# MANUKA BLIGHT IN NORTHERN HAWKES BAY

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But for the fortuitous appearance of a hitherto unknown scale insect of the *Eriococcus* genus on manuka, in the Geraldine District of Canterbury in the mid 1930's, this paper may well have been titled "Manuka-the problem weed of the Hawkes Bay hill. country." We might have been telling of a losing battle fought on farms and stations against a persistent and relentless foe; of properties verging on bankruptcy and abandonment, because of the difficulty of securing. labour and finance for cutting and control.

The red manuka (Leptospermum *scoparium)* has been a real problem in Northern Hawkes Bay since the 1890's, particularly on the inland pumice country. Guthrie Smith in his book "Tutira," has recorded very vividly how the manuka succeeded the bracken fern following successive burns. On this country the recovery of bracken fern was so vigorous that it had to be fired every five or six years ; no fertiliser was used, and only poor quality seed was available, so that in consequence the constant firing and lessening fertility encouraged complete colonisation by manuka. This was first cut on Tutira in 1912 and successive cutting has been necessary since.

This story can be repeated on dozens of properties on the East Coast. By the 1930's manuka was succeeding the low fertility pastures even on the better mudstone and limestone hills. The application of the 4B scheme, whereby hundreds of unemployed were directed to scrub cutting, gave a temporary respite, but during the second war period, and since, the labour supply has become scarcer and scarcer and the manuka has got away unchecked, until in 1950 a Department of Agriculture survey showed that at least 16% of the area of farmable hill' country in the Wairoa County (64,000 acres in all) had become heavily infested by scrub and fern while manuka was also getting away on much of the balance. But now the slasher is no longer required. It is our pleasure to tell instead how millions

of tiny insects, individually hardly discernible to the naked eye, are eradicating manuka in a way that makes man's effort seem very puny indeed.

We have estimated that upwards of one and a half million acres on the East Coast inland from Napier to Gisborne are completely infected by the manuka blight. It has cost, on an average, between £4 and £8 an acre to cut scrub, a task that has had to be repeated every 5 to 7 years. In the Wairoa County alone on some 400,000 acres of unploughable farmable hill country, the blight is thus saving farmers a similar figure in pounds cash (i.e. $400,000 a year), which otherwise would be spent in cutting alone.

This saving, accompanied by favourable prices for meat and wool, is allowing farmers to carry out long neglected improvement measures such as fencing, top-dressing and oversowing. The advent of aerial top-dressing in this period (there are between 70 and 80 airstrips. in operation in the Wairoa County alone), has meant that fertiliser and seed can be applied to the greater part of this country, and that the blighted areas can be topdressed where otherwise it would be quite impossible.

The picture is one of advance, prosperity and increased earnings which, but for the blight, would have been more than absorbed in battling that worst weed of the hill country-manuka.

## HISTORY AND METHOD OF SPREAD

The 'story of the introduction and spread of the blight on the East Coast is one of absorbing interest. The East Coast Commissioner, the late Mr J. S. Jessep of Waihi station, was instrumental in introducing the blight from Canterbury. Transplantings were made in the springs of 1945 and 1946, at Waihi and Te Reinga. Early introductions were also made at Frasertown and Tangoio by others. After an establishment and acclimatisation period of four or five years the blight spread extremely rapidly and by 1952 half of the Wairoa County was affected.

The spread was most rapid in a south-east and to a lesser extent north-east direction, the insects obviously being carried by the prevailing winds. In 1952, for example, while the blight had travelled towards and reached the coast twenty miles awav. manuka only 2 or 3 miles inland from the early infestations was not affected and is only now showing the blight. For two years from 1.952 a very clear demarcation line could be drawn direct between Waihi and the sea at Waihua.

To the north, the manuka was well blighted, to the south it was clean. A secondary infestation then spread across the back country and again coastwards, which, joining up with the spread from Tangoio has meant that the whole country east of the ranges, from Napier to Gisborne and beyond, is now thoroughly blighted.

The insect worked most rapidly and thoroughly along the sheltered valleys and gulleys, then up the warm northerly faces and only now is the manuka on the colder slopes and high exposed ridges being really affected.

