EXPERIMENTS IN CONTROL OF THE TERMITE PEST OF YOUNG RUBBER TREES

BY

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Some time ago considerable criticism arose as to the suitability of Paris Green dust for the control of White ants; it was alleged that considerable damage by bark burning had been noticed in many cases; it was also alleged that the application of Paris Green to the bark of the tap root of a tree increased its susceptibility to a certain type of root disease *(Sphaerostilbe repens)*.

As a result of this criticism a questionnaire was circulated to all estate managers who were known to be using Paris Green. The information derived from this questionnaire may be summarised as follows:—

1. In ordinary well drained soils Paris Green will efficiently and cheaply control the white ant pest of rubber trees of all ages if a suitable method of inspection and treatment is adopted.
2. There is no evidence of damage done to the bark by Paris Green unless excessive quantities are used; such damage applies more especially in wet acid soils.
3. It is possible that any damage may be avoided by mixing the Paris Green with hydrated lime in equal proportions.
4. There is no foundation for the suggestion that treatment with Paris Green causes or predisposes towards the incidence of *Sphaerostilbe* root disease.
5. Severe attacks of this root disease in previous years have been found to be a direct consequence of flooding of rubber areas.
6. The fungus *Sphaerostilbe repens* and termites, by reason of their similar habitats, have been found in association, while the association of this fungus with Paris Green does not hold.

Experiments showed that as much as 4 ozs. per tree in dry situations and 3 ozs. in wet situations could be applied without killing the tree, though slight bark damage occurred at the junction of lateral roots with the tap root and around wounds caused during the root exposure operation. Other arsenic compounds were found to have the same effect when applied to the roots in this excessive quantity. The addition of hydrated lime to these insecticide dusts slightly reduced this tendency to burn the bark The margin of safety is however sufficiently great as the recognised amount to apply is from $\frac{1}{4}$ oz. to $\frac{1}{2}$ oz. according to the size of the tree, and degree of infestation.

The chief source of danger lies in the actual process of dusting. If powder falls in lumps on the roots, the bark is burned locally. Attention to ensure efficient dusting is therefore a prime factor in this method of treatment.

During these investigations a search was made for alternative methods of control of the termite pest.

With the help of Mr. Tilley of Imperial Chemical Industries and Mr. Westrop of Malayan Fertilisers Ltd. it was possible to design an experiment to try various insecticides giving a range of effects viz. fumigants, contact poisons, stomach poisons and concussion death by explosive gases.

An area of 3 year old rubber trees which had suffered heavily from termite attack since planting was put at our disposal. The area was already divided by deep main drains into fourteen blocks each of approximately 4½ acres. The soil was peat over a very stiff clay, the depth of peat varying from one to three feet. The land was quite flat and even, bearing an excellent cover crop throughout. For various reasons it was decided not to include Paris Green and Perchloride of Mercury in the experiments.

Work commenced on the test blocks late in June while the majority of the insecticides were applied during the first week of July, and two inspections were made at intervals of five weeks each.

The species *Coptotermes curvignathus* Holmgr appeared to be the only offender attacking the rubber trees. *C. curvignathus* is of common occurrence in lowlying soils and shows a strong preference for damp sheltered situations such as obtains under a heavy growth of cover crop.

Though it must be admitted that an attack of root disease predisposes a tree to termite attack nevertheless there is ample proof that *C. curvignathus* will attack apparently healthy young rubber trees and, if left undisturbed, can cause the death of a tree within three or four weeks.

The seat of attack may vary considerably and may be at a point a few inches above ground or at any point below ground level. The most usual point of entry is at a fork of the taproot or near some hollow malformation of the taproot at about nine inches below soil level. As the attack is extended upwards above ground level a mud wall or casing is built round the trunk to protect the colony from other insects, birds and heat. Beneath this mud casing the bark is attacked almost at once at many points, causing exudation of latex which coagulates with the attached mud forming a rubbery mass very difficult to clean off when treatment is given.

