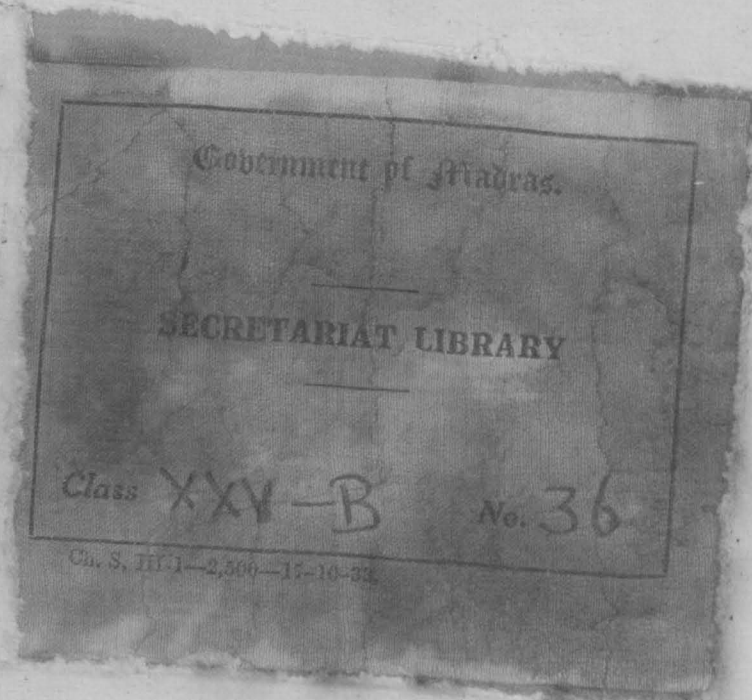


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REPORT OF THE SPECIAL
RINDERPEST OFFICER

MADRAS PRESIDENCY

(M.R.Ry. C. SURYANARAYANAMURTHI PANTULU GARU, Q.M.V.O.,
Madras Veterinary Service)

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REPORT OF THE SPECIAL RINDERPEST OFFICER, MADRAS.

I. INTRODUCTION.

(a) The Director of Veterinary Services, Madras, in proposing to Government in his letter C. No. 3045/A-30, dated the 29th September 1930, the appointment of a special officer for rinderpest investigation has adduced the following reasons in justification for the creation of the post :—

"Rinderpest has more or less become a permanent disease and is causing great havoc in this Presidency. The number of deaths from contagious diseases has been steadily on the increase, particularly in recent years, and rinderpest has been the main cause thereof. The subject of rinderpest and its prevention has engaged the attention of the authorities in this country from time to time and since the submission of the report of the Indian Cattle Plague Commission in 1871, much valuable work has been accomplished in the field of research on rinderpest prevention. Much still remains to be done in order to bring the disease more effectively under control."

The Director has further detailed in his letter to Government the various problems requiring solution in connexion with the disease. Government accordingly in their order No. 480. Development, dated the 28th March 1931, sanctioned the creation of the post of a Special Rinderpest Officer for a period of two years to investigate the methods adopted for controlling rinderpest in this Presidency on the lines indicated in the memorandum of instructions, viz.—

Questionnaire.

(1) How far has the serum simultaneous method of inoculation against rinderpest which has been in vogue on a progressive scale since 1920, succeeded in controlling the disease in each of the areas specified ?

(2) What is the cause for the marked variation, if any, in the duration of immunity in the inoculated animals in the various parts of the Presidency ?

(3) Is there any marked variation in their susceptibility to the disease as between the different breeds of cattle of this Presidency, and if so, what modification is necessary in the dosage of serum, etc. ?

(4) Does the virulence of the disease vary on account of locality, climatic conditions, etc., apart from the breed of cattle ?

(5) What is the percentage of cases in which immunity following serum simultaneous inoculations has broken down resulting in reinfection and death during periods up to five years ?

(6) Is the failure to confer lasting immunity referable to blocking out, by massive doses of serum, the reactions in the animals during the serum simultaneous inoculations ?

(7) Is the age of the animal at the time of serum simultaneous inoculation a factor in the duration of the immunity ?

(8) Is there any evidence to suggest the existence of "plurality" or mutation of virus in this disease ?

(9) What line of research should be undertaken so as to make the problem of prevention and control of rinderpest more economical and efficient in this Presidency ?

(10) Is the objection to branding or tattooing of inoculated animals in order to prevent wastage of serum by inoculating the same animals again, so strong as to make the inoculation itself unpopular if branding is made compulsory ?

(11) Vaccination against rinderpest.—Can this be undertaken as an alternative to serum simultaneous inoculations ?

(12) Should inoculation against rinderpest by the serum simultaneous method be made compulsory ? If so, what are the lines on which legislative measures are necessary ?

(13) What should be the future plan of campaign ?

(14) Has the time yet arrived when the wealthier cattle owners can be expected to pay for the protection afforded to their cattle ?

The following questions have been added from time to time, the first six questions having been received through the kindness of the Director, Imperial Institute of Veterinary Research, Muktesar, and the remainder from the Director of Veterinary Services, Madras:

- (1) The incidence of rinderpest in and the relative susceptibility of each pure breed.
- (2) The relative susceptibility of animals of different ages within each pure breed.
- (3) Cases of breakdown in immunity, partial or complete, in animals known to have been protected previously either by natural or artificial means.
- (4) The complications observed in cases of rinderpest, both natural and artificially induced, in the province, e.g., piroplasmiasis, trypanosomiasis, coccidiosis, etc.
- (5) The question of the plurality of the rinderpest virus and any difference observed in the behaviour of virus obtained from extraneous sources, e.g., Muktesar.
- (6) The epizootiology of rinderpest in Madras with special reference to—
 - (i) the infectivity of convalescents;
 - (ii) possible carriers either domesticated or wild;
 - (iii) possible reservoirs either living or inanimate.
- (7) The determination of the correct minimum dose of serum for each local area which would give the maximum degree and period of immunity, assuming the serum to be of standard and constant quality.
- (8) The examination of the present methods of report and record of rinderpest attacks and deaths and suggestions for their improvement.
- (9) The most economical methods of utilizing the available serum, e.g., whether it will be better to inoculate the cattle in affected areas only or healthy cattle of say, of over two years of age in all the areas.
- (10) To investigate the causes for the fall in the number of animals sent for grazing to Government forest grazing areas during recent years and to ascertain whether it is due to the incidence of rinderpest in those areas.

(b) Mr. H. C. Sampath Ayyangar was appointed to the post. He took charge of it on the afternoon of the 13th July 1931. On the 21st December 1931 he proceeded on leave, on the expiry of which he was transferred as District Veterinary Officer, Vellore. I took charge of the post on the afternoon of the 21st December 1931 and continued to hold charge of it till the end of the period, i.e., till the end of April 1933. I was on privilege leave from the 25th August 1932 to 12th September 1933 during which period the post was without an officer.

(c) In the course of these two years, all the districts except Ganjam, Ramnad and Chittoor have been visited covering a distance of 2,780 miles by road and 12,056 miles by rail, the number of villages visited being 162.

(d) I wish to state here that the questionnaire is too comprehensive to be answered within the allotted period of two years (actually one year and nine months). Further I was very much handicapped in my work for want of a technical assistant, as I had to do everything myself. However, I have tried to answer the questionnaire as far as possible.

An interim report was submitted to the Director of Veterinary Services, Madras, in this office B.O.C. No. 140/32, dated 5th July 1932. Many of the statements submitted with the interim report are now revised and enlarged in the light of further investigations made and the whole matter of the interim report and the statements and graphs have now been embodied in this final report.

2. GENERAL.

(a) *Territorial changes in the constitution of the districts and taluks.*—For a comprehensive statistical study of the census and mortality in the different districts and taluks, it is first necessary to know the territorial alterations that took place in the several districts and taluks from time to time. A statement (statement No. 1) is therefore prepared showing the territorial changes in the constitution of the revenue districts and taluks during the past thirty years. From this statement it will be seen that most of the districts underwent territorial changes during the years 1910 and 1911 and in years prior to 1910. The following districts underwent territorial changes subsequent to 1910-11:—

Ganjam in the years 1921 and 1923.

Vizagapatam in the years 1921 and 1923.

Godavari in the years 1921 and 1923.

East Godavari, West Godavari and Kistna. Formation of East Godavari, West Godavari and Kistna districts from Godavari and Kistna in 1925-26.

Trichinopoly and Salem in 1918.

Many taluks had territorial changes during the years 1909, 1910 and 1911. A few had changes subsequent to 1911, and they are given below:—

Certain taluks of Bellary district in 1923.

Sriperumbudur and Saidapet taluks in Chingleput district—1917.

Rasipur, Salem, Namakkal, Tiruchengode and Atur taluks of Salem district—1918.

Musiri taluk of Trichinopoly district—1918.

(b) *Cattle census—Remarks.*—A statement of cattle census (statement No. 2) taken from the year 1890 with the percentage of increase or decrease worked out is attached hereto. The census taken during the years 1909-10 and 1914-15, as seen from the season and crop reports show two figures against each district. One represents 'actuals' and the other 'estimates.' The 'actuals' refer to Government villages and the 'estimates' to zamindari tracts. The 'actuals' have been arrived at by actual enumeration and the 'estimates' by rough estimation and these form about one-third of the 'actuals.' No censuses of cattle for zamindari villages were taken at all during the censuses prior to 1909-1910.

From a perusal of the statement, it will be seen that the rate of increase or decrease per cent in the census figures up to the census for 1914-15 inclusive, for the several districts is incredibly high and excepting in the last three censuses, the figures appear to be unreliable for purposes of statistical study.

(c) *Cattle mortality from rinderpest—Remarks.*—A statement showing the cattle mortality from rinderpest in the several districts of the Presidency from the year 1900-01 to 1931-32 is enclosed (statement No. 3). In the earlier years up to 1902-03 there used to be separate columns under "rinderpest" and "diarrhoea and dysentery" in the mortality returns and deaths were used to be recorded under these diseases separately. The annual reports from the year 1907-08 (the annual reports for the years 1903-04 to 1906-07 being not available) do not contain figures under "diarrhoea and dysentery" separately, but in the comparative statement of mortality for five years ending with 1907-08 attached to the same report, the columns under "rinderpest" and "diarrhoea and dysentery" are seen combined into one column under the heading "rinderpest, diarrhoea and dysentery," presumably to avoid confusion and wrong classification of deaths from these diseases.

The Presidency mortality figures and the district mortality figures include deaths due to "diarrhoea and dysentery" up to the year 1907-08, excepting in the case of district mortality figures for the year 1906-07. The figures under "diarrhoea and dysentery" for the year 1906-07 are not available, as the annual report is not forthcoming. From the year 1907-08 the column "diarrhoea and dysentery" was altogether omitted from the mortality statements.

The Agency tracts of Ganjam, Vizagapatam and East Godavari districts.—No mortality returns are received from the Agency taluks of Vizagapatam district and from some of the taluks of Ganjam Agency as no cattle mortality registers are maintained in these parts. In the few taluks in which the cattle mortality reports are maintained the recording and reporting of cattle mortality is very defective.

Vizagapatam district, though the biggest district in the Presidency, chiefly consists of the Agency tracts which form 8/11 of it. No mortality returns are received from the Agency taluks of this district and this probably accounts for the low death-rate in this district. The cattle census of the Agency tracts of this district is about $\frac{1}{3}$ of the total census.

Census of goats and sheep in the Presidency.—As outbreaks of rinderpest among these animals are occasionally met with in villages and as the disease breaks out among these animals now and then generally either before or after an outbreak among cattle in a village, it is necessary to have an idea of the census of sheep and goats. A statement (No. 4) showing the districtwar census according to the latest census of 1930 is attached. The total census of sheep and goats is 20,270,361 and is therefore nearly equal to that of cattle (22,440,730).

Mortality among sheep and goats from rinderpest.—Unfortunately deaths from rinderpest among these animals are not now recorded. During the earlier years up to 1895-96 deaths from "rinderpest" and "diarrhoea and dysentery" among sheep and goats were recorded,

as can be gathered from certain Proceedings of the Board of Revenue. Figures for a few years are given below as an example in order to give some idea of the mortality among sheep and goats—

	Cattle.			Sheep and goats.		
	Rinder-pest.	Diarrhoea and dysentery.	Total.	Rinder-pest.	Diarrhoea and dysentery.	Total.
1891-92	11,445	19,151	30,596	1,919	2,687	4,606
1892-93	13,104	32,810	45,914	2,098	5,777	7,875
1893-94	13,155	18,104	31,259	2,700	2,901	5,601
1894-95	13,867	9,775	23,642	2,715	2,096	4,811

(The figures for 1891-92 have been worked out on 9 months' actuals).

The mortality from rinderpest among sheep and goats seems to be about $\frac{1}{3}$ of that among cattle.

The abandonment of recording deaths among sheep and goats as well as deaths from natural causes and accidents among cattle was sanctioned by Government from the year 1895-96, as can be seen from the Board's Proceedings No. 23, dated the 18th February 1896, which contains the following observation:—

"As the Government has sanctioned the abandonment of all attempts to record deaths from natural decay and accidents as well as those among sheep and goats, all reference to these particulars may be omitted in future."

The annual loss of sheep and goats from rinderpest will be found, in my opinion, to be not insignificant, if accurate records were maintained.

Mortality among country pigs from rinderpest.—Outbreaks are occasionally met with among country pigs but no mortality figures are available.

Rinderpest mortality compared with that of all contagious diseases.—A glance at the graph No. 1 showing the mortality from rinderpest and the total mortality from all contagious diseases in the Presidency reveals the fact that this disease is responsible for nearly 50 per cent of the total mortality from all contagious diseases.

(d) *Economic loss from rinderpest.*—Taking the figures for the period of nine years ending 1931-32 into consideration, the economic yearly loss from rinderpest an an average works up to the staggering figure of Rs. 21,56,684 (please see statement No. 5). This figure has been arrived at by basing the calculation on the reported mortality. If the unrecorded deaths are also taken into account the above figures will show a considerable increase and may indeed be doubled. To this must also be added the economic loss in holding up agricultural work, as the incidence of rinderpest seems to be more severe during the agricultural season (please see statement 6). The economic importance of research into the methods of prevention of rinderpest is therefore obvious.

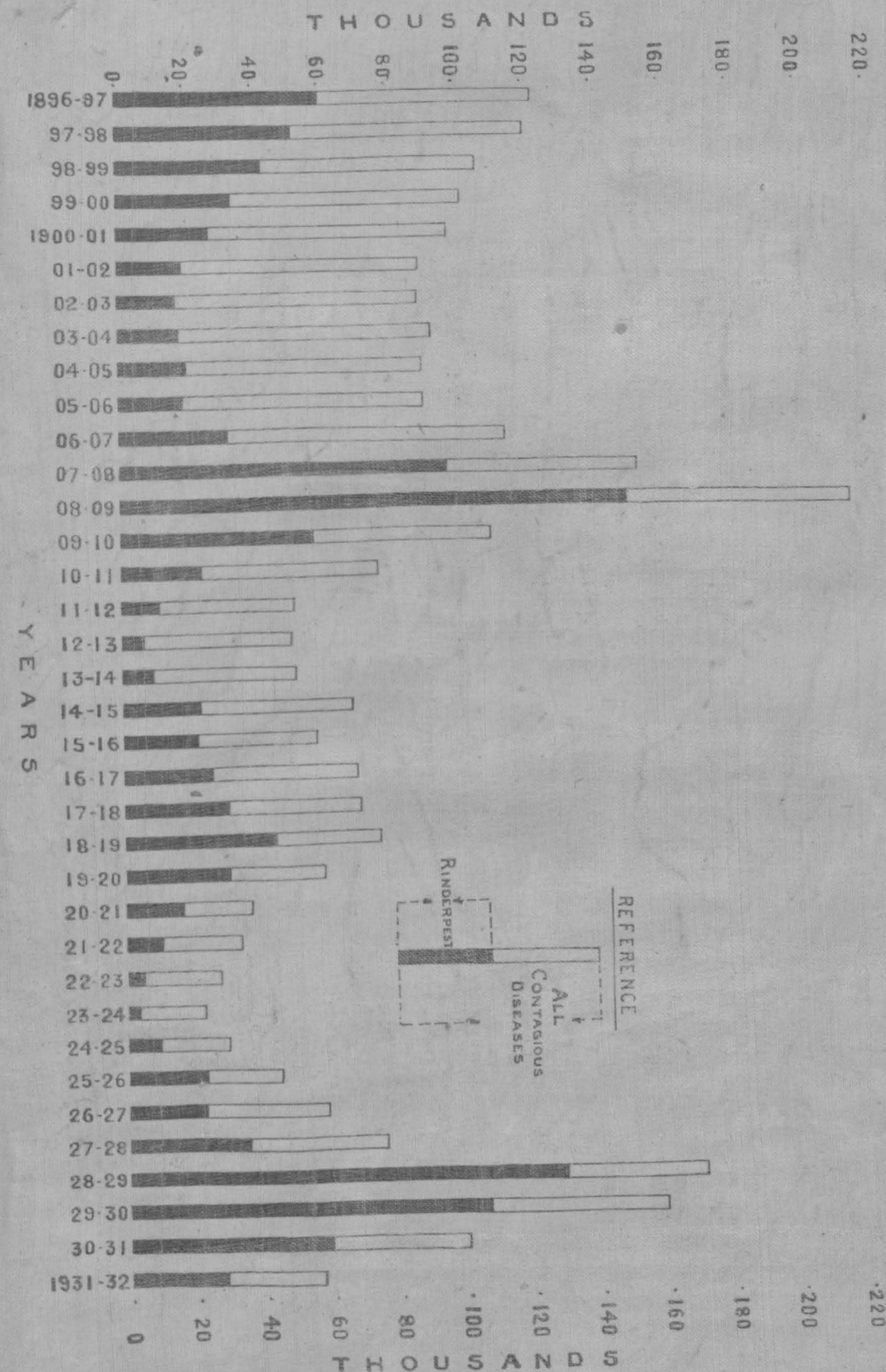
3. EPIZOOTIOLOGY OF RINDERPEST.

(a) *The incidence of rinderpest in the Presidency, taking the Presidency as a whole.*—From graph No. 2 and statement No. 7 showing the cattle mortality from rinderpest for the past forty-one years in the Presidency, it is of interest to note that each curve of high mortality reaches the crest almost regularly after a period of ten years. From the available statistics the first known wave was for nine years from 1894-95 to 1902-03, the second for ten years from 1903-04 to 1912-13, the third for ten years from 1913-14 to 1922-23, and the fourth (the current one) from 1923-24 up to date and is still continuing though on the downward grade. The crest of the first wave was in 1896-97, the second in 1908-09, the third in 1918-19, and the fourth in 1928-29. Again the lowest figure in the yearly mortality (trough) similarly occurred once in almost every ten years, viz., during the years 1894-95, 1903-04, 1912-13 and 1923-24. A most important point to be noted in regard to these four waves is that a wave of greater intensity is followed by a wave of lesser intensity, placed approximately midway between the major waves. The total mortality during a wave of lesser intensity is about half of that during a wave of greater intensity. Both the factors responsible for the major waves, viz., simultaneous appearance of outbreaks in different localities and increased death-rate per outbreak seem also responsible for the formation of these minor waves.

(b) *The incidence of rinderpest in the districts.*—From a study of the district mortality figures for the past thirty-two years (statement No. 3) it can be seen that no district was completely free from rinderpest during any year, excepting Ramnad during 1921-22 and the Nilgiris during the years 1905-06 and 1914-15. The disease therefore seems to be enzootic in every district, taking the district as a whole.

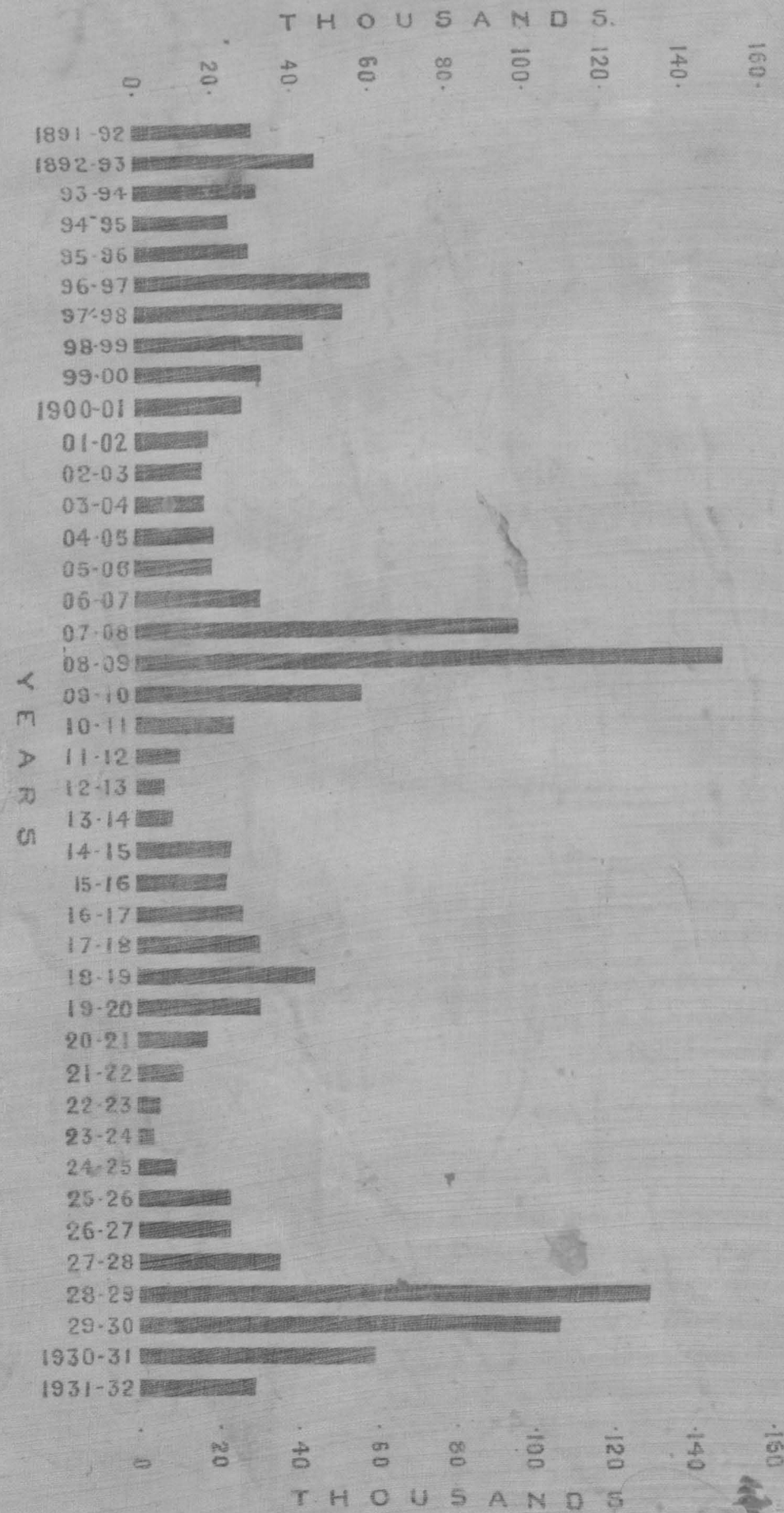
GRAPH No. 1.

Mortality from rinderpest and total mortality from all contagious diseases.



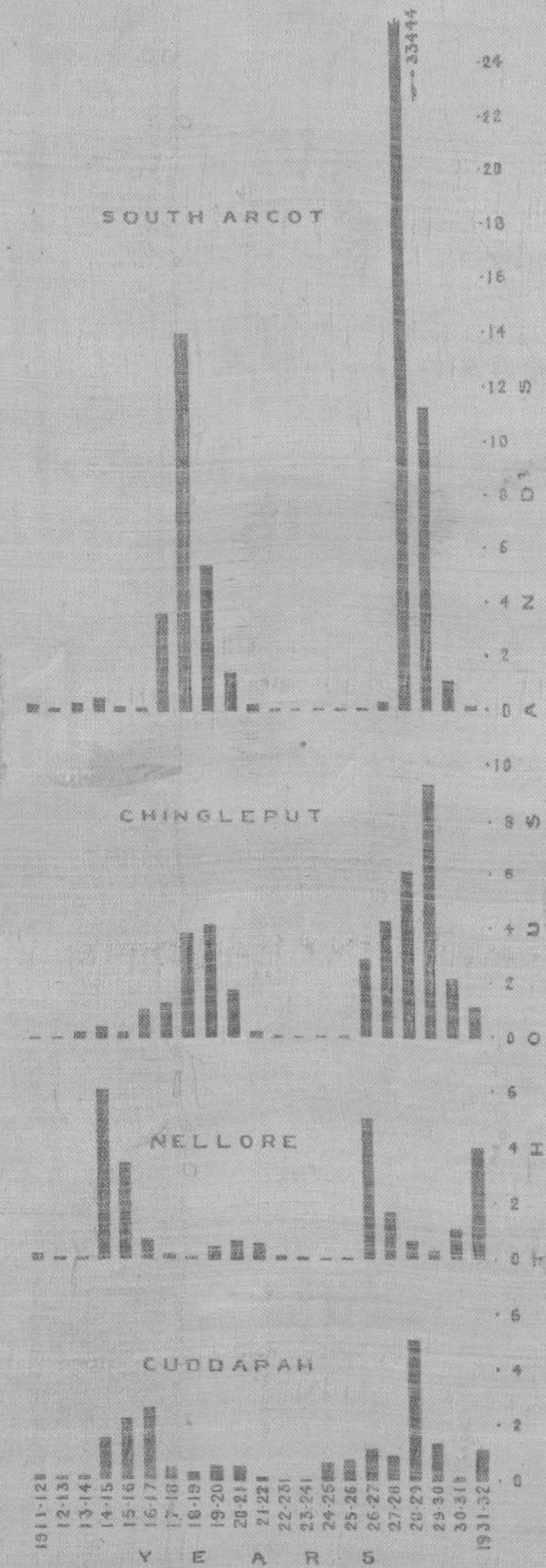
GRAPH No. 2.

Mortality from rinderpest for the past forty-one years.

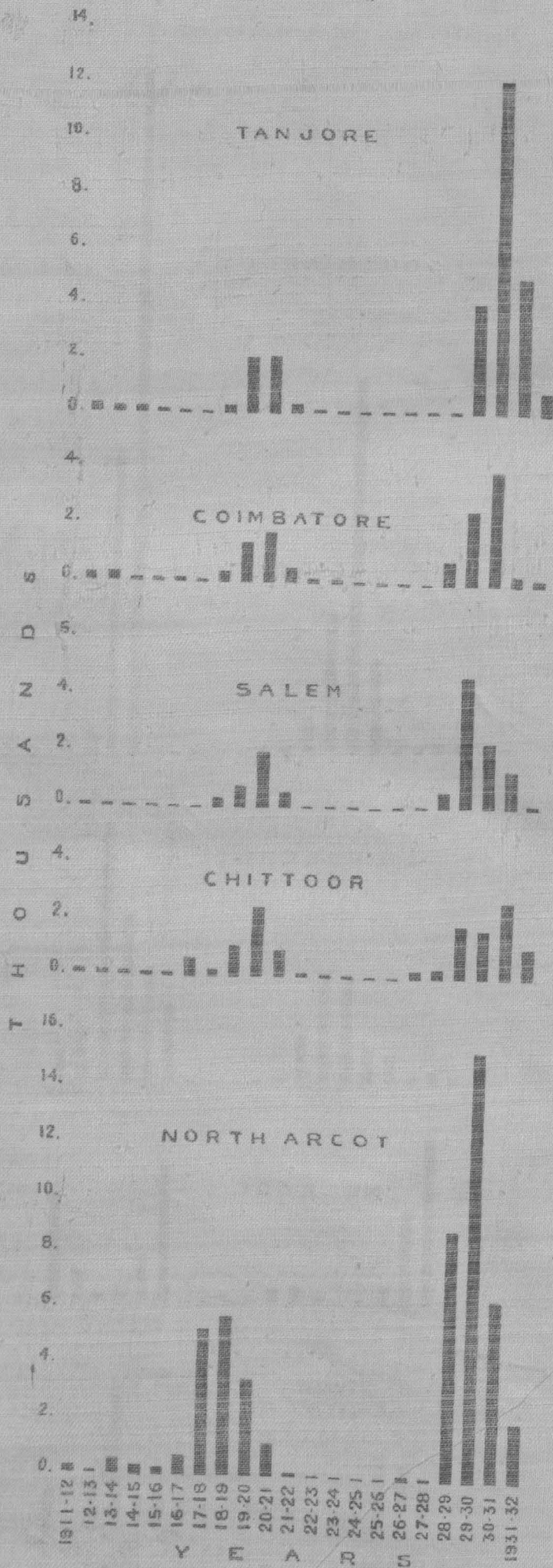


GRAPH No. 3.

