

Growing *Nymphaea thermarum*

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Based off of: Fischer E, Magdalena-Rodriguez C. 2010. *Nymphaea thermarum* (Nymphaeaceae). *Curtis Botanical Magazine* 27: 318–327.

Growth Conditions and Materials

Greenhouse

- Air temperature: 18°C (night) – 25°C (day)
 - Vents open at 25.5°C
- Air humidity: 70+% (or as high as possible)
- 12 or 12.5 hour day cycles, shading should be avoided
 - Supplementary lighting used for winter months
 - Lights switch on when light levels drop below 145 watts/m²

Soil and fertilizer

- It is important to use a rich, high-quality soil, with as few ‘floating particles’ (vermiculite, perlite, wood chips) as possible. Do not use “potting soil”, as those tend to have many components that float. We have found that soils labelled “top soil” or “loam” tend to be the most suitable. Can supplement with Turface or small stone particles. Soil quality can vary across different production batches, but we have had good luck with:
 - Fafard® Ultra Outdoor Planting Mix
 - Fafard® Premium Topsoil
 - Coast of Maine® Topsoil
- **Preparing soil for planting:** Before planting or repotting, we cover soil with water in a tub, and let it soak for 2 hours (or overnight) and then skim floating material from the top. The soil at the bottom of the tank is ready to use for planting --- scoop out and partially drain as needed. The best texture/moisture for planting is when the soil is fully moistened, but will hold together as a clump.
 - Paint-strainer bags are very useful for draining soil or skimming off floating bits
- Sheep pellets (Organic Dried Sheep Manure) are recommended as fertilizer. These can be purchased online from multiple vendors.

Tanks or tubs to hold plants and water – Tanks/tubs need to be at least a few inches taller than the pots in which you are growing the plants. Which option works best will depend on your space and capacity. We like to keep the pots in fitted grid trays inside of the tubs/tanks, to help keep the plants evenly spaced.

- Plastic tub, shallow– good for seedlings and small plants (or plants in shorter pots); can be kept easily on greenhouse benches (a Sterilite 7-Gallon (28-Quart) Storage Box, 23.12" x 16.9" x 6.38")



An empty tank, showing the grid tray (and two different pot sizes – the “adult-sized” on the left, and the “seedling-sized” on the right):



A full (and crowded!) tank, with pots placed in a grid tray:

- Plastic tub, deep – may be necessary if your pots are too tall for the more-shallow tubs (Sterilite 66 qt Storage Box, 24-1/2" x 17-3/4" x 13-3/8")
- Fish tanks – 5 to 10 gallon tanks
- Stock tanks (<https://www.globalindustrial.com/c/storage/bins-totes-containers/stocktanks>)
 - High Country Plastics Stock® Tank/Feed Bunk W-75 75 Gallons, 54"L x 26"W x 18"H
 - Rubbermaid, structural foam, 300 gallon capacity – great for maintaining larger populations. Can comfortably fit ~67 adult individuals in a tank. Pots in this large stock tank are kept spaced with fitted grid trays:



- Custom Tanks – if you have unique space requirements, you might consider having custom tanks and rack systems fabricated. We have had a good experience working with Midwest Custom Aquariums (www.midwestcustomaquariums.com).

Pots

- Small Pots for plantlets
 - ~9-10cm or 3.5in in diameter and height
- Large Pots for adult plants
 - 15cm or 6 in in diameter and height
 - Or can use the 'deep' version of 4 or 4.5 inch diameter square pots
- Smaller pots slow down the growth of plants, and the plants tend to be smaller
- Pots larger than what we have described can be used
- Always place potted plants in a watertight container/tank/tub filled with water to about the level of the soil contained in the pot (plant shoot apical meristem should be covered, but leaves should not be)

Plant Care

Seed to Seedling

1. Prepare a small tray or set of pots with about 10cm (~3 in) of soil and appropriate tank (such as a Sterilite 7-Gallon (28-Quart) Storage Box, 23.12" x 16.9" x 6.38"). Fill the tank with enough water to just barely cover the soil. To the water, add some small, freshwater snails (e.g. *Physa* or *Planorbis*) and water fleas (*Daphnia*). This flat can be prepared a few days beforehand in the greenhouse, to allow the water to come to room temperature, and to allow the soil to settle before sowing.
 - We put the soil in an interior tray/container in order to leave some room around the edge to ease water flow during refilling to prevent disturbing the soil/seeds too much.
2. Spread seeds over the soil. You can mark their location with plastic tooth picks.
3. Gently refill flat as needed to keep the water level consistent.
4. After about 10-15 days, seedlings should have extended their primary roots into the soil and the filiform leaf should have appeared.

