MECHANICAL TRUNK INJECTION FOR CONTROL OF *Ganoderma*

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Basal stem rot (BSR) caused by *Ganoderma boninense*, which is a serious disease, especially in the replanted areas from old oil palm and coconut, remains the major disease of oil palm in Southeast Asia (Idris *et al.*, 2003). *Ganoderma* is a saprophyte that can infect a living palm if there is a large enough inoculum (*Figure 1*). The fungus, which is soil-borne, initially invades one or more roots and from there gradually extends into the stem, causing a dry rot, that eventually leads to the death of the palm. The disease can kill up to 80% of the stand by the time when the palms are halfway through their normal economic life span. As with most soil-borne diseases, it is extremely difficult to control once the disease has become established. The best approach to disease control is avoidance. All potential sources of infection from old stem and roots of oil palm and coconut should be destroyed.

Attempts to control this disease in the field with fungicides have been made by various workers, but the results are inconclusive, though some systemic fungicides seem to be promising (Idris *et al.*, 2002). The methods of fungicide application include soil drenching, trunk injection, or combination of these two methods. This paper describes the development of a mechanical trunk injection mainly to facilitate chemical injection into the oil palm trunk. This machine employs a pressure-injection technique that injects the chemical into the healthy tissues to control the spread of the disease from the infected tissues.

PROTOTYPE

The machine (*Figure 2*) comprises of a prime mover (hydrostatic mini-tractor of 27 hp), a 200 litres capacity chemical tank, pressure regulated reciprocal pump, 50 m length flexible hose and a power unit. A specially designed stainless steel injecting nozzle of 7 mm diameter and 70 mm length is fixed onto this power unit, while a special drill bit of 5 mm diameter and 300 mm length embedded in a cast-nylon holder is fitted onto the injecting nozzle. The reason for the nozzle to be slightly bigger than the drill is to ensure tightness between the nozzle and the drilled hole so that no chemical would come out during the injection process.

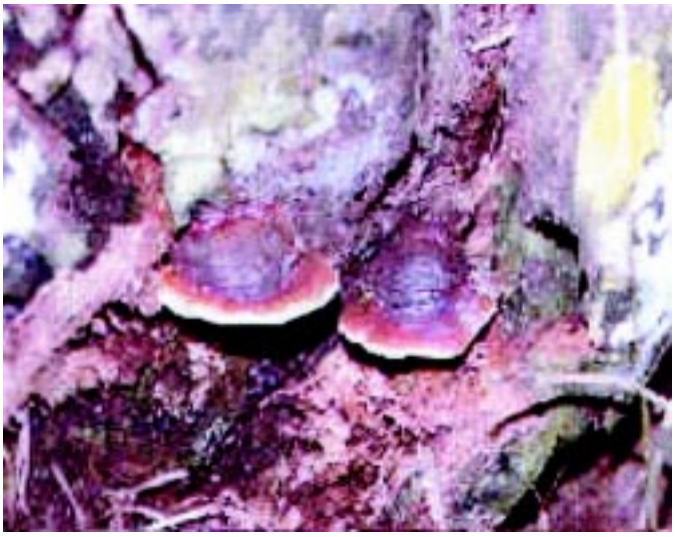

Figure 1. Ganoderma.

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Figure 2. The trunk injection machine.

The chemical from the tank is supplied through the hose to the injecting nozzle. Using the drill bit, a hole is drilled at an angle of about 45° downwards into the palm trunk. Once the drilling process is finished, the holder is then removed to allow the injecting operation to take place. The injecting nozzle was then screwed into the drilled hole and the chemical from the tank was pressure-injected by the pump mounted on the tractor. *Figure 3* shows the drilling and injecting process. The quantity of chemical injected can be controlled by the stop-cork. An advantage of this design is that only one power unit is required to carry out two operations.

Figure 3. (a) Drilling palm trunk to make a hole before putting the injector (b) injecting dye into the trunk.