## THE CAUSATIVE ORGANISM AND ITS EFFECT ON MANUKA

This paper would hardly be 'complete without a brief entomological interlude, even though the cause and effect of the blight has been well described in publications by Mr J. Hoy, Entomologist, D.S.I.R. The primary organism, *Eriococcus orariensis*, is a small scale insect, which, living under the bark of the plant, can in sufficient numbers extract enough sap to cause desiccation and death. A honey dew excreta giving off a very sickly odour in the spring is a very suitable medium for the growth of black mould fungi, from which the common term "manuka blight" is wrongly derived. It is, however, a very convenient description.

Once the plant has been largely exhausted of sap it becomes a haven for some tertiary organisms, namely borer and huhu insects. These riddle the base of the trunk and roots, causing very large trees in particular soon to fall to the ground, especially if exposed to strong winds or to cattle pushing in and out of the area.

In coastal districts blighted manuka has been observed to die in two to three years, even large bushes going in that time. Single or scattered clumps and bushes go much quicker than do large dense blocks where the insect population may take some time to build up. In many inland districts, however, in spite of rapid initial infestations, considerable areas of manuka are still remaining very much alive even 7 or 8 years after infestation. Each spring the extremities of mfested plants green up and start growing vigorously, even although the trunks and branches are brittle enough to be easily broken down. There is nowhere any evidence of a complete recovery. It can be expected though that, where very cold, wet, stormy winter con-

ditions are met, as has occurred in these districts in the last two years, the insect population could be sufficiently reduced to allow the manuka a respite, which is only temporary, however, as populations are sufficient to build up rapidly to a lethal level. The blight affects all stages of growth from seedlings to old man scrub, plants from 5 to 10 feet high being the most affected. We have observed that seedling manuka can continue to grow in spite of blight infestation ; there is record of at least one plant so growing two feet in one year. This young manuka seems to be either vigorous enough, or to have a sufficiently smooth or tough bark, to grow up with or to resist the insect attack. Then upon flowering the plant seems to succumb very quickly.

The evidence then is that on some areas short-term cycles of manuka recovery and the subsequent multiplication of the insect will be the order, but that even here as a serious farm weed and problem the manuka era is gone ; provided always that a parasite of the *Eriococcus* insect does not appear.

## VEGETATIVE CHANGES FOLLOWING MANUKA BLIGHT INFESTATION

The most important and significant fact that is everywhere evident, where manuka is being. eliminated by the blight, is that in every instance something else is taking its place. Whether it be low fertility grasses, or exotic or indigenous weeds and- plants, nowhere is the ground left bare; the quicker that the blight is reducing the manuka the more rapid is the invasion of such species. Just what is taking the place of the manuka depends on the density and age of the stand, climate, soil type, aspect and access by stock. In the main throughout Hawkes Bay the sequence may be divided into three main categories. (1) Scattered scrub and small thickets occurring in pastures. (2) Dense stands recently reverted from grass, and (3) areas that have been in scrub for 25 to 30 years or more.

### 1. SUCCESSIONS IN OPEN COUNTRY

It is on the open hill country, subjected over the past 40 years to manuka invasion wherever the turf has been opened or weakened, that the *Eriococcus* insect is doing a great job. Reference has already been made to what this is saving farmers, who can simply sit back and watch the blight at work. Even if nothing is done these areas are rapidly being covered by what-

