Factsheet 20/08

Ornamentals

Project HNS 147

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Wet heat treatment to sterilise pots for re-use

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Project HNS 147 demonstrated that wet heat treatment provides the best alternative to methyl bromide for sterilising plastic pots and containers. This factsheet provides growers with a practical guide on how to achieve wet heat sterilisation.

Background

With the loss of the chemical fumigant methyl bromide, HDC commissioned a research project (HNS 147) to find an alternative method to sterilise plastic pots and trays for re-use on nurseries. Wet heat treatment (via a hot water bath) proved to be the most effective method for controlling the test organisms, which included two fungal diseases *Rhizoctonia solani* and *Pythium intermedium*, the seeds of hairy bittercress (*Cardamine hirsuta*) and pearlwort (*Sagina subulata*), bud and leaf nematode (*Aphelenchoides* spp.) and western flower thrips (*Frankliniella occidentalis*). Control was achieved with minimal risk of carry-over when pots were exposed to 10 minutes wet heat treatment at 60°C. Other nursery materials such as capillary matting can also be treated this way.

How to conduct wet heat sterilisation on the nursery

Pots and containers are stacked in crates (Figure 1 and 2 – overleaf) and submerged in hot water (60°C) for at least 10 minutes. The water is held in tanks, which can be purchased new (See Further information section) or second hand (from other horticultural sectors). Alternatively, tanks can be designed and built to specific requirements to allow existing nursery crates of pots to be lowered into the tank. The exact tank size chosen will depend upon the required numbers of pots/containers to be sterilised in a given period of time. In practice, with an average tank size, up to 8 batches of pots/containers can be treated in a day. Table 1 (overleaf) provides an outline of the numbers of pots that can be treated per day for two different tank sizes.

1 Used pots stacked in purpose built crate

Heating the water

Hot water may be heated by the nursery's boiler, by providing flow and return pipes with a heat-exchange grid of pipes in the bottom of the tank. A pump is installed in the flow pipe, which is governed by a thermostat which samples the water temperature within the tank, whilst the process is taking place.

Alternatively, less complex systems can be employed to heat the water tank. Examples include a stand alone electric immersion heater and a kerosene burner with heating elements in the base of the tank providing the heat source.

Tanks used by bulb growers for bulb sterilisation are also suitable for the job, although in practice, availability of good second hand bulb sterilisers is limited.

It is best to tailor the design and construction of the system to the set up and needs of the individual nursery business. Growers are well advised to do this in conjunction with a specialist engineer.

Table 1 Throughput of pots per day at different tank sizes

Tank size	Number of 1 litre pots treated/day	Number of 3 litre pots treated/day
2.04 m³ (2,000 litres)	67,200	20,800
1.8 m³ (1,800 litres)	59,300	17,640

Operating the system

Preparation and stacking

- Knock growing media out of pots/containers prior to stacking them into crates according to size and shape, ready for treatment.
- Discourage staff from squashing pots together as this makes it difficult to separate the pots afterwards.
- Stack round pots vertically to avoid distortion (Figure 1 – see page 1).
- Lay square pots horizontally, leaving gaps between tubes in crossed layers to improve water penetration and drying.

Submerging the crates

Crates can either be lowered into hot water tanks by forklift (Figure 2) or placed onto a platform and lowered down via a winding mechanism (Figures 3 and 4). Alternatively an electric motor may be used. It can be helpful to insert ballast in crates to weigh them down during treatment whilst a lid on the crates will help to prevent pots from floating. Alternatively, some growers achieve both simultaneously by stretching a net with weights on top, across the top of the crate.

2 Crates being lowered into hot water tank by forklift truck

3 Platform fitted to top of tank to lower crates into tank

Maintaining water temperature

Inevitably, heat is lost from the water leading to temperature drop. The following guidelines will help to maintain water temperature at the optimum level:

- It is best practice to operate at a higher temperature than 60°C as the water temperature can drop by up to 5°C when cold pots and crates are added. The initial temperature needs to be sufficiently high to ensure that the required temperature is reached immediately after immersion.
- An insulated tank lid will reduce heat loss and water evaporation (Figure 5).
- Following the addition of any water to top up the tank volume between batches, water will need to be raised to the target temperature before treatment re-commences. This may take surprisingly little time.

