

Eradication of Tuberculosis from Cattle in the Territory of Papua and New Guinea 1954-1964.

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ABSTRACT.

Progress in the eradication of tuberculosis from cattle in the Territory of Papua and New Guinea is described. Incidence was reduced from 2.3 per cent. in 1954-1955, the first year of testing, to nil in 1963-1964. Cattle under test increased in that period from 1,515 head in 25 herds to 14,597 in 190 herds.

INTRODUCTION.

IT has been the policy of the Territory of Papua and New Guinea Administration to establish a cattle industry free, as far as possible, from serious infectious and parasitic diseases. (Anderson 1962) Tuberculosis (caused by infection with *Mycobacterium tuberculosis*) is one of the most important diseases of cattle, because of the economic loss it causes, and because the bovine strain of *M. tuberculosis* can affect man.

The symptoms exhibited by tuberculous cattle depend on the extent and location of the lesions. If the disease is progressive, general symptoms are weakness, anorexia, emaciation and low-grade fever. An intermittent cough may be present when the lungs are involved. In non-progressive cases affected animals may appear normal but nevertheless shed the causative organism and spread the disease.

A clinical diagnosis of tuberculosis is only possible in advanced cases, by which time the affected animal is generally shedding tubercle bacilli. The detection of non-clinical cases depends on the tuberculin test. Tuberculin is a derivative of some of the specific proteins of tubercle bacilli. When it is injected intradermally into affected animals it causes a local reaction characterized by inflammation and swelling. If injected subcutaneously in an appropriate dosage, it causes a systemic reaction characterized by a transient fever.

Control of tuberculosis is generally based on testing of all cattle with a tuberculin test and

slaughter of positive reactors. Other methods include segregation of positive reactors, immunization of all exposed cattle, and chemo-therapy of reactors to a tuberculin test.

When it became apparent in 1952 that bovine tuberculosis was present in the Territory of Papua and New Guinea, it was decided to control and ultimately attempt eradication of the disease while cattle numbers were still low. Because of the management conditions existing at the time, a test and slaughter scheme was decided on. The scheme was initiated in areas where veterinary officers of the Animal Industry Division were available to carry out the tuberculin tests. As staff increased and communications improved the scheme was extended to the majority of cattle in the Territory. This paper records progress in the eradication of tuberculosis from 1954 to 1964.

TESTING METHODS AND FIELD ORGANIZATION.

The Tuberculin Test.

All cattle over six months of age were tested.

Tuberculin SM¹ was injected intradermally into the caudal fold of cattle under test, generally using a pre-set automatic hypodermic syringe² graduated to deliver 0.1 ml. of tuberculin. Preparation of the site of injection was not routinely practised.

As the majority of cattle under test were beef cattle, most testing was carried out in crushes, animals being packed in tightly for restraint. Dairy cattle were generally tested in milking bails.

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1. Tuberculin SM prepared by Commonwealth Serum Laboratories, Parkville, N2. Victoria.
2. McLintock pre-set tuberculin testing syringe.

Interpretation of the Test.

The test was read 72 to 96 hours after injection, depending on the circumstances, but the longer interval was preferred. Palpation of the fold after raising the tail was routine, with visual examination of suspected reactions.

In the initial period of the campaign, only positive and negative reactions were recognized. As herd histories became better known, it became practice to class doubtful reactions in known infected herds as positive. In herds where the disease had not occurred or was considered eradicated, doubtful reactors were retested one to two months later.

Frequency of Testing.

Until 1962-1963 the aim was to test all herds at six-monthly intervals. If a reactor was found, three-monthly testing was introduced until three consecutive negative tests were obtained. The disease was then considered eradicated from the herd and six-monthly testing begun.

In 1962-1963 12-monthly testing was introduced with a two-monthly interval in infected herds. Eradication was considered accomplished after three consecutive two-monthly negative tests and another six months later.

Fate of Reactors.

Reactors to the tests were identified by description and ear tag numbers, immediately removed from the herd and slaughtered on the property as soon as possible. Post mortem examination was carried out whenever possible and material for histopathological and bacteriological examinations forwarded to the Veterinary Laboratory, Kila Kila. Unexamined reactors and condemned parts from those examined post mortem were burnt.

