MONDAY, 3 NOV 2025 AT 10:34 PM • 28 NEWTON ROAD, CAMBRIDGE

Upgrading X-Stream (20) vessels for fogponics

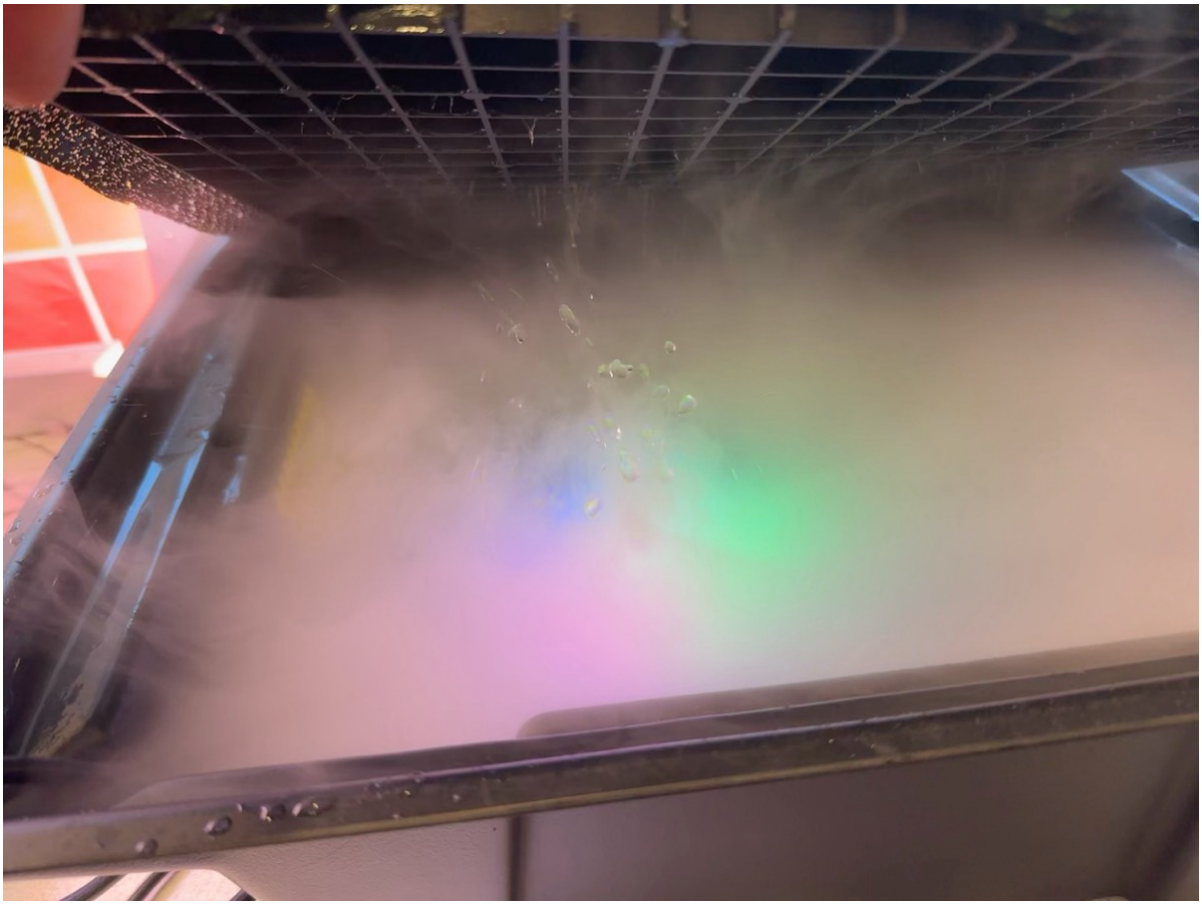
Two X-Stream vessels had been set up and growing gemmalings on different substrates since 04Oct25, using the off-the-shelf aeroponics units from X-Stream. These produced a vigorous stream of nutrients. Although initial growth was adequate, it slowed, and a couple of issues were seen. (I) The temperature of the nutrient media was consistently high, around 26ºC, and (ii) rhizoid growth appeared slow, perhaps due to the effects of temperature or spray velocity.

The vessels were progressively upgraded to: (I) remove the spray system and replace this with ultrasonic foggers, and add an aeration system for the media.

Ultrasonic fogger

A 3-transducer ultrasonic fogger, float and power supply was purchased from Amazon (~£30). Matt black pigmented Humbrol model paint was used to paint over the ornamental LEDs on the device, to minimise emission of stray light in the tank - and minimise algal growth.

A splash guard was designed in Fusion360 and printed in Greentec Pro carbon fibre filament. The splash guard slots into the flotation device, and protects the underside of plant membrane support from water droplets propelled upwards from the fogger device. The fogger was initially operated with a 20sec ON, 5min OFF duty cycle (based on published suggestions). The light duty cycle helps with maintaining a lower temperature for the media, and letting nutrient drain from the rhizoids, and helping to avoid asphyxiation. (Needs optimisation).



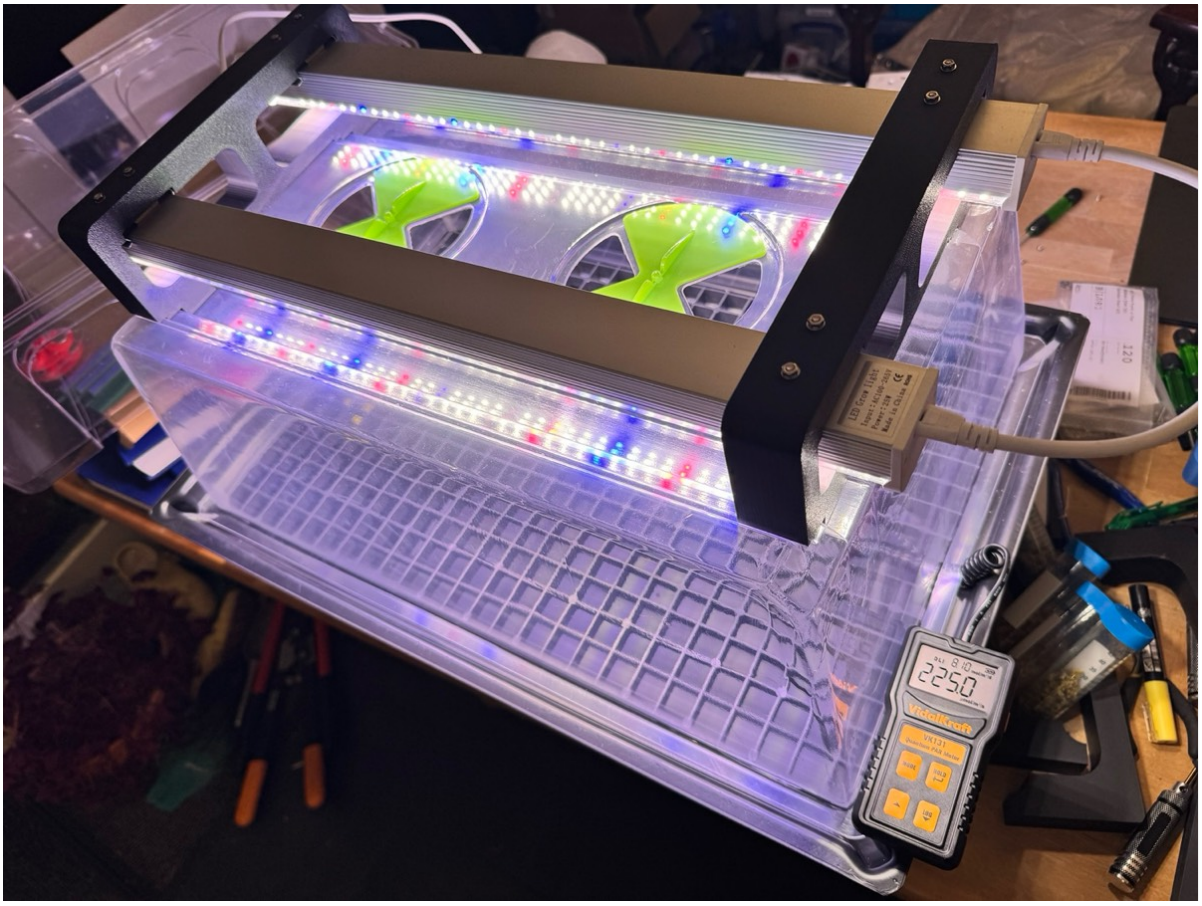
An 8W air pump was added to aerate the systems - with airlines split between the two tanks, and feeding "nano" airstones. The pump was run continuously. In addition, a small fan was positioned to blow air over the propagators, initially used to help temperature control with the X-Stream aeroponic sprays, but kept for the fogponic upgrade.

