The New Generations of Capillary Mats: Aquamat and Aquathermat

Sylvain Hélie
Soleno Textiles, 1261 Berlier Street, Laval, QC, H7L 321 Canada
Email: jpicard@soleno.com

INTRODUCTION

Capillary mats have been used by grower almost for more than 75 years. They were made of different types of fiber such as wool, cotton, and more recently with synthetic fibers like fiber glass polypropylene, polyester, and acrylic. Their use was principally to get uniform watering on greenhouses benches. This is also one reason they are still needed by grower, but they lost some popularity due to important problems of disease and algae propagation into their open structure that is remaining wet all the time, and evaporating water at the same time. In fact, capillary mats were never popular on their ability to save water because they never did so, but mainly to save time in getting a uniform crop. Growers are facing now more water and energy restrictions than never, and we would like to present you the new generation of capillary mat that can really save water and energy and solve major disease, runoff, and environmental problems.

AQUAMAT HISTORY

1991: Beginning of the research at Laval University in Quebec City, Canada.

1991 – 1994: Fundamental research leading to the multilayered capillary mat.

1994 – 1995: Nursery comparative performance trials at Laval University: Aquamat performed as well as catchments in term of water saving.

1995 – 1998: Technology improvement and optimization included the following:

- Reducing surface evaporation.
- Reducing production costs.
- Improving hydraulic properties.
- Assessing the rooting problem.

1999 – 2001: Nursery comparative performance trials at the University of Florida: Up to a 30% growth increase and 60% water saving on Aquamat vs. microirrigation and overhead watering.

2002: Beginning of Aquamat marketing.

2003: Greenhouse comparative performance trial with the Ministry of Agriculture and Food of Quebec: Aquamat drip tape integrated versus hand watering on greenhouses benches yielded a water saving of 68%, labor savings of 92%, and fertilizer savings of 75%.

2006: Greenhouse comparative performance trial at Sunshine Growers, Florida: Aquamat (drip tape integrated) versus overhead Vibro spray produced a water savings of 90%, insect and fungal disease control, and uniform and faster crop growth.

AQUAMAT APPLICATIONS.

- On greenhouse floors or outdoor nursery growing areas (Figs. 1 and 2).
- Greenhouse benches for propagation or finishing potted crops (Figs. 3 and 4).
- Aquamat works with propagation trays and from 3-inch to 3-gal pots with bottom holes (Figs. 5 and 6).

Figure 1. Use of Aquamat on a greenhouse floor.

Figure 2. Use of Aquamat on an outdoor growing area.

Figure 3. Use of Aquamat on a propagation bench.

Figure 4. Using Aquamat to finish potted crops.

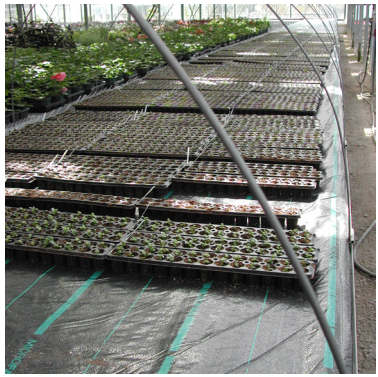

Figure 5. Using Aquamat with propagation trays.

Figure 6. Aquamats work with pots from 3 inch to 3 gallon.

Figure 7. Using Aquamat with root-zone-heating system.

AQUATHERMAT: HEATING AND IRRIGATION SYSTEM

Aquathermat History. Many growers doing propagation have been asking for better heat and humidity uniformity of their actual root-zone heating system. Aquamat was installed by an innovative grower directly on top of a root zone-heating system and drying patterns were eliminated, as was the need for frequent misting and watering (Fig. 7). This was the beginning of Aquathermat.

Aquathermat Research and Development. Successful trials were conducted at a grower's site south of Montreal. Soleno Textiles then designed custom manufacturing equipment and fine tuned the processes to produce Aquathermat.

RESULTS OF FROM RESEARCH AT THE CENTER OF INFORMATION AND DEVELOPMENT EXPERIMENTAL (CIDES).

Agronomic. A 20% to 50% increase of root mass on Aquathermat versus air heating after 1 month growth with bacopa, abutilon, and New-Guinea impatiens in 4-inch pots.

Energetic. Aquathermat consumes 4.3 times less oil (no. 2) than Biotherm to raise temperature of substrate 1 °C (Table 1).

Table 1. Energy required to increase substrate temperature of 1 °C per ft² of mat on night period.

System	Energy cosumption per ft² of mat (liters no. 2 oil)	Difference between substrate temperature of air and root heated zones (°C)	Energy required to raise substrate temperature of 1 °C (liters no. 2 oil)
Biotherm	0.083	7.4	0.0112
Aquathermat (bottom insulated)	0.014	5.4	0.0026

RESULTS OF TDMG (ENGINEERING COMPANY/THERMAL DESIGN MANAGEMENT GROUP).

Aquathermat with bottom insulation of 1-inch Styrofoam requires 51% less energy versus Biotherm to maintain substrate temperature of 17.5°F over ambient air. In addition, substrate temperature is always 7 °F cooler than ambient air with any air heated method.

Aquathermat Technical Informaion. The general specifications and specifications on heating and irrigation are found in Tables 2, 3, and 4).

Table 2. Specification on heating.