Meanwhile the termites have been vigorously mining the tap root so that numerous long radially flattened galleries are formed

in the wood. These galleries are extensively interconnected and in time so weaken the tree that the slightest wind will blow it over.

In the case of buddings being attacked by white ants the upper limits of the mud wall may not extend beyond the union, the attack being concentrated on the snag. In heavy cover such infested trees may easily be overlooked until too late when the trees are usually blown down.

Dr. A. S. Corbet in one of his reports considers it probable that these attacks are made by occupants from a central nest which may be situated some distance under ground. The fact that the large number of "soldiers" which are found in the early stages of an attack gives place subsequently to a preponderance of "workers" indicates that communications are maintained between the termites on the tree and those in a central termitarium. The queens of *C. curvignathus* can rarely be found and there is no evidence to indicate that this species makes permanent nests in young rubber trees.

Experimental

Experiments carried out in the various plots were as follows:—

EXPERIMENT 1

Digging over to eliminate buried timber and nests.

Procedure. The cover crop was rolled up and by prodding at distances of 9 inches with long pointed iron bars the ground was explored for buried timber to a depth of over 3 feet. The buried timber indicated by flagged sticks was then dug out completely and burned. It was hoped that all the buried timber and termite nests would be removed, while attacked trees were cleaned up and their tap roots exposed to a depth of nine inches.

It might be mentioned here that charred timber was dug up from depths of 3 ft. to 4 ft. showing that this must have sunk into the swamp since the clearing was burned. Most of the timber had at one time been well mined by termites, but at the time of these experiments comparatively little timber was still inhabited. The two common types of termites found were *C. curvignathus* Holmgr. and a species of Capritermes probably *C. dolichocephalus*, O. John, both of which were found nesting in the soil.

It was hoped that, by digging over and removing timber and nests, an area might be cleared of the pest, but actually few nests were found and these contained extremely small colonies.

Owing to the high costs of the digging, in this method of treatment, only half the plot was completed.

Results. Reference Table I. Plot 1

Though a fair degree of control has been obtained, the number of new cases is very high. The disturbance caused by this method of treatment seems to have caused the termites to migrate and reform colonies to attack other healthy trees.

EXPERIMENT 2

Infested zones, as indicated by attacked trees, were dug over to the clay subsoil, removing and burning all timber, tracing out galleries and destroying nests. This method is very similar to (1) but less extensive and less expensive.

Results. Reference Table I. Plot 2

It will be noted that 60 per cent. of the original active cases have recurred up to the 10th week after treatment and the number of new cases equals 100 per cent. of the original; this is a very poor result.

EXPERIMENT 3

Termite infested zones, as indicated by attacked trees, were explored with rods; galleries or nests were located and about 25 ccs. (about one ounce) of Carbon bisulphide poured into the hole leading to a gallery. After waiting for five to ten minutes for the liquid to vapourise and penetrate the galleries a lighted match was dropped into the hole thus causing an explosion, said to be sufficient to kill the termites by concussion.

Undoubtedly termites near the seat of ignition were killed either by the original gas, the explosion or by the gases remaining after the explosion. If a large underground system of galleries was located carbon bisulphide was injected at two or more centres. All infested trees were cleaned to a depth of 9 inches in the soil.

Results. Reference Table I. Plot 3

It will be noted that although 50 per cent. control has been obtained over the known cases, the increase in number of new cases is 100 per cent. indicating that colonies of termites have reformed and passed on to neighbouring trees.

EXPERIMENT 4

All trees were opened up to a depth of one foot and lateral roots exposed to a distance of one foot from the bole. Calcium

arsenate powder was then lightly dusted on to the bole, tap root, laterals and soil in the crater. Infested trees were cleaned up and dust blown into the mass of mud and termites collecting in the hole. The supplies, mostly too small to be opened up in this area, were trenched round to a depth of one foot at a distance of 2 feet from the plant. Dust was then lightly blown into the base and walls of the trench.

These holes and trenches were not filled in until after a period of 5 weeks, the latest time at which a second treatment should have been given.

The amount of powder used averaged about $\frac{1}{8}$ oz. per tree.