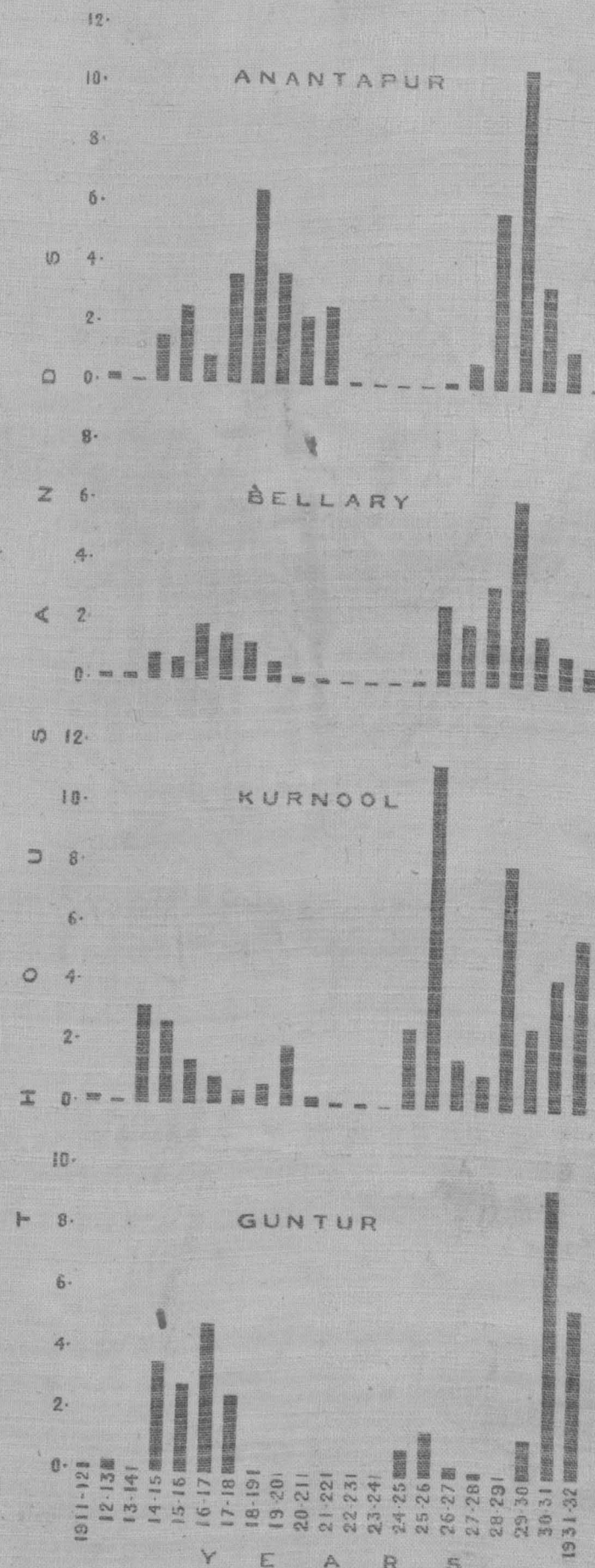
Mortality from rinderpest in the several districts.



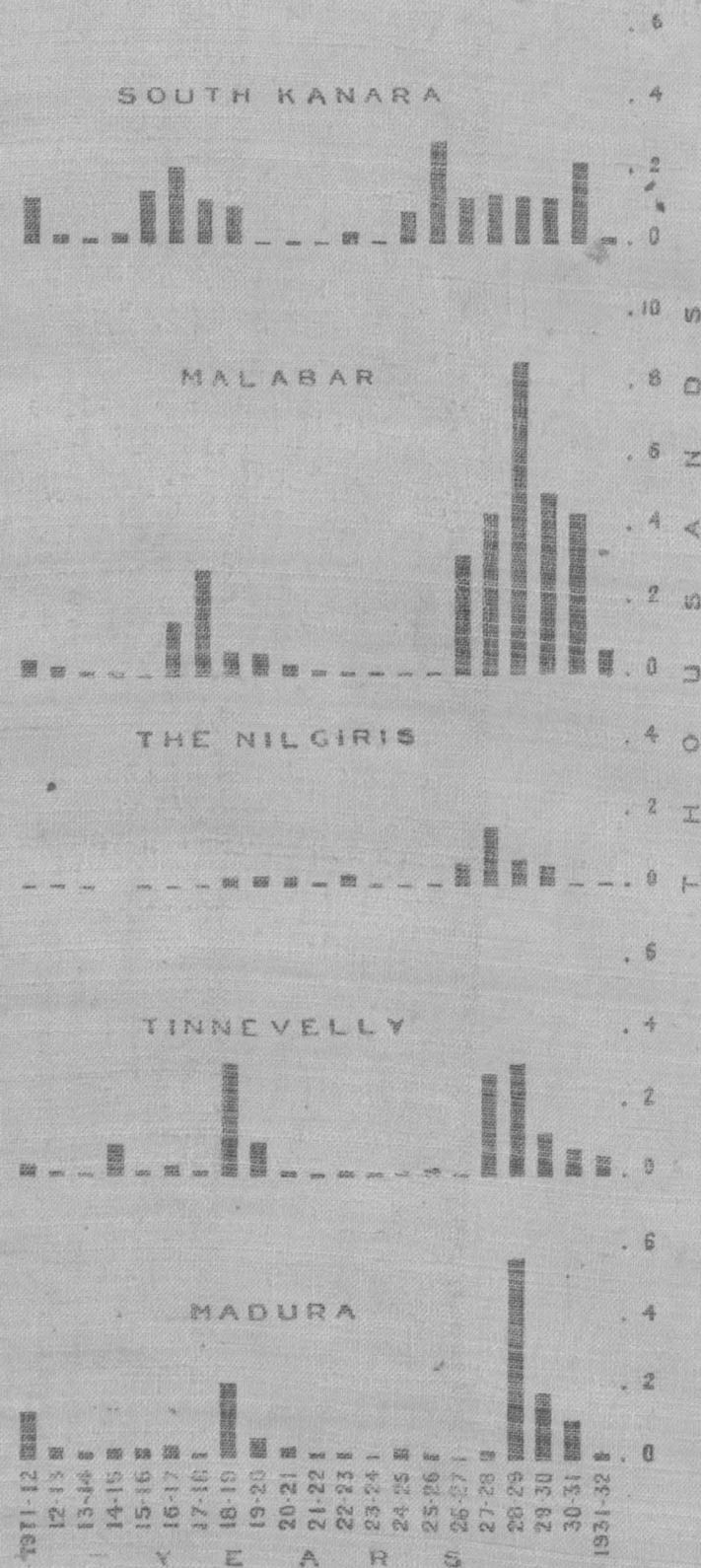
GRAPH No. 3—cont.



GRAPH No. 3—cont.



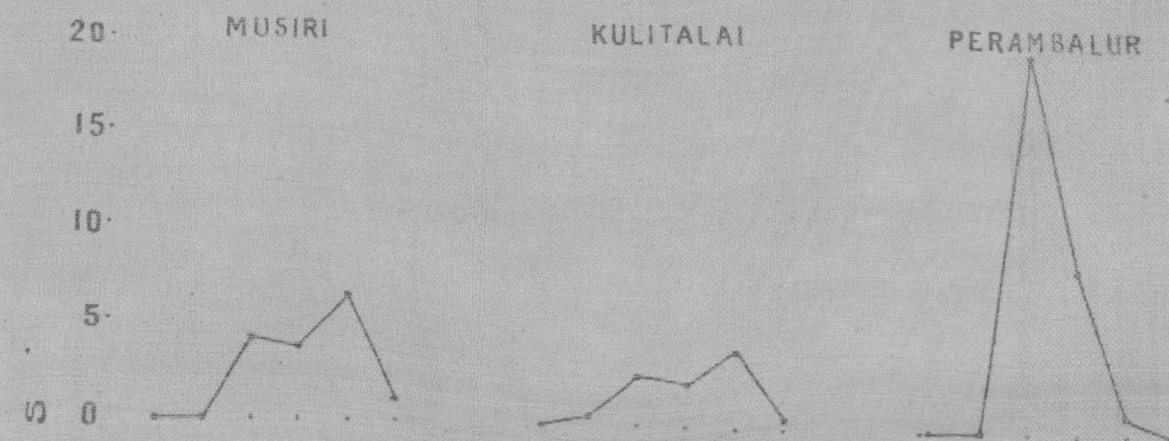
GRAPH No. 3—cont.



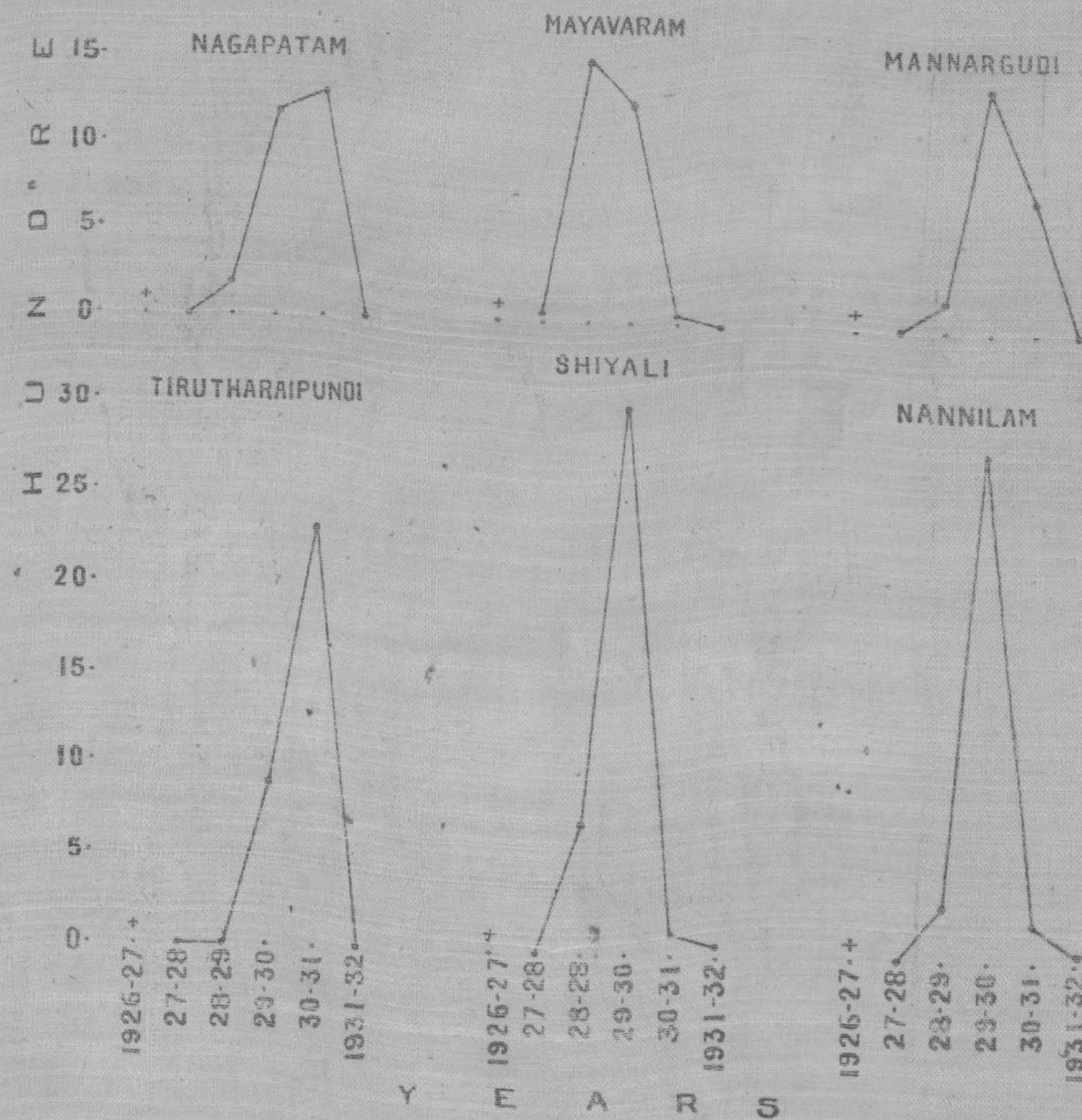
GRAPH No. 4.

Mortality from rinderpest in certain taluks.

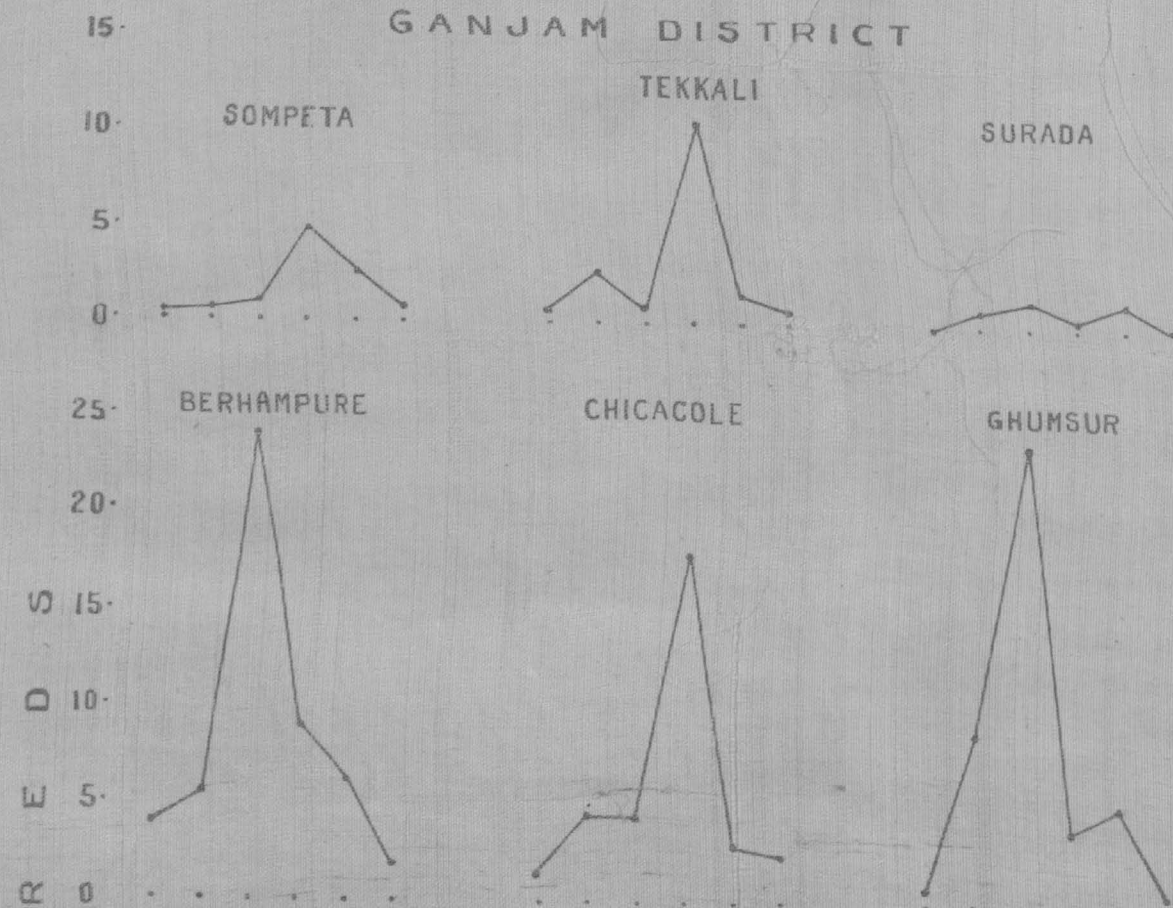
TRICHINOPOLY DISTRICT



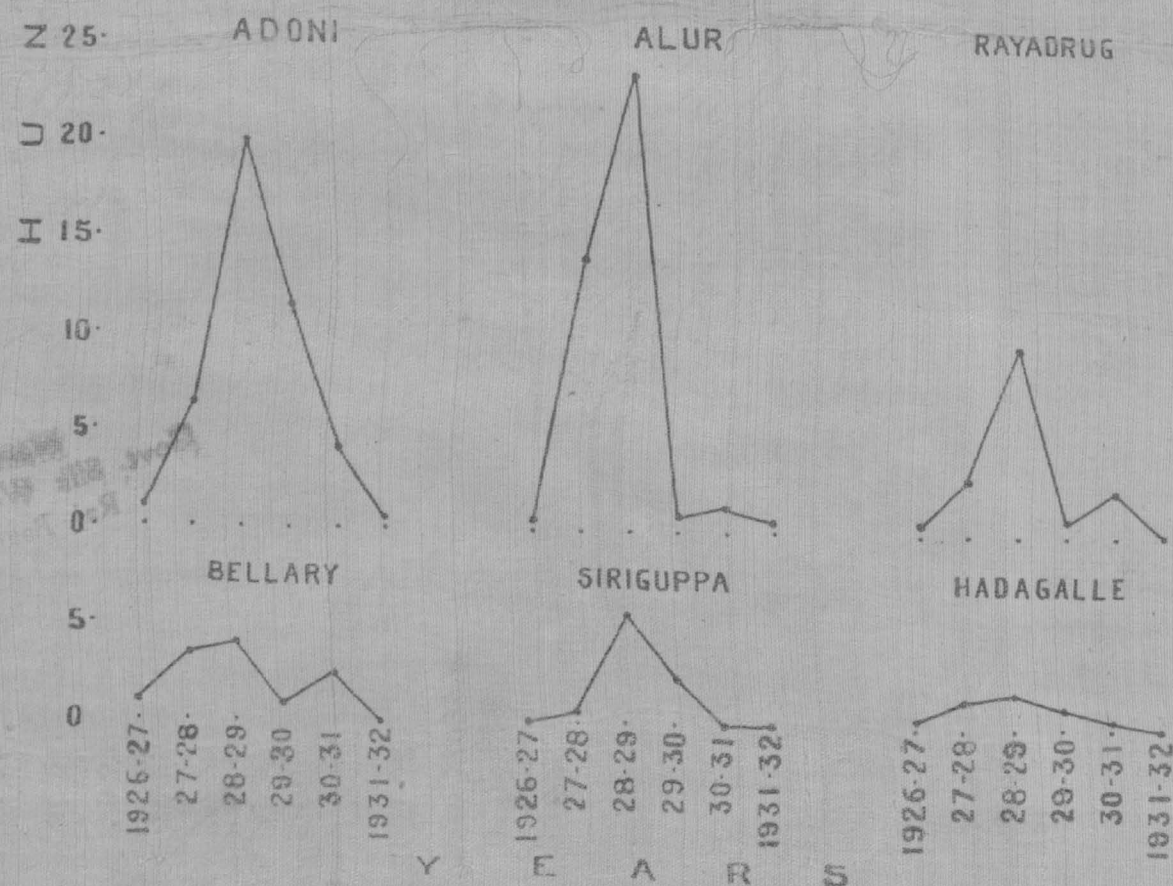
TANJORE DISTRICT



GANJAM DISTRICT



BELLARY DISTRICT



From a study of the waves in the several districts (graph No. 3 and statement No. 3) it will be seen that the periodicity and the duration of the district waves are not so regular as the Presidency waves. However, the following observations will be of interest:—

- (1) that the disease appears in a wave form once in about ten years,
- (2) that a wave of lesser intensity is followed by one of greater intensity and vice versa in almost all the districts. This is in accordance with what is observed in the case of Presidency waves,
- (3) that the duration of each wave (the period between the rise and fall of the wave) seems to be generally about four or five years and is therefore about half of that of the Presidency waves,
- (4) that the period of lull (period of mildness intervening between the waves) seems to be generally about five or six years. Such periods of lulls are not observed in the Presidency mortality graph, and,
- (5) that the period from the crest of one wave to the crest of another is generally about nine to ten years.

(c) *The incidence of rinderpest in taluks.*—Unfortunately the mortality figures per taluk are not available for more than six years and even the six years' figures are not available for all the taluks. From a perusal of the statement showing talukwar mortality for the past six years (statement No. 8 and graph No. 4), it can be seen that

- (1) that, unlike districts, taluks seem to be free from the disease for some years due, no doubt, to the smaller area involved, and
- (2) that the duration of the wave (the period between the rise and fall of the wave) is generally about three to five years. As the figures are available only for six years the periods of mildness, the periods of complete freedom from the disease and other points cannot be fully studied.

(d) *The incidence of rinderpest in villages.*—The periodicity of the disease in villages varies within wide range from about one year to 10, 15 or 20 years or even more. In some villages which I have visited in the course of my tours, it was said that the disease had not prevailed there for about 20 years but such instances are very rare. Generally the period of freedom from disease varies from about 6 to 7 years to 10 or 12 years. The duration of the outbreak in a village usually extends to about two or three months or it may extend to several months depending upon the size of the village and the facilities for the spread of infection.

In some of the villages in which the disease has not broken out for many years it assumes an intense form. The figures for some outbreaks visited by me are given below:—

Number of villages visited.	The period from the last outbreak to the recent one.	Number of cattle exposed to infection.	Number of attacks.	Number of deaths.	Number unaffected.
17	5 to 8 years in 3 villages, 10 to 20 in 14 villages	3,566	2,429	1,082	1,137
	Percentages calculated on the number of cattle exposed to infection	...	68	30	32

The intensity of the disease in a village seems to depend chiefly on the period of time that has elapsed since the occurrence of the last outbreak. This is in accordance with what is to be expected.

Thus the study of the waves of rinderpest in the Presidency, in the districts and in the taluks will enable one to predict the probable time of appearance of the next wave.

(e) *The movement of the wave of rinderpest from district to district.*—I have stated in paragraph 3 (b) above, that there was no district which was completely free from the disease in any complete year, excepting Rannad and the Nilgiris for a year or two. The infection is always present, but it assumes serious proportions during some years and is followed by a period of mildness or lull. The disease seems to take a circuit, as it were, of all the taluks in a district in about four or five years' time, lurks in some corner or other of the district in a very mild form for about five years, and then begins another round when the herd susceptibility is on the increase.

Infection spreads from village to village, taluk to taluk and district to district chiefly by the movement of cattle to and from the adjoining districts or taluks where the disease has assumed an intense form.

The Presidency sketch maps Nos. 5, 6 and 7 show how the wave of rinderpest seems to have travelled from district to district year after year during the last three waves. The wave was traced in these sketch maps from district to district according to their contiguous position and to the year in which the wave commenced in each district.

(f) *Seasonal variation in the incidence of rinderpest.*—From the statement No. 6 and graph No. 8 showing the monthly rainfall and mortality from rinderpest in the several districts for six years ending with 1931-32, it will be observed that the disease does not restrict itself to any season, i.e., it cannot be said that the disease prevails only in particular seasons of the year and stops completely during the other seasons. Although it appears to follow the course of its own wave, irrespective of season yet in the majority of the districts the mortality is greater during the rainy season than during the other seasons of the year. It has not been possible to ascertain whether this is due to lowered resistance to disease on the part of the animals owing to bad weather and insanitary conditions and increased agricultural work during rainy season, or to increased resistance of the virus during rains and consequent facilities for the spread of infection, or to any other cause.

(g) *The incidence of the disease on account of locality, climatic conditions, etc., apart from the breed of cattle.*—In statement No. 9, 18 districts are arranged into groups on the basis of geographical and climatic conditions, as adopted in the Statistical Atlas and the differences in the average death-rates for a period of the past 19 years in the several districts and groups of districts are studied. The districts of Ganjam, Vizagapatam, East Godavari, West Godavari, Kistna and Trichinopoly are omitted in the statements, as they underwent territorial changes during the period. As the northern portion of Chittoor district has to be included under the 'Deccan districts,' and the southern portion under the 'Central districts,' according to the Statistical Atlas and as mortality figures are not available for the two portions separately, this district also is omitted from the statement. The several groups of the districts are arranged below according to the death-rates:—

Groups of districts	Death-rates.
1 The Nilgiris	49.1
2 The Deccan	31.7
3 The Carnatic	24.5
4 The West Coast	15.8
5 The Northern Circars	15.1
6 The Central districts	11.2
7 The Southern districts	9.9
The mean for 18 districts	17.7

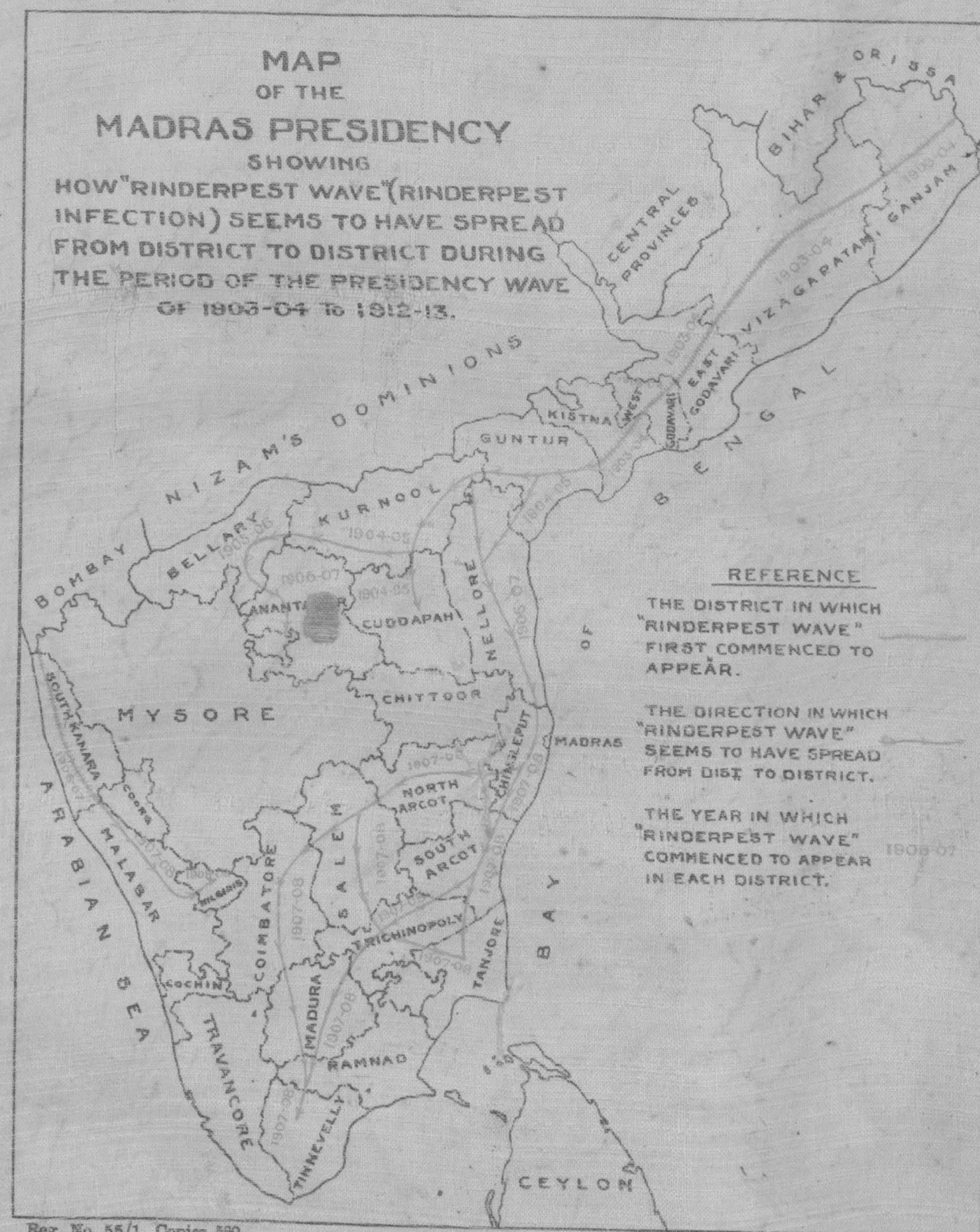
From the above figures, it will be seen that there is much variation in the death-rates between the several groups. Not only is this the case but there is an appreciable variation in some cases between one district and another within a group.

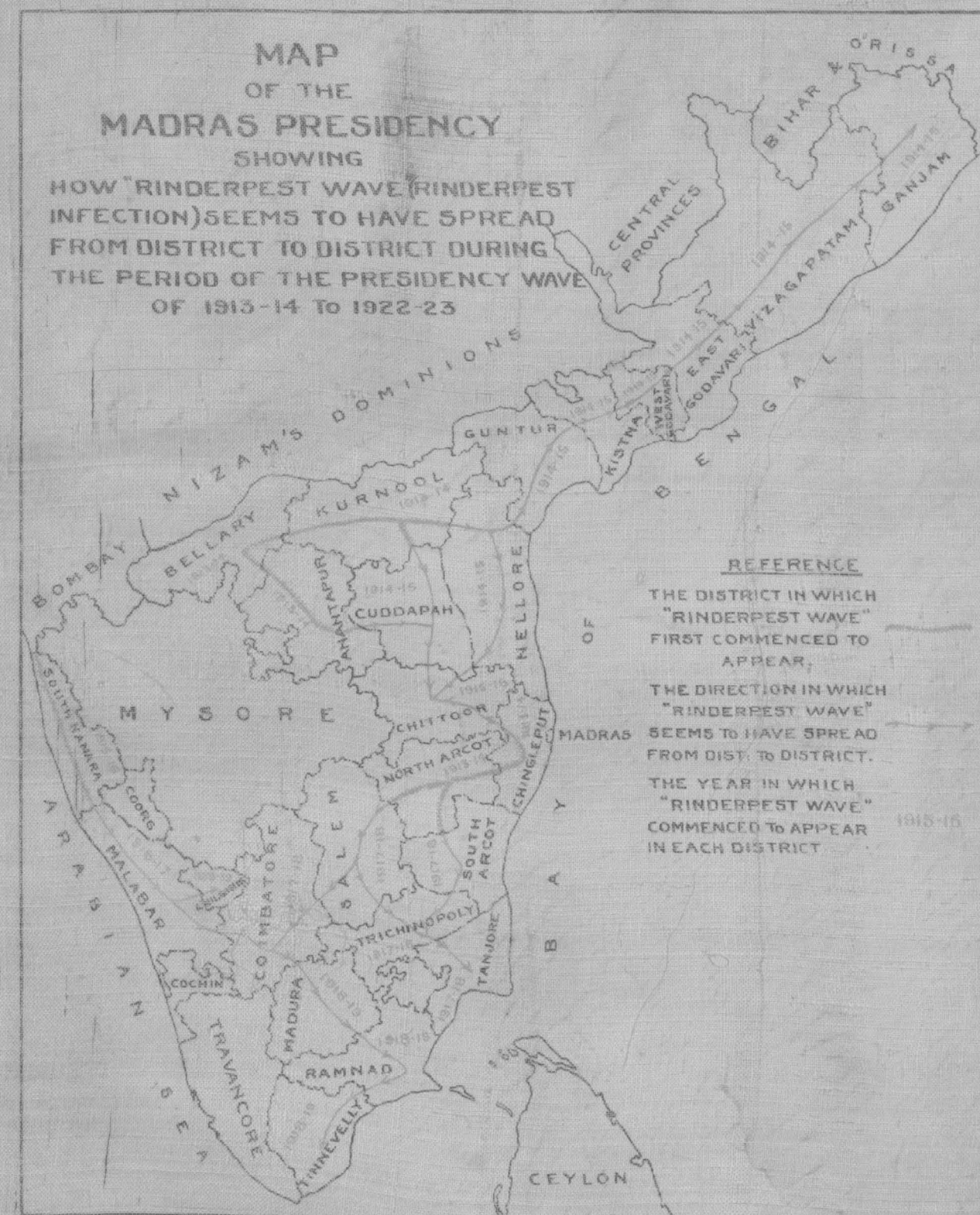
In order to study the causes for the variations in the death-rates in the various districts, many factors should be considered such as the condition and growth of cattle, sufficiency of fodder, climate, rainfall, temperature, altitude, humidity, and facilities for the spread of infection such as cattle fairs, grazing areas, cattle routes, and the part, if any, that may be played in exalting or attenuating the virus by alternations of passages in an outbreak among oxen, buffaloes, sheep and goats of the locality, as such a change in the virus is said to be possible by such alternations, and any other factor which may predispose an animal's body and lower its resistance to disease.