Temperature intake (max)	140 °F (60 °C)
Pressure (max)	15 psi
Flow rate	0.006 gpm/ft² (0.017 LPM/m²)
Heating tubes (int./ext. diameter)	0.170/0.250 inches (4.3 mm/6.35 mm)
Energy consumption to heat pot substrate 1 degree over ambient air	2.32 BTU/h/ft23/°F 4.18 BTU/h/ft²/°C 44.7 BTU/h/m²/°C

Table 3. Specifications on irrigation.

Mat water holding capacity	2.1 gal. us/yd²
Drip tape flow rate	1.35 gpm/100 ft
Mat flow rate	0.007 gpm/ft² (0.3 liter/min/m²)

Table 4. General Specifications.

Mat widths (std. roll lengths 50-100 ft)	Heating tubes (in and out) (no.)	Drip tapes (no.)
3 ft (0.91 m) / 4 ft (1.22 m)	8 / 12	2 / 2
5 ft (1.52 m) / 6 ft (1.83 m)	14 / 18	3 / 3
7 ft (2.13 m) / 8 ft (2.44 m)	20 / 24	4 / 4
11 ft (3.35 m)	32	6

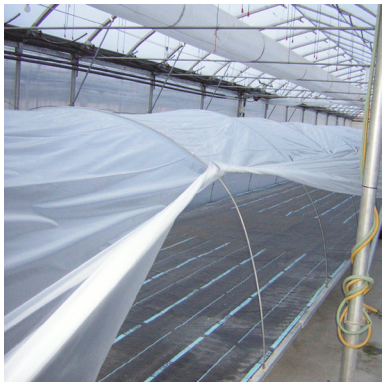

Figure 8. Aquathermat used for propagation under mini-tunnels.

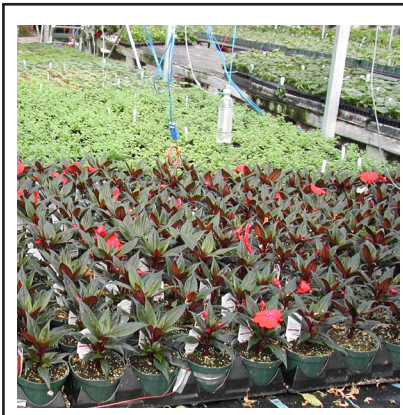

Figure 9. Aquathermat used for finishing crops.

Figure 10. Installing bottom insulation in combination with Aquathermat.

Aquathermat Applications. It can be used from propagation (for example under mini tunnels to avoid overhead misting and diseases) (Fig. 8) to the finishing of crops. For such application it can be used on benches or directly on the floor (Fig. 9). In addition, bottom insulation (Fig. 10) can provide a 40% energy saving and better heat uniformity on crop.

Aquathermat Installation. Connection suggestions are shown in Figure 11.

WHAT ARE AQUAMAT AND AQUATHERMAT

These products are under license from the University of Laval, Quebec in Canada, Soleno Textiles produces two patented capillary mats for use with container grown plants. One mat is designed to water (Aquamat) and second mat (Aquathermat) is used for watering and heating container grown plants. Aquamat, the watering mat consists of five main elements:

1. Lower water proof polyethylene total containment layer.
2. Lower highly absorbent layer (up to 2.5 gal/yd^2) and is sectioned every 10 ft by a capillary break.
3. Lower non-absorbent, resilient layer that prevents surface evaporation.
4. Top root proof layer protects lowers layers also from UV, algae, dirt contamination, and wear.
5. Irrigation drip tubes every 2 ft of the width of the mat that run the length of the mat.
6. On Aquathermat only, warm water EPDM tubes spaced at 3.75 inches apart.

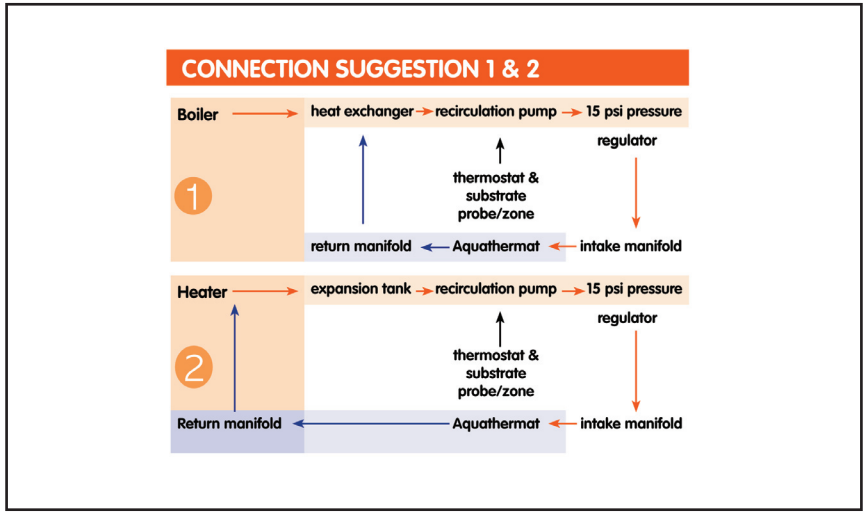

Figure 11. Connection suggestions for Aquathermat.

CONCLUSION

Water and energy are now important issues for actual and future grower's production costs, and these new generations of capillary mats will certainly help growers to think outside of the box.