Results. Reference Table I. Plot 4

This method of treatment gave over 90 per cent. control on the first round of inspection and 65 per cent. control over the ten week period which is considered extremely good, and it seems possible that two or three such rounds of treatment should banish white ants from heavily infested clearings such as this. The cost for labour ($2.50 per acre) is rather heavy, and was due to the dry weather during the first few days of the experiments when the labourers found difficulty in digging through the baked peat and clay. After rain similar opening up was done for about $1 per acre or 45-50 trees per labourer per day.

EXPERIMENT 5

The area was mechanically treated as in the case of Plot 4 but Sodium silicofluoride powder was the insecticide dust used. The costs are very similar to Plot No. 4. Again about $\frac{1}{8}$ oz. of dust per tree sufficed.

Results. Reference Table I. Plot 5

Like the previous insecticide dust Sodium silicofluoride has given excellent control, especially when it is realised that there were over 90 recently supplied stumps mostly replacing trees killed by white ants and therefore still potential danger zones.

It is apparent, however, that repeated applications of the powder will be necessary to effect complete control.

The appearance of 19 new cases at the 10th week is not so good as was desired.

EXPERIMENT 6

This area was demarcated into infested zones as indicated by the supplies and present infested trees. Trees within these

zones were then opened up to a depth of 9 inches and a proprietary fumigant meal known as "Seekay" was applied at the rate of two ounces per tree, admixed with a little soil then covered over with soil so as to retain the poisonous gases. All attacked trees were thoroughly cleaned from termite mud walls, latex and soil debris normally found adhering to such trees.

Results. Reference Table I. Plot 6

The results obtained by this method are quite good; the number of old cases recurring being only 13 out of 46 originally attacked. The appearance however of 33 new cases indicates that more than one ring of neighbouring trees must be treated at the same time as the attacked one.

EXPERIMENT 7

All trees were opened up to a depth of 6 inches to a distance of 9 inches from the bole. To each tree was applied two gallons of a solution of Calcium cyanide (Cyanogas dust). This solution rapidly gives off hydrocyanic acid gas and should always be prepared on the spot. In practice a 4 gallon bucket is filled with water and two level tablespoonfuls of the powder added, stirred and at once applied to the base of the tree, one such bucket being sufficient for two trees. This solution caused immediate death to all termites present in the bole or tap root of the tree.

Results. Reference Table I. Plot No. 7

Although an apparently large number of new cases have appeared since the cyanide treatment the early effects are good in that none of the old cases reappeared in the first five or ten weeks. This again shows a possibility of dealing easily with a heavy infestation by means of two or three rounds of treatment. Water was very handy on the clearing so that labour costs were low.

EXPERIMENT 8

Trees in infested zones only were treated with Carbon bisulphide jelly. This jelly is made by treating small pieces of dry rubber clippings with Carbon bisulphide in the proportion of one pint of fluid to one pound of dry rubber. The rubber absorbs the fluid to form a soft jelly-like mass. Three to four pieces about the size of a walnut were then dibbled in close to the tree to a depth of 6-9 inches. Carbon bisulphide gas, which is slowly evolved from the jelly, poisons the termites. The components of

the jelly may be varied to make easy handling in the field. All infested trees were opened up to a depth of nine inches and thoroughly cleaned of debris.

Results. Reference Table I. Plot No. 8

The results are rather poor; although 60 per cent. control of affected trees has been obtained the appearance of 31 new cases in the block indicates that the fumigant has merely driven the termites to other untreated trees. The experiment is however worth repeating but all trees in the block should be treated.

EXPERIMENT 9a

One half of the area of Plot 9 was treated tree by tree with a similar rubber jelly containing Orthodichlorbenzene. The jelly was dibbled in to a depth of 9 inches and the hole closed over with the heel. Although very few active cases of termites were recorded at the time of treatment the plot had been heavily infested as indicated by the number of recent supplies.

Results. Reference Table I. Plot No. 9a

This experiment definitely indicated the advantage in treating all trees irrespective of their condition. Though the original number of infestations was very small, the fact that not a single old case has reappeared in 10 weeks nor any new cases developed indicate that control can be obtained cheaply by treating every tree in the area.