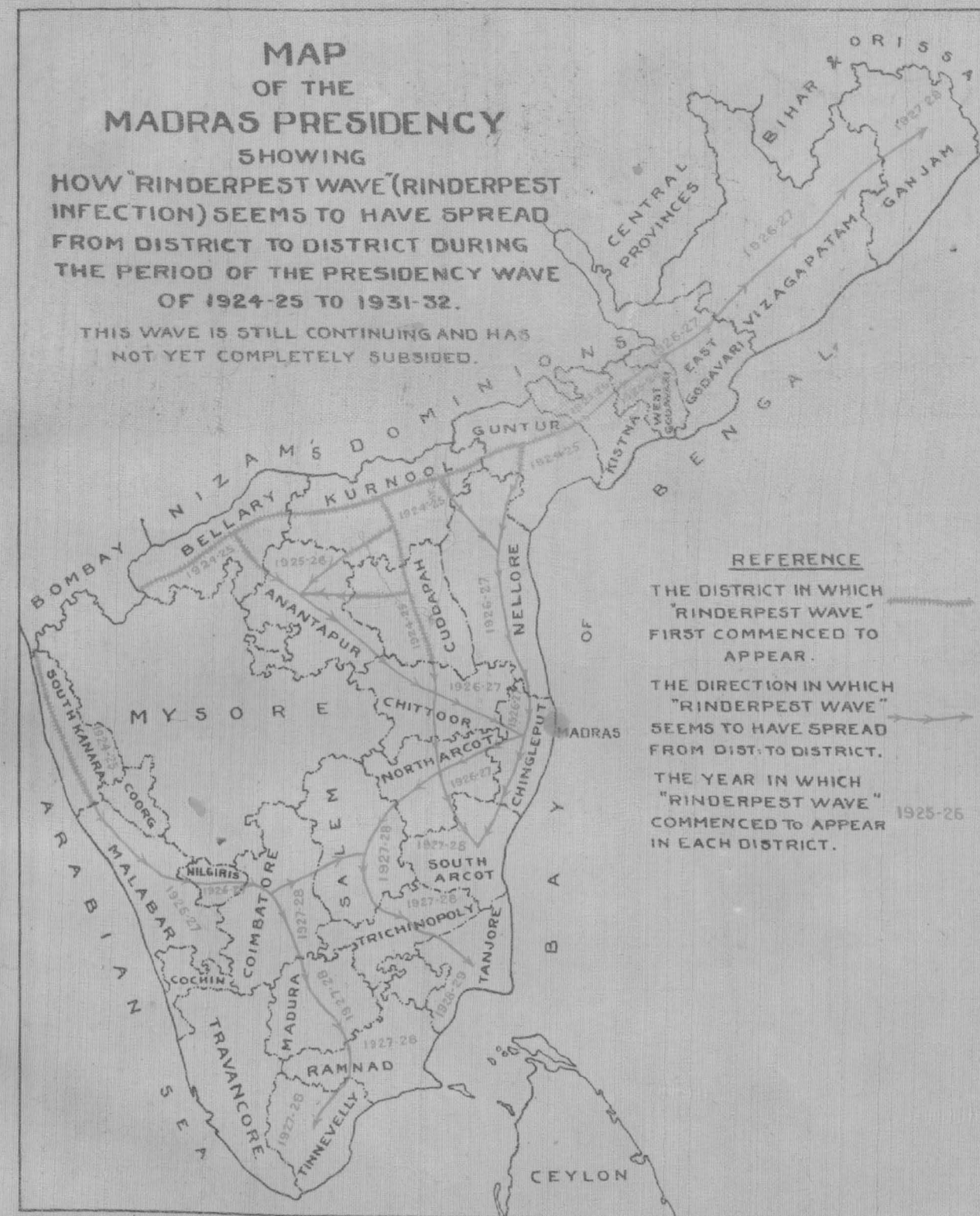
Some of the above factors are considered below:—There seems to be no correlation between (1) the death-rates and the total amount of rainfall in a year in each district (vide graph No. 9 and statement No. 10), (2) death-rates and the density of cattle census (statement No. 11 and graph No. 10), (3) death-rates and the number of cattle fairs held (statement No. 12 and graph No. 11), and (4) death-rates and the ratio of buffaloes, sheep and goats to every hundred of oxen in each district (statement No. 13 and graph No. 12). The study of this question is incomplete and requires further investigation.

- (h)
- The infectivity of convalescents*
 - Possible carriers either domesticated, or wild.*
 - Possible reservoirs either living or inanimate.*

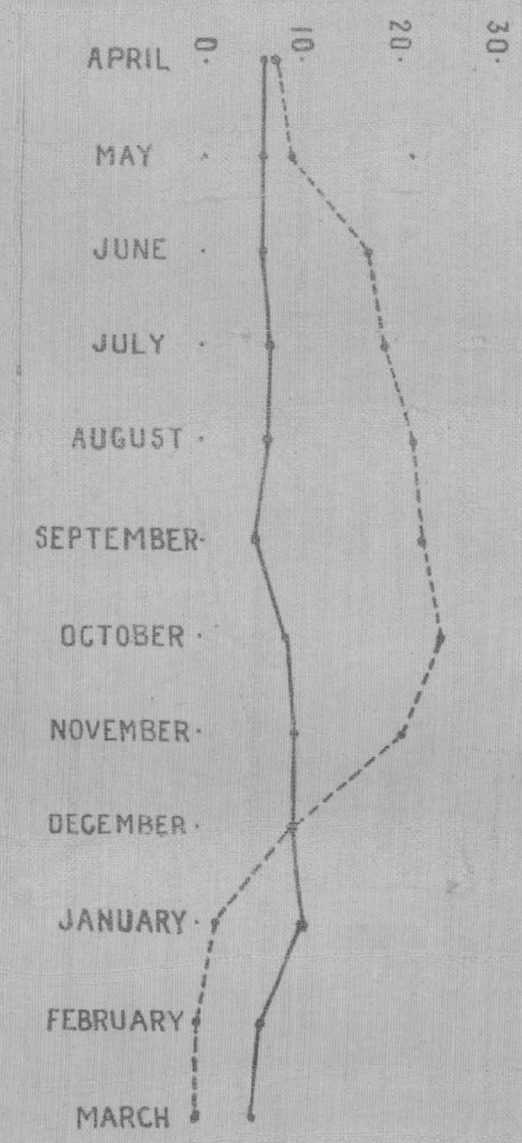
The above points require prolonged investigation and could not therefore be taken up for want of time.







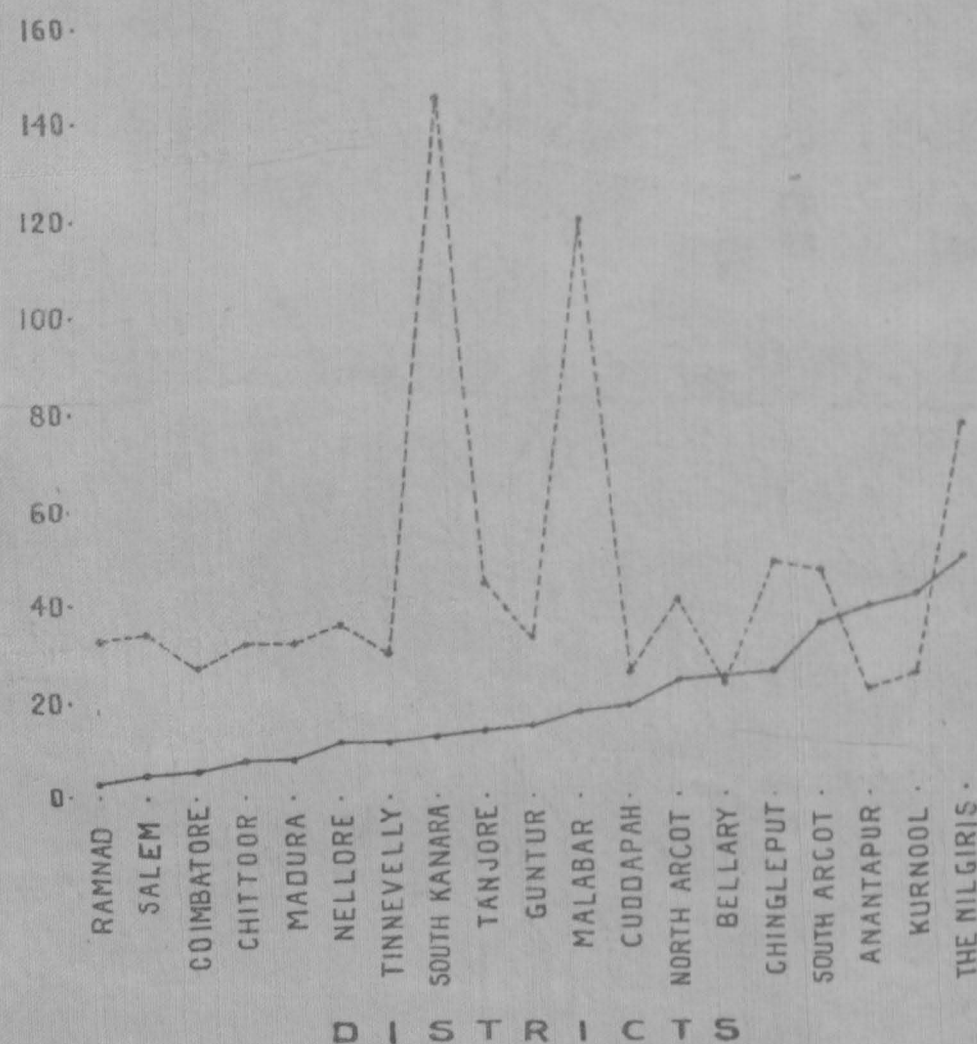
GRAPH No. 8.
The relationship between rainfall and mortality.



Number of districts showing increased incidence of rinderpest in a particular month (average mortality during six years ending with 1931-32).
Number of districts showing increased rainfall in a particular month (average rainfall during six years ending with 1931-32).

GRAPH No. 9.

Comparative chart showing rainfall and death rate from rinderpest in the several districts.

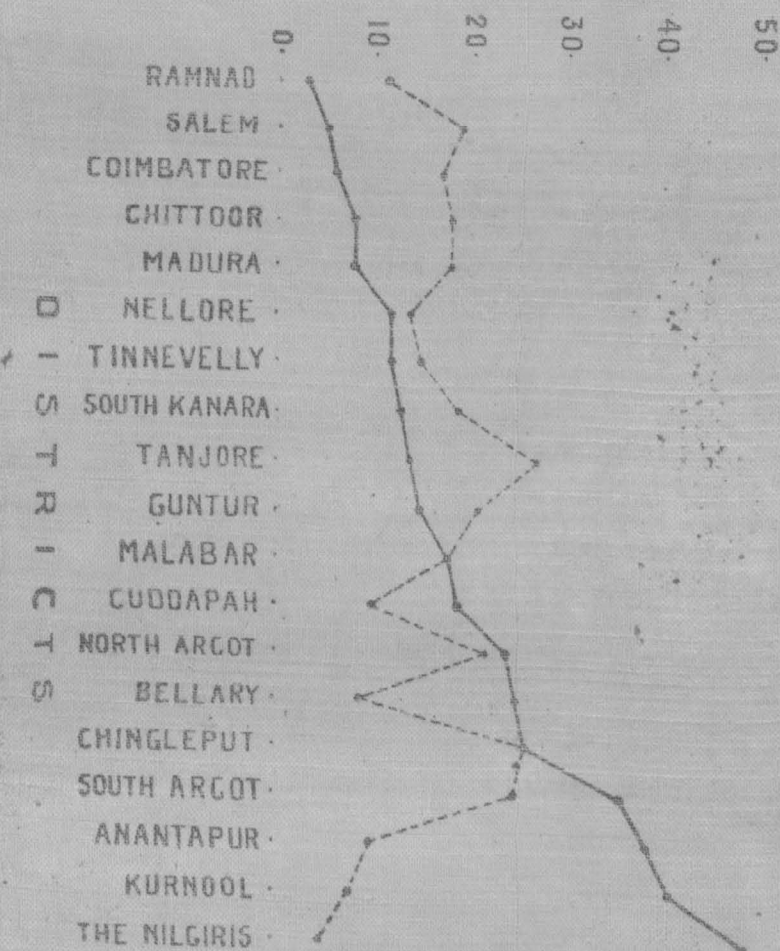


Average rainfall in inches for 40 years ending with 1930.

The average yearly death rate per 10,000 for 19 years ending with 1931-32.

GRAPH No. 10.

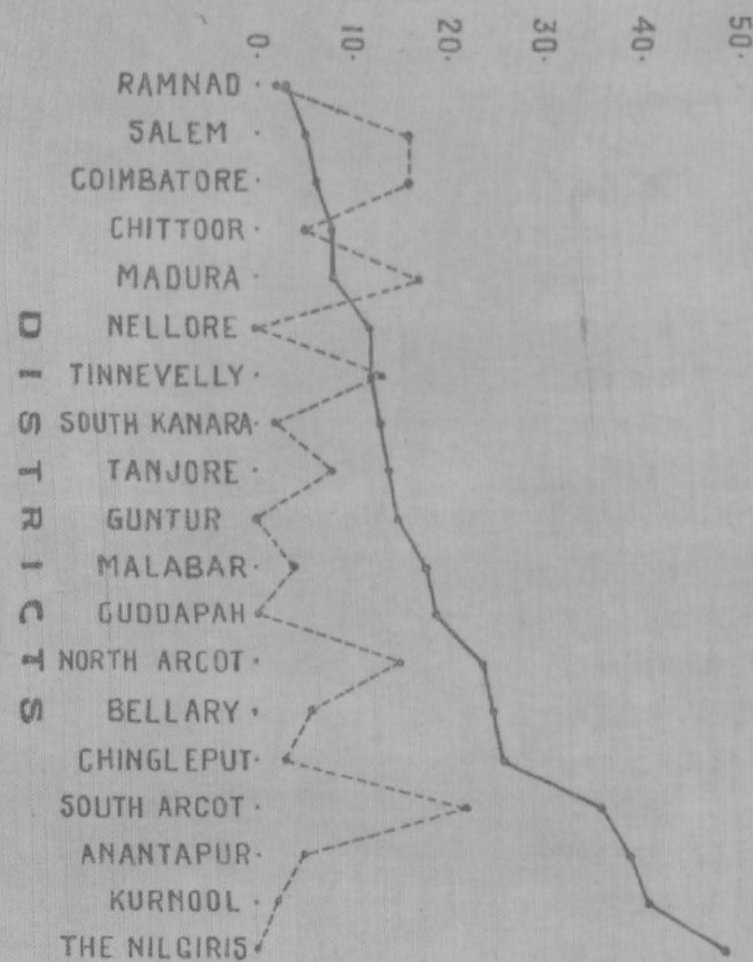
Comparative chart showing death rate from rinderpest and density of cattle in the several districts.



The average yearly death rate per 10,000 (for 19 years ending with 1931-32).

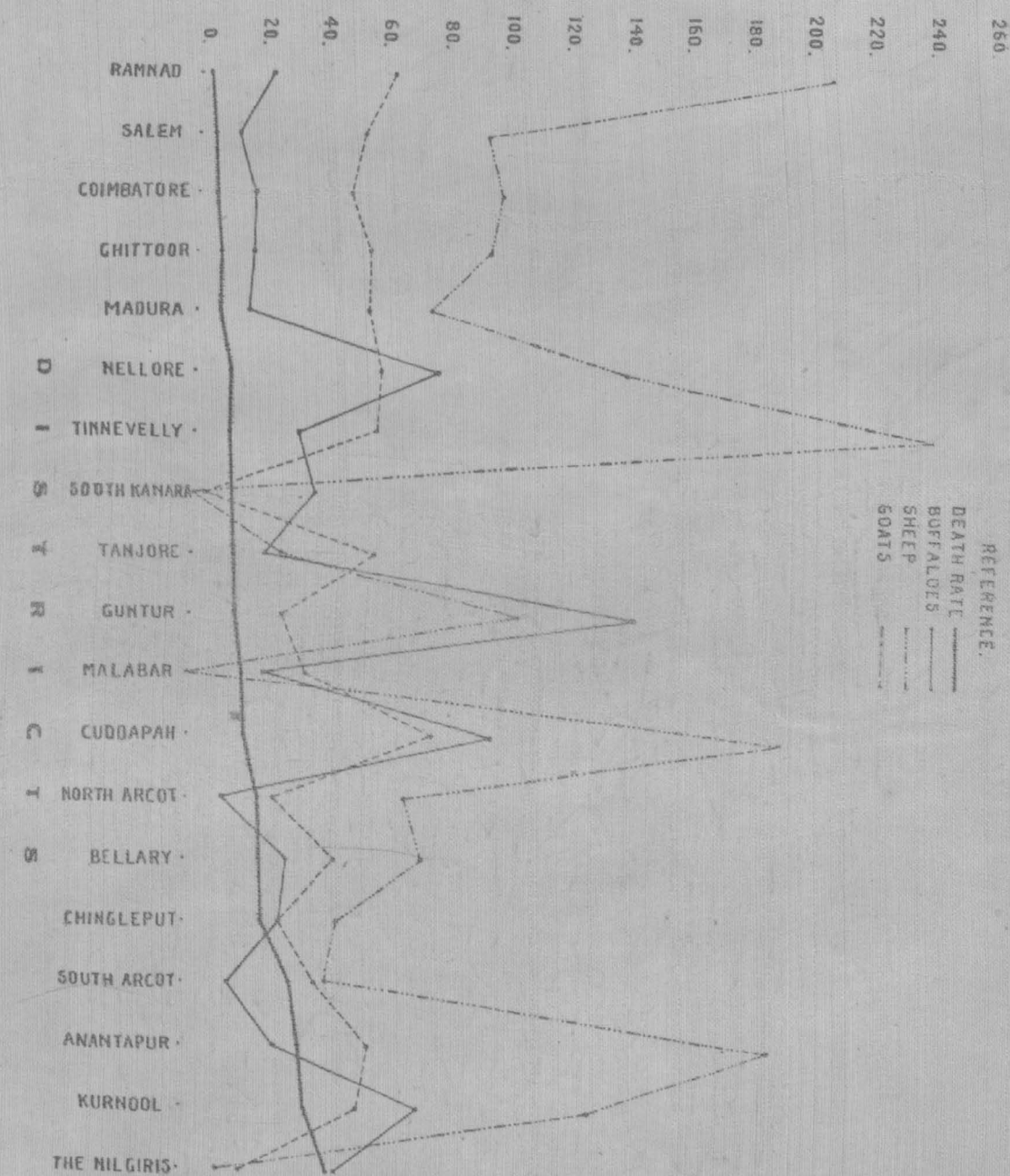
Cattle census per square mile in each district (according to cattle census of 1930).

GRAPH No. 11.
Comparative chart showing cattle fairs and death rate from rinderpest in the several districts.



Number of cattle fairs (weekly and annual) held in each district
The average yearly death rate per 10,000 for 19 years ending with 1931-32.

GRAPH No. 12.
Comparative chart showing death rate from rinderpest and the ratio of buffaloes, sheep and goats to one hundred of oxen in the several districts.
According to cattle census of 1930. The average yearly death rate per 10,000 for 19 years ending with 1931-32.



4. SERUM SIMULTANEOUS INOCULATIONS IN THE MADRAS PRESIDENCY AND THE DURATION OF IMMUNITY.

(a) One of the main points of reference was—how far has the serum simultaneous inoculation against rinderpest which has been in vogue on a progressive scale since 1920, succeeded in controlling the disease in each of the areas specified.—Before this question is considered, it is necessary to review briefly the inoculation work done till now in this Presidency.

Serum alone method.—A Veterinary section was first opened in 1881 as a branch in the Agricultural Department when the first permanent Inspector of cattle diseases was appointed; subsequently, the Civil Veterinary Department seems to have been formed about the year 1890 or so. The inoculation by the serum alone method against rinderpest seems to have been undertaken for the first time in this Presidency in the year 1900-01 in which year 60 inoculations were recorded. From this year onwards inoculations by the serum alone method were done every year in large numbers up to the year 1929-30 when this method was practically replaced by the serum simultaneous method. (Vide statement No. 14 and graph No. 13.)

Serum simultaneous method.—The efficacy of the 'serum simultaneous' method has been accepted by almost all workers and its advantages over the 'serum alone' method may be briefly stated here. The latter method confers only a passive immunity which is said to last for about nine days, and as an outbreak in a village generally lasts for about two or three months, the inoculated animals have to be reinoculated once in every nine days, i.e., about 6 to 10 times before an outbreak subsides. In addition to the waste of time and labour of the staff and the inconvenience to the ryots involved in this method, experience has shown that it is very difficult, if not impossible, to get animals for reinoculation every nine days, with the result that some of the animals which are not reinoculated, contract the disease and die, thereby bringing the inoculation into disrepute. On the other hand the serum simultaneous method confers a lasting immunity by a single inoculation. It has not got the drawbacks of the serum alone method pointed above and is cheaper than the serum alone method when the number of reinoculations done in the latter method are taken into consideration.

Further, a village in which an outbreak has been controlled by the serum alone method cannot be safe from the visitation of another outbreak or even a number of outbreaks at short intervals of time as the inoculated animals are still susceptible to the disease, unless they contract the disease during the period of passive immunity and subsequently recover. An extract from the Report of the Royal Commission on Agriculture in India on this subject is quoted below:—

"The 'serum alone' method is, however, subject to the very serious limitation that it confers complete immunity for less than a fortnight whilst infection may persist in a village for a much longer period. Animals are liable to contract the disease unless reinoculated and when they do so, the process is discredited in the eyes of their owners. Reinoculation on the other hand is not only expensive but when an outbreak is widespread, is often impossible."

"The principle on which protected animals are exposed to infection is sound but it would appear that in practice, the chances that the disease will be contracted at the right moment are not good. To ensure infection therefore, another process known as the 'serum simultaneous' method or active method of conferring immunity has been devised." * * * "It is now about thirty years since the serum simultaneous method was first used. Its efficacy has been proved in countries as far apart as Russia, South Africa and Philippines where, in all cases satisfactory results have been secured."

An extract on the efficacy of the serum simultaneous method of inoculation from the Annual Report of the Imperial Institute of Veterinary Research for the year 1930-31 is given below:—

"*Infection by contact.*—In continuation of the small preliminary experiments referred to in last year's report, striking confirmation of the indications given there was obtained from an experiment conducted during the past year. Three lots of susceptible hill bulls were placed in three different sheds, each lot being allowed to run free in a box, and being subjected to contact with other animals infected with rinderpest at different stages of the disease.

Before the experiment was undertaken it had been realised that contact was made much more closely and continuously than would occur usually under natural conditions in a village, and the results obtained indicate clearly that rinderpest spreads by contact only very slowly among healthy susceptible cattle.

This is a strong argument in favour of the wholesale introduction of the 'serum simultaneous' method of immunisation of cattle in India, since it can easily be understood from the results of this experiment that control of rinderpest by 'serum alone' must at best be a very prolonged and therefore tedious and expensive procedure."

The above extracts show the efficacy of 'serum simultaneous method' over 'serum alone' method of inoculation.

Serum simultaneous inoculations were first commenced in this Presidency in the year 1919-20. During the subsequent nine years only 8,336 animals were done. Only from the year 1928-29 were large numbers done, the largest number, viz., 168,780 being done during the year 1929-30. Till the end of the year 1931-32, five hundred and ten thousand, three hundred and thirty-nine cattle had been inoculated by this method giving a percentage of 2.3 to the cattle census of the Presidency (vide statement No. 15).

A large percentage of inoculations is shown in Madras City and the Nilgiris, being 16.6 and 9.6 respectively. Next in order comes Chingleput district with a percentage of 5.8. The following districts show a percentage of 3 and less than 4:—Kistna, Bellary and Tanjore. The following districts show a percentage of 2 and less than 3:—East Godavari, West Godavari, Guntur, Kurnool, Anantapur, Nellore, South Arcot, Chittoor, Trichinopoly, Madurai, Malabar and South Kanara. The following districts have a percentage of one and less than two:—Cuddapah, Salem and Coimbatore. The following districts show a percentage of less than one: Ganjam, Vizagapatam, Ramnad and Tinnevely. The smallest percentage, viz., 0.50 is shown against Vizagapatam.

From a study of graph No. 13, it will be observed that the serum simultaneous method was practically commenced from the year 1928-29, when the last wave of rinderpest in the Presidency had reached its crest. It is in the nature of the wave, as has already been remarked, that it generally rises for five years and subsides during the next five years, and accordingly it has commenced to subside from 1929-30. But how far the serum simultaneous method of inoculation has hastened its subsidence is difficult to determine at this stage. In order to reach conclusions on this point it is necessary to consider what the serum simultaneous inoculations have done in actual outbreaks in villages.

The question is considered below from two stand points:—

- (1) The safety (immunity) afforded to the inoculated animals, and,
- (2) checking the spread of infection. Taking up the first point, the safety of the inoculated animals, enquiries show that the serum simultaneous inoculation, as practised in this Presidency, has certainly justified the claims made for it and does confer a lasting immunity.

In order to elucidate this point, 162 villages were visited in 20 districts where serum simultaneous inoculations had been done and where subsequently outbreaks of rinderpest occurred and careful enquiries were made regarding the number of deaths among the inoculated animals both during the same outbreak or during a subsequent outbreak. Out of the 22,808 inoculated animals there were 211 deaths from all causes, giving a percentage of 0.93. Out of the 211 deaths, 186 occurred within six months from the date of inoculation. These deaths are, in my opinion, chiefly attributable to the animals having been inoculated during the incubation period, the incidence of complications such as piroplasmiasis, coccidiosis, etc., and the possibility of the virus being inert at the time of inoculation under field conditions and in transit over long distances.

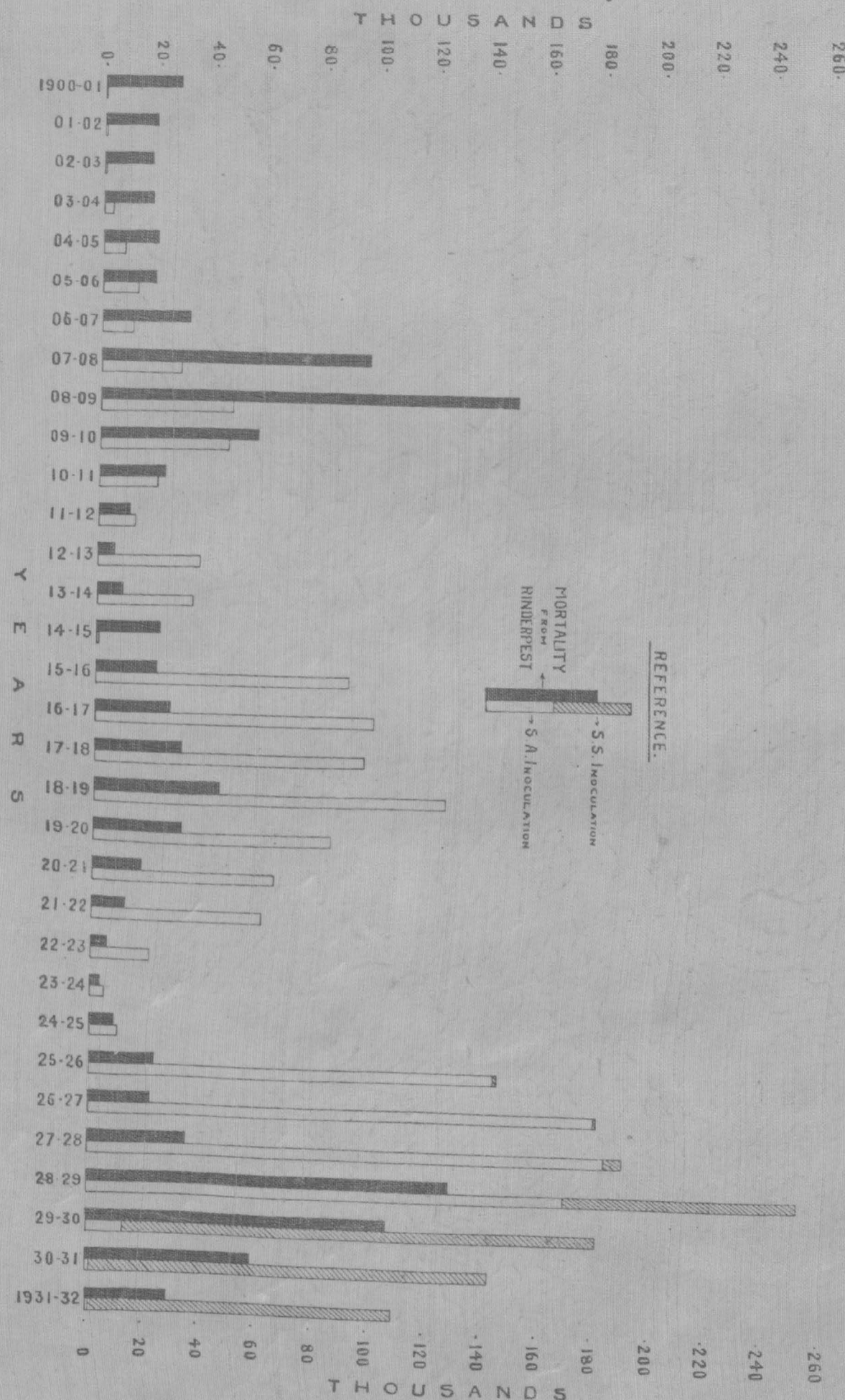
The percentage of deaths among the inoculated from all causes in this Presidency is less than that reported from other countries, as can be seen from the following extract from the report of the Royal Commission on Agriculture in India:—

"In 1917-18, when 100,000 cattle were inoculated in Nyasaland with the object of providing a protecting belt for South Africa, there were many deaths, the number of which was reported at 'not more than 5 per cent.' In other countries too, such losses as 1.3 per cent, for 10,000 cattle inoculated in South Africa, 1.5 per cent, for two million cattle inoculated in Russia and two per cent for 7,000 inoculated in the Sudan have been recorded."

