HEAT AS AN ALTERNATIVE TO METHYL BROMIDE FOR DISINFESTING EQUIPMENT CONTAMINATED WITH THE GOLDEN NEMATODE

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Methyl bromide (MBr) fumigation is the treatment of choice for disinfesting equipment and other articles to free them of the golden nematode. The impending phase-out of MBr, has forced the development of more environmentally compatible procedures for disinfesting items that are contaminated with the golden nematode to ensure the integrity of the golden nematode quarantine.

High temperature holds the greatest potential as an environmentally safe treatment to disinfest items contaminated with the golden nematode. In previous studies we found that golden nematode eggs in cysts that were presoaked in water were killed when exposed to 55C for as little as 30 seconds. However, eggs in desiccated cysts tolerated temperatures as high as 75C for brief periods.

The most common source of heat used to sterilize soil and other items is steam, but steam has not been used as a lethal treatment to disinfest equipment contaminated with the golden nematode. High-pressure steam is often used to clean equipment infested with the golden nematode but its direct effect on survival of nematode eggs is not known. Earlier studies indicate that solarization with supplement heat is a potential means of disinfesting items contaminated with the golden nematode. We found that treatments where temperatures of 55C or higher were achieved were lethal to golden nematode eggs when cysts had been previously wet. Although some eggs appeared to survive the treatment, the resultant juveniles did not infect plants.

The current experiments were concerned with the influence of moisture on the effectiveness of high temperatures against the golden nematode. Four small nylon sackettes containing 20 golden nematode cysts each were placed in small crevices of each of 4 pieces of tillage equipment. Each treatment was applied before and after the equipment had been prewashed with high pressure water to wet the cysts. For the solarization treatment a potato hiller was sealed in clear polyethylene for 28 hours. For the steam heat treatment, a cultivator was sealed in clear polyethylene for 28 hours and supplemental steam heat was applied for 6 hours on each of 2 days with a small household steamer. For the dry heat treatment, a 2-bottom plow was sealed in clear polyethylene for 28 hours and supplemental dry heat was applied for 6 hours on each of 2 days with a household space heater. The MBr treatment was used as a control and consisted of sealing a 2-bottom plow in black polyethylene for 28 hours to which

MBr was immediately applied at 15 lbs/1000 ft^3. The check consisted of cysts contained in nylon sackettes that were not subjected to treatment. The temperature was recorded under the polyethylene of all treatments except the MBr treatment.

After the treatments were completed, the sackettes containing the cysts were retrieved and the cysts were extracted and subjected to a hatching test. The hatching test consisted of soaking the cysts in water for 5 days then placing them in potato root diffusate for 3 weeks. The number of juveniles that emerge were counted weekly and fresh diffusate was added.

The highest temperature achieved under the polyethylene without supplemental heat (solarization) was 50-56C which was maintained for 3 hours on each of two days. The highest temperatures under the polyethylene where steam heat was applied was 66-72C which was maintained for 3 hours. The highest temperature under the polyethylene where dry heat was applied was 71-79C which was maintained for 3 hours.

Hatch from the nontreated cysts averaged 78 juvenile/cysts. Hatch from the MBr control averaged 0.6 juveniles/cyst. Hatch from cysts under polyethylene where supplement steam heat was applied averaged 0.07 juveniles/cyst when the equipment was not prewashed with high pressure water and 0.2 juveniles/cyst when the equipment was prewashed. Hatch from cysts under polyethylene where supplemental dry heat was applied averaged 69 juveniles/cyst when the equipment was not prewashed and 25 juveniles/cyst when the equipment was prewashed. Hatch from cysts under polyethylene without supplemental heat (solarization) averaged 56 juveniles/cyst when the equipment was not prewashed and 24 juveniles/cyst when the equipment was prewashed.

These results indicate that solar heat alone in the Northeastern USA is not sufficient to disinfest equipment contaminated with the golden nematode. Although lethal temperatures were achieved, addition of supplemental dry heat under polyethylene did not sufficiently disinfest equipment contaminated with the golden nematode. The use of supplement steam heat was as effective as MBr in disinfesting equipment contaminated with the golden nematode. Prewashing equipment with high pressure water increased the sensitivity of the eggs to high temperatures but not sufficiently to achieve the desired amount of kill.