FIELD EVALUATION

A trial of the prototype unit was carried out at MPOB Kluang Station, Johor. The performance of the machine was studied by injecting different volumes of 0.1% eosin dye solution on healthy oil palm stem tissues to see the dye distribution profile. The injection pressure was set at approximately 20 bar without causing the dye solution to come out from the drilled hole when pressure is applied. Three treatments of different volumes were evaluated, *viz* 3, 4, and 5 litres of dye solution on three different palms. Immediately after the injection, the palm was felled and cut into two sections, *i.e.* along its longitudinal and cross-section axes. This is to measure the distribution profile of the dye in the palm trunk on each axes. The distance of the vertical and horizontal movement, and also diameter of dye distribution was measured (*Figures 4a* and *4b*).

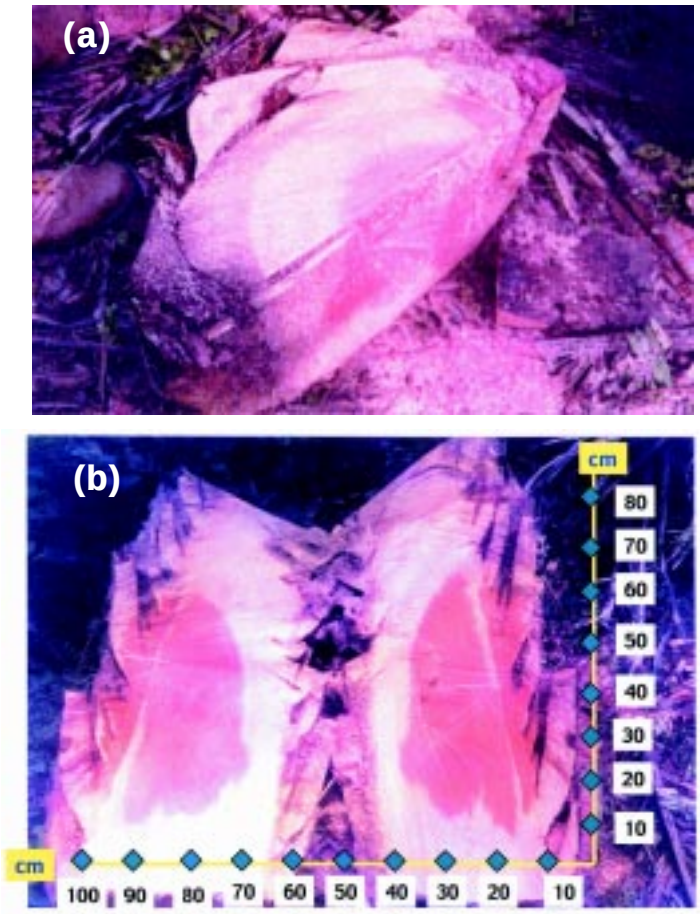

Figure 4. Dye distribution profile on (a) cross-section axis (b) longitudinal axis.

It was recorded that time taken to complete the operation were 1.5, 2.1 and 2.8 min per hole for the injection volume of 3, 4 and 5 litres, respectively (*Figure 5*). Measurements from the point of injection taken showed that distances of the vertical movement were 42, 54, and 65 cm for 3, 4 and 5 litres injection volume, respectively. While for horizontal movement, the distance of dye solution for 3, 4 and 5 litres volume were 40, 30 and 30 cm, respectively (*Figure 6*). *Figure 7* shows the dye distribution profile for cross-section axis, where the movement of dye solution for 3, 4 and 5 litres injection volume were 12, 14 and 14 cm, respectively.

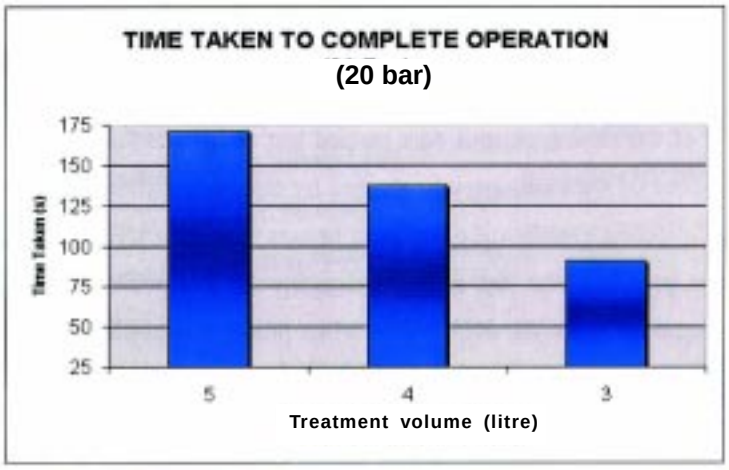

Figure 5. Time taken to complete operation for different volume treatment.