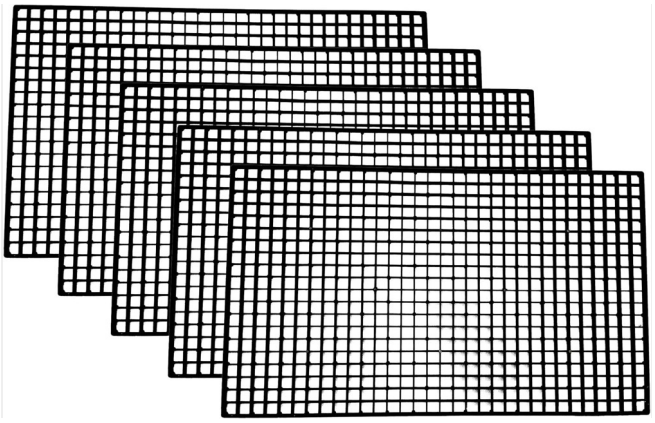
Tank 1 was upgraded first (03Nov25), followed by Tank 2 (07Nov25). There were immediate changes after the upgrades. (I) the temperature dropped close to ambient temperature in the room (~22°C). (ii) Rhizoid grow accelerated - shown below for Tank 1, 3 days after switching to fogponics.

FRIDAY, 7 NOV 2025 AT 11:08 PM

Assembly of Fogponic-40

Vessels and propagator lids were purchased from GH Products. These are spare parts for the 40-place X-Stream aeroponics system. The base and lid are each ~£20. Heavy duty plastic mesh were purchased to provide a base for membranes used to support the growing plants. These are normally used to hold large water filters and are 680x400mm, with 1 cm square subdivisions. These were cut to size using a saw - to fit neatly into the tank.

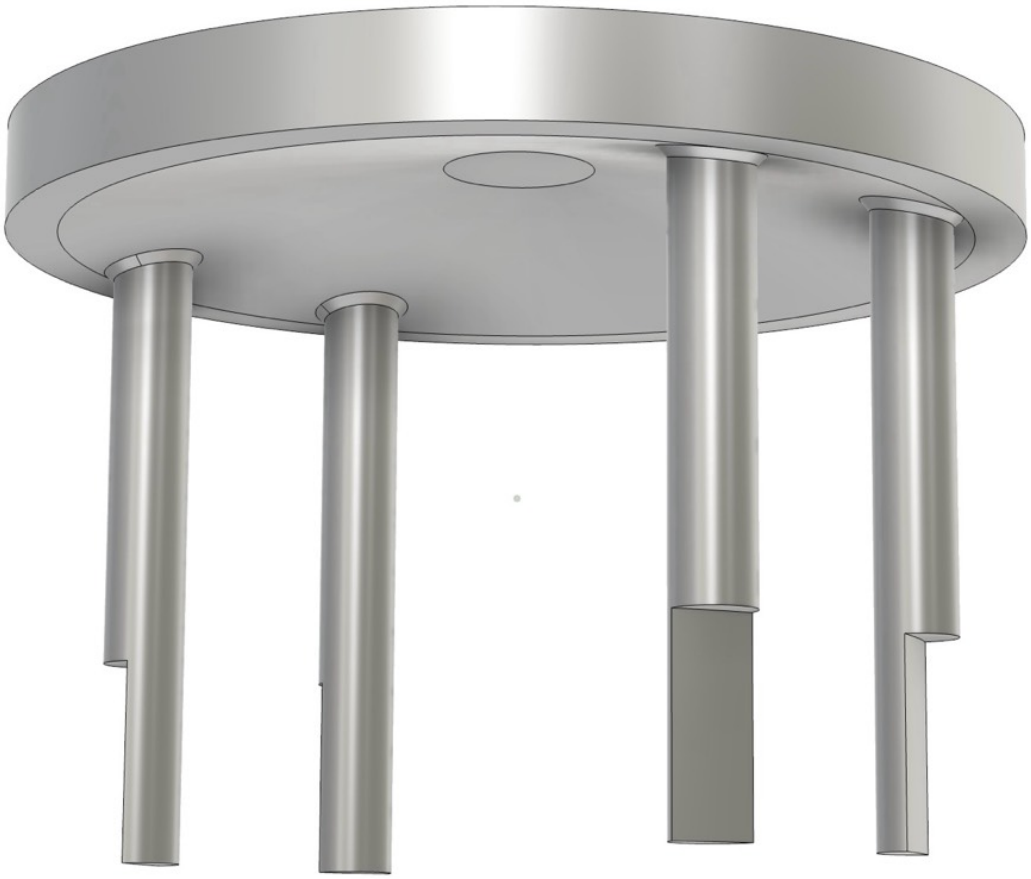




Fog

Nutrient fog is provided by an ultrasonic mister. A 3-transducer device was chosen (~£30). This device had ornamental LEDs, which were painted over with Humbrol matt black oil paint (used for plastic models) to minimise availability of stray light when the tank was in use. The ultrasonic mister was supplied with a float, to maintain proper depth of liquid over the transducers - with lead and mains power supply.

When operating, the transducers push droplets of water upwards, in addition to the copious fog produced. The water droplets appeared to inhibit or damage rhizoids growing directly above the device, so a splash guard was designed in Fusion360 and 3D printed with Greenprotech carbon fibre filament. The splash guard (below) was designed to slot into the top of flotation device. It has ~4 cm clearance above the float, and it effectively prevented water droplets being projected into the underside of the plant support, while allowing free dispersal of mist when operating.