EXPERIMENT 9b

This half of Plot 9 was treated as for Plots 4 & 5 except that a proprietary poison known as "Cyanomag" was the insecticide used. Every tree in this half of the plot was opened up and dusted.

Results. Reference Table I. Plot No. 9b

The effect of the treatment is excellent; though there were only 6 active cases at the time of treatment there were 43 infested zones where supplies had been planted.

EXPERIMENT 10a

A further type of rubber jelly fumigant prepared as for Plots Nos. 8 & 9a. using Trichlorethylene, was tested in Plot 10a. This was dibbled in round all trees in this plot. This jelly was very stiff and was difficult to separate into small bits for dibbling in.

The addition of a little more Trichlorethylene would have rendered it a little less viscous.

Results. Reference Table I. Plot No. 10a

Here again the result is excellent but unfortunately the original infection was very light.

EXPERIMENT 10b

In this half of Plot 10 all trees were opened up to a depth of 6 inches and a dessert spoonful of crystalline Paradichlorbenzene was scattered round near the trees and the soil replaced in the hole.

Results. Reference Table I. Plot No. 10b

Unfortunately there was no direct evidence that active colonies of termites were attacking the trees at the time of treatment; there were however a fair number of supplies. The plot has remained free of white ants since treatment.

Plot 11. This area received no treatment owing to the small number of attacks.

EXPERIMENTS 12 & 13

Part of Plot 12 and the whole of Plot 13 were opened up to a depth of 6 inches round each tree and into the shallow circular trench so formed was placed about 1¼ lbs. of Castor Seed Meal and the trunk left open. Castor Seed Meal is a stomach poison containing a poisonous protein. It also has an appreciable manurial value.

Results. Reference Table I. Plot No. 12

This shows an 80 per cent. control of the infested trees and an appearance of only 5 new cases per acre over the 10 week period, which is a very good result.

EXPERIMENT 14

Plot 14. *Control.* This plot was not treated in any way except that all attacked and suspected trees were opened up to a depth of 6 inches thoroughly cleaned and the soil at once replaced. In this way the number of active cases of termite attack at the time of treatment of other blocks was determined. Often, early attacks could be determined only by opening up in this way.

Results. Reference Table I. Plot No. 14

This result indicates a normal increase of 50 per cent. in the number of cases occurring after a lapse of ten weeks in areas where no form of insecticidal treatment is carried out.

Conclusions

Owing to the difficulty of obtaining plots of suitable size under similar conditions and with the same degree of infestation by termites the results vary a great deal from plot to plot. For example, the results in Plot 4, where 7 cases recur out of an initial number of 79 active cases, after dusting with calcium arsenate, are considered to be of greater value than the results in Plot 10 where there were no recurrent cases out of an initial number of only 2 active cases after treatment with fumigant rubber jellies.

An estimation is given in Table I of the results to be expected for the various treatments represented as the number of re-attacked trees and new cases appearing after 10 weeks from treatment (a) per plot of 500 trees (including supplies), (b) per 100 diseased trees and (c) per 100 infested tree spaces indicated by number of diseased trees plus number of recent supplies.

In Table II a summary is given of the general results to be expected from the use of various methods of control. It is indicated that the efficiency of these methods lie in the following order of merit.

(1) Opening up of roots and applying insecticidal dusts.

(2) Dibbling in around the base of the tree a small quantity of fumigant rubber jelly.

(3) Castor Seed Meal placed in a shallow trench round all trees.

(4) Use of explosive gases to kill the termites by concussion.

(5) Digging to eliminate buried timber and nests.

No method of treatment will at once eradicate the termite pest; a carefully planned campaign involving monthly inspection and treatment of affected areas must be carried out in order to effect a reasonable degree of freedom from this pest. The thoroughness with which the treatment is performed is more important than the type of insecticide applied.

I am indebted to Mr. Gopal of the Pathological Division for his valuable assistance in supervising the work and in making records of progress of the experiments.