Ninety-two animals inoculated by the serum simultaneous method, some of them as long back as 9 or 10 years were tested for immunity with virus alone and of these, eight showed a severe reaction and three, a mild reaction but all recovered, thus proving the duration of immunity.

GRAPH No. 13.

Inoculations done by serum alone and serum-simultaneous method and the mortality from rinderpest in the Madras Presidency.



The second point is how far the serum simultaneous inoculations have succeeded in preventing the spread of infection. A reference to the statements Nos. 16 and 17 shows that the average number of cattle inoculated per outbreak or per village affected by the serum simultaneous method amounts to only 3.5, 16, 31, 42, and 82, during the years 1927-28, 1928-29, 1929-30, 1930-31 and 1931-32 respectively against an average census of 550 cattle per village. It has therefore to be supposed in spite of the increased number of inoculations per outbreak that the infection was allowed to spread among a large number of uninoculated cattle and those of the neighbouring villages. The infection can be prevented from spreading, only by inoculating all the cattle of an affected village and those of the adjoining villages or in other words by effectively and promptly "ringing" the outbreak by a zone of protected cattle. This could not be done during the period of the last Presidency wave partly for want of adequate staff, and want of supply of serum and virus in time.

Judging from the small percentage of deaths from all causes among the inoculated viz., 0.93, which is almost negligible and from the good reports made by the ryots concerning its efficacy and from the popularity of the serum simultaneous method of inoculation in almost all the villages I visited, it can be said, without hesitation that the serum simultaneous inoculations done so far are a success.

(b) The following questions are considered together as the points raised in them refer to the same subject, viz., the duration of immunity in the inoculated animals and the cases of break down of immunity, if any.

What is the cause for the marked variation, if any, in the duration of immunity in the inoculated animals in the various parts of the Presidency?

What is the percentage of cases in which immunity following serum simultaneous inoculations has broken down, resulting in reinfection and death, during periods up to five years?

Is the failure to confer lasting immunity referable to blocking out, by massive doses of serum, the reactions in the animals during the serum simultaneous inoculations?

Is the age of animal at the time of serum simultaneous inoculation a factor in the duration of the immunity?

Cases of breakdown in immunity, partial or complete, in animals known to have been protected previously either by natural or artificial means.—In order to elucidate the points arising out of these questions, I have conducted certain immunity tests and collected data in regard to the behaviour of the inoculated animals in villages during subsequent outbreaks as well as during the original outbreaks.

Immunity tests.—In order to find out the duration of immunity against rinderpest in the animals protected by the serum simultaneous method, 92 inoculated animals have been tested with virus alone [vide statements 18 (a) and 18 (b)]. They were all found to possess solid immunity excepting eight which had a severe reaction and three which showed a mild reaction, and all recovered. Controls were used for 81 animals, out of the 92 tests conducted.

The following is the classification of the animals tested, according to their breed:—

Breed	Number of animals tested.	Number of cases in which there is a breakdown of immunity.
Ongole	43	9 (8 severe and 1 mild reaction).
Mysore	4	
Kangayam	15	
Sindhi	2	
Montgomery	1	
Belhi Buffaloes	3	
Mixed country	13	1 (mild reaction).
Cross (foreign)	11	1 (mild reaction).
Total	92	11 (8 severe and 3 mild reaction).

For further information they are again arranged below according to the period of time between the date of inoculation and the date of testing with virus alone.

Period between the date of inoculation and the date of testing	Number of cases tested.	Number of cases in which there is a breakdown of immunity.
3 months	1	1 (mild reaction and recovered).
1 year	..	..
1½ years	8	3 severe reaction but recovered.
2 years	18	..
2½ years	2	..
3 years	7	..
3½ years	8	..
4 years	17	2 (both mild reaction and recovered).
4½ years	3	1 (severe reaction and recovered).
5 years	2	..
5½ years	..	..
6 years	..	..
6½ years	9	2 (both showed severe reaction but recovered).
7 years	4	..
7½ years	6	2 (both showed severe reaction but recovered).
8 years	..	..
8½ years	..	..
9 years	6	..
9½ years	1	..
10 years	1	..
Total ..	92	11 (8 severe and 3 mild reactions).

They are again arranged below according to the age of the animal at the time of inoculation :—

Age at the time of inoculation.	Breed.	Number of animals tested.	Number of cases in which there is a breakdown of immunity.
Under 6 months	Ongole ..	5	4 (all severe reactions).
	Cross breed ..	1	1 mild reaction.
6 months to 1 year	Ongole ..	8	4 severe reaction.
	Delhi buffaloes ..	1	..
2 years	Ongole ..	3	..
	Kangayam ..	1	..
	Mixed country ..	3	..
3 years	Ongole ..	7	..
	Kangayam ..	5	..
	Mixed country ..	1	..
4 years	Ongole ..	5	..
	Kangayam ..	2	..
	Sindhi ..	1	..
	Cross breed ..	4	..
	Montgomery ..	1	..
5 years	Ongole ..	7	1 mild reaction.
	Kangayam ..	1	..
	Cross breed ..	1	..
6 years	Kangayam ..	1	..
	Cross breed ..	2	..
7 years	Ongole ..	2	..
	Kangayam ..	2	..
	Mixed country ..	2	..
	Cross breed ..	2	..
	Delhi Buffaloes ..	2	..
8 years	Ongole ..	3	..
	Mixed country ..	3	..
	Mysore ..	2	..
	Cross breed ..	1	..

Age at the time of inoculation.	Breed.	Number of animals tested.	Number of cases in which there is a breakdown of immunity.
9 years	Ongole ..	1	..
	Kangayam ..	2	..
10 years	Mixed country ..	2	..
	Mixed country ..	1	1 mild reaction.
11 years	Mysore ..	2	..
12 years	Ongole ..	1	..
	Ongole ..	1	..
13 years	Mixed country ..	1	..
15 years	Kangayam ..	1	..
	Sindhi ..	1	..
Total ..		92	11

The breakdown of immunity in the 9 cases out of 11 may be put down to the animals being young at the time of inoculation; this is in accordance with the experience of workers in other parts of the world.

Except in the case of animals inoculated in their youth, all the abovementioned animals which include all breeds, seem to possess a lasting immunity, even as long as ten years.

At Hosur Cattle Farm, 333 reinoculations were done during June and July 1932 (vide statement No. 19). Of the 167 animals reinoculated, when under two years of age, 44 reacted, or in other words, showed breakdown of immunity, while among the 166 animals which had been inoculated when over two years of age, only one showed a mild reaction.

There were 41 cases of breakdown of immunity resulting in death in 24 cases among the inoculated cattle at Hosur Cattle Farm during June and July 1928 and the matter was investigated by the Circle Officer (now the District Veterinary Officer). The 41 cases are arranged below according to the breed :—

	Ongole.	Cross breed.	Sindhi.	Kangayam.	Total.
Recoveries ..	5	7	2	3	17
Deaths ..	3	16	..	5	24
Total ..	8	23	2	8	41

They are rearranged below according to the age at the time of inoculation :—

Age at the time of inoculation.	Number of animals.
Two years and less ..	38
More than two years (one—four and a half years; one—six years; and one—seven years of age) ..	3
Total ..	41

They are again arranged below according to the interval between the date of first inoculation and the date on which the animals were found affected with rinderpest during June and July 1928 :—

About four months ..	8 animals of which 7 died. (Of the 7 that died, 4 were of six months of age and 3 between six months and one year of age at the time of inoculation.)
About one year and four months ..	21 animals of which 11 died.
About two years and four months ..	6 animals of which 2 died.
About three years and four months ..	5 animals of which 4 died.
About seven years ..	1 animal which recovered.
Total ..	41 animals of which 24 died.

Thus it will be seen that 38 out of the 41 animals were aged two years and less at the time of inoculation.

Therefore the breakdown of immunity in these cases is attributable to the age factor.

In the Annual Report of the Imperial Institute of Veterinary Research, Muktesar, for the year 1931-32 the following observation on this subject was made :—

"Immunity following serum simultaneous inoculation.—It appears that using either hill-bull or goat strains of virus, a certain number of calves are not susceptible to immunization, the proportion of refractory animals being greater when the latter virus is used."

Cases of breakdown of immunity in protected animals, when exposed to subsequent natural infection.—I have classified these cases under two heads, viz., (1) those occurring within six months after inoculation, and (2) those occurring after six months from the date of inoculation. I shall first deal with the cases coming under the latter category.

With a view to finding out the cases of breakdown of immunity, if any, among the animals inoculated against rinderpest by the serum simultaneous method, 105 villages were visited in 19 districts where serum simultaneous inoculations had been done and where subsequently outbreaks of rinderpest occurred not earlier than six months after inoculation. The results of this investigation are embodied in statement No. 20. There was breakdown of immunity resulting in death in 25 animals among a total number of 13,558 inoculated animals inspected, giving a percentage of 0.2 to the number inoculated as detailed below:—

(1) Reported to have died of rinderpest but the cause could not be definitely ascertained	11
(2) Young age, i.e. under two years of age	4
(3) Inert (probable) virus used for inoculation	2
(4) Waning of immunity for which no reasons could be attributed	8
Total	25

Excluding the last three items there were eight cases of breakdown of immunity among the 13,558 inoculated animals, i.e., 0.06 per cent which is negligible.

Of the 13,558 inoculated animals, 1,728 were calves of two years of age or less at the time of inoculation. Among these there were only four cases of breakdown of immunity, i.e., 0.2 per cent. Age, as a factor does not therefore seem to exert the same influence under natural conditions among village cattle, but it must be stated that in the case of village cattle not much reliance can be placed on the reported age of the animals at the time of inoculation unlike in the case of animals tested for immunity (referred to above) which mostly belonged to Government breeding farms. The inoculated animals include all kinds of breeds. The question whether the failure to confer lasting immunity was referable to blocked-out reaction or not could not be studied as the temperature records in most of these cases were not available.

Deaths among the protected animals occurring within six months after inoculation.—In the course of my tours I have visited some villages where serum simultaneous inoculations were done and where some deaths were reported to have occurred among the inoculated within six months from the date of inoculation. The results of this investigation are embodied in statement No. 21. Fifty-seven villages in 12 districts were visited and 9,250 inoculated animals inspected. Among the 9,250 inoculated animals, there were 272 deaths, giving a percentage of 2.9 to the number of inoculated animals. The deaths are classified below according to the period in which they occurred:—

86 deaths within 14 days after inoculation.
128 deaths from the 15th to the 30th day after inoculation.
19 deaths during the second month after inoculation.
14 deaths during the third month after inoculation.
25 deaths during the fourth, fifth and sixth months after inoculation.

272 Total.

I do not consider these deaths to be due to breakdown of immunity, except in the case of calves. The causes are various and in my opinion chiefly attributable to—

- (1) Inoculation of animals while in incubation period. Most of the deaths occurring within the first fortnight and some of those occurring during the second fortnight are due to this.
- (2) The incidence of complications in the inoculated animals, such as, piroplasmiasis, coccidiosis, etc.
- (3) The possibility of the virus being inert at the time of inoculation. The virus is liable to lose its viability in some cases under field conditions and in transit covering long distances.
- (4) The so-called anaphylaxis or serum sickness.

In the Annual Report of the Imperial Institute of Veterinary Research, Muktesar, for the year 1931-32 the following observation on this subject was made:—

"Natural outbreaks in protected cattle.—Several reports were received upon the occurrence of rinderpest in cattle which had been previously protected by the serum simultaneous method with either goat or bull virus. Investigation of

the reports revealed the presence of several factors which may have influenced the result and the necessity for accurate knowledge on the part of the operator upon the conditions which adversely affect the keeping qualities of the virus was emphasized. In most cases, the breakdown of immunity occurred in animals immunized during calfhood, but in some cases it was observed that animals immunized at a later period were also affected."

The results of our investigation in this Presidency are in agreement with the points raised in the Muktesar report referred to above.

No cases of breakdown of immunity are met with among animals which have recovered from a natural attack of the disease.

(c) *Transmission of immunity to the progeny.*—An attempt has been made to study the possible transmission of immunity to the progeny, when the dam was inoculated during pregnancy. A comparative study is made of the reactions shown by the inoculated calves whose dams had been inoculated, while these calves were in utero, and of the reactions shown by the other calves whose dams had been inoculated prior to conception (vide statement No. 22). Out of 25 cases, the dams of which were inoculated by the serum simultaneous method when these calves were in utero, 20 reacted, while out of 153 calves, the dams of which had been protected by the serum simultaneous method prior to conception, 92 reacted. It would appear therefore that the dams inoculated by the serum simultaneous method during pregnancy do not seem to transmit immunity to the progeny.

(d) *Anaphylaxis or protein reactions.*—From the enclosed statement (No. 23) showing particulars of animals which showed anaphylaxis during serum simultaneous inoculations against rinderpest at Hosur Cattle Farm in June and July 1932, the following observations are made:—

- (a) Animals of all breeds and of all ages are equally affected by this complication during inoculation.
- (b) Many of the animals showed severe anaphylaxis even with a small dose of 5 c.c. of serum, and the after effects lasted in some cases for seven or eight days.
- (c) Of the 513 animals inoculated, 87 showed this complication, giving a percentage of 17.0.
- (d) Out of the 445 animals which had been previously inoculated against black-quarter or rinderpest, 86 showed anaphylaxis, giving a percentage of 19.3, while among the 68 animals which had not been previously inoculated with serum against black-quarter or rinderpest, only one showed anaphylaxis, giving a percentage of 1.5.
- (e) The animals which had been previously inoculated against rinderpest or black-quarter are arranged below, as far as information is available, according to the time between the date of last inoculation with serum and the date of present inoculation.

Period of time that elapsed from the date of last inoculation against black-quarter or rinderpest to the date of present inoculation.	Number of animals inoculated during the present inoculation.	Number of animals which have shown anaphylaxis.	Number of animals which have not shown anaphylaxis.
5½ months	291	65	226
9 months	6	3	3
15 months	6	2	4
20 months	4	4	..
2 years	24	5	19
3 years	19	2	17
3½ years	5	4	1
4 years	81	1	80
Total	436	86	350

(f) From the above data, it will be seen that the so-called anaphylaxis or protein reaction occasionally occurs in animals which had received black-quarter or rinderpest serum previously.

(e) *A ready reckoner for finding out the weight of animals.*—One of the important things in the conduct of serum simultaneous inoculations is the correct estimation of serum required for each animal. If more serum is given than is necessary, there will be a blocked out reaction; and, if less is given, the reactions will be too severe. It is therefore necessary to ascertain the correct weight of an animal and this is generally arrived at by multiplying

the length of the animal by the square of its girth (both the length and girth being in inches) and dividing it by 300. In practice in the field this laborious process is not generally gone through, but the weight of an animal is roughly estimated by simply looking at it. A Veterinary Assistant Surgeon after some experience may be able to say approximately the weight of an animal by this means but a novice cannot do so and his estimate may be far from correct. Even an experienced Veterinary Assistant Surgeon has to verify now and then his estimate by taking the measurement of an animal. In order to find out the weight of an animal easily in the field without wasting much time in calculation, a ready reckoner of weights was prepared and submitted along with the interim report with proposals for printing and distributing it.

5. THE RELATIVE SUSCEPTIBILITY TO RINDERPEST OF THE DIFFERENT BREEDS OF CATTLE IN THIS PRESIDENCY AND THE CORRECT MINIMUM DOSE OF SERUM REQUIRED IN SERUM SIMULTANEOUS INOCULATIONS FOR EACH BREED.

(a) The following questions are considered together as the points raised in them refer to the same subject, viz., the relative susceptibility of the different breeds and the minimum dose of serum required for each :—

Is there any marked variation in their susceptibility to the disease as between the different breeds of cattle in this Presidency and, if so, what modification is necessary in the dosage of serum, etc ?

The incidence of rinderpest in, and the relative susceptibility of, each pure breed.

The determination of the correct minimum dose of serum for each local area which would give the maximum degree and period of immunity, assuming the serum to be of standard and constant quality.

The above questions are too comprehensive to be answered fully within the period of two years. They can be solved only after prolonged experiments and observations in the different parts of the Presidency which may extend over a number of years. The attempts made by me towards solving this question are given below :—

In considering the susceptibility or resistance of the different breeds of cattle to a disease, the following factors are of importance :—

- (1) Acquired resistance to the disease. The degree of resistance or susceptibility of cattle to the disease in a particular locality may vary according to the number of cattle with acquired immunity to the disease.
- (2) Environmental factors in each locality.
- (3) Nutrition.—It would appear that the quality and the quantity of feeding and the power of assimilating are associated with the capacity to resist the disease.
- (4) The incidence of complications in the animals affected with the disease.
- (5) Other factors such as constitutional, etc.

Breeds in this Presidency.

The prevailing breeds of this Presidency are the Ongole, the Kangayam, the Alambadi and the Mysore. The chief centres of these breeds may be said to be the Ongole taluk of Guntur district and the Nellore, the Coimbatore, the Salem and the Chittoor districts, respectively. The rest of the cattle in the Presidency may be said to consist mainly of non-descript breeds. It must, however, be noted that the contiguous parts or the contiguous districts of each of the abovementioned areas contain, besides nondescript cattle, a few cross breeds between those respective breeds and nondescript cattle. In confirmation of this statement, extracts from the Statistical Atlas regarding agricultural stock, the breeding of cattle and the breed and size of cattle in the several districts are herewith appended as enclosures Nos. 24, 25 and 26. If we consider the susceptibility of the cattle of Nellore, Coimbatore and Salem and Chittoor districts which are the recognized centres of breeding for the respective breeds of Ongole, Kangayam, Alambadi and Mysore, we may be able to ascertain the relative susceptibility of these breeds. These are the best districts in the Presidency for the rearing of cattle. The nutrition and other environmental factors required for the proper growth of cattle may be said to be equally obtainable in these districts. The rate of mortality in a breed to a large extent depends upon its susceptibility to the disease. Statement No. 9 contains the average yearly death-rate per 10,000 cattle for the past 19 years in the several districts. The period of 19 years is taken as it includes two waves—one of greater and the other of lesser intensity. Only such of the districts as have

had no territorial alterations during this period are taken into consideration in this statement. As no district was completely free from rinderpest in any year during the past 32 years excepting Ramnad and the Nilgiris for a year or two, and each district has had periodical waves of rinderpest during the period of the past 19 years, it can be safely assumed that all the districts have been equally exposed to rinderpest infection during this period on the whole. The average yearly death-rate from rinderpest in Nellore, Salem, Coimbatore and Chittoor districts is 12.4, 5.4, 5.5, and 8.1, respectively, while the average for 19 districts considered in the statement is 17.1. The death-rate appears to be almost uniform in Coimbatore, Salem and Chittoor districts while it is higher in Nellore. From this it would appear that the Kangayam, the Alambadi and the Mysore breeds are of the same susceptibility and that the Ongole breed seems to be more susceptible than the other breeds.

The breeds of cattle are referable to oxen only, and while calculating the death-rates in the several districts, buffaloes, should have been excluded from the census and mortality figures. As the mortality figures are not available for oxen separately, death-rates have been worked out on the total mortality and the total census. The above attempt at statistical study (with the available statistics) with a view to estimate the relative susceptibility of different breeds can at best furnish only a very rough idea of the situation.

The question of the susceptibility of the different breeds may also be ascertained from a study of the number of reactors and the nature of reactions among the animals inoculated by the serum simultaneous method. From a study of reactors and the nature of reactions among the animals of the pure breeds primarily inoculated by the serum simultaneous method at Hosur Cattle Farm in the year 1932, it is observed that the percentage of reactors and the nature of reactions among the cattle of the Kangayam and the Ongole breeds are the same, but in the case of Sindhi, the percentage seems to be slightly less (vide statement No. 29).

Another way of estimating the relative susceptibility of the different breeds is by carefully noting the number of attacks and deaths in the affected villages in the districts in which the different breeds are chiefly found. For this purpose, I have visited 11 villages in Nellore district, the area of the Ongole breed, where outbreaks recently occurred and noted the number of cattle attacked, died and unaffected under different ages. The disease had not prevailed in these villages for some years (vide statement No. 27). In these 11 villages, of 1,604 cattle (oxen only) exposed to infection (only those in the affected herds are taken into consideration), 844 were attacked with the disease, and 195 died, giving a percentage of 23 deaths to the number of attacks. It must, however, be noted that the data are insufficient for any definite conclusions to be drawn and further investigation has to be conducted in Ongole area, as well as in the areas of the other breeds.

So far as observations have gone, there seems to be no appreciable variation in the susceptibility of different country breeds in the Presidency.

Comparative susceptibility of buffaloes and oxen.—In 20 outbreaks visited by me in Tinnevely, Nellore and Bellary districts (3 in Tinnevely, 11 in Nellore and 6 in Bellary), the comparative susceptibility of buffaloes and oxen has been studied, by carefully noting the number of attacks, deaths and unaffected among the oxen and buffaloes in each outbreak. The disease was widespread in each village and had subsided in all these villages by the time I visited them. The villages were previously free from infection for a number of years; for five years in two villages, six years in one, eight years in one, ten years in six, eleven years in one, and about twenty years in nine villages. From the figures gathered in these villages and given below, it would appear that buffaloes seem to be more susceptible than oxen.

Class of animals.	The number exposed to infection.	Number of attacks.	Percentage of attacks to the number exposed.	Number of deaths.	Percentage of deaths to attacks.
Oxen	2,243	1,369	61.0	441	32.2
Buffaloes	1,323	1,060	80.1	641	60.5

In an outbreak at Karivena village, in Kurnool district, it was found that the percentage of deaths to the number of attacks among oxen and buffaloes was 42 and 58, respectively.

With regard to this point, statistical study cannot be made as mortality returns do not show deaths under buffaloes and oxen separately, though separate census of these two classes of animals are available.

The following extract from the Annual Report of the Government Veterinary Surgeon, Ceylon, for the year 1931 is given below:—

"Rinderpest.— . . . The losses have been extremely heavy in this province and unfortunately the buffaloes have suffered to a greater extent than the ordinary cattle."

On a reference made by me to the District Veterinary Officers, 5 officers out of 12 expressed as their opinion that buffaloes seem to be more susceptible than oxen but did not furnish any data in support of their statement. The other District Veterinary Officers were reticent on this point. Buffaloes seem to be more susceptible than oxen but the data collected under this head are too meagre for any definite conclusions to be drawn, and the question requires further investigation.

With a view to estimate the safe minimum dose of anti-rinderpest serum required in serum simultaneous inoculations for the different breeds, 256 animals (139 adults and 117 calves) of different pure breeds were inoculated with varying doses of serum. Excepting 29 animals of Ongole breed, which belonged to one private gentleman of Gudur taluk of Nellore district, all the animals belonged to Government Farms at Hosur, Chintaladevi, Guntur and Hagari. The particulars of these inoculations are given in statement No. 28.

The serum given for all the animals was the Special Anti-rinderpest serum, class II of Muktesar and the virus was supplied from the Madras Veterinary College and the Serum Institute, Madras. There were no deaths among the inoculated, except two in the case of buffaloes (one, inoculated at the rate of 6 c.c. died of other causes and the other inoculated at the rate of 8 c.c. died of severe reactions). The particulars of reactions and the rate at which the serum was given are given in the statement.

The number of inoculations done is too small to draw any definite conclusions. However, the following points may be mentioned in regard to country breeds except buffaloes:—

- (1) The rate of 6 c.c. or 7 c.c. of serum per 100 lb. body weight appears to be too risky to be used. Of the 48 animals inoculated with 6 and 7 c.c. of serum per 100 lb. of body weight 41 reacted, and among the reactors, 19 animals showed very severe reaction and required control by additional serum though no deaths occurred.
- (2) Most of the animals inoculated with 8 c.c. or 9 c.c. of serum per 100 lb. body weight reacted. Of 74 animals inoculated, 63 reacted of which 32 showed fairly severe reaction and 6, severe reaction. Almost all these animals belonged to Government Farms and were in good condition, comfortably housed as well as taken care of, during the inoculation period. When these animals showed severe reactions with a dose of serum at the rate of 8 c.c. or 9 c.c. the village cattle, which are not generally so good in condition and cannot be expected to be taken care of so well as the farm cattle, it appears to be unsafe to use a smaller dose than 10 c.c. Another point to be borne in mind is that the reaction in the inoculated animals should not be so severe as to make the inoculation itself unpopular in villages.
- (3) It is stated in the next sub-paragraph of this report that calves under 6 months of age seem to be more resistant to the disease. From this observation and from the observations shown by calves weighing less than 300 lbs. there appears to be some scope for reducing the minimum dose.
- (4) So far, there seems to be no difference in the dose of serum required for the different country breeds, as they seem to possess the same degree of susceptibility.
- (5) Nothing can be said about the dose of serum required for buffaloes, as only a few were inoculated.

(b) *The relative susceptibility of animals of different ages within each pure breed.*— From a study of statement No. 29 of the reactions shown by the animals primarily inoculated at Hosur Cattle Farm in the year 1932, it may be observed, that, among calves of all breeds (Kangayam, Ongole, Sindhi and cross breeds) of six months of age and less, the percentage of reactors seems to be far less than that in animals between the ages of 6 months and 3 years or in other words calves seem to be more resistant to infection.

Eleven outbreaks in Nellore district, the area of the Ongole breed, were visited by me and the actual number of attacks and deaths and unaffected among oxen and buffaloes separately under different ages were noted. The figures are given in statement No. 27. Similar investigation has to be continued for the different breeds in different localities.

6. LEGISLATION AND OTHER PROBLEMS CONNECTED WITH SERUM SIMULTANEOUS INOCULATIONS.

- (a) *Should inoculation against rinderpest by the serum simultaneous method be made compulsory? If so, what are the lines on which legislative measures are necessary?*

Some of the difficulties in compulsory inoculation.

The following ideas about the cost and the number of hands required for compulsory inoculation by the serum simultaneous method have been communicated to me by the Director of Veterinary Services, Madras:—

- (i) If the inoculation be made compulsory throughout the Presidency, the cost and the number of hands that may be required are as follows:—

The cattle population of the Presidency according to the latest census is 22,440,730.

Supposing the cost of serum simultaneous inoculation with serum and virus prepared at the Serum Institute, Madras, is 8 annas per head of cattle, the total cost of inoculating all the cattle of the Presidency is Rs. 1,12,20,365. The average life of cattle in this Presidency may be roughly taken at 10 years. So, the whole stock of cattle will be practically replaced by fresh generation of susceptible cattle every ten years. To complete the inoculation of all the cattle in the Presidency before the fresh stock springs up it should be completed within ten years. Assuming a ten year basis and supposing a Touring Veterinary Assistant Surgeon does on an average 1,500 inoculations per month, the number of hands required exclusively for this inoculation work is $\frac{22,440,730}{10 \times 12 \times 1,500}$, i.e., 125 hands. Taking into consideration the leave reserve also, we may require exclusively for this work about 125 plus 15, i.e., 140 hands.

Provision should also be made for the increase of the cattle population, as will be seen from statement No. 2 and for the reinoculation of young stock after they attain two years of age. The question further arises whether sheep and goats which are also susceptible to rinderpest should also be inoculated compulsorily. A yearly provision of about Rs. 11.2 lakhs under the cost of inoculations, increase of staff under Touring Establishments and the proportionate increase under pay and travelling allowance of the touring staff is at present impossible, especially, in these days of financial stringency, and the problem would still remain unsolved. Firstly, infection would continue to be introduced into the Presidency from the adjoining Native States and other British Provinces and from wild animals such as bisons, etc. Secondly, fresh susceptible stock would constantly be added to the number.

- (ii) If we omit inoculating certain classes of animals such as young stock, very old stock and worthless stock, the position will be as follows:—

Class of animals.	Cattle population according to the latest census (1930).	Approximate number to be excluded.
Breeding bulls	85,283	10 per cent of which are old and unfit for service. 8,528
Other bulls	1,315,352	10 per cent being worthless 131,535
Bullocks	6,001,071	15 per cent being very old and worthless. 900,160
Cows	5,622,356	Do. 843,353
Young stock	3,423,254	These can be inoculated after they attain the age of two years as the immunity conferred is not lasting and may therefore be excluded altogether. 3,423,254
Male Buffaloes	1,354,894	15 per cent being very old and worth less. 203,234
Cow buffaloes	2,765,694	Do. 414,854
Young stock (buffalo calves).	1,872,826	Vide remarks above against young stock. 1,872,826
Total	22,440,730	7,797,744

Thus, the number of animals to be inoculated works up to about two-thirds of the cattle population and therefore the amount of money and the number of hands required for inoculating this number will be two-thirds of what has been stated above.