Nutrient media

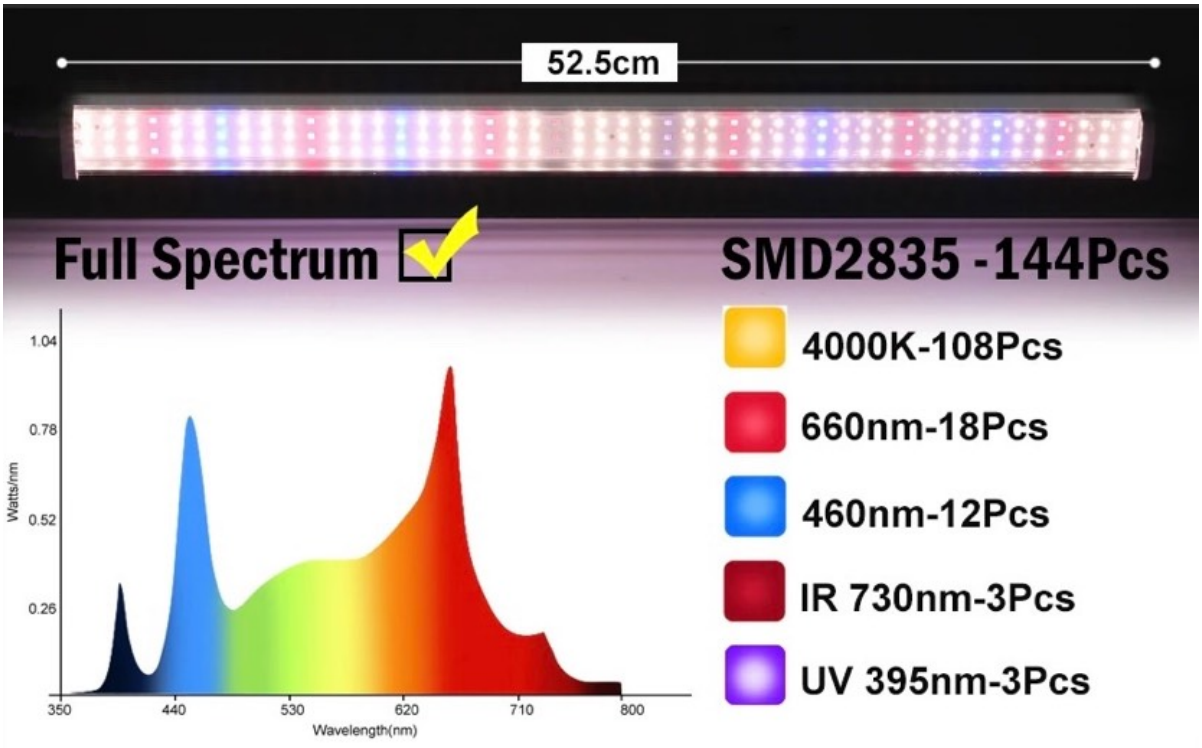
The nutrient media was made up of Shogun Samurai Grow (Hard Water) A+B, with 2mL per litre of each component. In the first trials, the ultrasonic misters were run on a duty cycle of 20 sec ON and 5 min OFF. The switched operation of the misters was controlled by an electronic mains timer device which allowed setting of the duty cycle, and which then ran continuous cycles.

Aeration

The media was aerated using an 8W air pump, where the output was split and directed into two adjacent tanks.

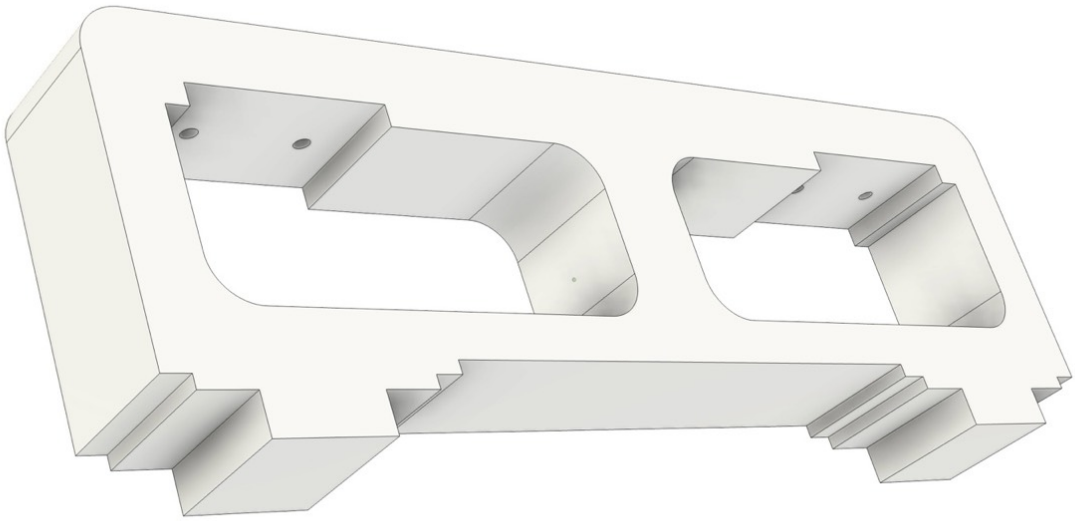
Lighting

LED lighting was provided by 52.5cm multispectral light bars obtained from Aliexpress (~£45 for 4 strips) - designed for plant growth, with optimised spectral output.

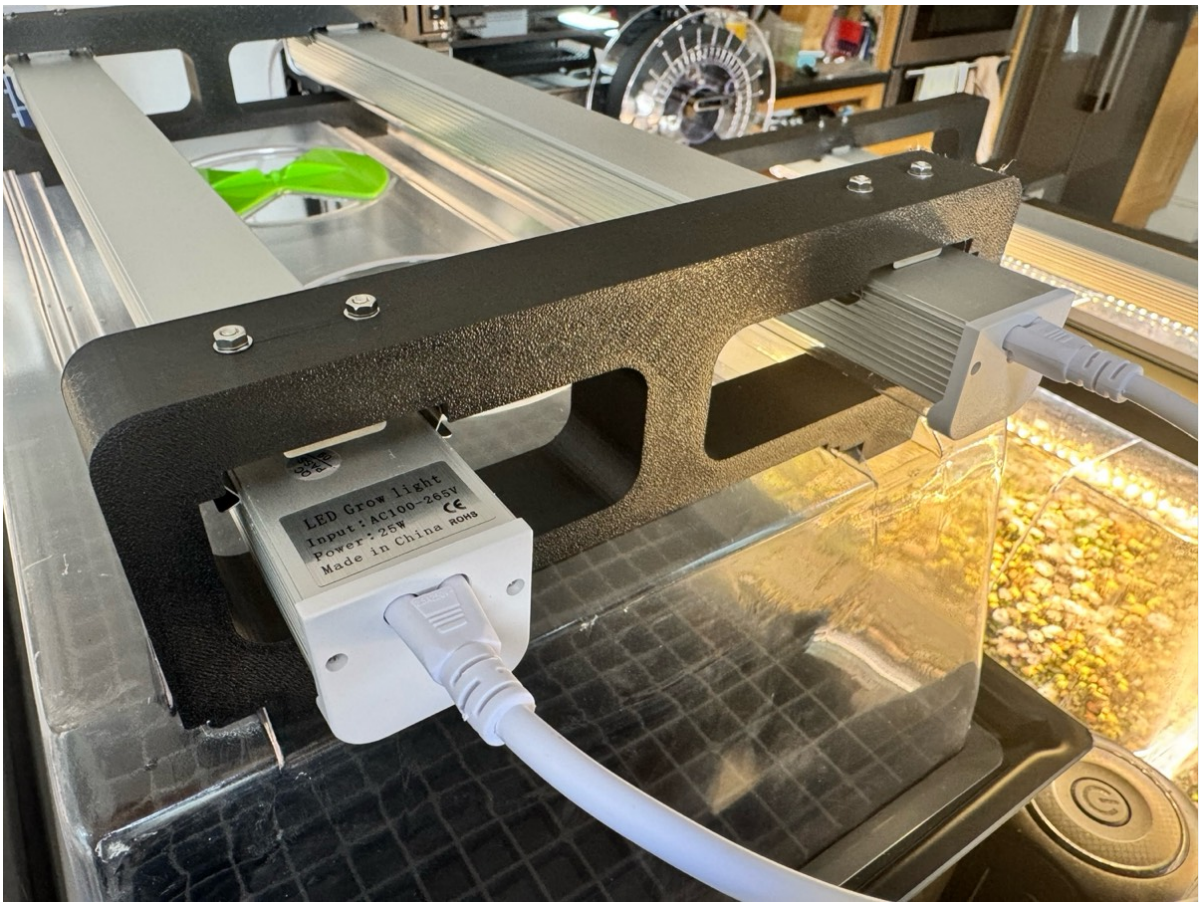


Mounting

In order to securely position the LED lights over the propagators, supports were designed in Fusion360 (below) and printed in GreenTec Pro carbon fibre filament. Each support base was designed to slot into the top of a propagator lid and provided mounting slots for metal brackets supplied with the LED strips that could support two lighting units for each tank. The light intensity at the growing surface was ~230 µmol/sec/m2 when both lights were powered on.