My thanks are also due to the estate managers for their assistance and kindly interest in the work.

TABLE I

Plot No.	Total No. of trees	Supplies	White ant cases	No. of trees treated	Treated 1st – 7th July 1933 — Nature of Treatment	Quantity used	Cost of labour	Results — Inspection on 10.8.33 cases appearing up to the 5th week — Old	Inspection on 10.8.33 cases appearing up to the 5th week — New	Inspection on 14.9.33 Further cases appearing up to the 10th week — Old	Inspection on 14.9.33 Further cases appearing up to the 10th week — New	Total up to 10 weeks — Old	Total up to 10 weeks — New	Cases in 10 weeks per plot of 500 trees — Old	Cases in 10 weeks per plot of 500 trees — New	Cases in 10 weeks per 100 diseased trees — Old	Cases in 10 weeks per 100 diseased trees — New	Sum of supplies and active cases	New cases and reattacks per 100 infested tree spaces — Old	New cases and reattacks per 100 infested tree spaces — New
1	175	59	17	All	Exploring and digging out buried timber	—	67.60	3	12	0	5	3	17	5	25	18	100	76	4	22
2	403	94	48	,,	do. near infected trees only	—	25.06	29	13	1	35	30	48	30	48	63	100	142	21	34
3	404	72	29	29	Explosion of carbon bisulphide	1 gal.	1.59	14	14	0	12	14	26	15	27	48	90	101	14	26
4	460	32	79	All	Calcium arsenate dust	3½ lbs.	11.53	3	4	7	14	10	18	10	18	12.5	24	111	9	16
5	432	91	66	,,	Sodium silicofluoride dust	3½ lbs.	13.52	5	2	4	19	9	21	9	21	13.5	32	157	6	14
6	382	91	46	160	Seekay fumigant meal	20 lbs.	12.73	13	19	0	14	13	33	14	36	28	72	137	10	25
7	443	40	12	All	Calcium cyanide	15	5.57	0	19	0	9	0	28	0	29	0	233	52	0	56
8	434	44	33	120	Carbon bisulphide rubber jelly	3 gals.	2.79	12	22	0	9	12	31	13	32	36	93	77	16	40
9a	199	26	4	All	Orthodichlorbenzene jelly	2 gals.	5.17	0	0	0	0	0	0	0	0	0	0	30	0	0
9b	214	43	6	,,	Cyanomag dust	4 lbs.	5.97	1	0	0	0	1	0	2	0	17	0	49	2	0
10a	180	7	2	,,	Trichlorethylene rubber jelly	3 gals.	4.37	0	0	0	0	0	0	0	0	0	0	9	0	0
10b	151	38	0	,,	Paradichlorbenzene cryst. fumigant	14 lbs.	4.37	0	0	0	0	0	0	0	0	0	0	38	0	0
11	325	47	0	—	No treatment	—	—	0	0	0	3	—	—	—	—	—	—	—	—	—
12	585	85	50	All	Castor Seed Meal	7 cwts.	7.96	8	8	2	23	10	31	8	25	20	62	135	7	25
14	462	11	17	—	Control	—	—	17	6	0	4	17	10	18	11	100	59	28	61	36

Old = trees previously recorded as infested now reattacked. New = trees attacked only since date of treatment.

TABLE II

Summary

No.	Total Number of Trees	Number of Supplies	No. of Trees Treated	Nature of Treatment	Active White Ant cases on 1st August	Average cost per acre	Total cases occurring in 10 weeks		New and Reattacks			
									per 100 diseased trees		per 100 infested tree spaces	
							Old	New	Old	New	Old	New
1	578	153	All	Digging Timber	65	$14.25	33	65	50	100	15	30
2	404	72	Affected	Explosives	29	0.35	14	26	49	91	14	26
3	1789	246	All	Fumigants	97	1.75	25	92	26	93	7	27
4	585	85	All	Castor Seed Meal	50	1.25	10	31	20	62	7	25
5	1106	166	All	Dusts	151	3.10	20	39	13	26	6	12
6	462	11		Control	17		17	10	100	59	61	36
7	1355	202	All	Fumigants, Cyanides, Benzenes and Ethylenes	64	2.00	13	61	20	96	5	23

APPENDIX I

Control of Termites in Young Rubber Trees using Insecticide Dusts

In view of the promising results obtained in these experiments the following method of control of termites by using insecticide dusts is tentatively suggested for use on estates by managers who are willing to assist us in obtaining further experimental data.

