

## ***If I have bulb and stem nematode in my garlic, what can I do to control it this fall?***

### Hot Water Seed Treatment

Hot water treatment has been used to reduce and sometimes eliminate nematodes in garlic cloves and many other bulbs such as daffodils and Easter lilies. These treatments have been worked out over time to kill the nematodes without killing the bulb. **Growers should experiment with smaller lots to start as the exact temperature and time may vary with the cultivar and clove size. The window between killing the garlic cloves and killing the nematodes is very narrow.**

WARNING – Accurate time and temperature controls are required to successfully heat treat garlic cloves! One to two degrees Fahrenheit can make a difference. Too high a temperature or too long an exposure may injure or kill the garlic tissue, while too low a temperature or too short an exposure may not kill the nematodes.

There are usually four steps involved in hot water treatment of garlic cloves:

1. Pre-soak bath - Soak in water maintained at 100°F/38°C for 30-45 minutes. This activates the nematodes in the clove and makes them more susceptible to the heat treatment. It also pre-warms the cloves so that the temperature of the hot-water bath is easier to maintain.
2. Hot-water bath – Take the cloves immediately from the pre-soak and put them in a 120°F/49°C hot-water bath. Maintain this bath at 120°F/49°C for 20 minutes. The temperature of the hot-water bath will fall when the cloves are added. You need a system to quickly raise the temperature to 120°F/49°C without hot spots. Start timing when the temperature is stable at 120°F/49°C.

The volume of water compared to the volume of the cloves is important. If there is too little water, the temperature will drop significantly when the cloves are added. Usually a ratio of 4-5 parts water to 1 part cloves is recommended.

3. Cool bath – Immediately submerge the cloves in a cool water bath for 10-20 minutes at 64-72°F/18-22°C. For very small lots run ning water can be used. Do not use ice water as it is too cold.
4. Drying - Dry the cloves and plant within a week of treatment. Do not try to store treated cloves. These baths while reducing the nematode population, may increase decay due to fungi especially if the seed is not dried and planted shortly after treatment.

Things you will need:

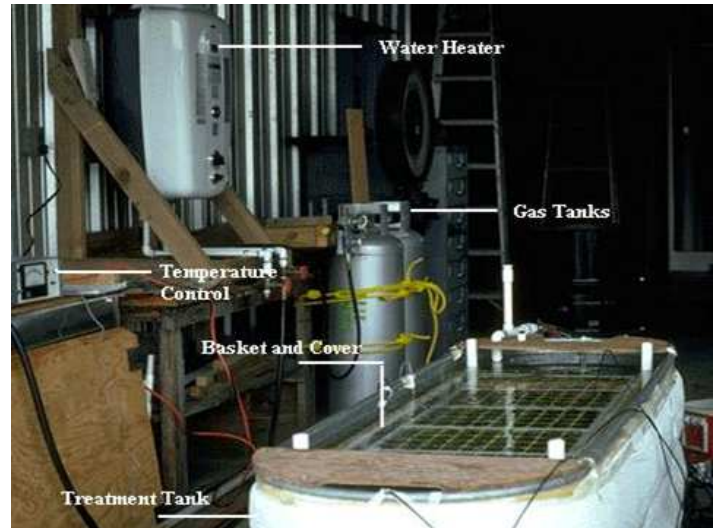
1. 2 baths with a heat supply and some type of circulation to reduce hot and cold spots –see the comments above on water volume
2. 1 cooling bath with some type of circulation

3. high-quality standardized thermometers preferably in Fahrenheit as it is more accurate (i.e. 120°F is actually 48.9°C)
4. a way to get the cloves in and out of the baths quickly
5. a way to dry the cloves after the cool-water bath (this can be a problem with larger volumes)

The following photos show an example of a hot-water treatment set up. Note that there is more than 1 tank involved.



Photos courtesy of Dr. Fred Crowe.



Check out the links at the end of this article for some additional ideas on equipment for hot-water treatment. When checking information of the internet, be aware that the temperatures and treatment times recommended for other bulbs are very different than that used for garlic. An excellent article on hot water treatment of bulbs can be found at <http://nematology.ucdavis.edu/faculty/westerdahl/courses/204NEM/PHWT.htm>

As hot water treating garlic is tricky and risky, growers in a number of parts of the world including California rely instead on clean seed programs using limited generations.

### Site Selection and Soil Testing

Before planting your hot-water treated seed, select the site carefully and get the soil tested for nematodes. Look for fields that have not grown garlic or any other alliums in the past 4 years. Even then soil testing for stem and bulb nematode should be done.

Soil samples can be sent to the University of Guelph, Laboratory Services, Agriculture and Food Lab (95 Stone Rd W, Guelph, ON N1H 8J7 phone 519-767-6299 fax 519-7667-6240) and tested for nematodes. Submission forms and instructions for sampling soil for nematodes can be found at [www.guelphlabservices.com](http://www.guelphlabservices.com) or by calling the lab. The cost is \$45/sample. There is also an OMAFRA factsheet "Sampling Soil and Roots for Plant Parasitic Nematodes" available from the OMAFRA website at <http://www.omafra.gov.on.ca/english/crops/facts/06-099.htm> .

The results from the PDC will be a count of *Ditylenchus* species (*spp.*) as it is difficult to distinguish the stem and bulb nematode from other nematodes in the same genus. Most of the other *Ditylenchus* nematodes live in soil and feed on fungi. Their populations are usually very low.

Select the site with the lowest *Ditylenchus spp.* counts. The economic threshold for stem and bulb nematode or *Ditylenchus spp.* is 100/kg of soil. Avoid using soils with counts above that level or implement a management strategy.

Useful links:

<http://nematology.ucdavis.edu/faculty/westerdahl/courses/204NEM/PHWT.htm>

<http://ucce.ucdavis.edu/files/filelibrary/5356/14424.pdf> - see slide 8 for another example of a hot water bath set up

[http://science-in-farming.library4farming.org/PlantDiseases\\_2/Ornamentals/Nematodes-in-Bulbs.html](http://science-in-farming.library4farming.org/PlantDiseases_2/Ornamentals/Nematodes-in-Bulbs.html)