This elimination of certain classes of animals from being inoculated cannot practically be carried out in villages and is beset with difficulties. Firstly, ryots will not consent to the elimination of certain classes from being inoculated. Secondly, the cattle of a poor man, though worthless, are to him, valuable and some cattle

which, to the Veterinary Assistant Surgeon may seem to be not worth while inoculating may be held to be worthy of being inoculated in the opinion of the owner. Thirdly, the most important objection to this elimination of certain classes of cattle is this. The conditions that generally prevail in villages are such that it is very difficult to enforce strict segregation and disinfection. The uninoculated animals always run the risk of getting the infection from the inoculated, unless they are protected by the serum alone method, which again means wastage of serum. The disease may thus run on for months among the uninoculated and may spread to other villages.

(iii) Another idea is the compulsory inoculation of all animals on attaining the age of three years. In this way the total cattle population could be immunized in about seven or eight years, with the exception of young stock under three years old and others not considered worthy of protection. The difficulties would be great, but the numbers to be handled during the period would be small enough to be within the bounds of possibility. Though this may be theoretically sound, it is practically impossible to get for inoculation only animals of three years of age and to segregate them during the reaction period, under village conditions.

Thus the compulsory inoculation of (1) all cattle, (2) selected cattle, leaving out certain classes of animals such as young, very old and worthless stock and (3) all cattle on attaining the age of three years seems to be impracticable.

(iv) Another idea is the compulsory inoculation of all the cattle in affected villages, i.e., serum simultaneous inoculation is to be made compulsory in notified affected villages as is done now in the case of serum alone method under the Cattle Disease Act. This seems to be feasible though there are many practical difficulties in enforcing compulsory inoculation.

The number of outbreak reports received during the period of 9 years ending with 1931-32 is as follows :—

1923-24	172	1929-30	5,484
1924-25	470	1930-31	3,339
1925-26	1,097	1931-32	1,320
1926-27	1,289	Total for nine years	20,078
1927-28	1,757	Number of reports received on an	
1928-29	5,150	average per year	2,231

As the cattle population of each village is roughly about 550 the number of animals to be inoculated against rinderpest per year will be roughly $2,231 \times 550$, i.e., 1,227,050. The cost of serum simultaneous inoculations per year will be roughly Rs. 6,13,525 or Rs. 6.1 lakhs and the number of hands required is $\frac{1,227,050}{1,500 \times 12}$, i.e., 68, taking that one can do 1,500 inoculations a month. So this idea of compulsory inoculation of all cattle in the affected villages seems to be feasible, though there are practical difficulties in enforcing compulsory inoculation. Now that a Serum Institute has been opened at Madras, the cost of serum simultaneous inoculation per head of animal may work up to about 8 annas.

Thus the only feasible thing seems to be the compulsory inoculation by the serum simultaneous method of all the cattle in the affected village and in the surrounding villages in order to "ring" the infection and prevent spread. The question therefore reduces itself to this, "Should inoculation against rinderpest by the serum simultaneous method be made compulsory in the affected villages as well as in the surrounding villages? If so, what are the lines on which legislative measures are necessary."

The necessity for compulsory inoculation.

From statement No. 16, it will be seen that the average number of serum simultaneous inoculations done in each affected village during the years 1927-28, 1928-29, 1929-30, 1930-31 and 1931-32 was 3.5, 16, 31, 42 and 82 respectively against an average cattle census of 550 per village. One of the important causes for the low number of inoculations done in each village is the apathy, indifference or refusal on the part of the ryots to get their cattle inoculated and unless all the cattle of an affected village and those of the surrounding villages are promptly inoculated, the infection cannot be effectively "ringed." To effect this, compulsory inoculation is necessary.

In this connexion, the following extract from paragraph 241 of the report of the Royal Commission on Agriculture in India may be quoted :—

"We have therefore considered the desirability of conferring general compulsory powers on officers who engage in inoculation campaigns in accordance with the policy which is being followed in Egypt. We are of opinion that this step would not be desirable in present conditions. It was not until the Egyptian fallahen had become accustomed to have their cattle immunized on a voluntary basis that compulsion was introduced and we think that cultivators should be given an opportunity of seeing what inoculation can do to protect their cattle before they are required to accept compulsory measures."

From the gradual increase in the average number of inoculations done in each outbreak year after year, mentioned above, it will be seen that this method is gaining popularity with the ryots and also from my personal enquiries made in the villages visited by me, I am in a position to say that the ryots of the villages in which serum simultaneous inoculation has been done during the past five or six years have had ample opportunities to see what inoculations can do to protect their cattle. I am therefore of opinion that the time has come to introduce compulsory inoculations in the affected villages and in the villages surrounding them.

Some of the difficulties likely to be encountered in a compulsory inoculation campaign are :—

- (1) Animals very weak and debilitated and cows in advanced stage of pregnancy cannot be safely inoculated by this method. These animals can be done by the serum alone method.
- (2) Loss in the yield of milk in the case of milch cattle. This is almost negligible and is only temporary.
- (3) The reluctance on the part of ignorant ryots to submit their cattle for inoculation. A small percentage of such ryots will always remain in a village so long as their illiteracy and superstition continue. It is for this comparatively small percentage of ryots that legislation is required.

An extract from paragraph 241 of the report of the Royal Commission on Agriculture on these difficulties may be given below :—

"There are however practical difficulties to be overcome in a serum simultaneous inoculation campaign to which brief allusion must be made. Bullocks after inoculation must be rested for about 15 days until recovery takes place. Cows temporarily decrease their yield of milk but quickly recover and we were informed in Egypt that the wide experience there obtained justifies the conclusion that the full milk flow quickly returns. Cows advanced in pregnancy, delicate calves under a month old and animals weak or debilitated from any cause are unsuitable subjects for inoculation. In India, the prejudice against handling blood in any form has also to be taken into account. There is finally the risk real, though not very considerable, that rinderpest may be introduced into a district from which it is absent; for inoculated cattle are infectious and must not be allowed to mix with others. These practical difficulties indicate that some opposition to the use of this method may be anticipated."

From the experience gained during serum simultaneous inoculation campaigns subsequent to the drafting of the report of the Royal Commission, it may be said, that some of the above-mentioned difficulties do not now exist and the remainder are not so serious as to be insuperable.

From practical experience it is found that the period of rest (15 days) after inoculation can be much reduced and the prejudice of the people against handling blood in any form is also gradually dwindling. With regard to the risk that rinderpest may be introduced into a district from which it is absent, it can be said that the present indications are that this risk is not very real and can have even less effect when rinderpest is rampant.

It may be said that the ryots should be educated in the benefits of inoculation by propaganda and gentle persuasion and thus won over. Propaganda and gentle persuasion are, of course, necessary and they are being done and will continue but there will always be a small minority in a village who cannot be won over by any such means and it is not reasonable that public interests should be allowed to suffer in order to avoid opposition from these few. In a campaign against rinderpest the most important thing is, as has been stated already the prompt and effective ringing of the first outbreak or the first few outbreaks in a taluk and this cannot be effected without the help of legislation.

Having discussed the necessity for the introduction of compulsory inoculation in affected areas, I shall now deal with the lines on which legislation should be undertaken.

The chief factors for the spread of infection may be assumed to be

- (1) Affected animals.
- (2) Cutting open or skinning of rinderpest infected carcasses.
- (3) Washing of the contaminated skins and organs in tanks, streams or rivers.
- (4) The discharges and droppings of the affected animals, infected places, cattle sheds, byres, utensils, fodder, pastures, etc.
- (5) The movement of cattle, sheep or goats from affected places to unaffected ones.
- (6) Cattle fairs, weekly and annual.

The Act should be sufficiently comprehensive and the Cattle Disease Act of 1866 includes all the above factors but the 'serum alone' method mentioned in it should be replaced by the 'serum simultaneous' method. In the new Act which is proposed to be brought into force through the agency of the Imperial Council of Agricultural Research the necessary provision will be made by the Local Government.

The opinion of the Royal Commission on Agriculture on this important question from paragraph 246 of its report may be quoted here in extenso:—

"No staff however large and however skilled can be fully effective unless Government have the power to control the spread of infection by Veterinary police measures. We recognize that such measures present much greater difficulty in India than in the countries in which they are now commonly adopted and it is partly for this reason that we lay such emphasis on the training of officers for the superior Veterinary Services. Conditions in India call for initiative, judgment, tact and high professional skill in a far greater degree than they do in countries in which rigorous police measures are possible. But it would be fair neither to the Veterinary departments nor to the tax-paying public which is called upon to contribute large sums for the suppression of the disease, if no attempts were made to give this work such aid as it is possible to give it by legislation."

More attention to the question of controlling disease appears to have been given in Madras than in any other province. A Cattle Disease Act was passed in that Presidency as early as 1866 and is still in operation. Under the powers conferred by this Act, the notification of certain diseases has been made compulsory; movements within the Presidency, can be regulated; "standstill" orders, for example, can be made, should disease break out during cattle fairs and the carcasses of animals which have died of disease can be destroyed.

But, though the powers conferred by the Act are extensive their effects are limited owing to the difficulty of applying them effectively. When for instance, a rinderpest outbreak is being dealt with, inoculations with anti-rinderpest serum is made compulsory and, where cultivators have objected, a few prosecutions have resulted in inoculation being carried out with little difficulty. In Burma, Cattle Disease Rules of 1914 which apply to all the areas in which the Burma Village Act is in force enable outbreaks of disease to be dealt with on much the same lines as in Madras, with the important exception that inoculation cannot be made compulsory.

The difficulties which have been encountered in enforcing legislation for the control of cattle disease in Madras have also been encountered in Burma. There are obvious objections to enactments the provisions of which cannot be strictly enforced and we should have hesitated to make any recommendations on this point, were we not convinced that the advantages of legislation greatly outweigh these objections.

The Act should be sufficiently comprehensive to ensure that all the powers likely to be required in dealing with any disease may be legalized and, following the usual lines of such legislation, should deal with the action required of Provincial Governments and District Boards or other local authorities and their officers, the reporting of disease, the isolation of infected animals and of animals which have been in contact with them, the disposal of carcasses of diseased animals and of other infective material, disinfection, the closure of markets and fairs, the regulation of movement and the compulsory inoculation of animals which have been in contact with the infected ones."

The present procedure of enforcing this Act in any locality entails a lot of delay. On the recommendation of a District Veterinary Officer, the Collector of the district, if he is convinced of the necessity and safety of enforcing the Act, addresses the Government in order to enforce the Act and a notification is published in the *Fort St. George Gazette* and the *District Gazette* and a copy of the same will be hung up in the village chavadi. All this procedure takes about a month or a month and a half to go through. The provisions of the Act should be such that they should automatically be brought into force, immediately a village has been declared by a District Veterinary Officer to be infected; otherwise the disease is likely to spread to other villages. This does not apply in the case of cattle fairs the dates of which are known in advance and the Act can be put into force sufficiently early.

The power to declare an area to be infected with rinderpest should be vested in the District Veterinary Officer and he should also have the power to enforce compulsory inoculation after due notification in the affected area.

In enforcing any legislative measures that may be passed it is necessary to proceed very cautiously for a few years till the ryots are sufficiently familiar with their provisions and great care should be taken to avoid antagonizing them.

- (b) *The most economical methods of utilizing the available serum, e.g., whether it would be better to inoculate the cattle in affected areas only or healthy cattle of, say, over two years in age in all areas.*

The first demand on serum should be for inoculating the cattle of the affected villages. We cannot undertake inoculations of cattle of any class or age in clean localities, leaving those of the affected villages to die of the disease. Public opinion cannot be satisfied unless we pay our first attention to the actual outbreaks. The next demand on serum should be for inoculating the cattle of the adjoining villages. If serum is available still after first meeting the above two demands it can be used for inoculating animals of over two years of age, excepting very old ones, in clean localities, provided the usual precautionary measures against the spread of infection can be observed.

- (c) *Has the time yet arrived when the wealthier cattle owners can be expected to pay for the protection afforded to their cattle?*

It is necessary here to consider the previous experience in this connexion.

Inoculations by the serum alone method.—Government in their Order No. 777, Development, dated the 8th June 1922, approved the proposal of the Veterinary Adviser that a sum of Rs. 8 per head of cattle inoculated by the serum alone method might be levied. It was however found out that the institution of a fee had the effect of limiting the number of animals inoculated.

Government in their Order Press No. 1362, Development, dated the 2nd August 1924, agreed with the Veterinary Adviser that no fee should be charged for inoculation of cattle against rinderpest by the serum alone method and by serum simultaneous method with local virus and it was given effect to from the 1st April 1925.

Inoculations by the serum simultaneous method.—Government in their Order Press No. 1147, dated the 11th August 1923 of the Development Department ordered that a fee of Rs. 2 should be charged for every animal successfully inoculated by the serum simultaneous method with Muktesar virus from the 1st October 1923. On the recommendation of the Veterinary Adviser, Government in their Order Press No. 339, Development, dated the 8th March 1926, again abolished the fee of Rs. 2. One of the reasons put forth by the Veterinary Adviser for recommending the abolition of the fee is quoted below:—"A more important matter, however, is the now well-recognized fact that simultaneous inoculations are far more efficacious in dealing with rinderpest than the serum alone method and I am entirely in agreement with the conference (conference of Veterinary Officers) in thinking that everything should be done to induce cattle owners to have their animals protected by this method."

Narrating the experience in the Mysore State of the serum simultaneous method of inoculation for rinderpest, the Commission already referred to stated as follows in paragraph 239 of its report:—

"No charge was made for inoculation and campaign was prosecuted with great vigour, until by the middle of January 1926, some 34,800 animals had been successfully protected; the mortality after inoculation was about 8 per thousand. In view of the high cost of treatment and the great benefit conferred on cultivators the Mysore Government decided to charge a fee of Re. 1 per head. The

result was remarkable. In spite of the havoc still being caused by the disease and the proved value of the treatment, inoculations dropped from nearly 35,000 in the first half of the year to little more than 5,000 in the second.

Experience in Mysore thus shows—and there is no reason to believe that adjacent parts of British India would furnish grounds for different view—that the serum simultaneous inoculation is safe, effective, and readily accepted by cultivators whose cattle are dying of rinderpest. It also shows how unwilling the cultivator is to pay for it."

Again in paragraph 243, the Commission states as follows:—

"Fees for inoculation.—Inoculation not only against rinderpest but against other contagious diseases is usually done without cost to the cultivator. Sometimes, however, a small charge is made as by some of the District Boards in Bengal. In Bombay, where rinderpest serum is provided free, a charge of annas two is made for doses of other vaccines. It is the invariable experience that, where charges, however small, are made for such preparations, their use is greatly checked and it was for this reason that the fee of Rs. 2 per head for inoculation by the serum simultaneous method which had been levied for some time in the Madras Presidency, was abolished from 1st January 1926. We recommend that all fees for inoculation not only against rinderpest but also against other contagious diseases should be abolished. The revenue derived from them is very small as compared with the expenditure, and they undoubtedly act as a grave deterrent to an extended use of preventive inoculation. We recognize that the widespread adoption of the serum simultaneous method must involve an appreciable increase in expenditure if no charge is levied when it is used. For the cattle of the plains the cost of the doses of serum and virus works out at about Re. 1 per head; but there is little doubt that, if the work were carried out systematically on a large scale, the cost could be greatly reduced, possibly to not more than half this sum."

From the conversations I had on this subject with the ryots of the several villages I visited, I can say that the consensus of their opinion is that it is too early to introduce any fee for serum simultaneous inoculations, that even the rich ryot will find it difficult to pay any fee, however small it may be, that it will retard the inoculation work and that it is difficult to differentiate a rich man from a poor man. These points have been fully dealt with in the recent G.O. Ms. No. 1055, Development, dated the 2nd August 1932, in which the Government have come to the conclusion that they are unable to accept the proposal for the levy of a fee.

It may be taken for granted that the objections to payment detailed by the commission hold good equally to-day and this is in spite of the fact that the ryot has since had much experience of what is proved to be a valuable inoculation.

It would seem that if a start is to be made again in charging fees, the appropriate method would be in cases of protection in the absence of outbreaks and at the owner's request. It is yet too soon however to advocate this course.

Further I have recommended in paragraph 6 (d) of this report that compulsory inoculation by the serum simultaneous method should be enforced in the affected villages and in the villages surrounding them. If this proposal be accepted, I think, that the question of the levy of a fee for inoculation will not arise.

(d) Is the objection to branding or tattooing of inoculated animals, in order to prevent wastage of serum by inoculating the same animals again, so strong as to make the inoculation itself unpopular if branding is made compulsory?

It is said that it is necessary that the inoculated animals should be marked for identification with a permanent mark or at least with a mark which lasts for a number of years—say about seven or eight years—in order to prevent wastage of serum by reinoculating them during subsequent outbreaks.

Usually, there are five methods of putting identification marks on cattle, viz., (1) branding on the skin, as is done now in some cases with 'O' mark on the left croup, (2) branding on the horns, (3) tattooing, (4) ear-punching, and (5) Chemical branding.

Branding on the skin, no doubt, leaves a permanent mark but the objection to it in most parts of the Presidency is so strong as to make the inoculation itself unpopular, if branding is made compulsory. The objections raised by the ryots to branding are:—

- (1) Depreciation in the value of the animal, when offered for sale. The ryots say that the brand mark will be looked upon as an indication of the animals having suffered from some sprain or dislocation at the part.
- (2) Sentimental.
- (3) The beauty of the animal is marred, in the case of good and costly ones.
- (4) Possible loss in the value of the hide.
- (5) Cruelty.

Against this, however, is the well established branding of animals in vogue in most parts of the Presidency. This is done for decorative purposes or to spoil the hide and so prevent malicious poisoning.

Branding on the horns.—If this is properly done, the impressions are said to last for at least five or six years, and may last even longer if the horns are sound and are not brittle. The marks are put on the inside and towards the root of the horns. The numbers or marks are about one inch in length and half an inch in breadth. The depth of the impression is about one-eighth of an inch and the breadth about one-fifth of an inch. At the Agricultural College, Coimbatore, marks on some animals done by this method in the year 1922 are still distinctly visible. The chief drawback in this method is that calves, the horns of which have not yet grown up and cattle which have very short horns or no horns cannot be done by this method. Another reason why this method cannot be adopted in the case of village cattle is that ryots in many parts of the Presidency are in the habit of paring the horns for beauty and for making them look younger.

Branding either on the skin or on the horns can be conveniently done only if the cattle in a village are brought to one place. Like inoculations it is beset with difficulties if it is to be conducted from house to house or from farm to farm.

Tattooing.—This method is free from the objections raised by the ryots against branding and is the least objected to. It was tried in this Presidency some four or five years ago but was given up as it was found to be costly and as the marks were not lasting. The reasons for the early fading away of the impressions seem to be due to not following the correct technique of tattooing and not using the proper ink. At the Wellington Imperial Dairy Farm, in the Nilgiris district this method was adopted for numbering the animals and in some of the animals tattooed years ago even in animals tattooed 10 to 15 years ago, the marks are distinctly visible. The method adopted there is as follows:—

China ink sticks are used, and ink paste is prepared by rubbing it with fresh water in a porcelain dish. It is then applied to the inside of the flap of the ear at its hairless middle portion after cleaning it of its dirt and grease. The tattooing forceps is then applied and pressed hard, so that the spikes penetrate right through the flap of the ear. The ink is, again rubbed well into the holes with a finger for about half a minute.

In the Punjab, this method is being investigated by the Civil Veterinary Department. The report received recently on the results of their trials is reproduced below:—

"The experiments have been in progress for about three years now. The results achieved so far are encouraging and hold out a definitely hopeful future. It is too early yet to claim that any of the inks used for tattooing leave indelible tattoo marks until they have stood the test of time for another few years. A lot of course depends on the technique and minor details of the actual operation. However, the following can be concluded from the observations made so far:—

- (1) that Burch's tattoo oil has given the best results but Reeve's Indian and China ink are not far behind;
- (2) that the tattoo marks on the young stock remain more brilliant than in older animals though so far there are no signs of fading even in the older animals;
- (3) that special attention to the details of the operations is most essential."

In the Livestock Research Station, Hosur Cattle Farm, 429 animals have been tattooed by me in June, July and August 1932 with China ink. Observations of the results will be recorded from time to time.

One advantage which this method has over the others is that the year in which an animal is inoculated can also be marked.

As regards the cost except the initial cost of the forceps it is trifling.

One drawback in this method, however, is that the impressions will not be lasting unless special attention is carefully paid to the details of the operations. I am doubtful whether these details can be attended to under field conditions, especially when a large number of serum simultaneous inoculations have to be done. Anyhow the results of the investigation in the Punjab may be awaited.

Ear-punch.—Mr. Sampath Ayyangar has tried to use the ear-punch on certain inoculated animals but the ryots seem to object to it, as it damages the ear.

Chemical branding.—This method has been tried by the Superintendent, Madras Serum Institute, on the animals at the Institute. The escharine solution and powder have been used on about 1,000 animals including calves, and the results seem to be quite satisfactory. The Superintendent, Serum Institute, informs me that this method, if properly done, leaves a satisfactory mark and is as good as branding with hot iron. The cost of materials used does not exceed two pies per animal as worked out in that institute. I therefore recommend that this method may be tried at first for a year as an experiment.

Another point, in this connexion, is that, if it is considered necessary that the inoculated animals have to be compulsorily branded or tattooed for identification it may also be necessary that the animals which have had a natural attack and recovery should also be branded or tattooed so as to avoid wastage of serum by re-inoculating them during a subsequent outbreak. This, however, presents difficulties.

It may not be out of place to raise here a point for consideration whether the inoculated animals have to be necessarily marked or branded at all. The chief reasons put forward by some against branding are :—

- (1) that it is difficult to carry out inoculation and branding side by side single handed at one time by a Touring Veterinary Assistant Surgeon in villages;
- (2) that the number of inoculations that could be done in a day will decrease so much so that there will be difficulty of the virus being utilized within the prescribed time and thus there may be chances of the virus becoming inert towards the end of inoculation work, especially, in remote interior villages where it will take three or four days for the virus to reach;
- (3) that the inoculation work will be hampered, though to some extent, and it will be difficult for the touring staff to cope up with the work during periods of wide-spread outbreaks;
- (4) the prejudices and objections on the part of the ryots which have been dealt with above;
- (5) the waste of time and labour on the part of the staff which can otherwise be utilized in inoculating a larger number of cattle;
- (6) the cost involved in branding;
- (7) the village conditions are such that it does not serve the purpose in view. This is amplified below.

Against the objections (1), (2) and (3) mentioned above, it may be said that the branding or marking of the inoculated animals may be done after inoculation is finished in a village. I unhesitatingly say that this is very difficult, if not impossible, to get all the inoculated animals for branding at a later date, as the ryots are not interested in getting them branded and will try to avoid it as far as possible. The branding of all animals has therefore to be done along with inoculations.

Outbreaks of rinderpest generally occur in a village at intervals of six or seven years to 10 or 12 years. There may be outbreaks occurring at intervals less than six or seven years but such outbreaks are not numerous. By the time an outbreak occurs in a village subsequent to the one in which inoculation has been done before, only a small percentage of inoculated animals remain in the village, as some would have died and some sold to the people of other villages, etc., during the interval of six to ten years. It may also be stated that the average age of the animals in this Presidency seems to be about 10 or 11 years.

In regard to the inoculated animals, sold to the ryots of other villages the brand mark will be viewed by the purchasers with doubt as to whether it is indicative of inoculation and they would naturally insist on the animals being re-inoculated. But in the case of inoculations undertaken in localities free from the disease some of the above arguments against branding will not hold good.

Up to the year 1928, the branding of animals inoculated by the serum simultaneous method in this Presidency was insisted on, but subsequently, owing to the difficulties mentioned above branding was not insisted on, except in the case of Government cattle. I therefore submit that this aspect of the question also deserves consideration.

7. THE EXAMINATION OF THE PRESENT METHODS OF REPORT AND RECORD OF RINDERPEST ATTACKS AND DEATHS AND SUGGESTIONS FOR THEIR IMPROVEMENT.

The present procedure of recording and reporting attacks and deaths from rinderpest is as follows :—

The village munsif maintains a cattle mortality register in which deaths due to certain important contagious and non-contagious diseases of animals are entered, with dates of occurrence. In the event of an outbreak of a contagious disease occurring in a village, the village munsif is required to send a report immediately to the Tahsildar of the taluk showing the name of the disease, class of animals affected and the number of attacks and deaths with dates, and a copy of the same in a service post card to the concerned Touring Veterinary Assistant Surgeon direct to avoid delay. The Tahsildar, on receipt of the report, forwards a translation of it in English to the Touring Veterinary Assistant Surgeon in a prescribed printed form. The initial outbreak report is followed by weekly progress reports until the disease subsides. There is no column in the cattle mortality register for showing attacks in an outbreak, but as the number of attacks has to be shown in an outbreak report and progress reports, the village munsif usually maintains a separate register in manuscript for attacks. A copy of every outbreak report sent by the Tahsildar to the Touring Veterinary Assistant Surgeon is sent to the District Veterinary Officer also for his information. This is with regard to reporting of outbreaks.

With regard to cattle mortality statistics, the village munsifs send monthly mortality returns to the Tahsildar who forwards them direct to the Collector of the district. These are consolidated in the Collector's office and a consolidated monthly return for the district is prepared and sent to the Director of Veterinary Services and a copy to the concerned District Veterinary Officer. The district figures are further consolidated into Presidency figures in the Director's office for record and copies are furnished to the various consulates for information.

I shall now discuss below how this system works at present in practice.

The registration of deaths from cattle diseases is grossly defective. The number of deaths reported is generally far less than the actual number. It may not be an exaggeration to say that the actual number may be at least twice the number reported.

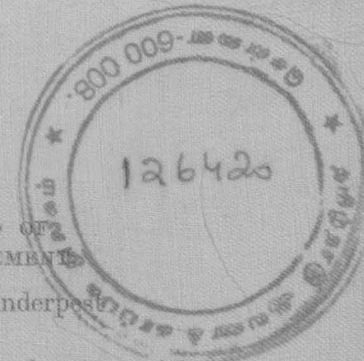
In the annual report of the Health Department for 1930, it was stated that in the rural areas alone, approximately 62,000 unregistered births and 20,000 deaths were detected by the subordinate staffs of the Health Department during the year. If this is the case in regard to the registration of human vital statistics in spite of the vigilance on the part of the officers of the Health Department and those of the Revenue Department, it can easily be imagined how many deaths among cattle go unrecorded and unreported.

Deaths are not correctly classified under the different diseases. Deaths from rinderpest are registered under Anthrax, and those from Anthrax, under Haemorrhagic Septicæmia and so on. This is due partly to the indifference on the part of the village munsifs and partly to their inability to differentiate diseases.

The defective registration of cattle mortality in India is clearly pointed out in the report of the Royal Commission on Agriculture in India, an extract of which is given below :—

"There is, however, reason to believe that the figures in the table (table of recorded deaths from rinderpest, haemorrhagic septicæmia and foot and mouth—statement omitted here) are very far from revealing the true state of affairs. That this is so is strikingly shown by an examination of the figures in Burma, one of the two provinces, in which the notification of deaths from cattle diseases has been made compulsory by legislation. An Agricultural Committee which examined the point in 1925, concluded that the losses due to epidemics had been very much underestimated. It further stated that the figures supplied by the Civil Veterinary Department clearly showed that the number of deaths among cattle were far in excess of those reported. That these views are not exaggerated is clearly brought out by a comparison between the number of deaths from diseases and natural causes in Burma in the 10 years 1915 to 1924 and the number of cattle as returned in the annual cattle censuses. If the number of deaths were correctly reported, the average life of Burmese cattle would work out at 54 years.

Not only is it probable that the deaths from epidemic diseases are several times greater than those actually reported, but the loss by death is only a small part of the loss which the cultivator suffers from this cause."



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In 20 villages in five districts which I visited, the number of unregistered attacks and deaths from rinderpest are 1,352 and 354 as investigated by me (vide statement No. 30). In almost every outbreak, many attacks and deaths go unregistered. In some of the interior villages even severe outbreaks with heavy mortality are not reported at all.

In the course of my tours I examined 99 cattle mortality registers in 62 villages scattered over 14 districts. As seen from the number of times a cattle mortality register has been checked by the Revenue and Veterinary Officers, it is observed that the Revenue Officers checked it during a year 3.2 times on an average (excluding the jamabandi checking) and the officers of the Veterinary Department did so 1.5 times a year (vide statement No. 31).

Out of 51 villages (in 12 districts) visited by me only in 22 villages was a separate register for attacks during an outbreak of cattle disease maintained (vide statement No. 32).

In 25 villages visited by me in the several districts it was noticed that the delay in reporting outbreaks of cattle disease by the village munsifs is about six days on an average (vide statement No. 33). The calculation of the delay in these cases is based on the date of commencement of the disease as given by the village munsif himself. Had the actual date of commencement of the outbreak been taken into consideration in each case, the delay would have been at least two or three times that noted above.

In 34 villages visited by me in the several districts, only from 12 villages were progress reports during an outbreak of cattle disease received before the disease completely subsided, in another twelve, they were sent some time but not till the disease completely subsided, and in 10 cases they were not sent at all (vide statement No. 34).

From what has been stated above it will be seen that the recording and reporting of cattle mortality is unsatisfactory.

I shall now deal with the suggestions for improvement—

- (1) *Cattle mortality register.*—The contagious diseases of small animals such as goats and sheep have been of late attracting due attention of the department and it is therefore necessary for the department to know the mortality from contagious diseases among these classes of animals. I therefore recommend that the mortality from the more serious diseases among sheep and goats may also be registered in future.

For the study of epizootiology of any contagious disease, with reference to the relative susceptibility of oxen and buffaloes and their susceptibility to a particular disease at different ages it may be necessary to record deaths separately under oxen and buffaloes with their ages at death. The advisability of the introduction of these particulars in the cattle mortality register may be considered.

- (2) *Scrutiny of the cattle mortality registers by the checking officers.*—In 99 cattle mortality registers I examined, no checking officer seems to have scrutinized the entries made in it with a view to detect unregistered deaths, if any, and to verify the dates of death. This work chiefly devolves more on the veterinary staff than on the revenue officers who have got multifarious duties to attend to. If the officers, Veterinary and Revenue, scrutinize a few entries in this way each time they check a register and the village munsifs who are found to be grossly remiss in this part of their duties, are suitably dealt with, I think it will set matters right in due course. It will not do if the registers are simply initialled.

