Impact of water reservoir pressure on controlling evaporation rate from atmometers

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Objectives

- To measure the rate of evaporation from a water reservoir under different negative pressure
- To find the relationship between evaporation rate under different negative pressure heads

Introduction

•Traditional atmometers respond to changes in vapour pressure influenced by air temperature, humidity, solar radiation and wind speed.

•The evaporation rate from the atmometer is used to predict the ET of plants using crop coefficients, assuming a well-watered condition.

•However, the ET of the plants decline with declining soil water content which is not taken into account by the traditional atmometers.

•The rate of evaporation across the menisci depends on the differential pressure between the atmosphere and the water pressure in the reservoir.

•The back pressure can be controlled to mimic the ET under soil limiting phase using this patented technology (Sri Ranjan 2012).

Materials and methods

Ceramic plate with Buckner funnel was connected to the water filled tube

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A 100mL burette was joined to the other end of the tube

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Level the height of of the water level in the burette with the ceramic plate

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The Evaporation rate is measured by the drop in water level in the burette

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The burette is lowered to impose greater negative pressure and a new evaporation rate is measured

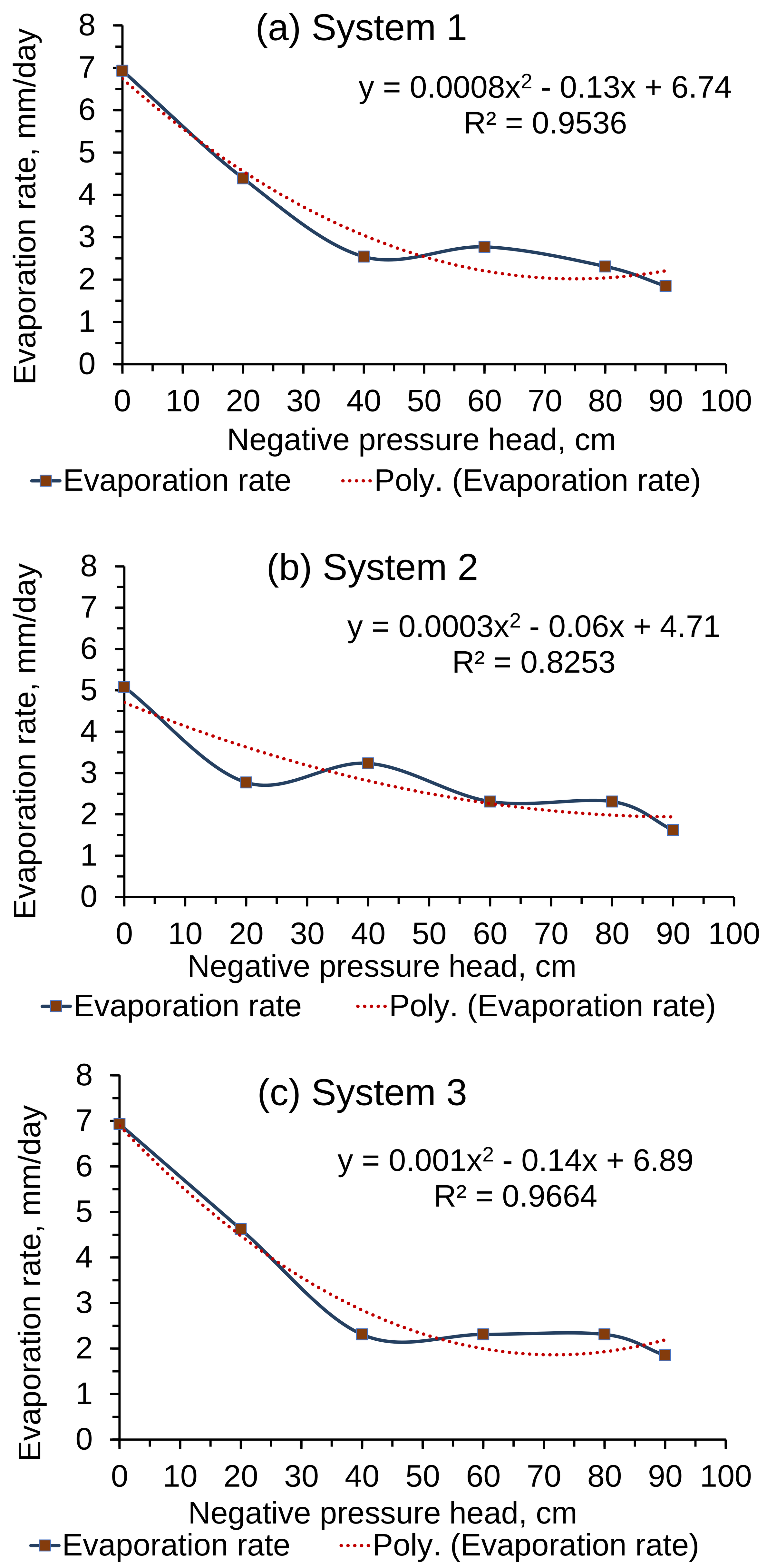

Figure 1 graphical representation of evaporation rate with different negative pressure head of three systems

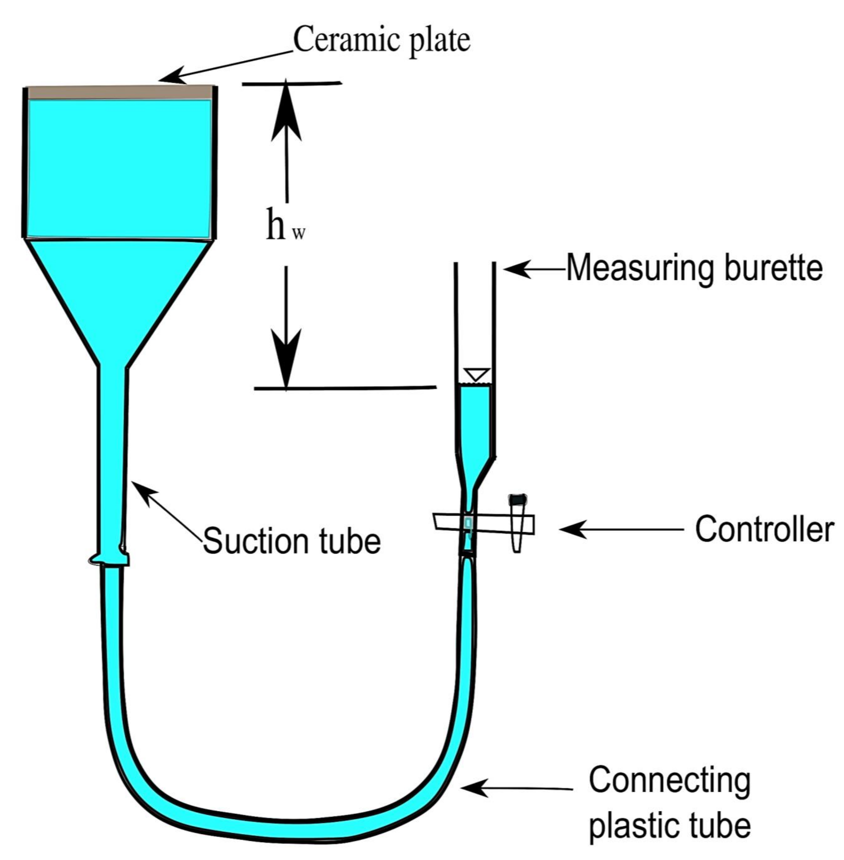

Figure 2 Schematic illustration of the distinct parts of the atmometer

Conclusions

- Evaporation rate was found to be significantly higher with lower negative pressure head on the reservoir side
- Evaporation rate can be controlled by adjusting the backpressure on the reservoir side

Results

- 22.2°C Lab temperature with ambient air pressure in the room
- In system-1
  - Highest evaporation rate 6.9 mm/day under no negative pressure head (h_w)
  - Lowest evaporation rate 1.8 mm/day at 90 cm of h_w
- In system-2
  - Highest evaporation rate 5.1 mm/day at 0 cm of h_w
  - Lowest evaporation rate 1.6 mm/day at 90 cm of h_w
  - Evaporation rate at 40 cm of h_w was higher than 20 cm
- In system-3
  - a similar trend with other systems
  - At no h_w, evaporation rate 6.9 mm/day
  - At 90 cm of h_w, evaporation rate 1.8 mm/day

Acknowledgment

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References

- Sri Ranjan, R. 2012. Plant-Controlled Atmometer for Measuring Crop Evapotranspiration. U.S. Patent No. 8,205,486. Washington, DC: U.S. Patent and Trademark Office.
- Scott Lynn, N., Henry, C. S., & Dandy, D. S. (2009). Evaporation from microreservoirs. *Lab on a Chip*, *9*(12), 1780–1788.