Compensation.

Compensation for cattle slaughtered during the tuberculosis eradication campaign was either replacement with a similar animal from an Administration owned herd or at the Administrator's discretion, in cash.

Testing Prior to Movement.

All cattle over six months of age were required to be subjected to a tuberculosis test prior to movement unless tested within the previous two months. Cattle from infected herds were tested within two months of arrival at their final destination.

Legislative Powers.

The legislative powers for the tuberculosis eradication campaign were embodied in the Animal Disease and Control Ordinance of 1952-1957.

Quarantine Regulations.

Cattle, pigs and goats imported into the Territory of Papua and New Guinea required a certificate from a Government Veterinary Officer that they had given a negative reaction to the intradermal test for tuberculosis within 30 days of embarkation.

RESULTS.

A summary of the annual results of tuberculosis testing from 1954 to 1964 is given in *Tables 1 and 2 and Figure 1*. In the first year of the scheme 35 positive reactors were identified from 1,515 cattle tested, an overall infection rate of 2.3 per cent. This was reduced to nil by the tenth year. In the first year, reactors were identified in 6 or 24 per cent. of herds tested and this was reduced to nil by the tenth year.

Table 1.—Summary of Tuberculosis Testing 1954-1964.

Year.	Total Cattle Tested.	Cattle Under Test.	Herds Under Test.	Infected No.	Herds. Per cent.	Positive No.	Reactors. Per cent.
1954-1955	1,700	1,515	25	6	24.0	35	2.3
1955-1956	1,790	1,537	16	5	31.3	29	1.9
1956-1957	1,963	1,604	15	3	20.0	8	0.5
1957-1958	7,352	5,133	43	7	16.3	75	1.5
1958-1959	4,816	4,161	37	3	8.1	3	0.07
1959-1960	9,378	8,198	74	13	17.5	42	0.5
1960-1961	12,807	9,953	65	10	15.4	43	0.4
1961-1962	11,129	8,710	58	4	6.9	7	0.08
1962-1963	20,784	16,161	159	7	4.4	8	0.05
1963-1964	14,692	14,597	190	....	....	....	....

Table 2.—District Summaries for Tuberculosis Testing 1954-1964.

District.	Total Cattle Tested.	Cattle Under Test.	Herds Tested.	Number of Infected Herds.	Positive Reactors.
1954-1955—					
Central	613	494	8	2	19
Eastern Highlands	113	113	2	1	5
Madang	289	289	7	1	2
Morobe	669	603	7	2	9
New Britain	16	16	1	....	....
Total	1,700	1,515	25	6	35
1955-1956—					
Central	593	397	8	3	15
Highlands	175	175	2	1	3
Morobe	1,022	965	6	1	11
Total	1,790	1,537	16	5	29
1956-1957—					
Central	421	327	3	1	5
Morobe	751	486	5	2	3
New Britain	791	791	7	....	....
Total	1,963	1,604	15	3	8
1957-1958—					
Central	3,197	1,750	10	1	1
Eastern Highlands	1,556	784	14	4	40
Madang	325	325	6	1	8
Morobe	820	820	3	....	....
New Britain	365	365	5	....	....
Northern	295	295	1	....	....
Western Highlands	794	794	4	1	16
Total	7,532	5,133	43	7	75
1958-1959—					
Central	575	575	7	....	....
Gulf	37	37	1	....	....
Highlands	1,966	1,866	16	2	2
Morobe	183	183	1	1	1
New Britain	2,055	1,500	12	....	....
Total	4,816	4,161	37	3	3
1959-1960—					
Central	929	929	10	....	....
Highlands	3,400	2,400	24	5	10
Madang	920	740	8	2	5
Morobe	2,593	2,593	20	6	27
New Britain	1,536	1,536	12	....	....
Total	9,378	8,198	74	13	42
1960-1961—					
Bougainville	8	8	2	....	....
Central	4,398	3,855	13	4	25
Highlands	903	903	6	....	....
Madang	977	977	9	2	6
Morobe	5,525	3,214	23	4	12
New Britain	274	274	11	....	....
Northern	722	722	1	....	....
Total	12,807	9,953	65	10	43
1961-1962—					
Central	3,023	2,378	14	3	4
Highlands	605	605	6	....	....
Madang	378	378	3	....	....
Morobe	5,345	3,838	27	1	3

Table 2.—District Summaries for Tuberculosis Testing 1954-1964—continued.

