Lamziekte.

By D. T. Mitchell, M.R.C.V.S., of the Division of Veterinary Research.

Lamziekte, or Gal-Lamziekte, are local terms used by farmers in certain areas of the Union to denote a disease in cattle, characterised by an apparent stiffness in movement followed by a partial or complete progressive paralysis of the limbs. It is met with in the South Western Transvaal, in the Bloemhof, Wolmaransstad and Lichtenburg districts, in the Orange Free State in the Boshof and Hoopstad districts and over the greater part of Griqualand West and in many parts of British Bechuanaland. A disease which, from the descriptions of various writers, appears to be synonymous, occurs in the South of the Cape Province, being most severe in the Coastal districts, South of East London. Definite information regarding the earlier outbreaks of the disease are difficult to obtain as farmers were, and still are, liable to confuse it with many other diseases which are found affecting cattle in the area. In the affected districts of the Transvaal and Free State the earliest known outbreak which can be traced occurred on the farm Smithskraal, in the Boshof District, on the Vaal River, in the year 1879.

The disease was known earlier than this on the Cape Plateau, and it is locally believed in the Transvaal and Orange Free State that the disease originated on the Cape Plateau and spread to the adjoining districts. Owing to the fact that the disease may suddenly disappear from an affected farm, and not reappear for several years, it is difficult to say if such spread has occurred, and although enquiries have been made, where possible, into all fresh outbreaks which occurred in the affected area of the Transvaal and Free State within the last few years, it has not been found possible to associate any of these with movements of stock.

Occurrence.

The disease occurs most frequently on sandy farms with a mixed grass and bush veld, less frequently on lime-stone formation, and very rarely on farms whose vegetation consists largely of " Ganna " bush. In the course of enquiries into the occurrence of the disease the immunity of farms on which an area of " Ganna " bush was found was particularly noted. Farmers assert that if an outbreak occurs among the herd, and the cattle are removed from the sand veld, and herded on the " Ganna " bush area, deaths will cease to occur in from four to fourteen days. One farm, of about 2,000 morgen, in the Boshof District, which consists solely of this type of veld, has been used by the owner in this manner for about seven years, and a perusal of the private stock-books, kindly shown to me by the owner, bears out the facts that not only does the disease cease soon after cattle are moved into this class of veld, but that no spontaneous cases have ever occurred in stock grazing there.

Although cases occur on the farms in the affected area at all seasons of the year the period when the disease is most severe is from September to January, that is, during the months when the rainfall is at its lowest.

Outbreaks of the disease are usually preceded by a period of drought. Intermittent slight showers of rain sufficient to cause a small amount of growth of grass, which afterwards becomes withered, seem to increase the number of cases of the disease or in some instances have been known to precede a sudden outbreak, involving a number of cattle in a herd where only a few sporadic cases had been previously occurring. Good rains diminish the number of cases. The result being apparent as soon as grazing becomes plentiful.

The accompanying chart which was drawn up from observations on the farm Smithskraal from September, 1907, to March, 1912, shows the relation between the occurrence of Lamziekte and the rainfall for that period. The records were kindly placed at my disposal by the owner, Mr. Leo. The figures given showing the percentage of animals which died from Lamziekte are as nearly accurate as possible, but owing to the variations in the number of animals on the farm from time to time, it is impossible to give the actual death-rate.

Animals Affected.

All cattle are liable to contract the disease, but variations in susceptibility in certain classes of animals occur on different farms. As a rule young cows in full milk are the most liable to contract the disease, and it is usually the case, as in some other diseases, that the best milkers are the first to become affected. Dry cows do not contract the disease so readily. On some farms outbreaks have been known to occur among young heifers from 19 months to 2 years old, while the cows remained unaffected. Young oxen are very susceptible, but working oxen and bulls seem to be less so, although cases in the latter animals are by no means uncommon. Young calves of from 8 to 12 months contract the disease generally in a very acute form, but cases in this class of stock are infrequent.

