USING HEAT TO DECONTAMINATE PINE CHIPS INFESTED WITH THE PINEWOOD NEMATODE

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In 1984, the pinewood nematode (PWN), Bursaphelenchus xylophilus, was found infesting wood chip exports from North America. Subsequently, the European Union banned the importation of softwood products except kiln-dried lumber from countries known to have B. xylophilus. Now, the forest industry is interested in importing conifer wood chips. APHIS has proposed regulations regarding the importation of wood chips that depend on methyl bromide and heat-treatment (59 FR 3002.3029, January 20, 1994). This study was undertaken to further define the time-temperature requirements for three heat sources for the eradication of pinewood nematodes in southern pine chips.

Dry heat: The time-temperature requirements for decontaminating pine chips with dry heat were determined by exposing 200 g lots of chips to 70, 80, 90, and 100°C for 15 to 55 min. Three samples were removed from the four temperature chambers every five minutes. To monitor wood temperature, needle microprobes were placed in one chip at each temperature. In this and subsequent experiments, nematodes were extracted using the Baermann funnel procedure. The wood moisture content was determined by drying samples at 105°C for 24 h. The initial pinewood nematode population of the pine chips was 54/g(dw).

Nematodes were not extracted from the chips after 45, 35, 30, and 25 min exposure to 70, 80, 90; and 100°C, respectively. Furthermore, the corresponding wood temperature at these times averaged 63°C.

Hot Water: The time-temperature requirements to decontaminate pine chips with hot water were determined by submerging 500 g lots of PWN-infested chips into water baths at 60, 70, 80 and 90°C for 0, 15, 30, 60, and 180 seconds. Each treatment combination was replicated three times. The chips used in the experiment averaged 18 PWN/g(dw).

Nematodes were not extracted from the chips after 60 sec for 60, 70, and 80°C and 15 sec for 90°C. At 80°C, there was a progressive decline in the number of samples with live nematodes after 15 sec. The wood moisture content of the treated chips increased about five percent.

Steam Heat: The chamber for steam treatment of wood chips consisted of a 19-L bucket with input/output orifices for the steam. The steam was 100°C at 2 psi. Three one-kg lots of PWN-infested chips were steam heated at 0, 30, 60, 120, 180 sec. The chips used averaged 8 PWN/g(dw).

Nematodes were not recovered from chips exposed to steam for 60 sec and longer. There was no appreciable change in wood moisture content.

Donnelev's Cannon: Charles Donnelly (Peeples Industries, Inc, Savannah, GA) designed and built an experimental apparatus that could be used to treat 200 lb lots of wood chips with steam or hot water (Fig. 1). Basically, the apparatus was a 3.6 m screw-type conveyor of 36-cm-diameter. The tube housing the conveyor was covered with insulation. The steam was introduced through four nipples along the length of the tube. The screw was driven by hydralic motor that could be adjusted to control the attack time. The tube had an open end discharge and was fed by a hopper attached to the opposite end. The exit temperature of the chips was measured. For hot water treatments, the hopper was filled with water at around 80°C. The attack times were 86, 63, and 42 sec. For steam, the attack times were 93, 55, and 37 sec. In both cases, the attacks were replicated three times. Twelve 1-kg samples for each treatment were taken at the exit point and assayed for nematodes. The base PWN population of the chips was 14/g(dw).

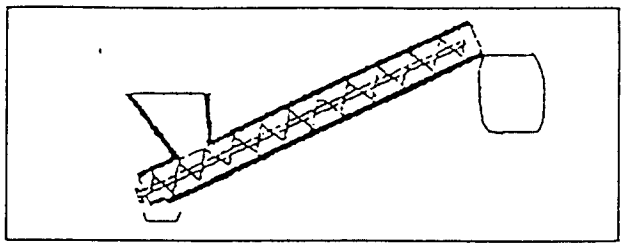

Figure 1. Apparatus for heating chips with steam or hot water.

Nematodes were not extracted from the chips that had been exposed to steam or hot water in the apparatus.

Summary: The eradication of pinewood nematodes in wood chips by heat, as evidenced in this study, is consistent with previous reports of the effect of high temperatures on the nematode in wood (Dwinell, 1986; Dwinell, 1990; Kinn, 1986). For example, previously it was reported that nematode populations in wood chips rapidly declined at temperatures above 45°C (Dwinell, 1986). Like most mesophilic organisms, the rate of mortality of the nematode in wood is largely a function of time and temperature. The data also confirms that wet heat (steam or hot water) is more effective than dry heat.

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