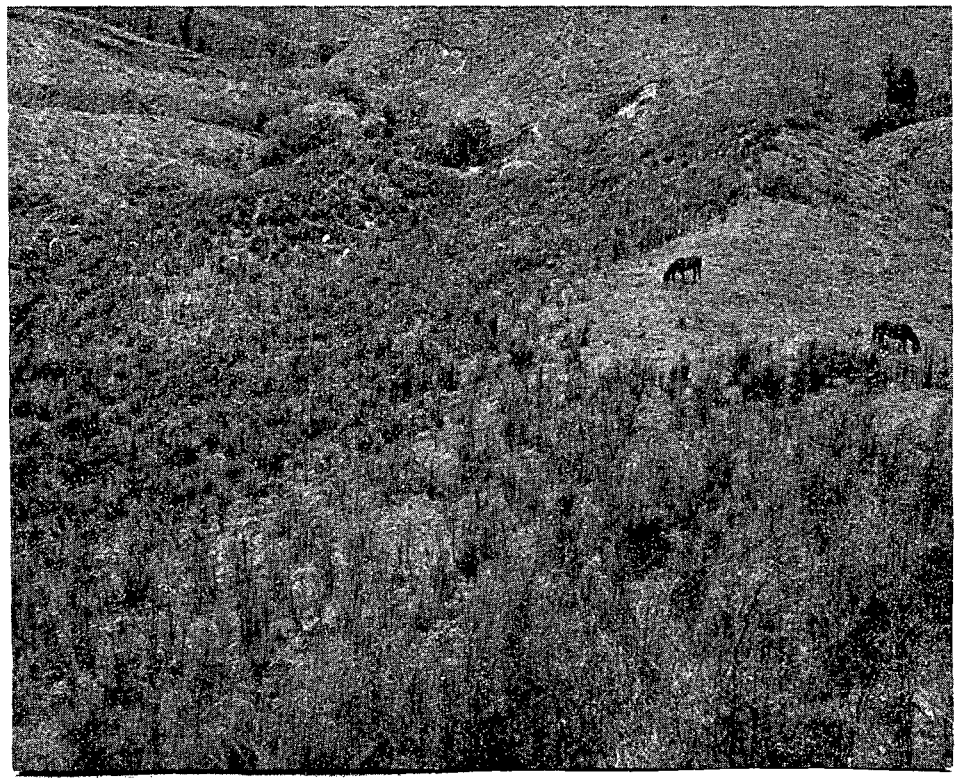
ever grass species are prevalent round about, *Danthonia*, sweet vernal, Chewings fescue, Yorkshire fog, *Eragrostis* brownii or bay grass, and ratstail being common associations. Even quite dense thickets of manuka on. the hillsides, in gulleys, or waste places, and wherever stock can find access, are being replaced by such species. Then the application of phosphate and clover seeed can be recommended with confidence.

Unfortunately many farmers in the Wairoa district in particular have become a little too complacent in believing that the blight *is* the be-all and end-all of their problems, The factors that originally lead to 'manuka invasion are allowed to remain and unless corrective farming practices are applied, other troublesome weeds will invade the land. Already many such areas are being invaded by blackberry, tauhinu, Strathmore weed, sweet briar and gorse.

## 2. SUCCESSIONS IN DENSE STANDS OF RECENT AGE

The type of vegetation that is succeeding the blighted manuka in formerly dense stands depends

An area of blighted-infected manuka reverting to low-producing pasture under grazing.



very largely on the ecological factors already mentioned at the beginning of this section, successions to low fertility native and introduced grasses occurring particularly under younger, more accessible stands while on inland areas, particularly on pumice soils, where stands are generally much older and less accessible, the manuka is quickly replaced by bracken fern and native shrubs. In younger stands and where the grass associations are favoured a complete ground cover can be rapid. The shady faces on observed areas are covered first, probably because of the more open nature of the manuka. Here, associations of Chewings fescue, sweet vernal, plume grass and *Microlaena* ***spp.*** occur, plus weeds such as'catsear, hawkbit, and native daisies and ***Acaena*** *spp.* Onae the sunny faces open up, a similar situation is found, except that *Danthonia pilosa* and sweet vernal generally are more dominant than Chewings fescue and other grasses.

By 1952, when the blight was getting well established in the numerous blocks of dense manuka throughout the Wairoa County, trials were laid down by the Department of Agriculture on Parkhurst Sta-

Ingress of volunteer grasses and flatweeds into dense stand of blighted manuka.

tion near Tuai to study the possibility of successfully seeding the scrub with desirable grasses and clovers. We felt at the time that some at least might be successfully established on the litter before the invasion of other species.

In March 1953 four such trials were laid down on Parkhurst Station, two on sunny faces, and two on shady, under old man manuka 15 to 20 feet tall and younger regrowth only 8 to 10 feet high. The ground beneath the manuka on the sunny slopes was almost devoid of vegetation, but on the shady slopes. Chewings fescue and sweet vernal were present. The manuka throughout was well blighted and just losing its leaf.

Four individual plots 1 x $\frac{1}{2}$ chain on each trial were hand sown with a shot gun mixture listed below:

| | |
|---|---|
| Perennial ryegrass | 7 lb. per acre |
| Cocksfoot | 5 „ „ „ |
| Crested dogstail | 3 „ „ „ |
| *Poa pratensis* | 2 „ „ „ |
| White clover | 2 „ „ „ |
| Montgomery red clover | 2 „ „ „ |
| *Lotus major* | 1 „ „ „ |
| Mt. Barker sub. clover | $1\frac{1}{2}$ „ „ „ |
| Tallarook sub. clover | $1\frac{1}{2}$ „ „ „ |
| *Phalaris tuberosa* (sunny faces) | 3 „ „ „ |
| Timothy (shady faces only) | 1 „ „ „ |

**Treatments were:**

1. Complete mixture plus 2cwt. per acre serpentine superphosphate.
2. Clovers only plus 2cwt. per acre serpentine superphosphate.
3. Complete mixture. No fertiliser.
4. Fertiliser only, as above.