It would be advisable to open a column in the summary sheet of the diary of the Touring Veterinary Assistant Surgeons for the number of cattle mortality registers checked and the number of unregistered attacks and deaths detected. The latter should find place in the annual reports. A quarterly review by the District Veterinary Officer of the comparative work done by the staff in detecting unregistered attacks and deaths may be communicated to them as such a review would stimulate them to show more work in this direction.

- (3) In every outbreak of cattle disease, if the officer who checks the cattle mortality register were to enquire in whose herd the disease first broke out, which it is not difficult to do, and ascertains the actual date of commencement of the outbreak, the delay caused, if any, by the village munsif in reporting an outbreak can be ascertained and the negligent village munsifs may be suitably punished. In the course of each outbreak attended to, the Touring Veterinary Assistant Surgeons may be asked invariably to furnish the date of actual commencement of the outbreak as investigated by him and the action taken by him in the case of inordinate delay on the part of the village munsifs in reporting the outbreaks.

- (4) The introduction of the grant of certain rewards to village munsifs showing promptness in reporting cattle disease, as is now done in the Punjab may also be considered. In this way, a sum of Rs. 1,200 out of a grant of Rs. 1,500 seems to have been spent during the year 1930-31 in the Punjab as seen from the annual report for that year.
- (5) The introduction of awarding sanads to land-owners and others in recognition of their assistance in reporting cattle disease and in carrying out veterinary work in the districts as is now done in the Central Provinces and Berar.
- (6) Taluk boards, union boards and village panchayats may be requested to report outbreaks of cattle disease, whenever they are brought to their notice.
- (7) Agricultural Demonstrators, Co-operative Inspectors and Forest Officers may also be asked to report the prevalence of cattle disease that may be brought to their notice during the course of their tours.
- (8) Outbreak reports of cattle disease should be forwarded to the Touring Veterinary Assistant Surgeon from the taluk office without any delay.
- (9) In certain districts and in certain taluks a separate register in manuscript for attacks in an outbreak is maintained by the village munsif. There seems to be no definite Government Order or Board's Standing Order to the effect that such a register has to be maintained, but the necessity for such a register is obvious as in the initial outbreak report and in the weekly progress reports of the disease the number of attacks has to be shown. At the instance of the officers of the Veterinary Department and of certain District Collectors these registers are maintained in certain districts and certain taluks. It is therefore necessary that Government may be addressed and their definite orders obtained on this.
- (10) It has already been stated above that service post-cards have been supplied to the village munsifs to enable them to send a copy of the initial outbreak report to the concerned Touring Veterinary Assistant Surgeon direct to avoid delay. The distribution of these cards was first effected through the Revenue department and subsequently for some reason it was taken over by this Department in 1930 and the distribution was actually commenced about the end of the year 1930 or at the beginning of 1931. The Touring Veterinary Assistant Surgeons have been asked to distribute these cards to the village munsifs during the course of their tours. In the circles of Madras, Bellary, Vellore, Coimbatore and Nellore for which full figures are available, the number of village munsifs supplied with service post cards since the beginning of 1931 up to date is 1,717 against a total of 14,467 villages, giving a percentage of 12. At this rate it may take about 16 or 17 years before all the village munsifs can be supplied with post cards. There are some difficulties in the distribution of these cards. If all the village munsifs are supplied every year with a certain number of post cards—say four or five each—through the post or the taluk office, the result would be that such of those village munsifs as have had no outbreaks in their villages would have no opportunity to utilize these cards which may be mislaid and lost sight of. To remedy these difficulties, I suggest the following procedure:—
 - (i) Every village munsif should have an initial supply of four or five post cards and this can be done through the taluk office. The village munsifs should be asked to stitch these cards to the cattle mortality registers so that they may not be mislaid and lost sight of.
 - (ii) When a Touring Veterinary Assistant Surgeon visits a village, he should check the post cards, when he checks the cattle mortality register and should replenish their supply if necessary.
 - (iii) It should be noted on the post cards in the vernacular as a foot-note that these cards are intended to notify the outbreak direct to the concerned Touring Veterinary Assistant Surgeon and to report the progress of the disease at weekly intervals.

Veterinary Statistics.—Every cattle disease investigation requires statistical information over long periods and the necessity for this cannot be over emphasized. The Veterinary Department is chiefly interested in and concerned with cattle mortality and it seems but proper that the compilation of the cattle mortality returns should be dealt with either in the office of the Director of Veterinary Services or in those of the District Veterinary Officers.

The Public Health Department seems to have agitated for some years for control over vital statistics compilation and finally secured it in 1931. The following extract appears in the Annual Report of the Director of Public Health, Madras, for 1931:—

"For years an effort was made to control vital statistics compilation either in the offices of the District Health Officers or in the office of the Director of Public Health. It was always postponed. This year, as a measure of retrenchment, Government sanctioned a small staff for this work in the office of the Director of Public Health to take effect from 1st January 1932. This staff of 16 clerks replaced 42 clerks employed for this work in Collectors' offices of the Presidency. This work will be reported on next year."

I suggest that similar arrangement may be made in regard to the compilation of cattle mortality returns.

In connexion with rinderpest investigation, it has taken me much time and labour to collect statistics, and I am still much handicapped for want of certain statistical information. The cattle mortality returns are liable to destruction in the Collector's offices after three years according to the Board's Standing Order No. 169, but it should be the concern of this department to preserve all veterinary statistics permanently, as these may be required for the study of epizootiology of any cattle disease. I would suggest that the monthwar mortality of the districts and taluks in the jurisdiction of a District Veterinary Officer should be posted in a bound register, to be kept permanently in the District Veterinary office, from the monthly returns received from the Collectors' offices, much in the same way as is done now in the Head office with regard to districtwar mortality. With regard to the cattle census, a District Veterinary Officer should be in possession of a cattle census of all villages, taluks and districts in his jurisdiction, and copies of the detailed cattle census taken every quinquennium should be supplied to the District Veterinary Officers and Touring Veterinary Assistant Surgeons.

8. THE LINE OF RESEARCH THAT SHOULD BE UNDERTAKEN AS TO MAKE THE PROBLEM OF PREVENTION AND CONTROL OF RINDERPEST MORE ECONOMICAL AND EFFICIENT IN THIS PRESIDENCY.—

(1) To continue the study of epizootiology of rinderpest in all its aspects, with particular reference to possible carriers and reservoirs of infection, factors influencing the intensity of the disease, infectivity of convalescents, etc.

(2) To carry on research and evolve a safe and efficient method of protection against rinderpest but at the same time cheaper than the present serum simultaneous method. The experiments which are now being conducted in this Presidency on the goat virus alone as a vaccine against the disease may be continued.

(3) To continue the experiments for determining the minimum dose of serum (now Madras serum) required for each breed of cattle in this Presidency.

9. THE FUTURE PLAN OF CAMPAIGN AGAINST THE DISEASE.

The future plan of campaign is to prosecute vigorously the serum simultaneous inoculation which seems to be so far the only safe and effective remedy, under the present conditions, until a better and cheaper method of protection is evolved and definitely established. I therefore recommend the following for the future plan of campaign:—

- (1) Prompt and effective ringing of the outbreaks by a zone of protected cattle with the aid of compulsory serum simultaneous inoculations.
- (2) Prompt and effective enforcement as far as possible, of such of the provisions of the Cattle Disease Act of 1866 as are designed to prevent the spread of infection and of the new Act when it comes into being.
- (3) To take steps for minimizing as far as possible the delay caused in reporting and attending of outbreaks and in carrying out serum simultaneous inoculations.
- (4) To carry out serum simultaneous inoculation in clean localities (localities free from disease) during times of low incidence of the disease, provided that serum can be spared and that the inoculated animals can be controlled, so as to avoid setting up new centres of infection.
- (5) To take steps for increasing the present staff to effectively carry out the above items.
- (6) To include Veterinary Branch in every rural uplift scheme.

- (7) To appoint suitable separate officers to carry on an intensive propaganda in the different parts of the Presidency in addition to the propaganda now carried on by the staff in their tours. The propaganda may include the following:—(i) Motor exhibition van, (ii) Cinema show, (iii) Magic lantern demonstrations, (iv) Lectures with illustrated charts, (v) Pamphlets, (vi) Posters, (vii) Bulletins, (viii) Short talks, (ix) Lectures, (x) Exhibitions, (xi) Weekly bulletins on the health of cattle in the Presidency may be sent to the papers, (xii) Articles on veterinary subjects may also be published in the local newspapers, (xiii) Lastly but not the least and as remarked by the Royal Commission on Agriculture, no form of propaganda is likely to be more effective than timely aid given to a cultivator by a trained officer.

- (8) To improve the reporting and recording of cattle mortality.

10. MISCELLANEOUS.

(a) *Is there any evidence to suggest the existence of "plurality" or mutation of virus in this disease?—The plurality of the rinderpest virus and any difference observed in the behaviour of virus obtained from extraneous sources, e.g., Muktesar.*

These questions were referred to the Madras Veterinary College for investigation by the Director of Veterinary Services and the investigation is now being continued by the Superintendent, Serum Institute, Madras. He has furnished me with a statement of the experiments conducted by him (statement No. 36). The number of experiments conducted is not sufficient for any definite conclusions to be drawn but as far as observations have gone, there seems to be no evidence to suggest the plurality of virus.

It may be mentioned here that Andrievsky (1931) could find no evidence that there was more than one strain of rinderpest virus (Veterinary Bulletin, Volume 2, No. 10 for October 1932).

(b) *Vaccination against the disease.*—For want of time no experiments could be conducted on this, but it may not be out of place to quote here the following extract on the subject from the annual report of the Imperial Institute of Veterinary Research, Muktesar, for the year 1931–32.

"Vaccination.—Mr. Menon continued the experiments upon formalized vaccines. The results were similar to those obtained in the previous years and his general experience was that the administration of vaccines which produce a reliable immunity was attended by a considerable amount of risk in that a certain proportion of animals so treated may develop a severe or even a fatal infection whereas in those cases where the vaccine is safe the immunity conferred is unreliable and of comparatively short duration.

It appears that in the conditions prevailing in India the serum simultaneous method of immunization is the best method available at present."

(c) *The complications observed in cases of rinderpest, both natural and artificially induced, in the province, e.g., piroplasmiasis, trypanosomiasis, coccidiosis, etc.*

I have had no opportunity of studying the complications in naturally affected cases of rinderpest in the field, but the Superintendent, Serum Institute, Madras, has however furnished me with a statement (No. 35) of complications noticed in rinderpest virus producers at the Madras Veterinary College and the Serum Institute during the years 1928–29 to 1932–33 (up to 22nd March 1933). The figures are given below:—

Total number of virus producers—1941.

Nature of complications.	Number of animals in which complications were noticed.	Percentage.
Trypanosomiasis	42	2.16
Piroplasmiasis	290	14.94
Coccidiosis	60	3.09
Filariasis	54	2.78
Spirochaetosis	1	0.05
Total ..	447	23.03

(d) *The efficacy of carbolic acid and cresol in the treatment of cases of rinderpest.*

In order to arrive at definite conclusions on this, controlled experiments have to be scientifically carried out and I could not take up this work for want of time.

However, the number of rinderpest cases treated by the staff of the Civil Veterinary Department, Madras, with these drugs and the results of treatment have been gathered and summarized below :—

- (1) Carbolic acid is generally given in one dram doses daily mixed in one or two pints of rice congee or gruel in all stages of the disease, especially in the early stages, i.e., before the commencement of diarrhoea.
- (2) Cresol is generally given in one or two dram doses daily mixed in one or two pints of rice congee or gruel in all stages of the diseases, especially in the latter stages of the disease, i.e., after the commencement of the diarrhoea.
- (3) Two hundred and seventy-seven cases of rinderpest were treated with carbolic acid, of which 177 recovered and 100 died, giving a percentage of 64 and 36 respectively.
- (4) Three hundred and one cases of rinderpest were treated with cresol of which 232 recovered and 69 died, giving a percentage of 77 and 23 respectively.
- (5) Four hundred and forty-one cases of rinderpest were treated with both carbolic acid and cresol using generally carbolic acid in the earlier stages and cresol in the latter stages of the disease. Of these, 366 recovered and 75 died, giving a percentage of 83 and 17 respectively.
- (6) Treatment with cresol alone in all stages of the disease seems to give better results than treatment with carbolic acid alone.
- (7) Treatment with both carbolic acid and cresol using generally carbolic acid in the earlier stages and cresol in the latter stages of the disease seems to be more efficacious than treatment with either of these drugs alone.
- (8) Some Veterinary Assistant Surgeons have stated that carbolic acid and cresol given together in the following manner have given better results :—
In the early stages of the disease, before diarrhoea has set in, one dram each of cresol and carbolic acid is to be given on the first day and half a dram of each of the drugs on the successive five to seven days. In cases in which diarrhoea has set in, two drams each of cresol and carbolic acid are given on the first day and one dram each of both on the successive five to seven days.
- (9) Acid carbolic and cresol do not seem to produce any beneficial results in any stage of the disease among foreign breeds and cross breeds as they get a very severe type of the disease.

As has been stated above not much reliance can be placed on the information furnished, and controlled experiments have therefore to be conducted for any definite conclusions to be drawn on this question.

The efficacy of drug treatment of rinderpest has been the subject of several experiments in the past in Muktesar and elsewhere and from a study of the available literature no drug seems to have been proved to be of any curative value in rinderpest.

(e) *The causes for the fall in the number of animals sent for grazing to Government forest grazing areas during recent years and whether it is due to the incidence of rinderpest in these areas.*

This question was referred to me for investigation, as it was said that there had been a fall in forest grazing revenue in recent years.

I have had no time to go in great detail into this question or to make a complete study of the grazing areas in each Forest District or Circle. An attempt is however made below to study the question from the available statistics.

The number of animals that may be sent for grazing in a year may depend upon various factors such as the scale of fee charged, number of animals allowed at concession rates or free, area of the forest thrown open for cattle grazing, provision of facilities such as drinking water in the grazing areas, conditions of weather such as proper rainfall at the proper time, economic condition of the cattle owners, the availability of other kinds of cattle fodder, the incidence of cattle disease, etc. It is not within the scope of this investigation to go into the various factors influencing the number of animals grazed each year. What this department is chiefly interested to know is, as stated in the question itself whether the incidence of rinderpest has anything to do with the fall in the number of cattle grazed.

As mortality figures are available for each revenue district and not for each forest district, the total figures for the Presidency are considered—

Year.	Mortality from rinderpest in the Presidency.	Total number of animals grazed in the Presidency including animals grazed free.
1921-22	10,121	1,784,989
1922-23	4,279	2,111,239
1923-24	3,434	2,235,069
1924-25	9,681	2,421,318
1925-26	23,724	2,444,824
1926-27	23,676	1,899,037
1927-28	35,803	2,658,568
1928-29	129,583	2,809,406
1929-30	106,046	2,730,482
1930-31	59,323	2,515,781
1931-32	28,412	2,399,632

The number of animals grazed, given against the year 1926-27, excludes panchayat figures which are not available for this year.

The total number of animals grazed, noted against each year, are those furnished by the Chief Conservator of Forests in his letter, Reference No. 1902-C-1/32, dated the 25th March 1933, and are inclusive of those allowed at concession rates or free in the reserved and unreserved forests and reserved lands under the control of the Forest department and under the panchayat management.

From the above figures, it will be seen that there is a gradual increase in the total number of animals grazed each year from 1921-22 to 1928-29 and then there is a gradual fall and this increase or decrease corresponds with the increase or decrease in the mortality (except during the first three years), i.e., the more severe, the incidence of the disease, the more, the number of animals sent for grazing. This is also in accordance with what I could gather in some of the villages I visited, that whenever cattle disease breaks out in a village the healthy cattle of that village and of the surrounding villages are sent away to the forest grazing areas, as far as possible, to avoid the animals contracting the infection.

The number of animals licensed to graze as furnished in the statement attached to the letter Reference, No. 1902-C-1/32-1, dated the 2nd February 1932, of the Chief Conservator of Forests to the Director of Veterinary Services is reproduced below :—

Year.	Number of animals licensed to graze in the forests under the control of the Forest department in the Madras Presidency.
1923-24	2,141,770
1924-25	2,197,632
1925-26	2,356,154
1926-27	1,816,572
1927-28	1,616,224
1928-29	1,672,257
1929-30	1,649,805
1930-31	1,531,661

From the above figures it will be seen that there is a gradual fall in the number of animals grazed from the year 1926-27. In the year 1926-27 certain changes seem to have been effected with regard to grazing areas, as can be seen from the Annual Administration Report of the Forest Department for that year, an extract from which is given below :—

"Paragraph 38.—. . . Grazing permits were issued for 1,816,572 as against 2,356,154 animals in the previous year. The decrease is due to the transfer of the large areas of the ryots' forests to panchayats; details regarding the number and description of animals allowed to graze in these areas are not available."

The figures furnished by the Chief Conservator of Forests do not include, from the year 1926-27, the number of animals grazed in the panchayat forests and the animals grazed free of charge, and if the figures for panchayat forests are also included they read as follows:—

Year.	Number of animals licensed to graze.		Total number of animals licensed to graze.
	Departmental forests.	Panchayat forests.	
1923-24 ..	2,141,770	Nil.	2,141,770
1924-25 ..	2,197,632	Do.	2,197,632
1925-26 ..	2,356,154	Do.	2,356,154
1926-27 ..	1,816,572	Not available.	1,816,572
1927-28 ..	1,616,224	960,836	2,577,060
1928-29 ..	1,672,257	1,054,093	2,726,350
1929-30 ..	1,649,805	991,504	2,641,309
1930-31 ..	1,531,661	895,781	2,427,442

From the above figures, it will be seen that there has been no fall in the total number of animals grazed except from the year 1929-30.

11. CONCLUSION.

It has to be borne in mind that the central idea in this investigation was to find out whether the serum-simultaneous method of inoculation against rinderpest as practised in this Presidency has justified the claims made for it. And in concluding this report I wish to state that the investigation and enquiries have shown beyond doubt that the serum-simultaneous method does confer lasting immunity against rinderpest in the vast majority of cases.

12. ACKNOWLEDGMENTS.

For the help and guidance which I have received in an unstinted measure from P. T. Saunders, Esq., O.B.E., M.R.C.V.S., I.V.S., Director of Veterinary Services, Madras, in connexion with the investigation, I am deeply grateful and I have great pleasure in acknowledging the helpful suggestions which I have received from Mr. K. Kylasamier, O.B.V.O., Superintendent, Serum Institute, Madras.

13. SUMMARY.

1. Rinderpest is responsible for nearly 50 per cent of the total mortality from all contagious diseases in the Presidency.
2. The economic yearly loss from rinderpest, on an average, works up to the staggering figure of Rs. 21,56,684, the calculation being based on the reported mortality.
3. The disease generally assumes a periodical intensity in the Presidency, districts and taluks and occurs in the form of waves.
4. The incidence of the disease does not restrict itself to any particular season, i.e., it cannot be said that the disease prevails only in a particular season of the year and stops completely during the other seasons. Although it follows the course of its own wave, irrespective of the season, yet, in the majority of the districts, the mortality is greater during the rainy season than during the other seasons of the year.
5. The serum-simultaneous inoculations done so far in this Presidency are a success, judging from the fact that the immunity conferred by these inoculations is found to be lasting in the vast majority of cases, but the number of inoculations done so far is too small to have any appreciable effect on the control of the disease.
6. The percentage of cases in which immunity following serum-simultaneous inoculations has broken down resulting in reinfection and death during the periods up to five years after inoculation is about 0.36.
7. There seems to be no marked variation in the duration of immunity in the inoculated animals in the various parts of the Presidency.
8. The age of an animal at the time of inoculation seems to be a definite factor in the duration of immunity. To confer permanent immunity serum-simultaneous inoculations must be done at 2½-3 years of age or over.
9. Calves of six months of age and less of all breeds seem to be more resistant to infection.
10. Anaphylaxis or protein reaction after inoculation occasionally occurs in animals which had received black-quarter or rinderpest serum previously.
11. In order to find out the weight of an animal easily in the field without wasting time in calculation and thereby correctly to estimate the quantity of serum required in each case during inoculation, a ready reckoner of weights has been prepared.

12. The introduction of compulsory inoculation of cattle of the affected village and of the surrounding villages by serum-simultaneous method seems to be feasible and also necessary as a means of control. It is however doubtful if this can be introduced at present.

13. The introduction of a fee for serum-simultaneous inoculations seems undesirable at this stage, until the ryots appreciate more fully its value.

14. It is necessary that the inoculated animals should be branded and for this purpose the chemical branding with escharine solution and powder seems to be handy, cheap and effective and is free from the inconveniences attending on other methods.

15. The line of research that should be undertaken so as to make the problem of prevention and control of rinderpest more economical and efficient in this Presidency is as follows:—

- (a) To continue the study of epizootiology of rinderpest in all its aspects, with particular reference to possible carriers, and reservoirs; spread of infection, factors influencing the intensity of the disease, infectivity of convalescents, etc.
- (b) To carry on research and evolve a safe and efficient method of protection against rinderpest but at the same time cheaper than the present serum-simultaneous method. The experiments which are now being conducted in this Presidency on the goat virus alone as a vaccine against the disease may be continued.
- (c) To continue the experiments for determining the minimum dose of serum (now Madras serum) required for each breed of cattle in this Presidency.

16. The future plan of campaign against the disease is to prosecute vigorously the serum-simultaneous inoculation which seems to be so far the only safe and effective remedy under the present conditions, until a better and cheaper method of protection is evolved and definitely established. I therefore recommend the following for the future plan of campaign:—

- (1) Prompt and effective ringing of the outbreaks by a zone of protected cattle with the aid of compulsory serum-simultaneous inoculations.
- (2) Prompt and effective enforcement, as far as possible, of such of the provisions of the Cattle Disease Act of 1866 as are designed to prevent the spread of infection and of the new Act when it comes into being.
- (3) To take steps for minimising, as far as possible, the delay caused in reporting and attending of outbreaks and in carrying out serum-simultaneous inoculations.
- (4) To carry out serum-simultaneous inoculations in clean localities (localities free from disease) during times of low incidence of the disease, provided that serum can be spared and that the inoculated animals can be controlled, so as to avoid setting up new centres of infection.
- (5) To take steps for increasing the present staff to effectively carry out the above items.
- (6) To include veterinary branch in every rural uplift scheme.
- (7) To appoint suitable separate officers to carry on an intensive propaganda in the different parts of the Presidency in addition to the propaganda now carried on by the staff in their tours.
- (8) To improve the reporting and recording of cattle mortality.

17. Taking into consideration the figures for the Presidency as a whole, the number of animals licensed to graze on payment and free of charge in Government as well as in panchayat forests seems to be directly proportionate to the incidence of rinderpest, as cattle owners send their animals to the forests to escape infection.

18. The data collected and the experiments conducted in regard to the following points are not considered sufficient for any definite conclusions to be drawn, but so far as observations have gone, the following points may be noted:—

- (a) There seems to be no appreciable variation in the susceptibility to rinderpest of the different country breeds in the Presidency so far as the oxen are concerned and the same dose of serum is required but buffaloes seem to be more susceptible than oxen.
- (b) With regard to the minimum dose of serum required for each breed in serum-simultaneous inoculations, the rate of 6 c.c. or 7 c.c. of serum per 100 lb. body weight appears to be too risky.
- (c) Many of the animals inoculated with 8 c.c. or 9 c.c. of serum per 100 lb. body weight showed severe reactions and it appears unsafe to use a smaller dose than 10 c.c.
- (d) There seems to be no evidence to suggest the plurality of virus in this disease.

STATEMENT NO. 1.

Statement showing the territorial changes in the constitution of the revenue districts and taluks during the past about thirty years.

Districts.	Changes in the constitution of the district.		Changes in the constitution of the taluk.	
	Date.	Changes.	Date.	Changes.
Ganjam	1921	Agency district created in G.O. No. 2680, Revenue, dated 6th November 1920.	.. ..	....
	16th October 1923.	Agency district abolished.		
Vizagapatam	1921, 16th October 1923.	Changes as above regarding Agency district.		
Godavari	October 1904 ..	Guntur district was formed out of Godavari, Kistna and Nellore districts. Tanuku, Ellore, Narasapur, Bhimavaram and Yernagudem taluks transferred to Kistna.	1909	Part of Narasapur and Nagaram island retained in Godavari and part transferred to Kistna.
	1909	Nugur taluk was transferred to Godavari from Central Provinces.	1919	Razole taluk was formed and the territorial limits of Amalapuram taluk was also changed.
	1909	Part of Narasapur and Nagaram island retained in Godavari and part transferred to Kistna.		
	1925-26	Reconstitution of Kistna and Godavari districts into Kistna, West Godavari and East Godavari.		
East Godavari and West Godavari	1925-26	Newly formed.		
Kistna	1900	Nagaram taluk was taken from Kistna to Godavari.	October, 1907 ..	Bander taluk was divided into Bandar and Divi taluks.
	October, 1904 ..	Guntur district was formed out of Godavari, Kistna and Nellore districts.	1st November 1910.	Gudivada taluk was divided into Gudivada and Kalkalur taluks.
	1909	Part of Narasapur and Nagaram island retained in Godavari and part transferred to Kistna.	1909	Part of Narasapur and Nagaram island retained in Godavari and part transferred to Kistna.
	1925-26	Reconstitution of Kistna and Godavari districts into Kistna, East Godavari and West Godavari districts.		
Guntur	1st October 1904.	Formation of the district from Nellore and Kistna district.	1st July 1910 ..	Tenali taluk was divided into Tenali and Repalle taluks.
Kurnool	1st October 1910.	Territorial changes in jurisdiction ..	1st October 1910.	New taluks of Kurnool and Dhonse formed. The constitution of the taluks of Nandyal, Nandikotkur and Pattikonda was changed.
Bellary	.. ..	....	1st October 1910.	Siruguppa taluk was newly constituted. The constitution of the taluks of Adoni, Alur and Bellary was changed.
			1st April 1923 ..	Siruguppa taluk was abolished and its villages distributed among Adoni, Alur, Bellary taluks. Eleven villages of Adoni transferred to Alur and ten villages of Bellary to Rayachoti.
Anantapur	1st October 1910.	Territorial limits altered, Kadiri taluk added to this district from Cuddapah.	1st October 1910.	The constitution of Anantapur, Gooty and Dharmavaram taluks was changed.
Cuddapah	1st October 1910.	Territorial limits altered, Kadiri taluk transferred to Anantapur district.	1st April 1911 ..	Kamalapur taluk was formed. The constitution of Proddatur and Cuddapah taluks was changed. The name of Pullampet taluk was changed into Rajampet.
	1st April 1911 ..	Vayalpad and Madanapalle taluks transferred to Chittoor.		
Nellore	1st October 1904.	Territorial limits underwent revision, Ongole taluk transferred to Guntur district.	1st October 1910.	Kovur taluk was formed. The constitution of Nellore and Gudur taluks altered.
Chingleput	.. ..	....	15th February 1911.	The constitution of Tiruvallur, Ponnuri, Conjeevaram and Saidapet taluks was changed.
			1st October 1917.	Sriperumbudur taluk newly formed. Constitution of Saidapet taluk was changed.
South Arcot	1st April 1911 ..	Change in the territorial limits of the districts Tiruvannamalai taluk transferred to North Arcot district.		
North Arcot	1st April 1911 ..	Change in the territorial limits of the district Chittoor. Palmaner, Punganur, Chandragiri, Kalesasli, Puttur and Tiruttani taluks transferred to Chittoor district.		
Chittoor	1st April 1911 ..	Constitution 1st April 1911 in addition to the taluks mentioned against North Arcot district. Vayalpad and Madanapalle were added from Cuddapah district.		

Districts.	Changes in the constitution of the district.		Changes in the constitution of the taluk.	
	Date.	Changes.	Date.	Changes.
Salem	October, 1910 .. 1st April 1911 ..	Change in the territorial limits .. Tiruppattur taluk was transferred to North Arcot district.	1st October 1910.	Omair taluk was formed. The constitution of Salem and Thiruchengodu taluks was changed.
	1918	Namakkal taluk added to Salem from Trichinopoly district.	April 1918 ..	Rasipur taluk formed change in the territorial limits of Salem, Namakkal, Thiruchengodu and Attur taluks.
Coimbatore	1910	Territorial limits of the district were changed. Karur taluk transferred to Trichinopoly district.	15th November 1910.	Formation of Avanashi taluk. Territorial limits of Gobichettipalayam, Palladam, Coimbatore and Kollegal taluks were changed.
Trichinopoly	1910	Changes in the territorial limits. Karur taluk was added to this district from Coimbatore.		
	1918	Namakkal taluk removed and added to Salem district excepting Thathiangarpatti firka which was added to Musiri taluk.	1918	Thathiangarpatti firka added to Musiri taluk.
Tanjore	.. ..	....	1910	Change in the territorial jurisdiction of Tanjore, Papanasam, Kumbakonam, Pattukkottai and Arantargi taluks.
Madura	October, 1910 ..	Territorial limits revised ..	1st July 1910 ..	Nilekkottai taluk was formed. The constitution of Madura and Dindigul taluks was changed from same date.
Ramnad	1st June 1910 ..	District newly constituted.		
Tinnevely	.. ..	Constitution of the district was changed.		
The Nilgiris	1906-07	Six villages, viz., Arakodu, Kolakodu, Nandipuram. Allimayur and Kallampalayam and one more village added to Nilgiri district.		
Malabar	.. ..	No change		
South Kanara	.. ..	No change	1902	South Kanara district. Amin Divi island from Mangalore taluk.
Anjengo	1906	Formation of the district originally belonged to Malabar district.	1st October 1910.	South Kanara district. Mudibidri taluk formed.
			1st July 1912 ..	Mudibidri taluk abolished.
			1st July 1912 ..	Karkal taluk formed. Constitution of Mangalore and Udupi taluks was changed.

