CONTROL OF *PORIA* ROOT DISEASE WITH METHYL BROMIDE

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Soil fumigation with methyl bromide applied under a polythene cover at the rate of ½ lb per 100 square feet of soil, controlled *Poria hypolateritia* effectively at St Coombs and five other estates. This treatment appeared to be more effective, more economical and less laborious than fumigating with DD.

Introduction

Poria Root Disease is at present controlled on many estates by treating affected areas with DD (1, 3-dichloropropene, 1, 2-dichloropropane) at the rate of 2,000 lb per acre. This method has given satisfactory control, but complete eradication of *Poria* is not always achieved, particularly below a depth of 18 inches (Shanmuganathan 1964), and *Tephrosia vogelii* has to be grown on the treated areas to indicate residual infection. To achieve complete control of the disease, it is necessary to get good penetration of the fumigant down to 3 feet. Further, because of the high dosage rate, the cost of treatment with DD is quite considerable. In a search for a more effective and cheaper material, methyl bromide has shown good promise. This paper describes experiments in which methyl bromide has been compared with the standard DD treatment.

Experiments and Results

Experiment 1

The first experiment to compare these materials was carried out at St Coombs. The plots were randomized and each treatment was replicated four times. *Poria*-infected roots were prepared by inoculating in the laboratory pieces of tea root, 4 inches long and about an inch in diameter. These were incubated at room temperature for 4 months before being used in the field, to ensure good penetration by the fungus into the root.

The soil was neither ripped nor forked before fumigation. Individual plots were 100 sq ft in area, and were separated from each other by a drain, 6 inches wide and 6 inches deep. Within each plot 9 holes were dug with a soil auger, 3 each at 1, 2 and 3 feet below the soil surface, and an infected root segment was buried in each of them. Each root segment was fastened to one end of a wire and then placed in the hole to facilitate recovery after treatment. The plots receiving methyl bromide treatment were covered with a polythene tarp (gauge 700) and the edges were sealed tightly by burying them in the trench around the plots. The methyl bromide was applied in 1 lb cans and contained 2% Chloropicrin (tear gas)*. It was vapourized more rapidly by immersing the cans in hot water, and entered beneath the tarp as a gas (Plates 1 & 2). Applications were made at the rate of 1, 2 and 4 lb per 100 sq ft, and the tarps were left in position for about two weeks. DD was applied at the rate of 20 ml per hole spaced 12 inches apart (approximately 2000 lb per acre). Injections were made with a Kyoritsu gun at a depth of 6 inches and the soil was sealed immediately with a thick thatch of Guatemala grass. A plot of the same

* The material used was *Pestmaster soil fumigant 1* supplied by Messrs A. Baur & Co Ltd Colombo

PLATE 1 — *Layout of experimental plots and soil fumigation in progress*

PLATE 2 — *Materials used in soil fumigation*

dimensions outside the treated area served as a check. The soil temperature was 73°F at six inches below the surface at the time of fumigation. The moisture was 23% by weight at 1 ft. Ten weeks after treatment, the root segments were retrieved and examined in the laboratory for living *Poria*. The results are shown in Table 1 from which it is clear that the three methyl bromide treatments were very effective and much superior to DD in controlling *Poria*.

TABLE 1—*Relative effectiveness of different doses of methyl bromide and a standard rate of DD in controlling* Poria hypolateritia

No of root segments containing living *Poria*

Treatments	Root depth (feet) 1	2	3
Methyl bromide at 1 lb/100 sq ft	0/12	0/12	0/12
Methyl bromide at 2 lb/100 sq ft	0/12	0/12	1/12
Methyl bromide at 4 lb/100 sq ft	0/12	0/12	0/12
DD at 2000 lb per acre	1/12	9/12	12/12
Control (untreated)	3/3	3/3	3/3

Experiment 2

In July 1965, a similar experiment was conducted on a *Poria* patch at Mattakelle Estate. In this experiment methyl bromide applications at ½ and 1 lb per 100 sq ft were compared with the standard DD treatment. The plots were 200 sq ft (10 × 20) and in each plot 12 infected root segments, 4 at each depth, were buried as before. Treatments were replicated four times and a single plot served as a check. At the time of treatment, the soil temperature was 63°F at 6 inches below surface and soil moisture 37.5% by weight at 1 ft. The treatments were applied as in the first experiment. The root segments were retrieved two weeks after treatment from the methyl bromide treated plots, and ten weeks later from the DD treated plots and control plots. The results are shown in Table 2.

TABLE 2—*Relative effectiveness of two dosages of methyl bromide and a standard rate of DD in controlling* Poria hypolateritia

No of root segments containing living *Poria*

Treatments	Root depth (feet) 1	2	3
Methyl bromide at ½ lb/100 sq ft	0/16	0/16	0/16
Methyl bromide at 1 lb/100 sq ft	0/16	0/16	0/16
DD at 2,000 lb/acre	2/16	1/16	13/16
Control (untreated)	4/4	3/4	4/4

It is evident that ½ lb of methyl bromide is adequate to control *Poria* in an area of 100 sq ft to a depth of 3 feet. This treatment is significantly better than the standard DD treatment.