It has been pointed out, on many farms, that the progeny of certain animals seem to have a special susceptibility, and in some cases entire families of cattle have succumbed to the disease, while very few of the other animals of the herd became affected. This would be looked upon as a coincidence did it only occur in a few instances, but, as it is a fairly common observation, it cannot be looked upon as such. Whether it is the result of similar grazing habits and of thus acquiring a taste for similar vegetation or an instance of hereditary predisposition, it is impossible, in the present state of our knowledge on the subject, to say definitely. Outbreaks of the disease have been known to occur in the herd belonging to a farmer whose cattle daily grazed on the same area and drank at the same water supply as the cattle belonging to a neighbour in whose herd no losses were occurring. As the "werf" was the only factor which was not common to both herds, it was thought that this might have some influence, but later this was shown to be wrong, as heavy mortality may occur among cattle which are not allowed access to the homestead.

Lamziekte occurs among all breeds of cattle and, though rare

outbreaks have been known to occur involving only one class of animals in a herd of different breeds, yet the bulk of the evidence gathered goes to prove that all breeds are equally susceptible.

Premonitory Symptoms.

It is not possible to say, with any degree of accuracy, when the disease is about to make its appearance in a herd, but there are certain indications which have often been noticed to precede a severe outbreak or a return of the disease to a farm which had for some time been free from it.

The first and most important of these is an aggravated form of Pica. Cattle, particularly cows in calf or with calf, in most of the sour veld areas in the Union, show an inclination to chew bones, cloth, riems or such other objects of a similar nature as they chance to come across in grazing, but previous to an outbreak of Lamziekte in very many instances a marked pathological aberration of taste is seen. Cattle, while in the veld, will look for bones from skeletons of other animals which have died, empty tins, etc., and will be seen to stand and gnaw these objects for hours. If there are any Kaffir kraals in the grazing area, the animals will be found around these kraals evidently searching for objects such as are above mentioned, or chewing material which they have found. If driven away the animals will soon return and renew their search. The desire to satisfy their depraved appetite leads to the animals consuming a great variety of material in addition to the abovementioned, viz., kraal manure, pieces of stone, preferably lime-stone, earth, particularly earth containing lime and clay, hoop iron, empty cartridge cases, old boots, ropes, etc.

The other premonitory symptoms which have been noticed are a general falling off in condition of the herd, and in milk cows a general decrease in the milk yield. These, however, are not well marked, and when present, are probably the result of Pica.

Symptoms.

For the purpose of description the disease may be divided clinically into three forms: Acute, Per-Acute and Sub-Acute or Chronic, but it must be remembered that there is no definite line of demarkation between the three forms. In the affected areas of the Transvaal and Orange Free State the Acute and Per-Acute forms predominate, cases of the Sub-Acute or Chronic form being rare, while on the Cape Plateau and in Bechuanaland all forms are found occurring in about equal numbers.

(*a*) *Acute Form.*

The initial symptoms are shown by a sluggish gait, dull appearance, and a desire on the part of the animal to isolate itself from the remainder of the herd or to lag behind when driven. The animal feeds as usual. A diminution in milk secretion in cows giving milk is often noticed, but this symptom is not constant. This stage may last for 6 to 24 hours. Later the animal shows alteration in locomotion in the forequarters, which at first sight appear to be due to stiffness, but on closer examination are found to be due principally

to relaxation of muscular tone affecting the muscles which fix the shoulder to the chest wall (right and left Serratus Magnus). This relaxation of tone in the muscles is shown when the animal's weight is thrown on to one foreleg by a distinct drop of the body on that shoulder projecting the cartilage of prolongation of the scapula beyond the summits of the first few dorsal spines of the vertebrae. When the limb is lifted it is carried forward by a slow laboured movement, the foot being often lifted higher than in normal progression.

The general appearance presented is not unlike that of an animal pulling a load. The head is carried low, the back arched slightly when walking, and markedly so when standing still.