1. Infested zones should be demarcated as indicated in the diagram showing (a) supplies (b) infested trees cut out and (c) present infested trees. The zone should include one ring of apparently healthy trees around the infested trees. See diagram attached.

2. The roots should be opened up as shown to a depth of 9 inches or more, if white ants are observed to be entering the tap root at a lower level. The exposed bole of the tree should be cleaned thoroughly and a light dusting of insecticide powder blown on to the bark. All mud walls or debris should be removed from the trunk above ground and more powder blown into the mass of mud and termites so collected and also lightly dusted on the cleaned trunk up to the height reached by the termites. About $\frac{1}{4}$ to $\frac{1}{2}$ oz. of dust is sufficient for one tree.

3. The crater at the base of the tree is left open for 4 to 5 weeks when a further treatment with insecticide dust is given after which the crater may be filled in.

4. An attempt should be made to trace up termite galleries to find and destroy nests.

5. In view of the fact that termites can destroy a four year old tree within four or five weeks of original attack, it is recommended that a small gang of labourers should patrol infested fields, so as to execute one round of treatment in that period of time, otherwise trees are too far damaged to respond to treatment and eventually have to be dug out.

In heavily attacked fields having a peaty or alluvial soil it is advantageous to treat all trees in the area at the first round of treatment.

6. Suitable insecticide powders are as follows:—

Sodium silicofluoride.
Calcium arsenate.
Cyanomag dust.
Paris Green (plus an equal weight of lime, if used in wet peaty soils).

Imperial Chemical Industries Malaya Ltd. also stock a proprietary Silicofluoride under the name of *Dutox* which can be used.

7. Suitable hand dust guns may be purchased from the Federated Engineering Company, Kuala Lumpur. Rubber bulb dusters may be obtained from Tan Kah Kee & Co., Ltd. Rubber Manufactory, Singapore. In regard to the latter type of duster a short tapered bamboo tube inserted into the neck and protruding 2 inches into the bulb lends rigidity to the nozzle and prevents choking up when dusting in a downward direction.

Suggested method of controlling the termite pest of young rubber trees by the use of fumigants

Infested zones should be demarcated as indicated in the treatment with insecticide dusts.

The tap roots of all infested trees should be opened up to a depth of 9 inches and the tree thoroughly cleaned of mud. Four pieces of impregnated rubber jelly the size of a walnut are then placed round the bole at a depth of about 6 inches below the surface. The hole should be filled in with soil, so that the level of soil slopes away from the tree, as the fumes penetrate better through dry than through wet soil.

In the case of supplies and non infested trees within the zone, three or four similar pieces of impregnated rubber jelly, should be dibbled in to a depth of six inches close around each tap root but not in contact with it.

Termite galleries should be traced to find and destroy nests.

All known infested areas should be inspected once per month and fresh treatment given where necessary.

The following fumigant liquids are suitable for use in this way:—

Orthodichlorbenzene
Trichlorethylene.
Mixtures of the above and
Carbon bisulphide.

The rubber jelly is made by treating small pieces of dry rubber clippings or scrap rubber with the fumigant liquids in the proportion of one point of fluid to one pound of dry rubber. More or less liquid may be added according to the required viscosity of the jelly. The jelly should be kept in well stoppered vessels. It is advisable to keep records of treated trees reattacked after four and eight weeks or more and costs of materials and labour used.

The following data would be of great value in our investigations and the writer would be grateful if estate managers would forward to him such information when available.

(1) Area of plot.
(2) Type of soil.
(3) Lie of land.
(4) Insecticide used.
(5) Number of trees in treated zones.
(6) Number of recent supplies.
(7) Number of trees infested with termites.
(8) Labour costs.
(9) Amount of insecticide used.