Below: end view of LED lights and support bracket.



SATURDAY, 8 NOV 2025 AT 4:52 PM

Testing hybrid growing surfaces for fogponics

Reset Fogponic vessels

Cleaned 2x Fogponic-20 vessels and replaced existing media and plants (after >4 weeks, 08Nov25) - laid down new membrane substrates for trial with fogponics (vs. X-Stream aeroponics), to test rate of establishment of plants from gemmae and thallus plantings.

Both vessels have 7.5L of nutrient medium (Shogun Samurai Grow for Hard Water: 2mL A + 2mL B components in tap water). Each has a triple transducer ultrasonic fog generator and nano-air stone pumped from a shared 8W air pump.

Growing surfaces

The vessels were set up with different growing surfaces laid over the support grid:

Tank 1

(a) Micro perforated black plastic sheet
(b) Spreader mat + micro perforated black plastic sheet
(c) Weedban non-woven textile sheet

Tank 2

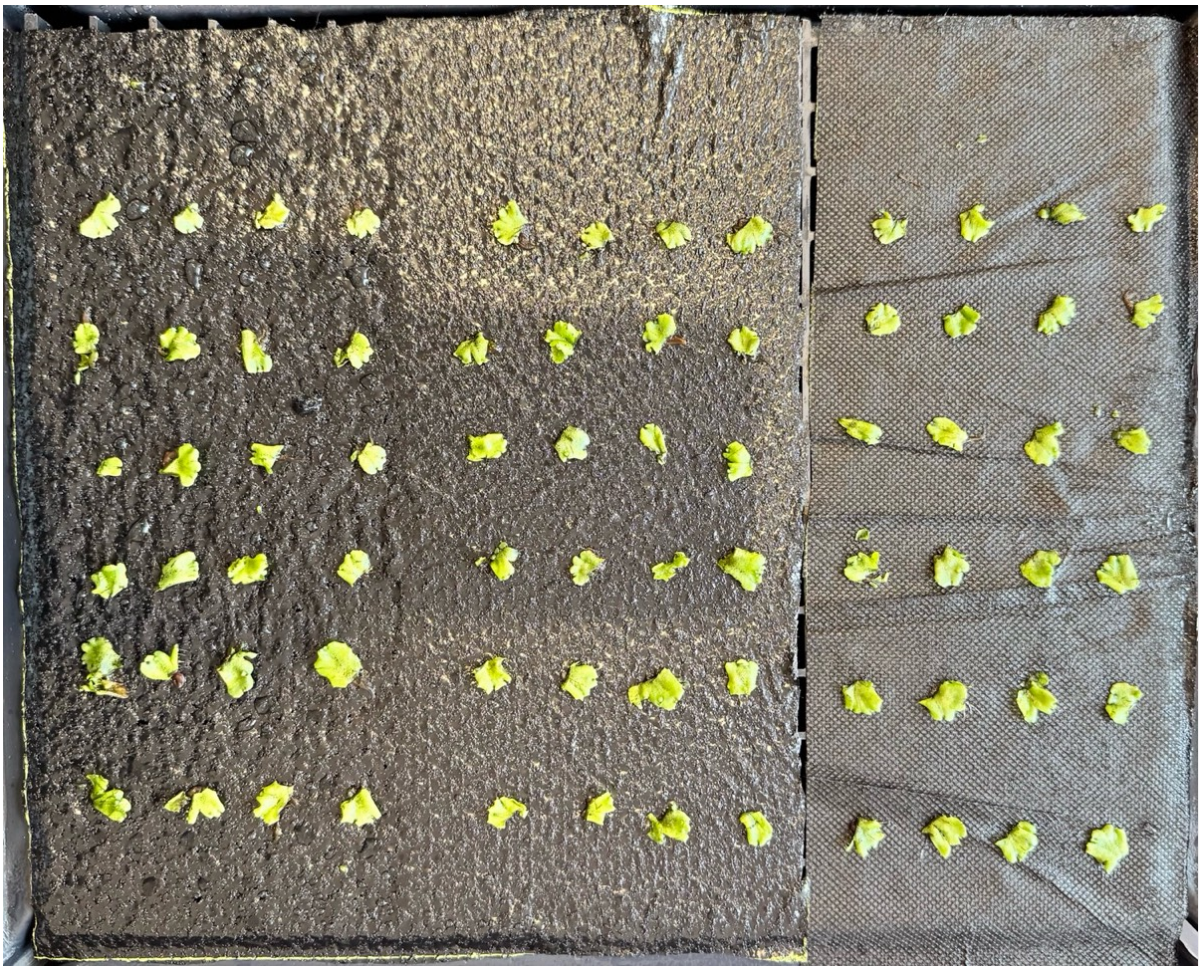
(d) Capillary matting (standard green-white) + micro perforated black plastic sheet
(e) Klavermat 300 mat + micro perforated black plastic sheet
(f) Henofa recycled 400 mat + micro perforated black plastic sheet

The mats and sheeting were laid out, and the air pump and mist generators were run overnight - but little sign of obvious wetting, apart from the spreader mat (under a layer of micro perforated plastic). The various surfaces were heavily sprayed with 2mL/litre nutrient solution before seeding with either collected gemmae or thallus pieces harvested from the earlier aeroponic trials. The vessels were run with closed vents on the propagator and 20sec:5min duty cycle for the ultrasonic misters, and continuous aeration. Only one LED panel (below, left) was illuminated (100% power) for the early stage of plant establishment and growth.

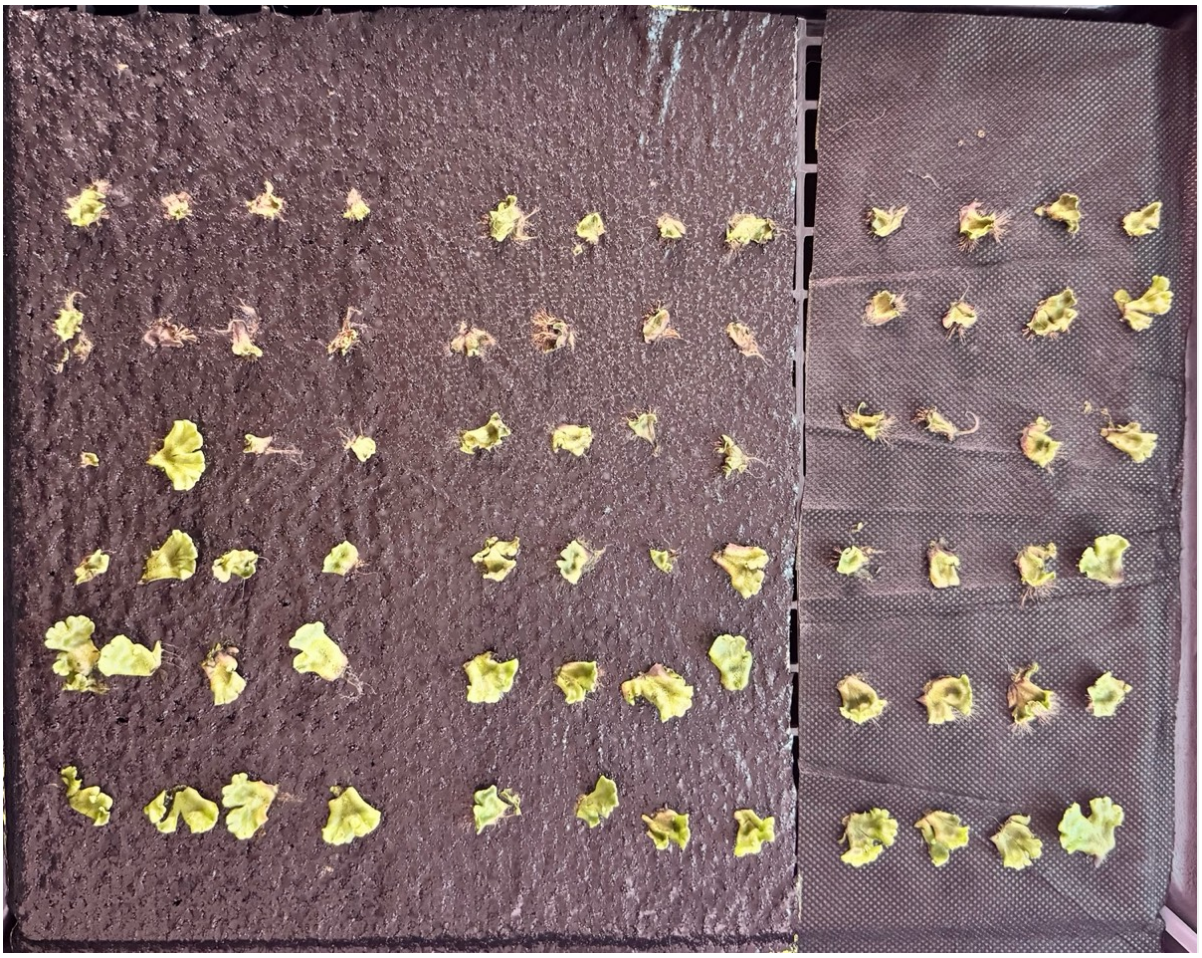
Notes:

