

Introduction

Annosum root rot affects conifers throughout the Northern Hemisphere, infecting their roots and eventually killing the trees. The fungus *Heterobasidion annosum* causes annosum root rot. The fungus colonizes readily on freshly cut stumps. Partially cut stands have a high risk of infestation because the fungus can colonize on each of the stumps and potentially infect the neighboring trees. Wind and rain carry the annosum spores. Spores that land on freshly cut stumps grow down the stump's root system where they can infect living trees through root grafts or root contacts. Once annosum becomes established, it can remain active for many years in the Southern United States and for several decades in the North. About 7% of the trees that become infected die.

When thinning, stumps can be treated successfully using a competing fungus, *Phlebia gigantea*, and with "Tim-Bor" in liquid formulations. These liquid products are no longer approved in the United States. Only the dry powder form is registered and approved by the EPA. Stumps can be treated with a dry formula of borax, (Sporax), significantly reducing one of the primary routes by which *Heterobasidion annosum* infects a stand of trees. Sporax is used by the USDA Forest Service to control annosum root rot. Sporax is now applied by hand, but once the felled trees are skidded it becomes very hard to locate the stumps. A stump applicator will reduce error, labor costs, and hazards to workers.

MTDC Applicator

The MTDC applicator has four main components that are added to a typical feller-buncher (Figure 1)—the reservoir/metering device, compressor, nozzle, and an electrical control box.



Figure 1—Typical feller-buncher with borax applicator.

The applicator which has a reservoir that holds 0.44 cubic feet of material is mounted to a feller-buncher. A metering device is located at the bottom of the 8- by 8- by 12-inch container (Figure 2). A small DC-powered air compressor (Figure 3) was added to supply compressed air. A nozzle attached to the back of the feller-buncher saw head (Figure 4) applies powder to the stump.

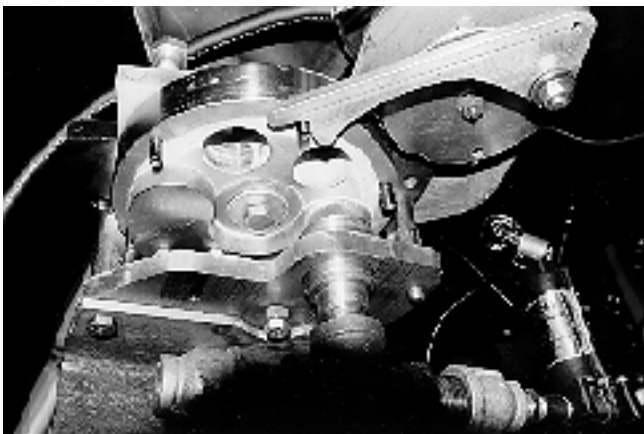


Figure 2—Borax metering device.



Figure 3—DC-powered air compressor and reservoir.



Figure 4—Nozzle at rear of saw head applying powdered borax.

A timer (Figure 5) controls the metering mechanism, allowing application rates to be adjusted. The metering mechanism drops a measured amount of borax powder into a chamber where it stays until it is ready to be applied. The chamber's outlet is attached to a delivery tube that carries powder to the nozzle. This chamber has an inlet that is attached to a solenoid valve. The solenoid valve controls the application of compressed air. Another timer controls the amount of air that is applied to the delivery tube.

The air compressor has a regulator valve that controls pressure of the compressed air. Higher pressures usually produce wider distribution patterns at the nozzle.



Figure 5—Timers in electrical control box for adjusting amount of air and dry powder delivered to nozzle.

The Fog-jet nozzle (Spraying System Co.) has 12 holes on an angled radius (Figure 6). This nozzle is modified by increasing the hole angle on every other hole and the holes are drilled out to 0.078 inches in diameter. This provides a uniform pattern of application and increases the angle of coverage (Figure 4). The Fog-jet nozzle is used with 40 psi pressure.



Figure 6—Nozzle with 12 radial delivery holes.

The height of the nozzle (H) above a stump determines the diameter (D) covered (Figure 7). The nozzle's angle of coverage is 18 degrees. The nozzle has to be positioned higher for larger stumps and lower for smaller stumps.