District.	Total Cattle Tested.	Cattle Under Test.	Herds Tested.	Number of Infected Herds.	Positive Reactors.
1961-1962—continued.					
New Britain	984	17	7	....	....
Northern	794	794	1	....	....
Total	11,129	8,710	58	4	7
1962-1963—					
Central	4,112	3,421	18	....	....
Eastern Highlands	1,634	1,586	41	3	4
Madang	3,377	606	12	1	1
Manus	28	28	3	....	....
Morobe	7,111	5,185	22	1	1
New Britain	925	738	17	2	2
New Ireland	202	202	1	....	....
Northern	972	972	2	....	....
Sepik	396	396	7	....	....
Western Highlands	2,027	2,027	36	....	....
Total	20,784	16,161	159	7	8
1963-1964—					
Bougainville	109	109	13	....	....
Central	564	564	12	....	....
Eastern Highlands	1,893	1,798	34	....	....
Madang	1,494	1,494	7	....	....
Manus	45	45	4	....	....
Milne Bay	282	282	11	....	....
Morobe	7,098	7,098	26	....	....
New Britain	607	607	19	....	....
New Ireland	462	462	7	....	....
Southern Highlands	60	60	11	....	....
Western Highlands	2,078	2,078	46	....	....
Total	14,692	14,597	190	....	....

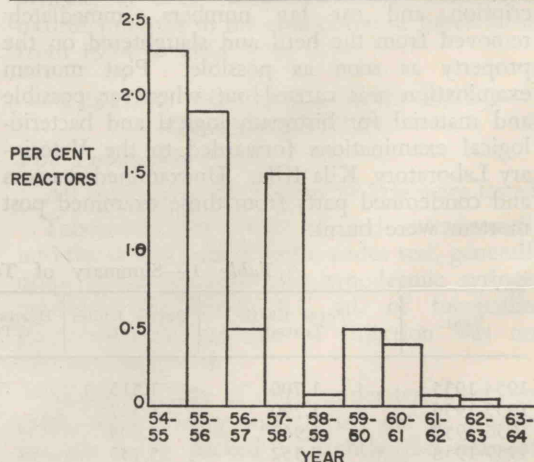


Figure 1.—Per cent. Reactors to Tuberculosis Test 1954-1955 to 1963-1964.

Within herds the highest percentage of infected animals at one test was 12.5 per cent.,

all being confirmed post mortem. Towards the latter part of the programme no visible lesion (NVL) reactions caused some herds to be classed as infected although only one reactor was identified in them. Thus in 1962-1963 only one of the seven infected herds had a confirmed reactor in it.

The fluctuations in per cent. reactors reflected new staff postings with resultant instigation of testing in previously untested herds. Thus the increases in 1957-1958 and 1959-1960 followed posting of veterinary officers to the Highlands and Morobe Districts respectively.

A summary of the incidence of NVL reactions among those examined each year is given in Table 3. No NVL reactions were found in the first year of testing but all except one or 83.3 per cent. were NVL's in the ninth year. Two of the reactors examined had histopathological tuberculous lesions only.

Table 3.—Incidence of No Visible Lesion Reactors.

Year.	Total Reactors.	No. of Reactors Examined.	No. of Reactors showing Visible Lesions.	NVL but +ve by laboratory methods.	NVL and -ve in laboratory.	% Reactors -ve in laboratory.
1954-1955	35	10	10	....	....	....
1955-1956	29	15	12	....	3	20.0
1956-1957	8	....	NA	NA	NA	NA
1957-1958	75	5	3	....	2	40.0
1958-1959	3	....	NA	NA	NA	NA
1959-1960	42	12	5	1	6	50.0
1960-1961	43	6	2	....	4	66.7
1961-1962	7	6	1	1	4	66.7
1962-1963	8	6	1	....	5	83.3
1963-1964	....	....	....	....	....	....

DISCUSSION.