1. The propagator vents were left closed for the fist 4 days, and the surfaces were regularly sprayed with nutrient solution. At beginning and end of day.
2. After 4 days, the propagator vents were opened 50%. Gemmae germinated best on the Klavermat300+BF surface, and the BWM400+BF was second best performer, but noticeably slower. The weedban surface came in as 3rd best performer, in terms of speed of germination. Very poor germination on the other surfaces.
3. Rhizoids developed quickly from the thallus pieces. After 5 days, rhizoids could be seen clearly, emerging underneath the Weedban surface matting (best performer). The various capillary mattings on Tray 2 looked to delay emergence of any rhizoids.
4. On Day 5, the inner base of the tanks was covered by a white coloured precipitate?
5. Checked rhizoid growth on Day 7 (images below). Capillary mat surfaces performed OK - but may reflect the early spray-watering regime and ability of the support to absorb and retain nutrient solution. Plastic film didn't perform well, and addition of spreader mat was helpful, but still didn't perform to the level of the capillary mat supports. Will need to evaluate where fog is delivered to the upper parts of the plants, as well as rhizoid system.

Day 0 - **Tank 1**: left to right, Supports a-c (top - gemmae, bottom - thalli)

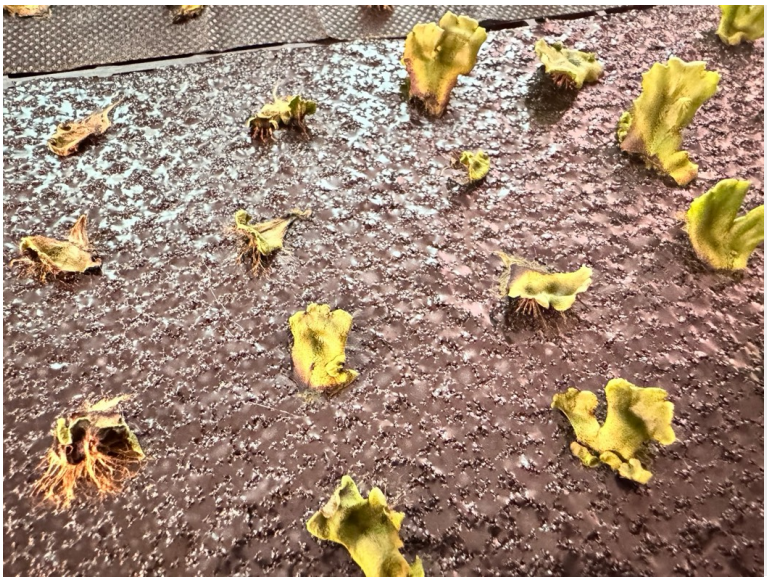
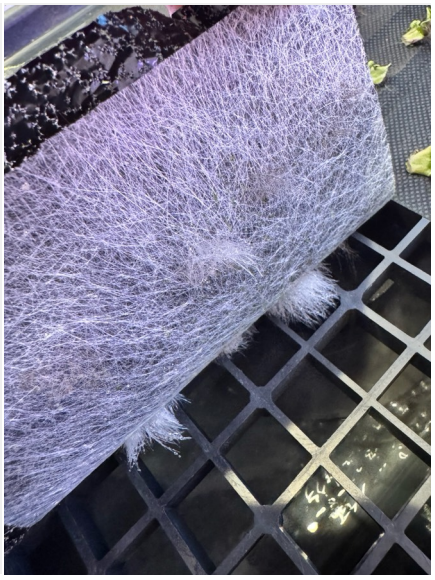


Day 7 - **Tank 1**: left to right, Supports a-c (top - gemmae, bottom - thalli)

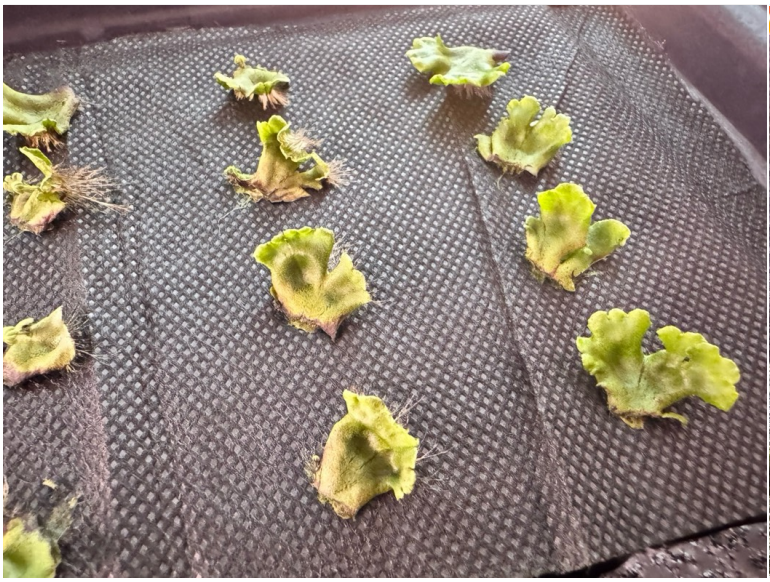


Day 7: top and lower surface of (a) Micro perforated black plastic sheet (images below)