Walking appears difficult to the animal and the symptoms increase in degree the further the animal is driven. If undisturbed the animal in this state will lie down preferably in the shade of a tree if one is near and will only rise whenforced to do so. Symptoms of inco-ordination in the movements of the hind limbs appear later. The animal, when made to rise or lifted, walks with a slow, staggering gait, often accompanied by plaiting of the hind legs. The movements of the fore-legs, previously described, are in this stage very well marked. Symptoms of impaired vision are sometimes evident, the animal lifting the fore-legs high when walking, stumbling over uneven ground or running up against wire fences. The tongue is usually limp and the animal is incapable of retracting it completely into the mouth after it has been forcibly pulled out. In many cases complete paralysis of the tongue is seen, the organ hanging four to six inches out of the mouth, movements of the jaws resembling mastication are usually present, due probably to the paralysed or partly paralysed tongue feeling like a foreign body in the mouth. An increased quantity of saliva is present and may be seen dribbling from the mouth in all cases where paralysis of the tongue is a well-marked symptom. The animal, after walking some distance, shows quivering of the muscles of the shoulder, flanks or thighs, and lies down or may collapse suddenly on the ground as though the legs had given way under it.

Examination of the animal at this stage shows the following symptoms: Temperature normal or slightly sub-normal. Respirations normal. Pulse slightly accelerated. Eyes dull. Eyeballs retracted. Muzzle dry. Diarrhaea may be present or the faeces may be drier than normal. In the latter case a fibrinous looking blood stained exudate is usually present covering the faecal matter like a membrane. Milk secretion in cows is very much diminished. The tail shows slight or almost complete paralysis. The animal in many cases may be seen making ineffectual attempts to use it to remove flies which have settled on the body. If paralysis of the tongue is not present, the animal will still attempt to feed, and will drink water readily. Rumination is suspended. Later the animal makes ineffectual attempts to rise, sometimes getting on to the knees, but being unable to raise the hind quarters from the ground; in other cases getting on to the hind legs, but unable to rise further than the knees. If assistance is given, the animal is still able to rise, but only walks a short distance before again going down. As a result of ineffectual attempts to rise the animal is not infrequently found lying with the

hind legs stretched out straight backwards. These attempts soon cease and afterwards efforts to get the animal to stand will be found unavailing. When lifted the legs hang limply down and no attempt is made to use them. Symptoms of abdominal pain are sometimes manifested by the animal looking towards its flank and attempting to kick at the abdomen with the hind legs. These symptoms have been seen in only a small percentage of cases.

Death is preceded by a more complete paralysis of the limbs. The head is thrown back on to the chest wall. The eyes are deeply retracted, breathing is slow. Sensibility in the limbs is unimpaired, but voluntary movements are very limited. Unless propped up on the brisket the animal falls on to its side with the head and legs stretched out. Coma supervenes, and death occurs in a few hours.z

(*b*) *Per-acute Form.*

This form only differs from the former in the sudden onset of the symptoms, and very rapid course. In many cases there is no previous history of irregularity of movement. The animal is found in a recumbent position a few hours after the herd has been driven to the veld, and examination shows a more or less complete paralysis and inability to rise or stand when lifted. Death is preceded by aggravated symptoms of acute Lamziekte and may occur in from six to twenty-four hours after the animal has been first noticed sick. Very often these cases are found dead in the veld without any previous history. This form occurs most frequently among young, recently calved cows in good condition or in young stock from 9 to 14 months old.

(*c*) *Sub-acute or Chronic Form.*

The Sub-acute or Chronic form is found occurring as a sequel to an acute attack where partial recovery takes place, or it may occur independently.