NOTE.—(1) The changes given above are from the foot-notes of the several statements given in the statistical appendices to the District Gazetteers.

(2) The changes noted in this statement are given as far as information is available and cannot therefore be said to be exhaustive.

STATEMENT No. 2.

RYMANNES.—(1) The incredibly high rates of increase or decrease is shown in italics.
(2) The decrease is taken from the Season and Cattle reports.

(1) The incredibly high rates of increase or decrease is shown in

STATEMENT No. 3.

Statement showing the cattle mortality from rinderpest in the Madras Presidency from 1900-01 to 1931-32.

Districts.	1900-01.	1901-02.	1902-03.	1903-04.	1904-05.	1905-06.	1906-07.	1907-08.	1908-09.	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.
Ganjam	4,760	4,765	4,765	4,639	4,626	3,645	1,298	2,790	3,441	2,812	3,880	2,093	365	95	606	355
Vizagapatam	745	1,752	1,752	1,002	743	640	206	977	668	808	689	268	337	64	237	379
East Godavari	2,707	2,069	2,069	3,932	4,082	2,287	674	664	763	1,152	1,492	563	964	30	815	4,452
West Godavari	3,394	3,023	3,023	2,332	2,012	2,012	2,093	3,342	1,410	2,050	1,051	324	1,314	389	995	1,322
Krishna	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Guntur	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kurup	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bellary	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Amantapur	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cuddapah	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Nellore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chingleput	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
South Arcot	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
North Arcot	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chittoor	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Salem	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Channarayana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Trichinopoly	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Madurai	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tirunelveli	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
The Nilgiris	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Malabar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
South Kanara	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Madras City	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	27,378	18,544	18,555	17,555	19,772	19,050	* 16,268	97,244	149,665	56,900	94,485	10,872	6,112	8,371	23,341	22,268

NOTE.—The figures are taken from the annual reports of the Civil Veterinary Department, Madras.

STATEMENT No. 4.

Statement showing the census of oxen, buffaloes, sheep and goats in the different districts according to the latest census of 1930.

District.	Oxen.	Buffaloes.	Sheep.	Goats.
Ganjam	928,887	241,936	179,577	200,320
Vizagapatam	1,204,299	489,527	433,421	366,808
East Godavari	772,813	293,840	60,207	127,463
West Godavari	454,978	273,397	64,337	76,660
Kistna	437,597	454,679	185,327	116,100
Guntur	484,154	727,120	527,610	154,798
Kurnool	360,054	279,786	475,521	209,495
Bellary	404,793	134,937	314,203	200,294
Anantapur	500,307	150,229	987,907	324,324
Cuddapah	272,198	265,871	530,029	222,555
Nellore	618,546	516,014	889,957	395,938
Chingleput	608,151	100,324	307,488	192,461
Madras	10,376	4,879	508	872
South Arcot	904,606	128,356	432,157	386,389
Chittoor	828,501	164,070	810,855	492,945
North Arcot	932,653	153,061	712,085	274,302
Salem	1,155,982	138,000	1,098,023	648,369
Coimbatore	1,003,906	199,233	1,012,361	534,889
Trichinopoly	673,911	163,997	949,945	659,557
Tanjore	836,257	195,942	268,882	506,083
Madura	727,682	131,672	561,277	412,345
Ramnad	433,484	107,593	991,589	281,360
Tinnevely	482,908	160,117	1,150,457	269,974
Malabar	819,068	198,769	6,360	317,163
South Kanara	559,698	213,326	114	27,711
The Nilgiris	32,465	16,799	4,146	6,843
Total	22,440,730		20,270,361	

NOTE.—The figures are taken from the Season and Crop report for the Agricultural year 1929-30.

STATEMENT No. 5.

Statement showing the yearly economical loss from rinderpest during the last wave commencing from 1923-24 to the end of 1931-32, i.e., for a period of nine years.

Average yearly mortality during the current wave from 1923-24 to 1931-32. (Vide statement No. 7) 46,631.

	RS.
1. The cost of the animals that die annually on an average putting the cost at Rs. 40 each	18,65,240
2. Economic loss in the loss of condition of animals which suffer from the disease and recover every year taking the number of recoveries at $1\frac{1}{2}$ times the number of deaths, at the rate of Rs. 5 per animal, i.e., $46,631 \times 1\frac{1}{2} \times 5$	2,91,444
(The ratio of deaths to recoveries is 4:5 according to the figures gathered in actual outbreaks)	
Total	21,56,684

To this must also be added the economical loss in holding up the agricultural work, as the incidence of rinderpest seems to be more severe during the agricultural season. (Please see statement 6).

The figures have been arrived at, basing the calculations on the reported mortality. If the unrecorded deaths are also taken into account, the above figures can easily be doubled.

STATEMENT No. 6.

Statement showing the monthly mortality from rinderpest and rainfall in each district during the period of 6 years ending 1931-32. (Of the two figures against each district the first is the average rainfall for 6 years ending 1931-32 and the second is the average mortality from rinderpest during the same period.)

Districts.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.
Ganjam	1.1	1.9	5.7	6.2	9.6	8.5	9.8	2.9	0.0	0.1	1.0	0.3
Vizagapatam	231	234	239	474	596	612	570	490	320	220	226	239
East Godavari	1.3	2.5	5.9	5.2	6.5	7.6	10.1	3.2	0.2	0.1	1.2	0.4
West Godavari	48	39	27	37	35	42	39	36	34	28	31	35
Kistna	0.5	2.1	6.2	8.1	5.4	6.5	10.5	4.1	0.4	0.2	0.5	0.0
Guntur	67	28	51	119	180	173	126	87	131	99	48	60
Kurnool	0.4	1.5	6.2	8.6	6.9	6.2	7.6	3.3	0.3	0.1	0.4	0.1
Bellary	55	41	20	143	223	128	222	114	55	73	76	54
Anantapur	0.6	1.6	5.2	6.2	6.1	6.4	6.9	3.4	0.1	0.1	0.6	0.2
Cuddapah	217	227	120	170	536	367	231	170	193	153	199	185
Nellore	0.5	1.9	3.8	4.0	4.3	6.0	6.4	4.4	0.3	0.1	0.7	0.0
Chingleput	190	163	178	266	312	280	241	321	264	230	183	172
South Arcot	0.3	1.3	3.7	3.4	2.4	6.1	3.5	1.6	0.1	0.0	0.5	0.1
North Arcot	374	473	426	246	242	275	267	230	184	217	301	520
Chittoor	0.8	1.9	3.3	2.4	1.8	6.2	3.6	1.4	0.2	0.1	0.4	0.2
Salem	344	428	347	180	170	64	106	68	67	155	240	306
Coimbatore	0.5	2.2	2.6	3.0	1.5	6.2	4.0	1.9	0.4	0.0	0.4	0.1
Trichinopoly	480	488	416	286	180	93	95	222	297	318	370	464
Tanjore	0.4	2.2	2.9	2.8	2.4	5.6	5.6	2.9	1.0	0.2	0.4	0.1
Madura	132	142	139	128	101	90	99	122	131	180	157	195
Ramnad	0.6	2.5	1.9	2.6	2.2	4.2	10.2	8.9	2.5	0.4	0.9	0.1
Tinnevely	167	94	74	101	134	81	92	129	152	287	392	361
Malabar	1.0	1.5	2.3	3.0	5.1	4.9	11.2	12.0	4.6	1.0	1.3	0.2
South Kanara	299	272	178	248	212	243	335	552	545	572	471	376
The Nilgiris	2.4	2.5	2.4	2.2	5.0	4.4	9.4	10.7	7.4	1.5	1.0	0.3
	369	261	404	353	559	836	1,044	1,140	1,034	792	559	347
	1.2	2.9	3.6	3.4	3.6	6.5	7.4	6.5	2.3	0.4	1.2	0.3
	305	433	311	368	424	306	455	695	874	576	415	354
	0.8	3.2	3.2	2.9	2.4	5.9	7.1	5.9	2.0	0.3	1.0	0.2
	108	87	79	126	101	83	132	145	124	79	121	117
	2.0	4.5	2.0	2.4	2.5	5.2	5.9	3.7	1.8	0.2	0.9	0.3
	141	178	124	137	158	105	109	125	115	160	165	78
	2.7	4.1	1.3	3.1	1.7	2.7	7.3	4.7	2.1	0.2	1.1	0.4
	270	159	115	151	82	92	77	91	59	65	43	121
	2.0	3.3	1.6	1.5	2.2	4.8	8.3	4.9	3.9	5.0	0.6	0.5
	201	241	192	174	149	124	119	130	166	173	103	94
	2.5	2.7	1.1	2.0	2.8	3.6	9.0	11.4	9.2	3.5	1.1	0.6
	369	551	889	580	288	128	98	165	228	87	64	278
	3.3	3.1	1.1	1.2	1.6	3.9	7.7	6.6	3.2	0.4	1.4	0.6
	109	104	88	83	88	112	71	157	263	223	118	96
	2.8	2.5	0.7	1.1	1.8	2.7	7.2	7.2	4.4	1.4	1.9	0.6
	6	9	3	11	18	14	10	32	31	24	2	25
	2.8	1.5	0.6	0.7	0.5	1.5	5.5	7.4	5.2	1.7	2.7	1.4
	97	124	135	87	27	37	68	73	240	250	126	136
	3.8	7.4	8.6	10.2	10.7	6.7	10.5	6.1	4.1	0.9	1.8	0.7
	86	89	102	38	54	38	55	17	55	45	15	39
	3.8	11.0	26.8	32.7	23.9	9.8	9.5	4.6	1.3	0.1	0.7	0.8
	438	255	393	320	419	392	540	432	420	276	330	232
	2.2	8.4	37.2	44.5	33.1	12.3	11.1	3.2	0.5	0.1	0.2	0.3
	102	112	45	61	74	67	127	198	206	145	100	66
The number of districts having rainy season.	7	9	17	19	22	23	25	21	10	2	..	..
The number of districts in which there was increased incidence of rinderpest.	6	6	6	7	7	6	9	10	10	11	6	6

NOTE.—(1) The rainy season and the period of increased mortality are shown in italics.
(2) The figures for the rainfall in each district are taken from the Season and Crop reports.

STATEMENT No. 7.

Statement showing the cattle mortality from rinderpest in the Madras Presidency during the period of 41 years ending 1931-32.

Year.	Mortality.	Third wave of ten years duration from 1913-14 to 1922-23.	Year.	Mortality.
1891-92	30,596	1913-14	8,871	
1892-93	45,914	1914-15	23,341	
1893-94	31,259	1915-16	22,268	
<i>First wave of nine years duration from 1894-95 to 1902-03.</i>		1916-17	26,215	
1894-95	23,642	1917-18	30,733	
1895-96	28,999	1918-19	44,164	
1896-97	59,990	1919-20	31,237	
1897-98	52,395	1920-21	17,273	
1898-99	42,592	1921-22	10,121	
1899-00	34,062	1922-23	4,279	
1900-01	27,378	Total for ten years .. 218,502		
1901-02	18,644	Average yearly mortality during the third wave .. 21,850		
1902-03	16,555	<i>Fourth wave of nine years duration from 1923-24 to 1931-32.</i>		
Total for nine years .. 304,257		<i>(The wave has not completely subsided.)</i>		
Average yearly mortality during the first wave .. 33,806		1923-24	3,434	
<i>Second wave of ten years duration from 1903-04 to 1912-13.</i>		1924-25	9,681	
1903-04	17,655	1925-26	23,724	
1904-05	19,772	1926-27	23,676	
1905-06	19,050	1927-28	35,803	
1906-07	31,611	1928-29	129,583	
1907-08	97,244	1929-30	106,046	
1908-09	149,666	1930-31	59,323	
1909-10	56,900	1931-32	28,412	
1910-11	24,435	Total for ten years .. 433,017		
1911-12	10,572	Total for nine years .. 419,682		
1912-13	6,112	Average yearly mortality during the second wave .. 43,302		
Average yearly mortality during the second wave .. 43,302		Average yearly mortality during the fourth wave .. 46,631		

NOTE.—The figures are taken from the annual reports of the Civil Veterinary Department, Madras, and old records available at the office of the Board of Revenue.

STATEMENT No. 8.

Statement showing the Talukwar mortality from rinderpest in certain districts for the years 1926-27 to 1931-32.

Taluka.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.
<i>Nellore District.</i>						
Kovvur	Figures not available	465	19	..	..	425
Kandukur	..	34	5	17	110	486
Nellore	..	251	26	4	10	354
Rapur	..	313	2	1	1	266
Gudur	..	90	1	11	..	667
Udayagiri	..	11	1	2	1	36
Kavali	..	395	7	..	31	128
Kanigiri	..	23	584	12	84	213
Atmakur	..	162	2	57	..	204
Peddi	..	7	1	..	417	614
Darsi	..	5	..	1	150	426
Venkatagiri	..	..	..	4	10	166
Sullurpet	..	31	1	15	6	36
Muthukur	..	..	..	..	34	112
<i>January to March 1931.</i>						

NOTE.—The figures are obtained from the District Collectors.

Statement showing the Talukwar mortality from rinderpest in certain districts for the years 1926-27 to 1931-32—cont.

Taluka.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.
<i>Bellary district.</i>						
Adoni taluk	81	678	1,970	1,156	401	47
Alur	65	1,394	2,348	89	97	56
Bellary	93	343	418	75	248	..
Rayadrug	70	294	902	81	222	3
Siruguppa	..	57	587	225	8	..
Hadagalle	94	168	199	109	39	..
Harpanahalle	147	131	128	252	279	716
Hospet	72	29	215	4	5	..
Kudligi	866	559	444	208	5	20

<i>Kurnool district.</i>						
Kurnool	220	156	853	688	613	108
Nandikotkur	87	40	123	2	791	1,041
Markapur	408	14	..	..	331	..
Cumbum	97	5	25	119	12	2,952
Pattikonda	Not available.	..	1,490	36	16	389
Dhone	Do.	..	369	290	530	..
Nandyal	273	..	177	398	842	239
Koilkuntla	206	18	1,430	256	158	4
Sirvel	336	2	551	253	118	105

<i>Trichinopoly district.</i>						
Musiri	1	13	435	390	687	98
Lalgudi	1	2	198	643	100	4
Karur	..	2	45	35	56	..
Kulittalai	2	44	275	267	430	36
Perambalur	..	..	1,967	853	124	8
Udaiyarpalayam	..	5	1,124	1,116	352	348
Trichinopoly	32	104	251	772	231	58

<i>Tanjore district.</i>						
Tanjore	..	..	97	197	34	4
Papanasam	..	5	853	788	5	277
Kumbakonam	..	..	133	683	105	386
Mayavaram	..	53	1,484	1,240	44	2
Shiyali	..	1	707	2,997	113	61
Namillam	..	1	333	2,791	236	61
Negapatam	..	4	178	1,188	1,319	..
Tirutturaipundi	..	..	9	897	2,321	11
Manthargudi	..	..	178	1,382	749	29
Pattukkottai	..	..	24	21	88	3
Arantangi	..	..	..	..	..	2

<i>Ganjam district.</i>						
Chatrapur	390	795	961	908	544	188
Berhampur	389	566	2,412	880	608	184
Chicacole	142	459	442	1,808	278	260
Ghumsur	106	946	2,410	415	531	89
Aska	123	531	433	632	967	269
Parlakimedi	172	216	1,101	1,552	160	123
Itchehapur	2	59	359	30	8	43
Sompeta	38	55	96	489	268	40
Tekkali	66	236	76	1,060	141	54
Surada	16	58	135	29	118	16
Kudala	8	14	725	140	26	82

NOTE.—The figures are obtained from the District Collectors.

STATEMENT No. 9.

Statement showing the death-rate from rinderpest in the districts of the Madras Presidency arranged on the basis of geographical and climatic conditions.

Districts.	Average mortality for 19 years ending 1931-32.	Mean cattle census for 14 years from 1919 to 1932.	Death-rate per 10,000.
<i>Northern Circars.</i>			
Guntur	1,758	1,163,922	15.1
<i>Carnatic districts.</i>			
Nellore	1,330	1,074,839	12.4
Chingleput	2,063	785,547	26.3
South Arcot	3,786	1,065,022	35.5
Total	7,179	2,925,408	24.5
<i>Southern districts.</i>			
Tanjore	1,475	1,037,172	14.2
Madura	726	910,763	8.0
Ramnad	167	575,923	2.9
Tinnevely	763	626,629	12.2
Total	3,131	3,150,487	9.9
<i>The Deccan.</i>			
Kurnool	2,604	630,437	41.3
Bellary	1,327	525,500	25.3
Anantapur	2,441	633,721	38.5
Cuddapah	1,032	548,987	18.8
Total	7,404	2,338,645	31.7
<i>The Central districts.</i>			
North Arcot	2,672	1,111,859	24.0
Salem	680	1,266,875	5.4
Coimbatore	664	1,205,434	5.5
Total	4,016	3,584,168	11.2
<i>The West Coast districts.</i>			
Malabar	1,752	998,483	17.5
South Kanara	972	750,186	13.0
Total	2,724	1,728,669	15.8
<i>Hill districts.</i>			
The Nilgiris	261	53,042	49.1
Total for 18 districts	26,473	14,964,441	17.7

NOTE.—(i) Ganjam, Vizagapatam, East and West Godavari, Kistna and Trichinopoly districts are omitted in this statement as they underwent territorial changes during the period.

(ii) Chittoor district was omitted as the southern portion of it has to be included under the Central districts and the northern portion under the Deccan, and as cattle mortality figures are not available for the two portions separately.

(iii) The above classification is the one adopted in the statistical atlas.

(iv) The cattle census figures prior to 1919 seem to be unreliable. Hence only 14 years figures have been taken for striking the mean.

STATEMENT No. 10.

Statement showing the average yearly death-rates from rinderpest in the several districts for the past 19 years ending with 1931-32 and the average yearly rainfall for 40 years ending with 1930.

Districts.	Average yearly death-rates for 10,000 cattle for 19 years ending with 1931-32.	Average rainfall during the 40 years ending 1930.	Districts.	Average yearly death-rates for 10,000 cattle for 19 years ending with 1931-32.	Average rainfall during the 40 years ending 1930.
Ramnad	2.9	32.5	North Arcot	24.0	40.6
Salem	5.4	34.2	Bellary	25.3	23.9
Coimbatore	5.5	27.1	Chingleput	26.3	48.5
Chittoor	8.1	31.6	South Arcot	35.5	47.1
Madura	8.0	32.1	Anantapur	38.5	21.9
Nellore	12.4	35.7	Kurnool	41.3	24.0
Tinnevely	12.2	29.8	The Nilgiris	49.1	76.1
South Kanara	13.0	145.6			
Tanjore	14.0	44.9			
Guntur	15.1	32.9			
Malabar	17.5	120.5			
Cuddapah	18.8	20.1			

NOTE.—The figures for the average rainfall are taken from the Fort St. George Gazette.

REMARKS.—There may not be any appreciable variation between the average rainfall for 19 years ending 1932 and the average for 40 years ending 1930.

STATEMENT No. 11.

Statement showing the average yearly death-rates from rinderpest in the several districts for the past 19 years ending with 1931-32 and the density of cattle census in each district according to the census of 1930.

Districts.	Average yearly death-rates for 10,000 for 19 years ending with 1931-32.	Cattle census including buffaloes per 1/10 square mile.	Districts.	Average yearly death-rates for 10,000 for 19 years ending with 1931-32.	Cattle census including buffaloes per 1/10 square mile.
Ramnad	2.9	11.2	Malabar	17.5	17.6
Salem	5.4	18.7	Cuddapah	18.8	10.0
Coimbatore	5.5	16.7	North Arcot	24.0	21.9
Chittoor	8.1	17.7	Bellary	25.3	8.2
Madura	8.0	17.5	Chingleput	26.3	28.0
Nellore	12.4	14.2	South Arcot	35.5	24.6
Tinnevely	12.2	14.0	Anantapur	38.5	9.7
South Kanara	13.0	19.2	Kurnool	41.3	8.4
Tanjore	14.0	27.7	The Nilgiris	49.1	5.0
Guntur	15.1	21.1			

NOTE.—The figures for the total area of each district are taken from the latest annual reports of the Public Health Department.

STATEMENT No. 12.

Statement showing the number of weekly and annual cattle fairs held in each district and the average yearly death-rates from rinderpest per 10,000 of cattle census during the period of 19 years ending with 1931-32.

District.	Number of weekly cattle markets.	Number of annual cattle fairs.	Total.	Death-rate per 10,000.	District.	Number of weekly cattle markets.	Number of annual cattle fairs.	Total.	Death-rate per 10,000.
South Arcot	18	4	22	35.5	Malabar	3	1	4	17.5
Madura	4	13	17	8.0	Chingleput	3	..	3	26.3
Coimbatore	10	6	16	5.5	South Kanara	..	2	2	13.0
Salem	9	7	16	5.4	Ramnad	..	2	2	2.9
North Arcot	14	1	15	24.0	Kurnool	..	2	2	41.3
Tinnevely	1	12	13	12.2	Nellore	..	..	..	12.4
Tanjore	7	1	8	14.2	Guntur	..	..	..	15.1
Bellary	..	6	6	25.3	Cuddapah	..	..	..	18.8
Anantapur	..	5	5	38.5	The Nilgiris	..	..	..	49.1
Chittoor	1	4	5	8.1					

NOTE.—The figures for the number of weekly cattle markets and annual cattle fairs are collected from the District Veterinary Officers and from the latest Village Calendar.

STATEMENT No. 13.

Statement showing the average yearly death-rate per 10,000 of cattle census during the past 19 years ending with 1931-32 and the ratio of buffaloes, sheep and goats to one hundred of oxen in the different districts according to the latest census of 1930.

Districts.	Death-rates.	Oxen.	Buffaloes.	Sheep.	Goats.	Districts.	Death-rates.	Oxen.	Buffaloes.	Sheep.	Goats.
Ramnad	2.9	100	24	208	64	Malabar	17.5	100	25	1	39
Salem	5.4	100	13	95	55	Cuddapah	18.8	100	103	195	51
Coimbatore	5.5	100	19	190	51	North Arcot	24.0	100	44	73	29
Chittoor	8.1	100	19	97	58	Bellary	25.3	100	31	71	50
Madura	8.0	100	18	73	58	Chingleput	26.3	100	32	51	32
Nellore	12.4	100	81	142	62	South Arcot	35.5	100	15	44	44
Tinnevely	12.2	100	35	243	61	Anantapur	38.5	100	31	192	62
South Kanara	13.0	100	41	1	4	Kurnool	41.3	100	73	183	59
Tanjore	14.2	100	24	30	61	The Nilgiris	49.1	100	52	13	20
Guntur	15.1	100	146	103	31						

STATEMENT No. 14.

Statement showing the number of inoculations done by serum alone method and by serum simultaneous method and the mortality from rinderpest in the Presidency for the past 32 years.

Year.	Serum alone inoculations.	Serum simultaneous inoculations.	Cattle mortality from rinderpest.	Year.	Serum alone inoculations.	Serum simultaneous inoculations.	Cattle mortality from rinderpest.
1900-01	60	..	27,376	1918-19	126,087	..	41,164
1901-02	..	..	18,644	1919-20	85,294	..	31,237
1902-03	377	..	16,555	1920-21	66,080	69	17,278
1903-04	2,805	..	17,655	1921-22	61,391	153	10,121
1904-05	8,251	..	19,772	1922-23	21,159	394	4,279
1905-06	12,689	..	19,050	1923-24	8,273	255	3,434
1906-07	11,043	..	31,611	1924-25	10,213	212	9,681
1907-08	28,788	..	37,244	1925-26	144,342	523	23,724
1908-09	48,357	..	149,866	1926-27	181,656	597	23,676
1909-10	46,832	..	56,900	1927-28	184,821	6,132	36,803
1910-11	21,086	..	24,435	1928-29	170,037	82,923	129,533
1911-12	13,058	..	19,572	1929-30	13,052	168,780	109,046
1912-13	30,393	..	6,112	1930-31	1,116	141,933	69,324
1913-14	33,847	..	5,371	1931-32	713	108,365	28,412
1914-15	23,241	..	23,241				
1915-16	90,893	..	22,268				
1916-17	100,463	..	26,215				
1917-18	97,388	..	30,733				

NOTE.—(i) The few sheep and goats inoculated have been omitted from this statement except for the years 1903-04 to 1906-07.

(ii) The figures for the number of inoculations are gathered from the annual reports of the Civil Veterinary Department, Madras.

STATEMENT NO. 15.

Statement showing the number of serum simultaneous inoculations done against rinderpest during the last 13 years ending 1931-32 and the percentage of animals inoculated up to the end of 1931-32.

Districts.	Number of inoculations done (Bovines).													Total inoculations.	Cattle census.	Percentage of inoculations done to the cattle census.
	1919-20.	1920-21.	1921-22.	1922-23.	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.			
Ganjam	..	..	..	..	..	..	..	..	..	..	..	..	..	4,092	1,170,823	35
Vizagapatam	..	..	..	..	..	..	..	..	..	..	..	..	..	8,506	1,693,820	50
Goavari, East	..	..	..	..	..	..	..	..	..	..	..	..	..	28,092	1,006,653	28
Goavari, West	..	..	..	..	..	..	..	..	..	..	..	..	..	17,458	728,373	24
Kistna	..	..	..	..	..	..	..	..	..	..	..	..	..	35,006	892,276	39
Guntur	..	..	..	..	..	..	..	..	..	..	..	..	..	27,746	1,211,274	23
Kurupol	..	..	..	..	..	..	..	..	..	..	..	..	..	10,773	639,710	17
Bellary	..	..	..	..	..	..	..	..	..	..	..	..	..	18,768	538,596	35
Avanapur	..	..	..	..	..	..	..	..	..	..	..	..	..	28,017	1,134,500	25
Chidambaram	..	..	..	..	..	..	..	..	..	..	..	..	..	46,568	788,476	59
Nellore	..	..	..	..	..	..	..	..	..	..	..	..	..	59,953	1,032,962	58
Chingapur	..	..	..	..	..	..	..	..	..	..	..	..	..	27,910	1,085,714	26
North Arcot	..	..	..	..	..	..	..	..	..	..	..	..	..	22,913	992,571	23
North Arcot	..	..	..	..	..	..	..	..	..	..	..	..	..	13,986	1,293,092	11
Uttar	..	..	..	..	..	..	..	..	..	..	..	..	..	15,607	1,303,189	12
Salem	..	..	..	..	..	..	..	..	..	..	..	..	..	23,038	837,908	27
Coimbatore	..	..	..	..	..	..	..	..	..	..	..	..	..	35,977	1,065,324	34
Tiruchinopoly	..	..	..	..	..	..	..	..	..	..	..	..	..	12,787	541,079	24
Tanjore	..	..	..	..	..	..	..	..	..	..	..	..	..	4,724	40,264	12
Ramanathapuram	..	..	..	..	..	..	..	..	..	..	..	..	..	20,501	1,071,837	19
Tinnevely	..	..	..	..	..	..	..	..	..	..	..	..	..	18,436	773,021	24
The Nilgiris	..	..	..	..	..	..	..	..	..	..	..	..	..	32,531	15,255	215
South Kanar	..	..	..	..	..	..	..	..	..	..	..	..	..	3,182	3,182	100
Madras City	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Agency Districts	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total for Presidency	69	156	204	285	312	529	597	612	612	82,925	185,780	141,933	108,265	510,339	22,440,730	23

STATEMENT NO. 16.

Statement showing the number of rinderpest outbreak reports received, the average mortality in each outbreak (i.e., affected village), the average number of serum alone and serum simultaneous inoculations done in each outbreak (affected village) in the Presidency during the past 15 years.

Year.	Average cattle census in each village, i.e., the total cattle census divided by the number of villages in the Presidency .. 22,440,730	Number of rinderpest outbreak reports received (i.e. the number of villages affected).	Total mortality from rinderpest.	Average mortality from rinderpest in each outbreak (i.e. village).	Total number of serum alone inoculations done.	Average number of serum alone inoculations done in each outbreak or village.	Total number of serum simultaneous inoculations done (Bovines).	Average number of serum simultaneous inoculations done per outbreak (i.e. village).
1917-18	40,850.	550	1,265	30,733	24	67,362	77	..
1918-19	550	1,904	41,164	22	126,087	66	..	..
1919-20	550	1,730	31,237	18	85,294	40	69	0.04
1920-21	550	1,363	17,273	13	65,980	48	158	0.2
1921-22	550	810	10,121	12	61,301	76	304	0.9
1922-23	550	833	4,279	13	21,159	64	235	1.7
1923-24	550	172	3,434	20	3,273	19	212	0.5
1924-25	550	470	9,681	21	10,216	22	529	0.5
1925-26	550	1,007	23,724	22	144,843	132	597	0.5
1926-27	550	1,289	23,676	18	181,656	141	612	0.5
1927-28	550	1,757	35,803	20	184,821	105	82,925	3.5
1928-29	550	5,150	129,583	25	170,037	38	108,780	16.00
1929-30	550	5,484	106,046	19	13,052	2	141,933	31.00
1930-31	550	3,339	59,323	18	1,116	0.3	108,365	42.00
1931-32	550	1,320	23,412	22	719	0.5	..	..

REMARKS.—The mother village and its hamlets are taken as one village. The number of villages entered in this statement is taken from the census of 1921, and it excludes the villages of Ganjam and Vizagapatam Agency.

NOTE.—The figures for the number of rinderpest outbreak reports received are gathered from the annual reports of the Civil Veterinary Department, Madras, and from information obtained from the District Veterinary Officers.

STATEMENT NO. 17.

Statement showing the number of outbreak reports received, the number attended, the number in which inoculation was undertaken and the average number of serum simultaneous inoculations done in each outbreak.