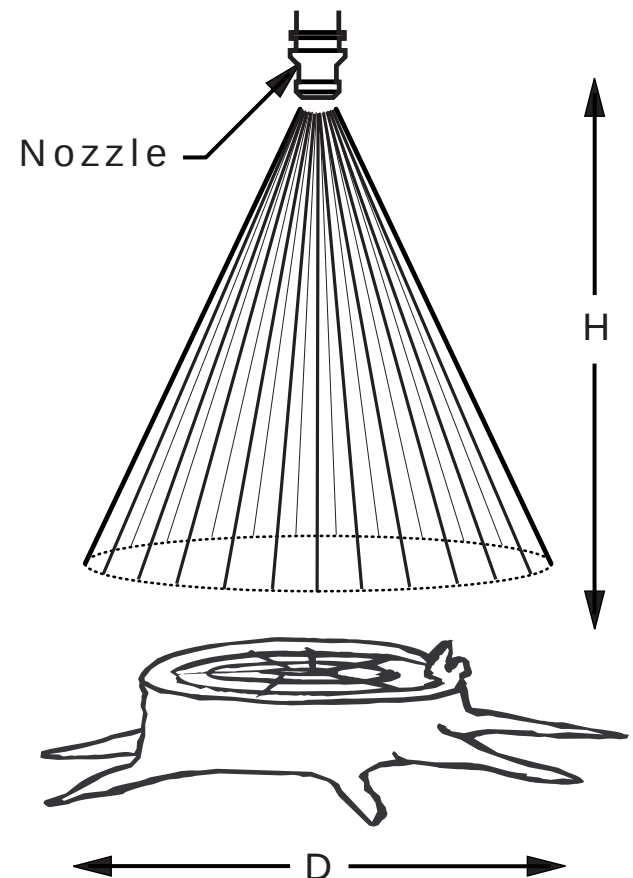


Figure 7—The diameter (D) covered increases as the height (H) is increased.

Once the feller-buncher operator cuts a tree, the operator raises the cutting head and positions the borax nozzle (at the back edge of the cutting head) directly over the stump. When the machine is positioned, the operator pushes a button that opens a solenoid valve on the compressed air line. Compressed air moves the borax powder from the applicator drop chamber through a delivery tube to the nozzle. The timer turns on the metering device so that the powder is in the delivery chamber for the next cycle. The procedure is repeated after each tree is cut.

Installation

The MTDC applicator (Appendix A) has four main components—the reservoir/metering device, compressor, nozzle, and an electrical control box (Figure 8).

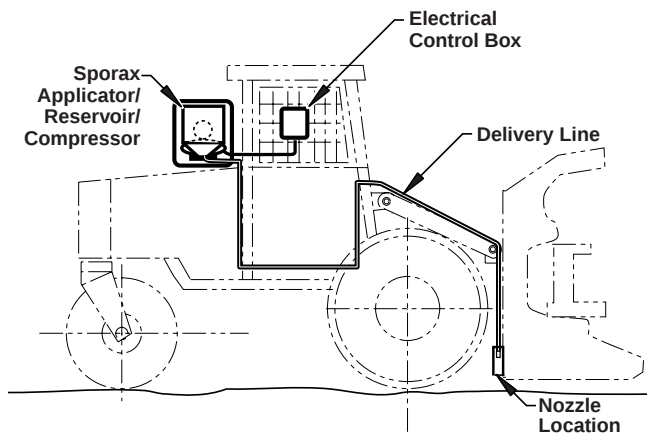


Figure 8—Applicator schematic.

Applicator Assembly

Place the compressor and reservoir/metering device on the machine's engine enclosure, directly behind the operator (Figure 9). Choose a position that minimizes obstruction to the operator's vision and one that does not expose the applicator to damage from falling debris. Mounting brackets have to be constructed (Figure 10) to attach the frame assembly to existing bolts or holes on the feller-buncher engine housing. On some machines this assembly may have to be located elsewhere.



Figure 9—Installing applicator assembly.



Figure 10—Typical mounting brackets fabricated to attach applicator to existing mounting bolts.

Delivery Tube

Route the delivery tube from the reservoir/metering device to the nozzle in locations that will provide some protection to the tube (Figures 11a, 11b, and 11c). Guards may have to be constructed in areas where the tube might be exposed to damage.



Figure 11a—Route delivery tube from applicator so that it is protected as much as possible without restricting or pinching the tube.



Figure 11b—Use existing machine components to protect the delivery tube.

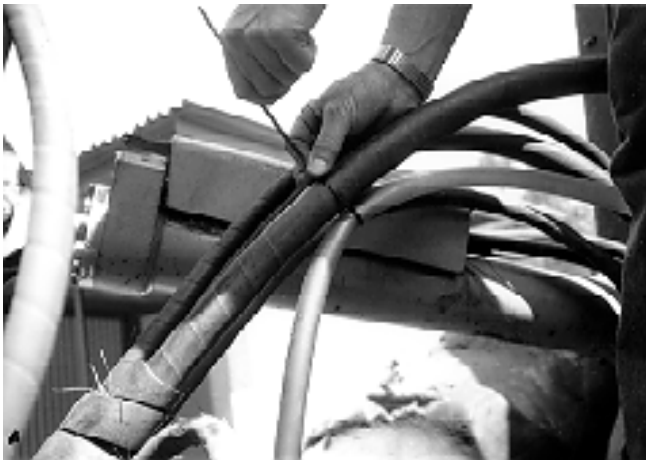


Figure 11c—Attach delivery tube to existing cables to prevent possible pinching by lift linkages.