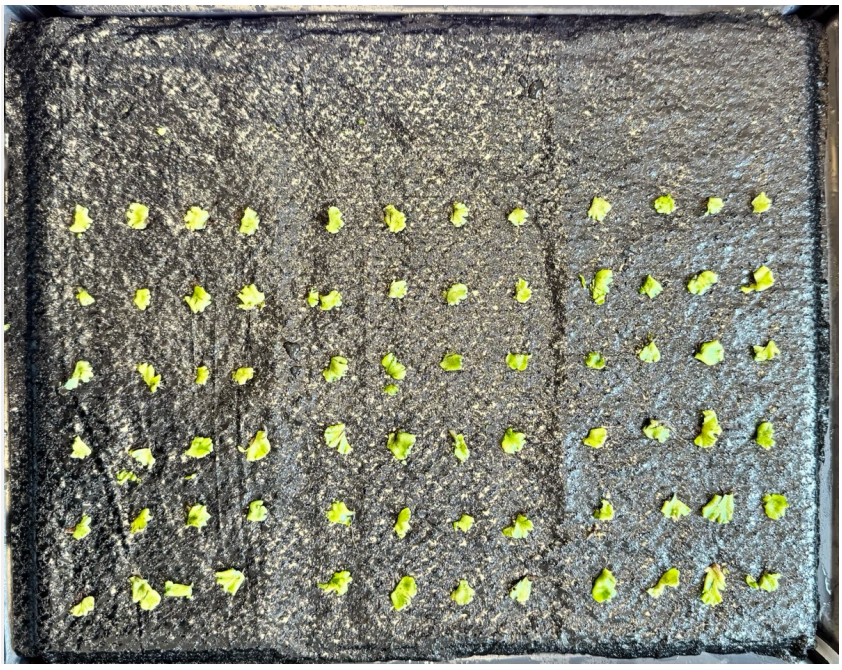
Day 7: top and lower surface of (b) Spreader mat + micro perforated black plastic sheet (images below)

Day 7: top and lower surface of (c) Weedban non-woven textile sheet (images below)



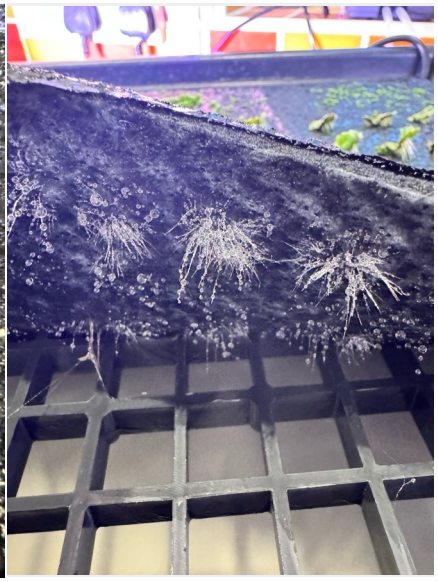

Day 0 - **Tank 2**: left to right, Supports d-e (top - gemmae, bottom - thalli)



Day 7 - **Tank 2**: left to right, Supports d-e (top - gemmae, bottom - thalli)

Day 7: top and lower surface of (d) Capillary matting (standard green-white) + micro perforated black plastic sheet (images below)

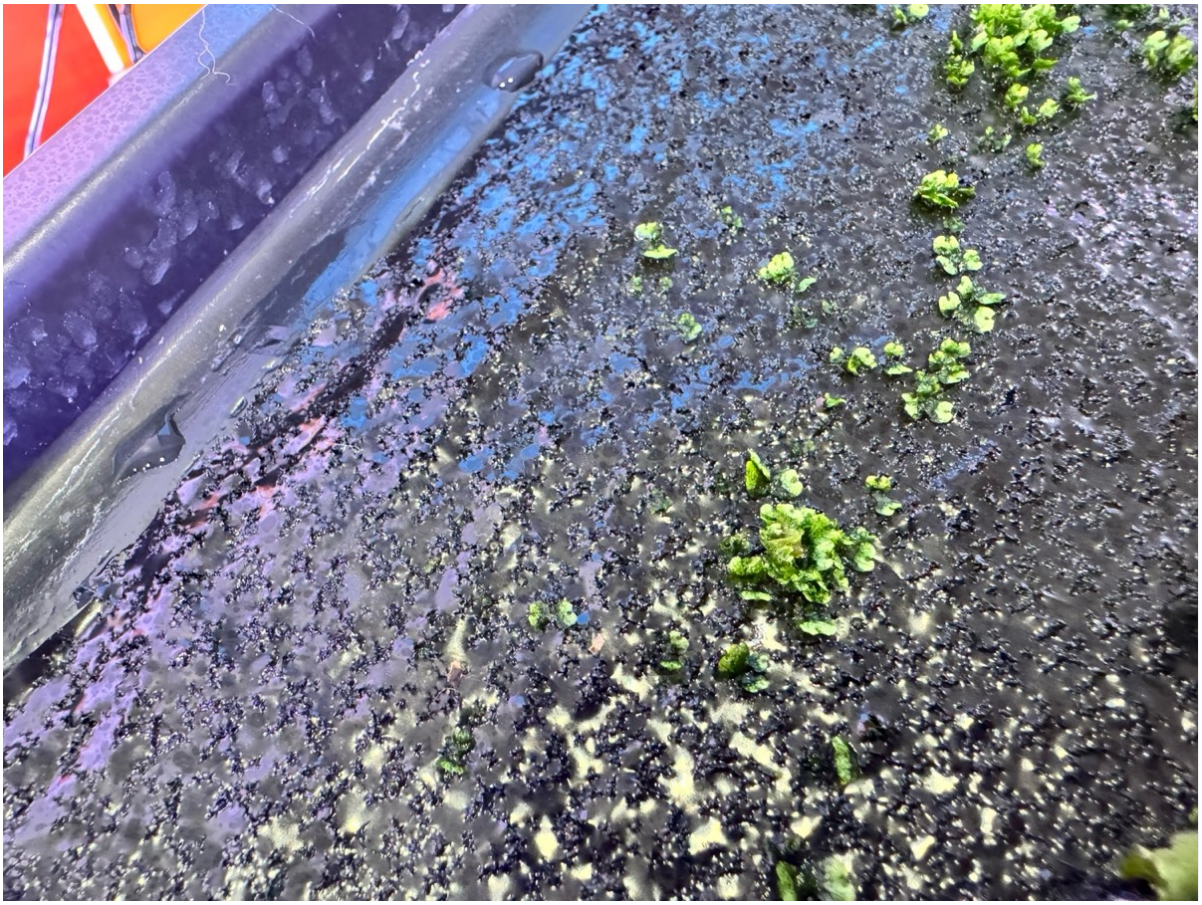
Day 7: top and lower surface of (e) Klavermat 300 mat + micro perforated black plastic sheet (images below)

Day 7: top and lower surface of (f) Henofa recycled 400 mat + micro perforated black plastic sheet (images below)

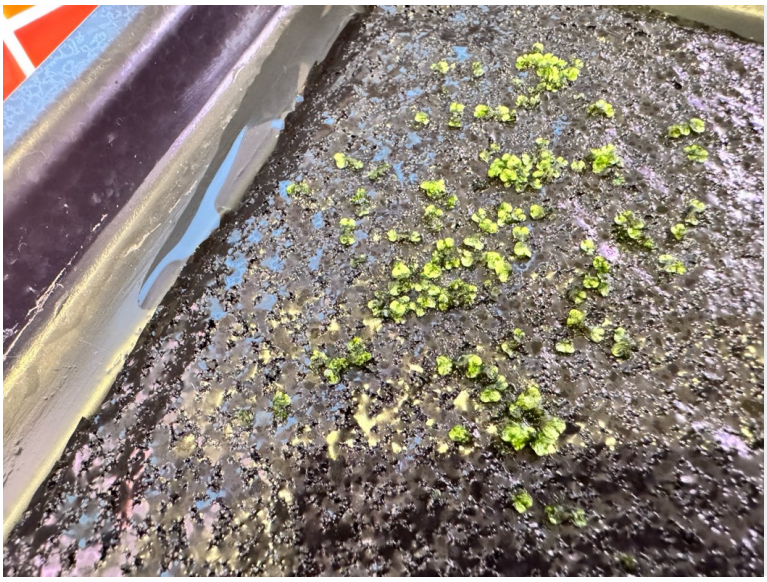
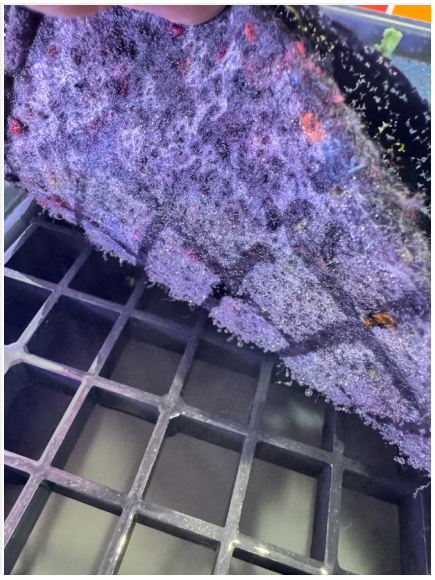

Gemmae germinated on capillary matting.