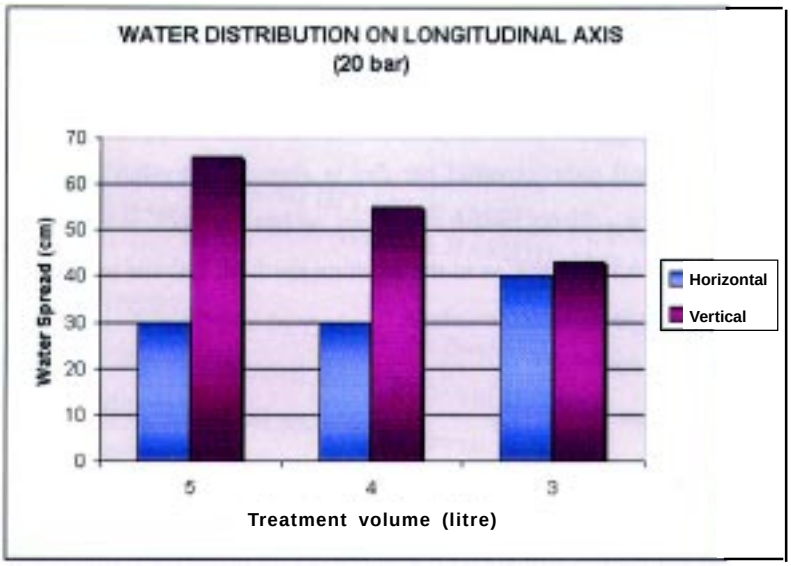

Figure 6. Dye distribution on longitudinal axis for different volume treatment.

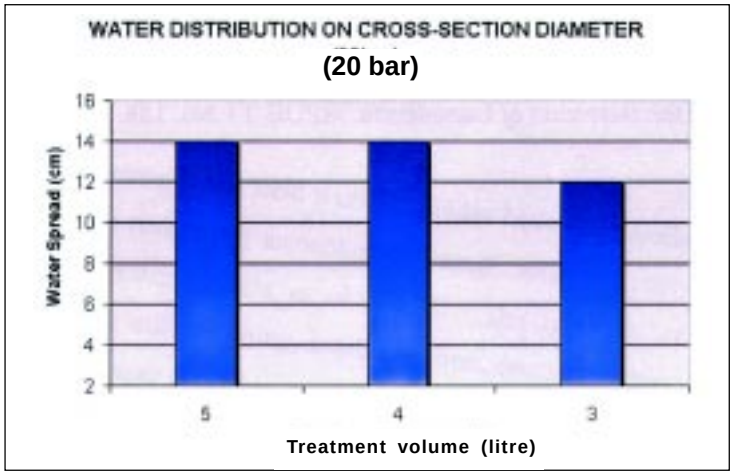

Figure 7. Dye distribution on cross-section diameter for different volume treatment.

CONCLUSION

The developed machine was found to be capable of injecting chemical into the targeted tissues effectively. Trial using dye solution has demonstrated that this machine could give a widespread of distribution profile in the oil palm stem. Besides, the use of this machine could speed up the injection time as compared to the present injection apparatus. It took only 1 to 3 min to complete an injection as compared to about 20 min per hole (existing apparatus), which is about 560% faster. It is estimated that the total palm covered per day is about 160 to 480 palms. Using this machine, the operator will no longer complain of having back strain since no more water tank is carried on his back as in the existing method. Labour requirement is very minimal as it is a single-operated machine.

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