On treatment 3 there was nowhere any establishment without the fertiliser, nor did the fertiliser alone on plot 4 have any effect, so that all remarks can be confined to the first two treatments.

The strike of grasses on the shady trials was negligible, a little ryegrass and dogstail showing for a time, On the sunny faces there was a fair strike of ryegrass, dogstail and cocksfoot but due to slug and insect damage and drought conditions subsequent mortality was complete. Sowings the next year were little better.

The clovers fared little better on the sunny faces but on the shady plots the story was quite different. Here on both trials, while- establishment and initial growth was very slow, subterranean clover at first, then later in the spring white clover and *Lotus major,* became quite prominent. The red clover was very con-

spicuous in the early summer. In the second season in spite of being trampled heavily by cattle attracted onto the plots the clovers thickened up quite markedly following a second manuring in the autumn,

However, the results obtained even here do not compare with those obtained following topdressing and oversowing of adjacent areas of low fertility hill country swards.

From these trials we conclude:—

1. That any oversowing should be confined to clovers only.
2. That nothing is gained by early sowing. It is better to wait until the manuka has been sufficiently opened up to allow full light at ground level.

## 3. SUCCESSIONS IN DENSE UNSTOCKED STANDS

Whether farming, soil or water conservation, afforestation or wild life interests are considered the type of vegetation that is everywhere succeeding the considerable areas. of heavy manuka throughout Northern Hawkes Bay is of real interest.

Some of the species of trees, shrubs and ferns which succeed blighted manuka on areas not subject to grazing.

The facts are that the majority of such stands are being rapidly and completely replaced! firstly, by bracken fern and secondly by many native shrubs, ferns and trees, and also some introduced species. The list of species replacing blighted manuka on unstocked areas contains more than fifty names, and is given as a separate appendix at the end of this paper.

Particular attention has been focussed on one block of formerly solid manuka right by the roadside at Te Reinga. Here only seven years after the introduction of blight numerous native species are to be found, many towering fifteen to twenty feet above the undergrowth of fern. As is common in this district, prominent species are *Leucopogon fraseri, L. fasciculatus, Gaultheria antipoda, Olearia furfuracea,* koromiko *(Hebe* ***salicifolia),*** tree tutu ***(Coriaria arborea),*** hangehange ***(Geniostoma*** *ligustrifolium), five* finger ***(Nothopanax arboreum),*** karamu *(Coprosma robusta),* mamangi ***(Coprosma arborea),*** rangiora *(****Brachyglottis*** *repanda)* wineberry, *(****Aristotelia*** ***serrata),*** akeake ***(Dodonaea*** *viscosa),* rewarewa or honeysuckle *(****Knightia excelsa),*** whiteywood *(Melicytus ramiflorus),* kohuhu ***(Pittosporum*** *tenuifolium),* kamahi *(Weinmannia racemosa)* and numerous species of ferns.

Pioneers all of them, pioneers and colonisers, the forerunner to ultimate heavy bush; which can be allowed to succeed the manuka anywhere that is too steep or inaccessible to farm.

In, his book, "Tutira" the late Mr Guthrie Smith gives an interesting account of the manner in which manuka invaded The Hanger, a steep easterly paddock near the homestead of Tutira Station. In the 1880's the paddock was dominantly bracken, and not a single plant of manuka could be seen, but after repeated burning manuka commenced to come in strongly. Since 1893 no stock have ever been allowed on this paddock, and for twenty years, from 1893 to 1913, the paddock was one solid sheet of manuka. Then the manuka commenced to open up, allowing some light to reach the ground, and species such as whiteywood, five-finger and -tree ferns commenced to appear. When the paddock was visited two weeks ago the manuka had died out almost completely, and the area had reverted almost entirely to the same second growth species which are coming in at Te Reinga, and elsewhere in Wairoa County where dense blighted manuka is dying out but no stock are being- allowed onto the areas. Thus on this type of country the main effect of the blight seems to be to accelerate the natural succession to second growth, and ultimately to bush.

## THE DEVELOPMENT OF DENSE MANUKA STANDS FOLLOWING BLIGHT INFESTATION

Now that the possibility of oversowing dense manuka apparently only has limited application two other development methods remain.