For water to be maintained at a minimum of 60°C, the heating water will need to be closer to 80°C when it enters the heat-exchanger. A typical heating boiler should be able to deliver water of this temperature. Experience has shown that pots can withstand temperatures of up to 80°C without risk of distortion.

Submersion duration

It is preferable to leave batches of pots in the tank for a period that is both sufficient to achieve adequate sterilisation and that is easy for the system operator to remember. In practice, some operators change batches every hour as this is easy to remember and practical, whilst it also ensures that pots are treated for at least 10 minutes. Staff operating the system should be trained to do so and allow between 10–20 minutes for changing batches of pots (depending on the system). Water does not need to be agitated in the tank as heat will rise through the crates from the heating elements in the base of the tank.

Pesticide residues

Pots and growing media attached to them can contain traces of pesticide residues which can accumulate in the hot water used for treatment. Be aware that such water will have to be changed more than once a season to remove residues, depending on the level of contamination, and disposed of in the same way as pesticide washings, ideally onto a bio bed.

Safety precautions

Systems should be located outside, in a well ventilated area. Operators must wear spray masks with carbon filters as pesticide residues may be present in the water vapour. Water tanks should only be loaded mechanically. All staff should be made aware of the risk of scalding hot water, and businesses should do everything reasonably practicable to reduce this risk. Be guided by the Health and Safety Executive (HSE) as to your obligations to your staff.

4 Side view of tank showing winding mechanism used to lower platform and crate into tank. Crates are placed on the platform using a forklift truck

5 Typical insulated tank lid to reduce heat loss and water evaporation

Storage after treatment

Following sterilisation, the pots should be labelled with the date of treatment. Be aware that they can take up to 5–6 months to dry, depending on temperatures and weather conditions. They should be stored under cover in a building to protect from weed seeds, dust (which is a potential source of *Rhizoctonia*) and plant debris (which can be a source of *Pythium* and other diseases). Experience has shown that although pot dispensers can cope with used, hot water-sterilised pots, they are more troublesome than new pots.

Typical system costs

The costs vary widely, depending on whether new or second hand systems are installed and the exact specification chosen.

- New, insulated polypropylene tanks with a 1 KW electric water heater operating at 70°C, cost approximately £3,800 for a 1 m³ (1,000 litre) system or £4,500 for a 2m³ (2,000 litre) system.
- Second hand bulb tanks, although sometimes difficult to come by, can be purchased for as little as £200.
- A purpose built system with 1.8 m³ (1,800 litre) capacity, connected to the nursery flow and return boiler, can cost approximately £10,000 in materials and labour to construct.
- A typical system operating at 80°C uses 50–60 litres of oil per day. In addition 3–4 hours labour per day is required to run the system.

Further information

Contact points for tank suppliers:

Niplast Products
Virginia Mills, Higher Hillgate
Stockport SK1 3JG
Tel. (01614) 776 777
Email. info@niplast.com
www.niplast.com
(Tanks suitable for temperatures up to 100°C)

Nicholson Plastics
20b Landsdowne Road
Croydon
Surrey CR0 2BX
Tel. (0208) 681 1981
Email. sales@nicholsonplastics.co.uk
www.nicholsonplastics.co.uk
(Tanks only guaranteed for temperatures up to 60°C for 1 hours use, unless a heat resistant resin gel is added to tanks)

IAC Plastics
Oak Mill
Dunnockshaw
Burnley
Lancashire
BB11 5PW
Tel. (01706) 212225
Email. sales@iacplastics.com
www.iacplastics.com
(Provided bespoke tanks for growers own needs)

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Further information: A full copy of the final report for HDC project HNS 147 is available to HDC members from the HDC office (01732) 848383 or website www.hdc.org.uk

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