Inspection after 4 weeks

(10) Number of old cases reattacked.
(11) Number of new cases in or outside zone.
(12) Number of trees retreated.

Inspection after 8 weeks

(13) Number of old cases reattacked.
(14) Number of new cases in or outside treated zones.

Further inspections and retreatment may be carried out if necessary.

APPENDIX II

CONTROL OF THE TERMITE PEST OF YOUNG RUBBER TREES

RESULTS OBTAINED IN ROUTINE WORK ON THE EXPERIMENT STATION

In his Report of Insect Pests in Ceylon during 1929 F. P. Jepson of the Department of Agriculture, Ceylon, suggested a method of using Paris Green in control of the termite pest on tea estates. After a little experimentation the method has been adapted to rubber and used to some extent on the Experiment Station. Perchloride of Mercury was also used on a similar number of trees for purposes of comparison.

The method of treatment was similar to that recommended to estates viz. the soil round infested trees was removed to a depth of nine inches, the trees scraped clean of mud and latex and Paris Green powder blown on to the roots and infested parts of the tree. The various fields were inspected periodically, usually at intervals of four to six months, and attacked trees duly treated. Observation however soon showed that it was possible for termites completely to kill a tree within four weeks of the commencement of attack, so that frequently trees were not discovered until they were too far damaged to respond to treatment; the results summarised below under the heading "One treatment" are therefore somewhat disappointing.

Treatment with perchloride of mercury consisted of opening up the roots in a similar way, then spraying the trunk, roots and soil with one pint of a 2 per cent. solution of the chemical or preferably 2 pints of a 1 per cent. solution of the perchloride in water.

During 1932 the following results were obtained:—

Degree of Control

(1) Paris Green.

(a) After one treatment 25 per cent: deaths nil.
(b) After two treatments 70 „ „ : deaths nil.
(c) After three treatments 75 „ „ : deaths nil.

(2) Perchloride of Mercury.

(a) After one treatment 32 per cent: deaths nil.
(b) After two treatments 55 „ „ : deaths 22 per cent.
(c) After three treatments 58 „ „ : deaths 30 „ „

The large death rate during 1932 is due chiefly to the activity of root disease fungi (Fomes) in conjunction with the white ants. In many cases the trees were too far gone with both disease and termite attack and should have been dug out at once.

During 1933 Paris Green only was used until the end of September when for experimental purposes a change was made to Cyanomag.

Degree of control with Paris Green Jan.—Sept., 1933.

(a) After one treatment 42 per cent: deaths 5 per cent.
(b) After two treatments 63 „ „ : deaths 25 „ „
(c) After three treatments 66 „ „ : deaths 32 „ „

Omitting those trees which were obviously too bad to respond to treatment it is found that the degree of control is as follows:—

(a) After one treatment 50 per cent: deaths 2 per cent.
(b) After two treatments 75 „ „ : deaths 13 „ „
(c) After three treatments 78 „ „ : deaths 20 „ „

Reference to the root disease records also shows that several trees were given up as lost by attack of root disease fungi before the white ants began to attack them. If these trees are also omitted from the total it is found that the degree of control after three treatments with Paris Green becomes 84 per cent and deaths 14 per cent.

This indicates that Paris Green has given excellent results under ordinary routine estate conditions. With regular monthly rounds of inspection it is almost certain that much better results would have been obtained.

It should be noted that 25 per cent of the trees attacked by white ants had been for some time previously suffering from Fomes root disease. While admitting that attack by root disease fungi predisposes to attack by termites, observations show that the species *Coptotermes curvignathus* will attack well grown, healthy trees of four or five years of age.

Two labourers have now been trained in the work of white ant control to inspect every tree on the Experiment Station once per month, at the same time treating all infected trees and a ring of healthy trees around each diseased one. These trees will be opened up and dusted with insecticide powder. During the year it is hoped that trials with several other insecticide powders will be carried out.

DIAGRAM ILLUSTRATING TREATMENT