The control or eradication of tuberculosis in cattle should be practised firstly on economic grounds, in the interest of the livestock industry and secondly for the maintenance of public health. (Committee on Tuberculosis 1949)

Cattle herds in the Territory of Papua and New Guinea were almost wiped out during the second World War and the desirability of re-establishing herds free from tuberculosis was realized by the Administration. Consequently, quarantine restrictions were applied to provide

for the importation of tuberculosis-free stock and an eradication scheme for existing herds instigated. This was based on techniques developed in the United Kingdom, Europe and United States of America and adapted to Australian conditions—that is a test and slaughter scheme based on the single intradermal injection of Tuberculin SM into the caudal fold. The Australian work has been described by Legg and Maunder. (1940 a and b, 1941 a and b), Bazeley and Barraclough (1940) and Gregory (1949).

Three problems associated with tuberculin testing encountered during this programme are discussed below. They were—

- (a) No visible lesion reactors (NVL's).
- (b) False negative reactors.
- (c) Suspicious or doubtful reactors.

(a) *No visible lesion reactors* have proved a problem in tuberculosis eradication programmes elsewhere, their importance increasing when the level of tuberculosis in the herds had been greatly reduced and presumably tuberculosis-free herds were being continuously retested. (Gregory 1949) For example, Karlson (1962) cites information that from the year 1893 to 1908, 98.39 per cent. of Tuberculin reactors slaughtered in the United States had tuberculous lesions, while in 1959, 57.6 per cent. reactors had no visible lesions. NVL reactions can be due to too potent tuberculin, non-specific sensitising agents, or incorrect interpretation of doubtful reactions (Maunder 1949), trauma of the caudal fold when carrying out injections (Legg and Maunder 1941a) or specific reactions prior to the development of lesions. (Watts 1949)

The increase in NVL reactors in this Territory's eradication programme from nil in 1954-1955 to 83.3 per cent. in 1962-1963 can be seen in Table 3.

The majority of NVL reactors in 1961-1962 and 1962-1963 were considered to be due to incorrect interpretation of doubtful reactions in herds whose history indicated an absence of infection. However, the necessity of exercising skill in interpreting reactions in such herds was demonstrated by the detection of single small reactions after a number of clean tests in two herds. In one case, macroscopic and in the other microscopic tuberculous lesions were revealed post mortem.

(b) The difficulty in detecting advanced cases of tuberculosis with the tuberculin test has been described by Legg and Maunder (1941b). A false negative reactor of this type prolonged eradication in one herd of over 500 head, being detected when culled. As its presence was suspected on herd history, the short thermal test was attempted on doubtful reactors and other suspect animals. However, the unexpected finding that all cattle had a pre-injection temperature of over 102.8 degrees Fahrenheit prevented its use. The cattle in this case were Shorthorns in a hot lowland environment and these temperatures were recorded even after overnight yarding.

(c) Interpretation of doubtful reactions to the intradermal tuberculin test has been referred to by Bazeley and Barraclough (1940), Legg and Maunder (1941 a and b), Maunder (1949) and Watts (1949). The procedure adopted with doubtful reactors is outlined above. If this procedure had been routine after the first few years it is considered the percentage of NVL reactors would have been reduced considerably without classing tuberculous cattle as negative.

Legg and Maunder (1941a) refer to the production of doubtful reactions by trauma of the caudal fold with the needle in poorly restrained cattle. Most of the cattle in this eradication programme were beef animals, many being Brahman crossbreds of vigorous disposition. Crushes were often rudimentary and not designed with ease of intradermal injection into the caudal fold in mind. Under these conditions needle trauma was common and considered to be a cause of doubtful reactions.

To date, the test and slaughter method for the eradication of tuberculosis based on the intradermal tuberculin test is considered to have been successfully applied in Papua and New Guinea and is seen as some contribution towards the establishment of a successful dairying and grazing

industry. Continued annual testing of all Territory cattle is planned for some time into the future. Extension of testing to small herds in inaccessible locations will be difficult. Utilization of helicopters represents an expensive but practical method of carrying out initial tests in such herds, although their status can generally be predicted by tracing their origin to larger herds in the various centres of the Territory.

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