Day 7: gemmalings on (d) Capillary matting (standard green-white) + micro perforated black plastic sheet, showing upper surface. (Growing poorly, worst of 3 capillary supports) (image below)

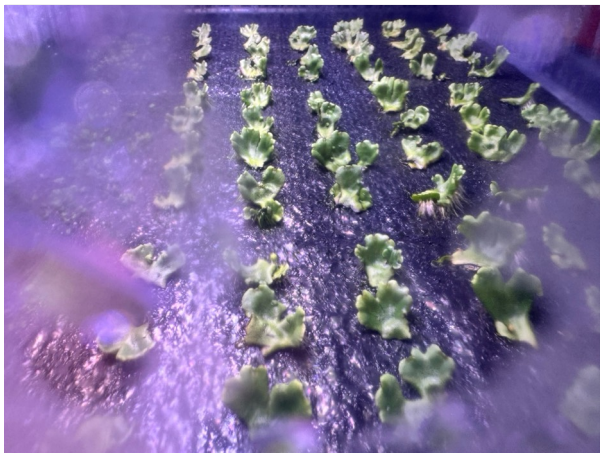


Day 7: gemmalings on (e) Klavermat 300 mat + micro perforated black plastic sheet, showing upper and lower surfaces. (Growing best of 3 capillary supports. Rhizoids best developed.) (images below)

Day 7: gemmalings on (f) Henofa recycled 400 mat + micro perforated black plastic sheet. Second best growth on capillary support. (images below)

