.4

### Conclusions

The fixed shading increases the differences between internal and external environments. That increase may occur in the direction of rise or reduction of temperature and relative humidity of internal air.

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<sup>1</sup> Tanny, J.; Cohen, S.; Grava, A.; Naor, A.; Lukyanov, V. *Acta Horticulturae*. **2009**, 807, 103-108.

<sup>2</sup> Tanny, J. *Biosystems Engineering*. **2013**, 114, 26-43.