(1) Crush with cattle.

(2) Burn.

Crushing may only be practical on smaller areas or where subdivision is adequate, and so far has not been attempted on any scale. Where burning is not permitted or possible this will be the only alternative. Such work should be left until the blight is well advanced, until the manuka can be readily pushed about, and in fact it might be better to leave crushing until the bracken stage.

Burning the standing scrub however does offer the quickest and easiest means of bringing such areas into production. Blighted manuka, provided that it still retains a fair proportion of leaf, will burn; such material is in fact extremely combustible even in humid conditions. One trial area was fired at the end of March two years ago, where the manuka which was 10-15 feet high and quite open underneath, burnt so fiercely as to completely singe off the wet grass covering the ground,. Only the standing skeletons of trunks and branches remained. The area was aerial topdressed but not seeded immediately due to the intervention of deluging rains amounting to over 30 inches in the week. In spite of this the subsequent strike and establishment has been very good, equivalent to the best results seen on burns of cut scrub. The incidence of seedling manuka here has been negligible, and already these have become blighted in turn. On large blocks, however, as a fierce burn would possibly eliminate all 'established insects, reinfection may be necessary.

Once the manuka has lost the leaf burning may become difficult, and only feasible in a dry season when the undergrowth and grasses can carry the fires. Otherwise it would be preferable to leave burning until the area has gone into bracken.

Prior to burning, preliminary work may involve clearing and repairing fence lines and putting in fire breaks. Burning should then follow in the autumn and fires started with the wind which should only be strong enough to fan the flames and carry them from bush to bush. Once going the fires will make their own draught. A complete burn cannot be expected, and some followup will be necessary. Seeding should wait

until the dry weather breaks. Where grasses are included in the mixture separate aerial sowing will be necessary and planes are now available with equipment to do this. Cross sowing is preferable. Superphosphate or equivalent manures at 2-3 cwt. per acre should follow and on inland pumice areas a further 2 cwt. per acre of cobaltised super should be applied early in the spring. Maintenance dressings would then be necessary each year. Seed mixtures will vary but should be kept as simple as possible. A suggested sowing for inland pumice country is:

| | |
|---|---|
| Perennial ryegrass. . | 35 lb. per acre |
| Cocksfoot . . . 4 | 2 " " " |
| Dogstail .. . . . . | 3 " " " |
| White clover . . . | 24 " " " |

Subterranean clovers could well be included on dry faces and in coastal districts.

The real disadvantage to burning at such a stage, however, is that the standing manuka skeletons not only leave a very untidy scene but also are a likely detriment to wool quality where sheep grazing would follow. Essentially initial grazings should be confined to cattle and wethers.

The alternative is to wait until the manuka has largely been destroyed by the insect, when better bracken burns could be expected.

To study the practical application of such measures the Department of Agriculture is assisting, on an experimental basis, with the develoament of one 600 acre block of solid blighted manuka in the Wairoa district. It is as yet too early to make firm rulings, but we feel that there is ample evidence to encourage farmers to immediately follow the blight invasion of similar areas along the lines sugested. This job is expected to cost up to $12 per acre to fully develop, but with an expected carrying capacity of at least 2 ewes per acre such development should be financially sound. Similar ventures could well be financed by Marginal Lands Board Loans where finance was otherwise difficult.

Before concluding may we say that we have shown what the manuka blight- is doing on the East Coast, and have indicated some of the ways by which the insect attack can be put to beneficial use.

The eradication of an indigenous plant by biological means is an amazing story second only to the control of prickly pear in Australia described by Dr Currie last evening. The difference is that .it was the New

Zealand farmers who, clutching for a last straw and overriding scientific caution, spread the insect to every part of the Dominion.