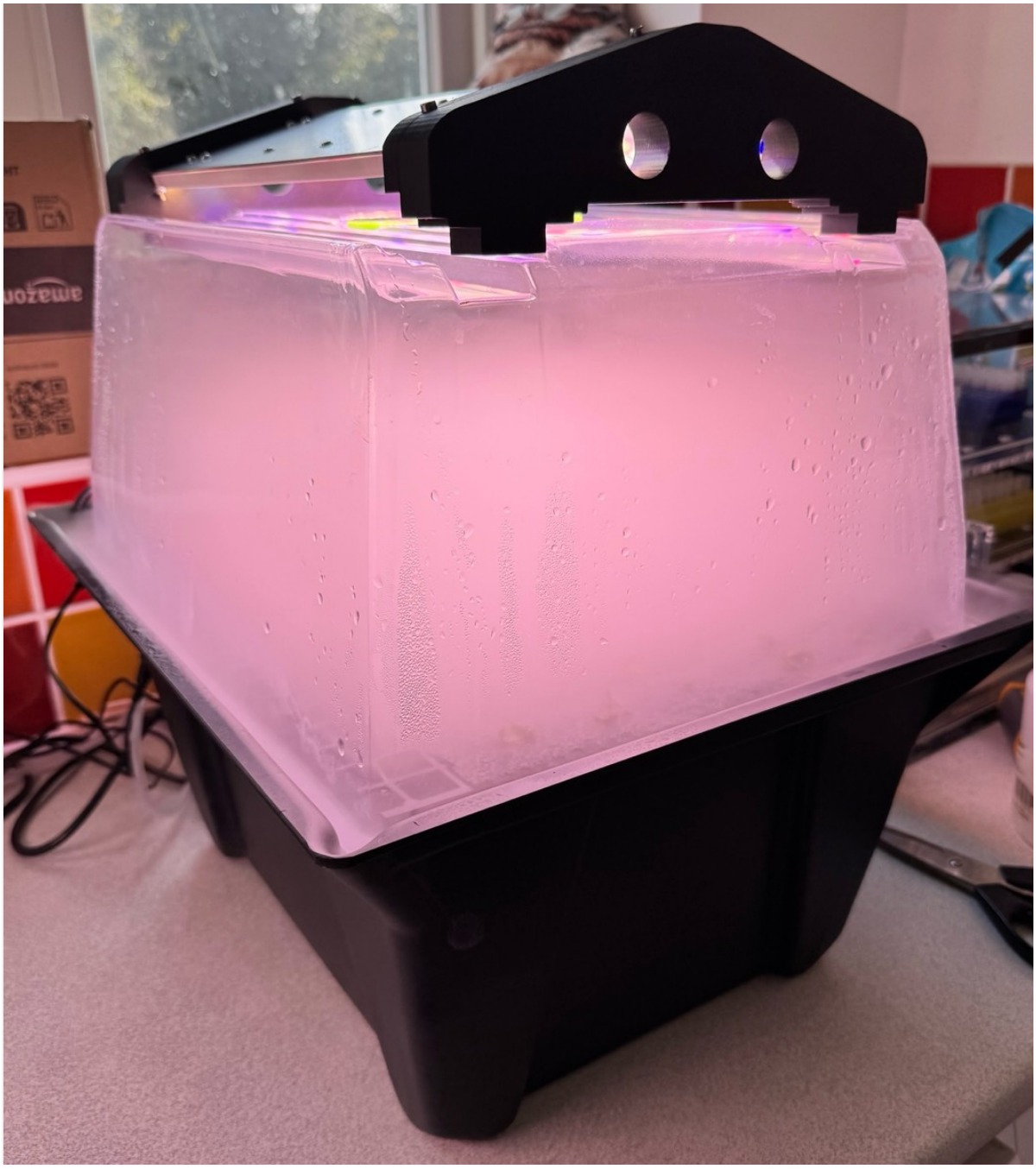



Overview of Tray 1 (left) and Tray 2 (right) - Day 7

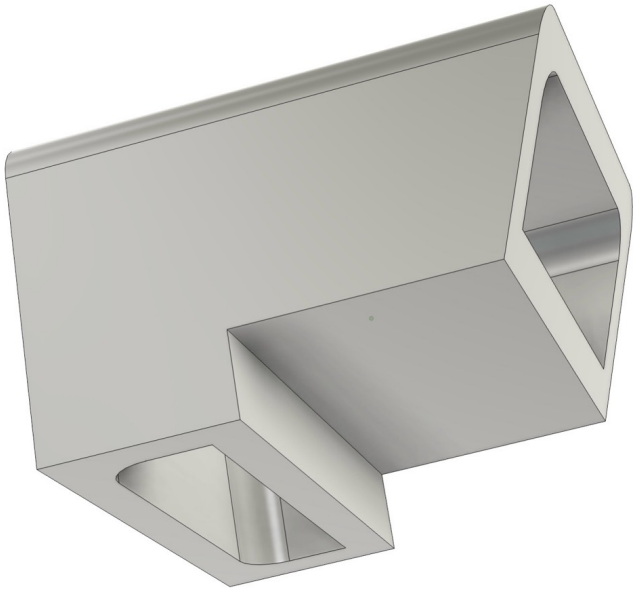



Upgrading X-Stream (20) system for blanket fogponics

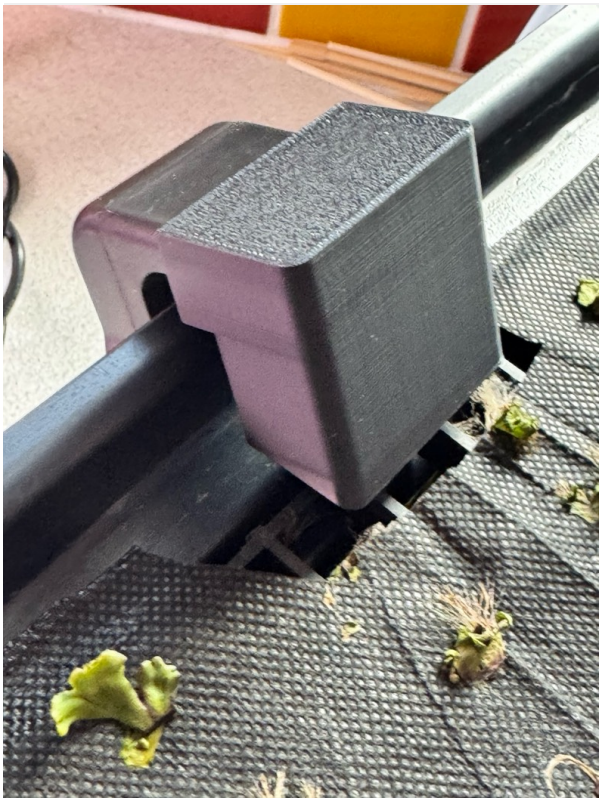
An adapter nozzle was printed for an aquarium fan - to allow clipping on to the tank of an X-Stream 20 system.



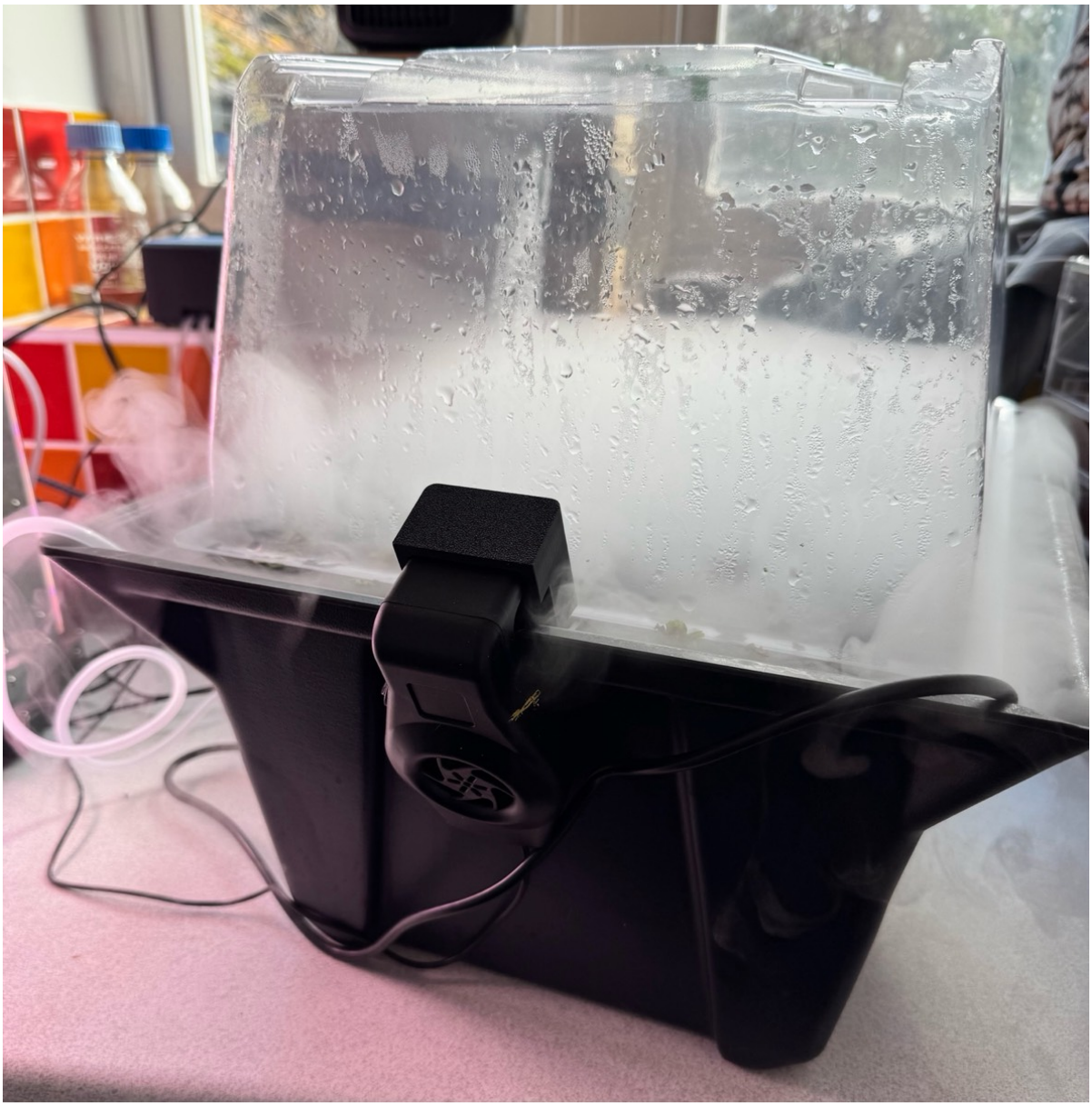
The nozzle has a push-on fitting to the fan assembly and allows the airflow to be directed downwards into the nutrient tank when clipped to the side of the tank.



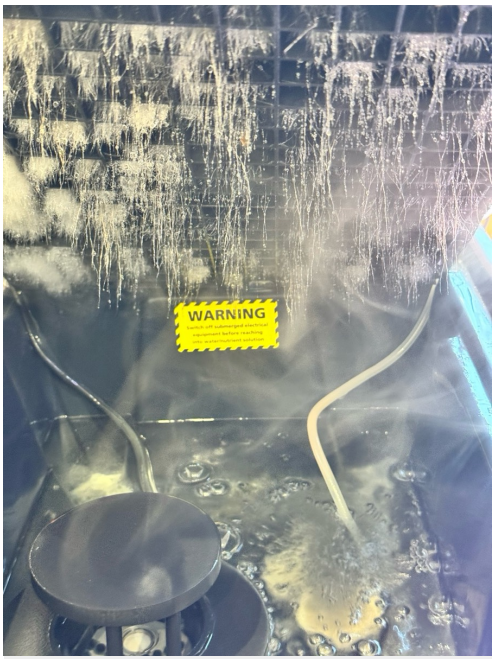
A suitable gap was cut from the support surface to allow unimpeded airflow into the tank. A gap was also cut from the propagator lid to allow it to seat properly around the fan. Gaps were also cut along the side of the support surface to allow fog to be blown into the top part of the vessel.



The ultrasonic transducer and fan were both connected to a mains/USB breakout connected to the electronic timer. The fan was set on the higher power setting. The timer was initially set to 30sec ON, 5min OFF. Running the fogger and fan for 30 seconds was enough to see the entire chamber filled with mist.



Below - Tray #2 upgraded: images of top and bottom views of the fogponic planter (after 2 weeks fogponics without fan, and 5 days with fan))



Below: Rhizoid growth after ~ 3 weeks with nutrient fog trapped under the support mat. Growth of plants in aerial part of the plant still seems limited by access to liquids - even after moving from a 20sec/5min on/off fogging regime to a 60sec/60sec on/off regime (although improved).
Conclusion: switch back to NFT approach and optimise.


WARNING