In the cutter head/lift arm area, the tube can be routed along the existing hydraulic lines to provide slack for cutter head movement and to keep the hose from being pinched in the linkages (Figures 12a and 12b). The frame of the applicator may need to be modified to fit certain machines. Guards may have to be added to protect the applicator.



Figure 12a—Operate head through extreme limits of travel to ensure the hose is the proper length and will not get pinched during operation. The head is in the forward position here.



Figure 12b—Operate head through extreme limits of travel to ensure the hose is the proper length and will not get pinched during operation. The head is in the rear position here.

Electrical Connections

If the installation is made to fit a particular feller-buncher, the electrical box can be mounted inside the cab and holes can be drilled for the electrical cables. This is the ideal location of the electrical control box. If this is not possible, or if the owner is reluctant to drill holes in the cab, the electrical box can be located outside the right-hand window. Attach the electrical box to the protective grill with plastic wire ties in a location that does not obstruct visibility (Figure 13) and that allows access to the electrical power switch. Route the push-button switch cable through the window opening and tape the switch to a convenient location, such as a control handle.



Figure 13—Attaching the electrical control box to the feller-buncher's protective grill.

Attach the green and white wires from the power cable and the extra black wire to the feller-buncher's positive (+) battery terminal (Figure 14). Attach the black wire (-) from this cable to a ground on the vehicle.

Attach the wires from the applicator cable as follows:

White —one terminal of the wiper motor's park switch to one wire of the wiper motor

Red —one terminal of the wiper motor's park switch

Green —one terminal of the air solenoid switch

Black —to a ground screw on the wiper motor.

Attach a wire from the other terminal of the air solenoid switch to ground.

Attach the black and green wires from the compressor cable to the small terminals on the solenoid located near the compressor.

Attach the extra wire (black) from the positive (+) terminal of the vehicle's battery to one of the large terminals on the solenoid. From the other large terminal on the solenoid connect a wire to the A1 terminal on the compressor. From the A2 terminal on the compressor attach a wire to ground (for instance, a mounting bolt on the compressor tank)(Appendix B).

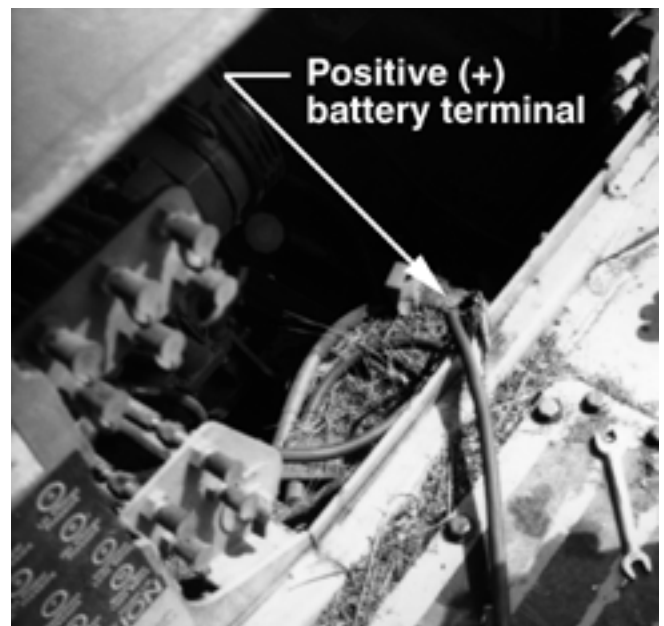


Figure 14—Attaching electrical cables to the feller-buncher battery.

Nozzle

Mount the nozzle to the back edge of the felling saw with a bracket attached to an existing capscrew on the saw head, slightly above the base of the saw (Figure 15). Most saw heads have a flange along the bottom of the saw with a series of attachment capscrews. Any one of these capscrews will work, but try to choose one near the center of the saw head. Care must be taken not to mount the nozzle too low. If the nozzle is too low, it may be broken off or plugged when the feller-buncher head is tilted back while the head is near the ground. Spacers can be added to raise the nozzle. Figure 16 shows a typical nozzle installation. A guard should be placed around the nozzle to protect it.



Figure 15—Mount nozzle at rear of saw head and above the lower surface of the head.



Figure 16—Typical nozzle installation.

One operator noted that the crossbar between the feller head lift arms obstructed the operator's view when the nozzle was positioned over the stump for borax application. Operators will have to develop a feel for positioning the nozzle when applying the borax powder.