## APPENDIX 1

## LIST OF SPECIES NOTED REPLACING BLIGHTED MANUKA IN WAIROA COUNTY

| | |
|---|---|
| Whiteywood | *Melicytus ramiflorus* |
| Five finger | *Nothopanax arboreum* |
| Tree tutu | *Coriaria arborea* |
| Rewarewa or honeysuckle | *Knightia excelsa* |
| Black matipo | *Pittosporum tenuifolium* |
| Lemonwood | *P. eugenioides* |
| Karo | *P. crassifolium* |
| Karamu | *Coprosma robusta* |
| Karamu | *C. lucida* |
| Raurekau | *C. grandifolia* |
| Mamangi | *C. arborea* |
| | *Olearia forsteri* |
| Akepiro | *O. furfuracea* |
| | *Leucopogon f asciculatus* |
| | *L. fraseri* |
| | *Gaultheria antipoda* |
| Koromiko | *Hebe salicifolia* |
| Tauhinu | *Cassina leptophylla* |
| Pohutakawa | *Metiosideros tomentosa* |
| | *Muehlenbeckia australis* |
| | *Muehlenbeckia complexa* |
| Kowhai | *Sophora* microphylla |
| Lacebark | *Hoheria sexstylosa* |
| Rangiora | *Brachyglottis* repanda |
| Kawakawa | *Macropiper excelsum* |
| Kanuka | *Leptospermum ericoides* |
| Titoki | *Alectryon excelsum* |
| Kamahi | *Weinmannia racemosa* |
| Hangeange | *Geniostoma ligustrifolium* |
| Bracken fern | *Pteridium aquilinum* |
| Ngaio | *Myoporum laetum* |
| Akeake | *Dodonaea viscosa* |
| Inaka | *Dracophyllum longifolium* |
| Hinau | *Elaeocarpus dentatus* |
| Fuchsia | *Fuchsia excorticata* |
| Broadleaf | *Griselinia littoralis* |
| Wharangi | *Melicope* ternata |
| Lancewood | *Pseudopanax crassifolium* |
| Mapou | *Suttonia australis* |
| Cabbage tree | *Cordyline australis* |
| Himalayan honeysuckle | *Le ycesteria formosa* |
| | *Osteospermum moniliferum* |
| Broom | Cytisus spp. |
| Gorse | *Ulex europaeus* |
| Blackberry | *Rubus spp.* |
| Sweet briar | *Rosa rubiginosa* |
| Wheki | *Dicksonia squarrosa* |
| Mamuka | *Cyathea medullaris* |
| | *Cyathea dealbata* |
| Hard fern | *Paesia scaberula* |
| | *Histiopteris incisa* |
| | *Bleohnum fluviatile* |
| Shining spleenwort | *Asplenium lucidum* |

## DISCUSSION

**Q.** (Dr Melville): Does Mr Ayson consider that soil erosion is worse on any area where blight has killed the manuka?

**A.** (Ayson): Despite erosion being a real problem in the district, there has been no evidence of increased erosion, due to the replacement of manuka by other species, such as bracken, tutu, rangiora etc.

**J.** W. Woodcock: Mr Ayson failed to mention that manuka blight does not attack other species, as far as is known. This is the main argument of those opposing its use, i.e., the possibility of other useful plants being attacked.

**Q.** What is the best time to spread the insect?

**A.** (Ayson) : I consider the best time for spreading is in the early spring, and that the insect should be liberated in the warm gullies where it has the best chance of establishment.

**Q.** What is the highest altitude where the blight has been known to establish ?

A. (Ayson): About 1800 ft. in the. East Coast District. The blight was slower acting at this altitude.
(Glue): The blight has been noticed at 2.600 ft. in the Upper Waimakariri area, where conditions are very cold.

Q. Is kanuka also affected?

A. (Glue): Kanuka is affected but seldom completely killed.

**Q.** (Iversen) : Do you consider kanuka -may replace manuka after it has been killed by blight?

A. (Ayson) : Yes, to some extent. However kanuka providee good shelter and has other advantages, and it may be of advantage to encourage kanuka.

**Q.** Do you find that the blighted manuka is attractive to stock to any extent?

A. (Ayson) : Goats appear to be attracted by the honeydew exuded by the insect to some extent.

N. A. Clarke. In North Auckland the *Eriococcus* appears to have been attacked to some extent by crickets, though not so seriously as to reduce the population of manuka blight.

Q. Has the speaker noticed a slower spread in areas adjacent to the sea and affected by salt spray?

A. (Ayson): The blight appears to be equally effective near the sea in the East Coast area. I have seen a farm. with 100 acres of manuka of which 60 acres were badly blighted. The farmer topdressed with 1 cwt. of superphosphate, oversowed llb white clover seed, and followed up with mob stocking with cattle, with very good results. Clover establishment was good. The cattle chewed the tops of the blighted scrub.

**Q.** Is fungus necessary for a complete kill, or is the *Eriococcus* capable of causing death on its own.

A. (Glue): The fungus, though almost invariably present, is secondary and is not necessary for a complete kill.