Seedling to Plant

1. Continue to refill water in the flat gently until the plantlet is about 2-3cm (~1in) in diameter (4-5 healthy-looking leaves). The plant should have enough root mass to be safely repotted into a small pot.
2. Repot the plantlets into individual pots (see Repotting instructions in the "General Care and Maintenance" section). You can use the adult-plant sized pots at this time, or pot the seedlings into a medium-sized pot first (you will then have to do another round of repotting in 2-3 months, into the adult-sized pots). Dampen the prepared soil and pack it around the plant, centring the plant as you're potting and keeping the crown of the plant at about the same level as the soil level.
3. Place the pots in a tank filled with water, so the water level barely covers the crown of the plants and sits comfortably above the soil line.
4. After 3-4 months, the plants should begin to flower.

General Care and Tank Maintenance

General

- Every few weeks remove flowers and developing fruits, if not needed for research, to avoid potential seed dispersal. If seeds are allowed to germinate, they can clog up and/or overcrowd the tanks.

Water Levels

- Water evaporates slowly, but tank should be refilled as needed
- Do not allow water level to rise higher than a few inches above the soil level. For younger plants, the water should only be a few cm above the soil level.

Fertilizer

Water lilies tend to be greedy. Under-fertilized plants will not flower.

- One pellet of sheep manure once every 7-10 days, plugged into soil 2-4 cm deep

Algae Control

You will get algae in your tanks; the goal is to prevent the algal growth from hurting the growth of your plants. Use opaque-sided tanks (such as stock tanks) to minimize light exposure to the water. We have found the biological controls tend to be the most effective and safe for use with aquatic plants:

- Small, freshwater snail (e.g. *Physa* or *Planorbis*)
- Water fleas (e.g. *Daphnia*)



(Snails and *Daphnia* can be ordered from Carolina Biological Supply)

Potential Pests

- Fungus gnats – do not appear to harm plants much, but annoying and may interfere with controlled pollinations.
 - (*Bacillus thuringiensis* ssp. *Israelensis* (BTI) treatment every 30 days to kill fungus gnat larvae that may wreak havoc on plant roots. Typically, we use floating dunks of a BTI maintenance formula in our tanks. Every so often we'll use mosquito bits of BTI quick kill formula in our flats)
- Thrips (*Frankliniella* sp.) – hard to see, but infected plants will produce unhealthy-looking leaves with curled edges and the “white spots” damage pattern typically associated with thrips.
 - Apply treatment only when thrip infestations are detected. Active ingredients used: spinosyn & s-kinoprene.
- Aphids – rare, but possible. Clean aphids off plants and/or remove infested organs or individuals.

Repotting - Repot every 3-6 months (or up to one year) for healthy growth and prolific flowering. Progressively more yellow leaves, slower flowering, poor fruit set, and emergence of shoot apical meristem from soil level are all signs that you need to repot.

We find it is useful to set up a few tubs and buckets as a repotting station. Performing the tasks over tubs helps minimize the mess.

- A) Bucket for collecting waste water and soil (see note at end about dealing with muddy waste water)
- B) Bag for collecting soil/debris to be disposed of. We autoclave our waste soil, to make sure that seeds and plantlets are destroyed.
- C) Tub 1: Plant cleaning
 1. Remove plant and soil from pot. If there are areas of loose soil, remove them with your hands.
 2. In a small bucket or large beaker of water, wash root ball thoroughly, but gently. You will need to periodically filter soil out of this water (use paint strainer bags, dump soil into bucket for collecting water and soil, reuse-the water).
 3. Remove offshoots and any dying leaves, snap off vertical rhizome as necessary
 4. If necessary, you can further rinse plant under a stream of room temperature water. This is useful to clean off pests or algae.
- D) Tub 2: Repotting
 5. Partially fill new pot with prepared soil (see note in “Soil and Fertilizer” section), place plant upright, with the shoot apical meristem 1 cm or so below the new soil level. Lightly but firmly, pack soil around the plant. It’s best to have the shoot apical meristem a little below the soil line – as the plant grows, the shoot apical meristem will grow upwards and will eventually re-emerge.
 6. Place re-potted plant into tank with water.

Avoid washing soil down any sink drain (even if there is a soil trap). We find it is best to let muddy water settle in tubs or buckets for a day or two – the clear water at the top can be poured or scooped off, and the thick muddy residue at the bottom can be disposed of more easily. If you have the time and space, it is best to let the muddy soil residue dry completely, and then you just dispose of the dry soil pellet.