Extension experiments on estates

Five extension experiments were carried out on estates situated in different districts using ½ lb methyl bromide per 100 sq ft as the only treatment. Two plots each of 200 sq ft were marked out on *Poria* patches, and one of them was treated with methyl bromide, while the other was kept as a control plot. Nine infected root segments were buried in each plot, *viz* 3 each at 1, 2 and 3 feet below soil level. One week after treatment these were recovered and examined for living *Poria*. The results are shown in Table 3.

TABLE 3—*Results of five extension experiments conducted on estates to determine the effectiveness of methyl bromide at ½ lb per 100 sq ft in controlling* Poria hypolateritia

Estate	Soil temperature (8″ depth)	Soil moisture (1′ depth)		No of root segments out of a total of 3 showing viable *Poria*		
				1 ft depth	2 ft depth	3 ft depth
Bogahawatte	69°F	25.0%	Treated	0	0	1
Dimbula (4300 ft)			Control	3	3	3
Dunsinane	67°F	25.6%	Treated	0	0	0
Pundaluoya (5000 ft)			Control	3	3	3
Kelaneiya	67°F	24.5%	Treated	0	0	0
Maskeliya (4300 ft)			Control	3	3	3
Kirkoswald	63°F	32.0%	Treated	0	0	0
Dickoya (4500 ft)			Control	3	3	3
Rahanwatte	64°F	37.7%	Treated	0	0	0
Dimbulla (5000 ft)			Control	3	3	3

Discussions and conclusions

The results of the experiments indicate that methyl bromide applied at the rate of ½ lb per 100 sq ft of soil is adequate to obtain very good control of *Poria* root disease in the top three feet of infested soil. Because almost all the *Poria* in infested patches of tea lies in the top 3 feet, treatment with methyl bromide is likely to result in complete eradication of the disease (Shanmuganathan 1964). In this respect methyl bromide is, therefore, far superior to DD which can bring about only a reduction of the inoculum in the top 18 inches of soil. In addition to its high penetrative effects, methyl bromide has also other advantages when compared with DD. For instance, to treat one acre of *Poria*-infested land only 218 lb of methyl bromide are required, whereas with DD one would need 2000 lb. A pound of methyl bromide costs about Rs 4/- and the cost per acre would therefore be less than Rs 1,000/-. This compares very favourably with the expenses incurred when other materials or methods are used. Furthermore, very little labour is required for applying methyl bromide, and no injector guns are necessary. It appears, therefore, that fumigation with methyl bromide will be more effective, more economical and less laborious than fumigating with DD.

Treatment with methyl bromide has shown good results even under conditions of high soil moisture. For example, in two of our experiments the moisture content of the soil was as high as 38% by weight at the time of treatment. This is in contrast to the observations of Larue *et al* (1962), who state that one of the conditions for successful treatment of *Armillaria* in citrus orchards with methyl bromide is low soil moisture. It should be noted, however, that these workers were aiming at control down to a depth of five feet. They also state that soil temperatures should be above 50°F for good treatment. In all our experiments temperatures were between 60° and 75°F, and it seems, therefore, that temperature is unlikely to be a limiting factor in Ceylon.

So far no obvious phytotoxic symptoms have been noted on tea growing near treated areas. This suggests that the lateral movement of gas is not appreciable, or the concentrations are not high enough to cause injury. Although tea has not yet been planted in any of the experimentally treated areas, we cannot envisage any danger in doing so in view of the excellent control obtained. It does not seem necessary to check for any residual infection by planting *Tephrosia vogelii* as in the case of DD. If desired, however, the treated area can be rehabilitated with Guatemala grass before planting tea. It has not yet been determined how soon tea or other crops can be planted on treated land, but buckwheat sown on some of the plots a month after fumigation grew well. As methyl bromide evaporates readily from the soil, it should be possible to plant crops much earlier than a month.

Some notes on the use of methyl bromide for soil fumigation

The following brief notes are intended for prospective users of this material:

As methyl bromide is very toxic to humans, it is strongly advised that only material containing 2% chloropicrin (tear gas) as a warning agent be used.

Method of application—The soil needs no special preparation. The *Poria* patch should be cleaned as for treatment with DD. Cut a trench 6 inches wide and 6 inches deep, around the area to be treated. Stretch the polythene sheet or cover over supports of straw-filled sacks or cardboard cartons placed in the centre of the patch (as shown in Plate 1). Insert the tree end of plastic tubing of the jiffy applicator (supplied by manufacturers along with the methyl bromide) under one end of the polythene sheet and stretch the sheet over the supports. Using the trenches, first anchor down firmly one edge of sheet, then tighten and anchor down the other edges. If there is extra sheeting, fold the surplus back on one side and then anchor the edge in the trench.

To apply the material, warm the can by immersing it in hot water, press the opener to the puncture position and hold the lever until the can is empty. The warm can should be held in an inverted position so that only gas passes through the tube. When the can is empty the applicator tubing can be withdrawn. More details regarding application can be obtained from the manufacturers' pamphlets. It is suggested that the polythene cover be kept in position for one week. When removing the cover, it is desirable to lift one end up and allow some time for any remaining fumes to escape before the entire sheet is removed.

Users are warned that the fumigation must not be entrusted to labourers but should be carried out personally by the Superintendent or the Assistant Superintendent. The material should be kept in a locker and used cans buried. A notice should be displayed on the treated area warning people to keep away from it.

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