Year.	Number of outbreak reports received.	Number of outbreak reports attended.	Number of outbreaks in which inoculation was done.	Number of serum simultaneous inoculations.	Average number of serum simultaneous inoculations done.	
					For each outbreak report received.	For each outbreak report in which inoculation was done.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1927-28	1,757	1,554	16	6,182	3.5	387
1928-29	5,150	4,318	739	82,925	16.0	112
1929-30	5,484	4,625	1,766	108,780	31.0	98
1930-31	3,339	3,112	1,443	141,933	42.0	123
1931-32	1,320	Not known.	883	108,365	82.0	..

NOTE.—The figures for the number of rinderpest outbreak reports received are gathered from the annual reports of the Civil Veterinary Department, Madras, and from information obtained from the District Veterinary Officers.

STATEMENT NO. 18-A.

Statement showing the immunity tests conducted with virus alone on animals inoculated by serum simultaneous method against rinderpest, arranged according to the breed and the period of time that elapsed between the date of inoculation and the date of testing with virus alone.

Number of tests conducted.	Breed.	The period of time in years, that elapsed between the date of inoculation and the date of testing with virus alone.																				Results of the test.			The number of tests for which controls were used and the reactions in the controls.	
																						Solid immunity.	Partial immunity.	Complete break-down in immunity.		
		$\frac{1}{2}$	1	1 $\frac{1}{2}$	2	2 $\frac{1}{2}$	3	3 $\frac{1}{2}$	4	4 $\frac{1}{2}$	5	5 $\frac{1}{2}$	6	6 $\frac{1}{2}$	7	7 $\frac{1}{2}$	8	8 $\frac{1}{2}$	9	9 $\frac{1}{2}$	10					10 $\frac{1}{2}$
43	Ongoles ..	..	..	5	4	1	2	2	8	1	1	..	..	2	4	6	..	..	5	1	1	..	34	..	..	For 81 tests controls were used and they reacted satisfactorily.
13	Mixed country ..	..	..	..	1	..	..	4	2	..	1	..	..	5	..	..	..	..	..	..	..	12	1 (c)	8 (a)		
4	Mysore ..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	1 (d)	..		
2	Sindhi ..	..	..	1	..	..	1	..	..	..	..	..	..	2	..	..	..	..	..	..	..	2	..	..		
11	Cross-breeds ..	1	..	1	6	..	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..		
1	Montgomery ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	1 (b)	..		
15	Kangayam ..	..	..	2	4	1	2	..	4	2	..	..	..	..	..	..	..	..	..	..	..	1	..	..		
2	Delhi buffaloes ..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..		
1	Do. ..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..		
62	..	1	..	8	18	2	7	8	17	3	2	..	..	9	4	6	..	..	5	1	1	..	81	3	8	

(a) Among the eight animals which had a breakdown in immunity two were inoculated 7 1/2 years prior to the test, two 6 1/2 years, one 4 1/2 years and three, 1 1/2 years prior to the test. They were aged a year and below at the time of inoculation.

(b) This animal was inoculated four months prior to the test. It was only a month old when inoculated.

(c) This animal was five years old when inoculated and nine years old at the time of test. The immunity seems to have partially waned away four years after inoculation.

(d) This animal was aged ten years when inoculated and 14 years when tested. The immunity seems to have partially waned away four years after inoculation.

STATEMENT No. 18-B.

Statement showing the tests conducted with virus alone on animals inoculated by serum simultaneous method arranged according to the age at the time of inoculation.

Ages of the animals at the time of inoculation.	Ongole.		Kangayam.		Mixed country.		Mysore.		Shadhi.	
	Number tested.	Cases of break-down.	Number tested.	Cases of break-down.	Number tested.	Cases of break-down.	Number tested.	Cases of break-down.	Number tested.	Cases of break-down.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Within 6 months	5	4 (a)	..	..	..	..	..	..	..	..
6 months to 1 year	3	4 (b)	..	..	..	..	..	..	..	..
2 years	7	..	..	..	..	..	..	..	..	..
3 "	3	..	..	..	..	..	..	..	..	..
4 "	7	(c) 1 (f)	..	..	..	..	..	..	..	..
5 "	2	..	..	..	..	..	..	..	..	..
6 "	3	..	..	..	..	..	..	..	..	..
7 "	1	..	..	..	..	..	..	..	..	..
8 "	1	..	..	..	..	..	..	..	..	..
9 "	1	..	..	..	..	..	..	..	..	..
10 "	1	..	..	..	..	..	..	..	..	..
11 "	1	..	..	..	..	..	..	..	..	..
12 "	1	..	..	..	..	..	..	..	..	..
13 "	1	..	..	..	..	..	..	..	..	..
14 "	1	..	..	..	..	..	..	..	..	..
15 "	1	..	..	..	..	..	..	..	..	..
Ages not known	2	..	..	..	..	..	..	..	..	..
Total	43	8 and 1 (f)	15	..	13	1 (f)	4	..	2	..

Ages of the animals at the time of inoculation.	Cross breeds.		Montgomery.		Delhi buffalo country breed.		Delhi buffalo.		Total.	
	Number tested.	Cases of break-down.	Number tested.	Cases of break-down.	Number tested.	Cases of break-down.	Number tested.	Cases of break-down.	Number tested.	Cases of break-down.
(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Within 6 months	1	(e) 1 (f)	..	..	..	..	..	..	1	4 and 1 (f)
6 months to 1 year	..	..	..	..	..	..	..	..	..	..
2 years	..	..	..	..	..	..	..	..	..	..
3 "	..	..	..	..	..	..	..	..	..	..
4 "	..	..	..	..	..	..	..	..	..	..
5 "	..	..	..	..	..	..	..	..	..	..
6 "	..	..	..	..	..	..	..	..	..	..
7 "	..	..	..	..	..	..	..	..	..	..
8 "	..	..	..	..	..	..	..	..	..	..
9 "	..	..	..	..	..	..	..	..	..	..
10 "	..	..	..	..	..	..	..	..	..	..
11 "	..	..	..	..	..	..	..	..	..	..
12 "	..	..	..	..	..	..	..	..	..	..
13 "	..	..	..	..	..	..	..	..	..	..
14 "	..	..	..	..	..	..	..	..	..	..
15 "	..	..	..	..	..	..	..	..	..	..
Ages not known	..	..	..	..	..	..	..	..	..	..
Total	11	1 (f)	1	..	2	..	1	..	15	8 and 3 (f)

(a) The interval between the date of inoculation and the date of testing of these 4 animals is 1½ years, 1½ years, 1½ years and 7½ years respectively.

(b) The interval between the date of inoculation and the date of testing of these 4 animals is 7½ years, 6½ years, 6½ years and 4½ years respectively.

(c) The interval between the date of inoculation and the date of testing of this animal is 4 years.

(d) Do.

(e) Do.

(f) Indicates partial break-down of immunity.

STATEMENT No. 19.

Statement showing the nature of reactions in reinoculations done in June and July 1932 at the Livestock Research Station, Hosur Cattle Farm.

The animals are arranged below according to the number of previous inoculations done—

Number of previous inoculations.		Nature of reactions.		
While the animal was under two years of age.	While the animal was over two years of age.	Number of animals inoculated.	Number of animals reacted with the nature of reaction.	Number not reacted.
1	Nil	61	11 mild, 4 good, 10 severe and 2 very severe. Total 27.	34
2	Nil	101	11 mild, 1 good and 5 severe. Total 17.	84
3	Nil	5	..	5
Nil	1	15	..	15
1	1	30	1 mild	29
2	1	45	..	45
3	1	2	..	2
Nil	2	52	..	52
1	2	10	..	10
2	2	10	..	10
Nil	3	1	..	1
1	3	1	..	1
Total	..	333	23 mild, 5 good, 15 severe and 2 very severe. Total 45.	288

They are again arranged below according to the interval between the date of last inoculation and the date of present inoculation—

Interval between the date of last inoculation to the date of present inoculation.	Nature of reactions.		
	Number of animals inoculated.	Number of animals reacted with the nature of reactions.	Number of animals not reacted.
1 year	2	1 mild	1
1½ years	186	21 mild, 5 good, 15 severe and 2 very severe. Total 43.	143
2 "	29	Nil	29
2½ "	15	..	15
3 "	18	..	18
4 "	52	1 mild	51
4½ "	31	Nil	31
Total	333	23 mild, 5 good, 15 severe and 2 very severe. Total 45.	288

STATEMENT No. 20.

Statement showing the behaviour of the animals inoculated by the serum simultaneous method against rinderpest with regard to their immunity during a subsequent outbreak of rinderpest.

The period of time that elapsed from the date of inoculation to the date of subsequent outbreak of rinderpest to which the inoculated animals were exposed.	Inoculated animals.			Causes for the break-down in immunity.				Uninoculated animals.		
	Adults.	Calves.	Total.	Number of deaths from rinderpest.	Percentage of deaths to the total inoculated.	Not investigated.	Young age at the time of inoculation.	Defects of virus used for inoculation.	Wanting of immunity due to attributed to any other cause.	Total number of un-inoculated cattle.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
6 months to 1 year	37	3,830	515	4,245	9	0.2	..	..	..	49,770
1½ years	23	1,777	201	1,978	5	0.3	..	..	..	16,504
2 "	223	1,869	226	2,095	4	0.2	..	..	..	23,710
2½ "	8	998	97	1,093	4	0.4	..	..	..	9,375
3 "	..	2,103	454	2,557	..	..	..	..	..	15,071
3½ "	..	354	74	428	..	..	..	..	..	875
4 "	..	579	107	686	3	0.4	..	..	..	8,479
4½ "	..	164	6	170	..	..	..	..	..	230
6 "	..	71	41	112	..	..	..	..	..	4,883
6½ "	..	87	7	94	..	..	..	..	..	2,759
Total	105	11,930	1,728	13,558	25	0.2	11	4	2	135,061

REMARKS.—It is generally the common experience that the number of deaths recorded in an outbreak of cattle disease in a village is far less than the actual number. The actual mortality in the subsequent outbreaks is certainly far more than what is shown in column 13 of the statement. Again the number of the uninoculated cattle given in column 12 includes not only the cattle population of the village or hamlet in which inoculations have been done but also the several hamlets which comprise each village, as cattle census figures for each village and for each hamlet are not available separately. Taking all these into consideration the percentage of deaths among the uninoculated should have been far more—at least four or five times more than what is given in column 14.

STATEMENT No. 21.

Statement showing the deaths among the animals inoculated by the serum simultaneous method within six months from the date of inoculation.

District.	Number of villages visited.	Number inoculated.	Deaths after inoculation.		
			Within 14 days.	15th day to sixth month.	Total.
Nellore	..	15	..	..	..
Coimbatore	..	3,983	44	98	142
Cuddapah	..	978	20	1	21
Kistna	..	621	2	..	2
Bellary	..	292	..	..	..
Malabar	..	385	6	38	44
Anantapur	..	556	11	4	15
Madura	..	279	..	6	6
Tanjore	..	1,222	3	12	15
The Nilgiris	..	79	..	2	2
North Arcot	..	15	..	6	6
Vizagapatam	..	487	..	15	15
	..	348	..	4	4
Total	57	9,250	86	186*	272

REMARKS.—Percentage of deaths to the total inoculations.—2.9.

* One hundred and twenty-eight deaths from the 15th to 30th day after inoculation. Nineteen deaths during the 2nd month after inoculation. Fourteen deaths during the 3rd month after inoculation. Twenty-five deaths during the 4th, 5th and 6th months after inoculation.

STATEMENT NO. 22.

A comparison of reactions shown by the primarily inoculated calves, whose dams were inoculated by serum simultaneous method when these calves were in utero with those shown by the primarily inoculated calves, the dams of which had been inoculated prior to their conception of these calves.

Age of calves at the time of inoculation.	Breed.	Inoculated calves the dams of which were inoculated when these calves were in utero.							Inoculated calves the dams of which had been inoculated prior to their conception of these calves.						
		Number inoculated.	Number reacted.	Nature of reaction.				Percentage of reactors.	Number inoculated.	Number reacted.	Percentage of reactors.	Nature of reaction.			
				Mild.	Good.	Severe.	Very severe.					Mild.	Good.	Severe.	Very severe.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Six months of age and below. Over six months and less than one year. Between one and two years.	Ongoles, Kangayams, Sindhi and crosses.	1	..	..	..	..	..	..	63	14	22	14	..	..	..
		15	13	87	3	6	2	2	53	44	83	13	25	6	..
		9	7	78	5	2	..	..	57	34	60	12	14	5	3
		Total	25	20	80	8	8	2	183	92	60	39	39	11	3

NOTE.—The information as to the dates of inoculation of the dams is gathered from the records available at the Hosur Cattle Farm.

STATEMENT NO. 23.

Statement showing the particulars of animals which have shown the so-called anaphylaxis or protein reaction during serum simultaneous inoculations against rinderpest at Hosur Cattle Farm in June and July 1932.

		Number of animals inoculated by serum simultaneous method in June and July 1932.							
Age of the animals at the time of inoculation.	Breed.	Number of animals inoculated previously against rinderpest or black-quarter.			Number of animals not inoculated previously against rinderpest or black-quarter.			Total.	
		Number that showed anaphylaxis.	Number that did not show anaphylaxis.	Total.	Number that showed anaphylaxis.	Number that did not show anaphylaxis.	Total.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Below 2 years	Cross-breed	..	4	26	30	1	10	11	41
	Sindhi	..	3	32	35	..	16	16	51
	Kangayam	..	6	73	79	..	35	35	114
	Ongole	..	5	17	22	..	6	6	28
	Total	..	18	148	166	1	67	68	234
Between 2 and 4 years.	Cross-breed	..	19	12	31	..	..	..	31
	Sindhi	..	16	21	37	..	..	..	37
	Kangayam	..	4	49	53	..	..	..	53
	Ongole	..	11	5	16	..	..	..	16
	Total	..	50	87	137	..	..	..	137
Above 4 years	Cross-breed	..	6	17	23	..	..	..	23
	Sindhi	..	7	35	42	..	..	..	42
	Kangayam	..	1	56	57	..	..	..	57
	Ongole	..	4	16	20	..	..	..	20
	Total	..	18	124	142	..	..	..	142
	Grand total	..	86	359	445	1	67	68	513

STATEMENT NO. 24.

Extracts from the Statistical Atlas of the Madras Presidency (1924).

(1)

Cattle breeding.

Agency Division.—Scientific cattle breeding is unknown and there are no breeding bulls.

Ganjam district.—Cattle breeding on a commercial scale is nowhere a common practice in the district.

Vizagapatam district.—Cattle breeding, except of the inferior non-descript breeds, is nowhere a common practice.

Godavari.—Scientific cattle breeding is unknown in the district. Here and there, Brahmini bulls are let loose and left to improve the breed.

Kistna.—Systematic cattle breeding is unknown in the district.

Guntur district.—The addition of Ongole taluk to this district since 1905 has brought with it a fine breed of cattle and cattle shows were being held every year up to 1918. There is no doubt that the price of cattle have risen considerably on account of this show, and that the animals were being exported in large numbers to foreign countries such as Brazil and Java. In order to improve the breed of cattle, good Brahmini bulls used to be purchased by the Government and supplied to important centres. But there are at present no such bulls anywhere in the district.

Nellore district.—Nellore is one of the chief cattle breeding districts in the Presidency. There is a fine farm at Chintaladevi since abolished—in the Kavali taluk. In other places, breeding is not, however, carried on in a thoroughly systematic manner, there being no proper arrangements for preventing the promiscuous inter-breeding of cattle. The absence of good and abundant fodder in most parts of the district together with the unrestricted crossing allowed with inferior bulls produce a miserable, stunted and undersized breed.

Cuddapah district.—Cattle breeding, except for inferior non-descript animals does not exist in the district.

Anantapur.—There is no scientific cattle breeding worth the name in this district.

Bellary.—Systematic cattle breeding is still unknown.

Chingleput district.—The cattle of the district are of a small and inferior type and usually poorly fed. No attempt is made to improve the breed of cattle.

Chittoor.—Cattle breeding does not exist in any part of the district as a special trade. The ryot does not seem to pay special attention to this very important industry. In a few villages of the Palmaner taluk and in certain zamiindari areas such as Punganur, Kallur and Pulicherla polliems, a few cattle of a very ordinary type are bred. Punganur was once famous for its breed of milch cattle, but it is now practically extinct.

North Arcot.—The breeding of cattle is an art unknown or at best little understood in the district. For agricultural and domestic purposes, the ryots of the district depend very largely on cattle imported from Mysore and other out-lying districts.

South Arcot.—The cattle available in the district are of inferior breed and are generally fit for the plough only.

Tanjore.—Cattle breeding is conducted to a very small extent; cattle are imported from Salem and other districts. The cattle of the district are poor and small.

Trichinopoly.—There is no organized system of breeding.

Madura.—Cattle breeding is not carried on to any appreciable extent in any of the taluks. Periyakulam of all the taluks in the district affords the greatest facilities for cattle breeding; but they are not largely availed of.

Ramnad.—There is little or no cattle breeding in the district.

Tinnevely.—There is little or no cattle breeding in the district, except the non-descript breeds kept for their dung. There is no useful breeding in the district except to a limited extent in the Kaliavur side of Srivaikuntam taluk.

Coimbatore.—Three breeds of cattle are chiefly found in this district—the Kollegal, the Burghur and the Kangayam breeds. The Burghur cattle are swiftest and strongest of the breeds, the Kangayam cattle are well known for their excellent qualities, whether for labour or milk and the Kollegal cattle are well fitted for purposes of heavy draught. The Kollegal cattle are bred in the hills and forests of Kollegal taluk and the Burghur cattle on the Burghur hills of Bhavani and in the neighbourhood. Cattle breeding is conducted on a large scale in the Kollegal taluk chiefly in Punachi, Madheswaram hills, Hoogiyan and Adabalnatham. The Kangayam cattle are bred all over the central parts of the district. The chief cattle fairs held in the district are those of Madheswaran-malai in Kollegal, Avanashi and Tiruppur. Many cattle are brought to the important weekly markets for sale.

The Nilgiris.—The buffaloes kept by the Todas for their milk are short and powerful animals and thrive well on the plateau but bullocks and cows do not. The cattle in the district are mostly poor specimens and are ill-fed, except that milch cows and buffaloes are daily allowed some barley or cotton seed as long as they are in milk. Endeavours to breed foreign cattle and sheep have

STATEMENT No. 28.

Statement showing the number of serum simultaneous inoculations done against rinderpest with different doses of special anti-rinderpest serum—class II—received from Muktesar.

Dose of serum in c.c. given per 100 lb. body weight.	Number inoculated.	Breed.	Number of animals for which controls were used.	Nature of reactions in controls.	Number Hyper-immunized.	Number reacted.	Nature of reactions in the inoculated.				Any complications such as pyrexia, oedema, trypanosomiasis, etc., in the inoculated during the reaction period.	Number of deaths in the inoculated.
							Mild.	Good.	Severe.	Very severe.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
6	12 (a)	Ongoles ..	5	Satisfactory.	NIL.	10	..	8	2	..	..	..
7	26 (b)	Do. ..	30	Do.	19	31	9	15	4	..	..	..
8	11	Do. ..	2	Do.	NIL.	5	3	2	..	..	..	..
9	17	Do. ..	17	Do.	2	16	8	6	2	..	..	..
9	26	Kangayam ..	26	Do.	4	26	8	17	1	..	..	..
9	26	Sindhi ..	26	Do.	5	26	8	17	1	..	..	..
9	2	Buffaloes ..	2	Do.	NIL.	4	..	4	..	..	..	1 (c)
8	7	Do. ..	2	Do.	NIL.	2	1	..	..	..	..	1 (c)
9	2	Do. ..	2	Do.	NIL.	..	..	..	..	..	..	..
129												
Calves weighing less than 300 lbs. which were given a minimum dose.												
15	2	Ongoles ..	2	Satisfactory.	..	2	..	2	..	..	..	..
20	24	Do. ..	24	Do.	13	24	1	6	6	1	..	..
20	11	Do. ..	11	Do.	5	11	4	2	..	..	..	..
20	26	Kangayam ..	26	Do.	2	26	15	10	2	..	..	..
20	21	Sindhi ..	21	Do.	..	21	5	4	..	..	..	..
25 c.c.	1	Do. ..	1	Do.	..	1	1	..	..	..	..	..
30 c.c.	2	Do. ..	2	Do.	..	2	1	..	..	..	..	..
117												
254 Grand total.												

REMARKS.—(a) Out of these, 4 animals, after they had definitely shown the reactions, had to be given a second dose of serum between the 7th and 10th day after inoculation to avoid the risk of death.

(b) Out of these, 15 animals, after they had definitely shown the reactions, had to be given a second dose of serum between the 7th and the 9th day after inoculation, to avoid the risk of death.

(c) Died of other causes.

(d) Died of severe reaction.

The serum given for all the animals in this statement was special anti-rinderpest serum, class II of the Imperial Institute of Veterinary Research, Muktesar, and virus was supplied from the Madras Veterinary College and the Serum Institute, Madras.

STATEMENT No. 29.

Statement showing the nature of reactions in the primary inoculations done at Hosur Cattle Farm in June and July 1932.

Dose of serum per 100 lb. body weight.	Breed.	Number of animals inoculated.	Number of animals reacted.	Percentage of reactions.	Nature of reactions.				Deaths among the inoculated, if any.	Nature of reactions in controls.
					Mild.	Good.	Severe.	Very severe.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Animals below 6 months of age.										
9 c.c. of class II serum (Muktesar) for all Indian breeds except in the case of pregnant animals, which received an additional quantity of 5 to 15 c.c. on the whole; 20 c.c. for cross-breeds and 25 for 4 cross-breeds—Serum Class I of Muktesar.	Kangayam ..	32	6	19	6	..	..	..	..	The controls used for inoculations on the 15th and 16th June and 17th and 18th July reacted satisfactorily. The controls used for inoculations done on the 23rd July were very young (about 4 months old). They did not react, but the reactions in the inoculated animals were satisfactory.
	Ongole ..	6	..	..	..	..	..	..	..	
	Sindhi ..	14	5	36	..	..	..	..	..	
	Cross-breeds ..	12	3	25	8	..	..	..	..	
	Total ..	64	14	22	14	..	..	..	..	
Animals over 6 months and under 1 year of age.										
	Kangayam ..	35	32	91	15	17	3	..	..	
	Ongole ..	9	9	100	2	5	2	..	..	
	Sindhi ..	15	11	73	1	8	2	..	..	
	Cross-breeds ..	9	5	56	1	1	1	2	..	
	Total ..	68	57	84	18	31	6	2	..	
Animals over 1 year and below 2 years of age.										
	Kangayam ..	19	13	68	8	10	..	..	..	
	Ongole ..	8	5	63	3	2	..	..	..	
	Sindhi ..	12	9	75	5	3	..	1	..	
	Cross-breeds ..	10	9	90	1	1	5	2	2	
	Total ..	49	41	83	17	16	5	3	2	
Grand total ..										
		172	112	65	47	47	13	5	2	

REMARKS.—Both the sires and dams of all the inoculated calves mentioned in this statement had been inoculated by serum simultaneous method, before the calves were born.

STATEMENT No. 30.

Statement showing the number of unregistered deaths among cattle from contagious diseases during outbreaks in villages.

District.	Number of villages visited.	Number of O.B.Rs.	As reported by the V.M.		As investigated by the S.R.O.		Number of unregistered.	
			A.	D.	A.	D.	A.	D.
Anantapur ..	1	1	38	15	45	18	7	3
Kurnool ..	1	1	55	37	97	51	42	14
Bellary ..	6	6	564	401	883	465	319	64
Nellore ..	8	8	662	387	1,585	630	923	243
Tinnevely ..	3	3	15	15	54	31	39	16
Coimbatore ..	1	1	..	3	22	17	22	14
Total ..	20	20	1,334	858	2,686	1,212	1,352	254

O.B.R. = Outbreak report. V.M. = Village Munsif. S.R.O. = Special Rinderpest Officer. A. = Attacks. D. = Deaths.

STATEMENT No. 31.

Statement showing the number of times a cattle mortality register has been checked by the Revenue and Veterinary Officers during a year.

District.	Number of villages visited.	Number of C.M.Rs. examined.	Total number of times a C.M.R. was checked by		District.	Number of villages visited.	Number of C.M.Rs. examined.	Total number of times a C.M.R. was checked by	
			Revenue officers.	Veterinary officers.				Revenue officers.	Veterinary officers.
Kurnool ..	2	2	6	2	South Kanara ..	5	7	19	20
Bellary ..	5	6	34	12	Malabar ..	1	1	3	6
Anantapur ..	1	1	4	2	Total ..	62	89	312	145
Nellore ..	9	16	23	11					
Chingleput ..	1	2	1	4					
South Arcot ..	1	2	6	4					
North Arcot ..	4	5	12	3					
Tanjore ..	6	16	31	23					
Madura ..	2	11	71	24					
Trichinopoly ..	2	2	8	4					
Tinnevely ..	3	6	58	5					
Coimbatore ..	17	22	37	25					

Average number of times per year a C.M.R. has been checked ..

C.M.R. = Cattle Mortality Register.

STATEMENT No. 32.

Statement showing whether a separate register for attacks during an outbreak of cattle disease is being maintained in manuscript or not in villages visited by the Special Rinderpest Officer.

District.	Number of villages visited.	Number of villages in which a separate register for attacks is maintained.	District.	Number of villages visited.	Number of villages in which a separate register for attacks is maintained.
Kurnool ..	1	1	Malabar ..	1	1
Bellary ..	6	4	Tanjore ..	4	..
Anantapur ..	1	2	Trichinopoly ..	1	..
Nellore ..	8	6	Madura ..	6	3
South Arcot ..	1	1	Tinnevely ..	4	..
Coimbatore ..	12	1	Total ..	51	22
South Kanara ..	6	2			

STATEMENT No. 33.

Statement showing the delay, if any, caused in reporting outbreaks of cattle disease by village munsifs.

District.	Number of villages visited.	Number of O.B.Rs. examined.	Total delay caused in all O.B.Rs.	District.	Number of villages visited.	Number of O.B.Rs. examined.	Total delay caused in all O.B.Rs.
Kurnool ..	1	1	45	Coimbatore ..	1	1	10
Anantapur ..	2	2	17	South Kanara ..	5	5	16
Bellary ..	5	5	25	Total ..	25	25	145
Nellore ..	7	7	2				
North Arcot ..	2	2	..				
Tinnevely ..	2	2	30				

Average delay caused by the village munsif in reporting one outbreak ..

O.B.R. = Outbreak report.

STATEMENT NO. 34.

Statement showing whether weekly progress reports have been received or not by the Touring Veterinary Assistant Surgeons during outbreaks of contagious diseases.

District.	Number of villages visited.	Number of O.B.Rs. examined.	Number of O.B.Rs. for which the progress reports were		
			Sent till the subsidence of disease.	Partly sent.	Not sent at all.
Anantapur	2	2	2		
Bellary	5	5	3	2	
Nellore	7	7	1	6	
North Arcot	4	4	2		2
Madura	2	2	2		
Tinnevely	3	3	1		2
Coimbatore	5	5	1	4	2
South Kanara	6	6			
Total	34	34	12	12	10

O.B.R.—Outbreak report.

STATEMENT NO. 35.

Statement showing the number of cases in which complications were noticed in rinderpest virus producers at the Madras Veterinary College and the Serum Institute during the years 1928-29 to 1932-33.

Year.	Number of virus producers.	Number of animals noticed with complications.					Total.
		Trypanosomiasis.	Piroplasmiasis.	Coccidiosis.	Filariasis.	Spirochaetosis.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1928-29	218	2	40	17	2		61
1929-30	478	27	51	2	7	1	88
1930-31	464	3	68	17	10		98
1931-32	367	1	59	23	18		101
1932-33*	424	9	72	1	17		99
Total	1,941	42	290	60	54	1	447

Percentage of complications to the total inoculated with virus ..

2.16 14.94 3.09 2.78 .05 23.03

* Up to 22nd March 1933.

STATEMENT NO. 36.

Statement showing the experiments conducted by the Superintendent, Serum Institute, Madras, in regard to the plurality of rinderpest virus.

Experiment number.	Calves number.	Date of active immunization with bull virus alone.	Reaction.	Source of supply of rinderpest virus for II injection.	Date of injection.	Reaction after II injection.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Buffalo calf No. 8	9th April 1932	Non-reactor	Received from District Veterinary Officer, Madras, on 26th April 1932.	25th April 1932	NIL
2	Calf No. 15	17th April 1932	Do.	Do.	Do.	NIL
	Buffalo calf No. 8	9th April 1932	Do.	Received from District Veterinary Officer, Madras, on 30th June 1932.	30th June 1932	NIL
	Do. 66	31st May 1932	Temperature, mouth lesions and diarrhoea.	Do.	Do.	NIL
	Calf No. 84	13th June 1932	Temperature and diarrhoea.	Do.	Do.	NIL
3	Buffalo calf No. 66	31st May 1932	Temperature, mouth lesions and diarrhoea.	Received from the District Veterinary Officer, Bezwada, on 27th October 1932.	27th October 1932	NIL
	Do. 8	9th April 1932	Non-reactor	Do.	Do.	NIL
	Calf No. 68	26th June 1932	Temperature, mouth lesions and loose faeces.	Do.	Do.	NIL
4	Do. 217	4th October 1932	Do.	Do.	Do.	NIL
	Buffalo calf No. 66	31st May 1932	Temperature, mouth lesions and diarrhoea.	District Veterinary Officer, Nellore, on 3rd December 1932.	3rd December 1932	NIL
	Do. 8	9th April 1932	Non-reactor	Do.	Do.	NIL
	Calf No. 98	26th June 1932	Temperature, mouth lesions and loose faeces.	Do.	Do.	NIL
	Do. 242	20th October 1932	Temperature and soft faeces.	Do.	Do.	NIL
	Buffalo calf No. 66	31st May 1932	Temperature, mouth lesions and diarrhoea.	Sheep virus from Serum Institute, Madras.	6th October 1932	NIL
	Calf No. 65	24th June 1932	Non-reactor	Do.	Do.	NIL

REMARKS.—It may be noted that all the calves have been in contact with infected animals during the entire period.



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