In the latter case the onset is sudden and there is no previous history of any constitutional or other disturbance. The animal is found lying and no disease is suspected until one tries to get the animal to rise, when it is found that no attempts are made by the beast to do so. Except for this symptom the animal appears normal. The pulse, respirations and temperature are found unaltered, the appetite is not impaired and the animal ruminates as usual. If efforts to raise the animal are made, it is found that the legs refuse to bear weight and hang limply as in the paralysed stage of the acute form.

An animal may remain in this condition for a period varying from two weeks to three months, provided that food and water are supplied. Loss of condition does not rapidly occur as there is no fever. Good nursing will often lead to recovery in these cases, but unless it is continued for a long period, death will occur either from Tympanites or Emaciation. Frequently an animal which has been affected for some time with chronic form will develop acute symptoms and die suddenly. Owing to the rare occurrence of this form of the disease in the area in which the experimental work was carried out, it was not possible to get a sufficient number of cases to work out the symptoms satisfactorily.

The details given represent the experience of many farmers who have had cases of this form of the disease in their herds, and these have been confirmed by personal observations on the few cases which it was found possible to locate and have for some time under observation.

Duration.

Owing to the fact that no definite line can be drawn between the three forms of Lamziekte and also to the initial symptoms being so slight in many cases that they escape notice, it is somewhat difficult to say with accuracy what the duration is. In cases which have a fatal termination, the following may be taken as being the average periods:—

(*a*) Acute: Three to twelve days.
(*b*) Per-acute: Six to twenty-four hours.
(*c*) Sub-acute or Chronic: Fourteen days to three months.

In cases which recover the difficulty is much increased, as a certain amount of alteration in movement may persist for months afterwards so that in many cases it is impossible to say when recovery is complete.

Anatomical Conditions.

The changes which are found on post-mortem examination depend on the form of Lamziekte with which the animal was affected, the duration of the disease and whether the animal was slaughtered or died as a result of the disease.

The details given hereunder have been taken from post-mortem records of 34 cases of Acute and Per-acute Lamziekte. With a few exceptions these animals were slaughtered for post-mortem.

Subcutaneous Tissue: In cases which have been down for some days there is always a certain amount of yellow gelatinous infiltration and blood extravasation.

Muscular tissue is unchanged.

Blood appears normal.

Body cavities: There is usually an increase in the volume of fluid in the pericardial cavity. The fluid may be clear or blood tinged and coagulæ are not infrequently found floating in it.

Lungs: Changes in the lungs were found in 19 per cent. of cases. The lesions varying from a slight injection of the vessels to a strong diffuse hyperaemia. This latter condition being usually associated with the Per-acute form.

Bronchial and Mediastinal Glands: Hyperaemia and enlargement of these glands was met with in 39 per cent. of cases.

Heart: Subepicardial and subendocardial petechiæ, extravasations and ecchymoses were found present in 85 per cent. of cases. Lesions of this nature are rarely absent from the interior of the left ventricle.

Liver: The liver is usually very little altered in appearance. Slight venous stasis was found present in 22 per cent. of cases.

Gall Bladder: The bile is frequently increased in quantity and may be viscid and of a dark green colour. This appearance was present in 41 per cent. of cases.

Kidneys: The kidneys show changes chiefly consisting of a hyperaemia of varying intensity localised or diffuse. The cortex is usually congested, congestion being marked in many cases by a prominence of the glomeruli and streaking of the medullary rays. These changes were present in 85 per cent. of cases.

Spleen: Changes in the spleen are rare. 78 per cent. of cases were found normal. Occasionally the pulpa is softer than normal, but no marked pathological lesion has ever been noticed on examination.

Jejunum and Ileum: In the small intestines lesions occurring with fair regularity, are found. These consist in a thickening of the mucosa, and the presence of a thick, viscid, yellowish muco-purulent-like material in the lumen of the gut. This material adheres to the surface of the mucous membrane and does not wash off easily. The mucous membrane is wrinkled transversely or longitudinally. Localised areas of strong hyperaemia are found distributed along the length of the gut. In other cases the mucous membrane is dark red and haemorrhagic looking and the superimposed catarrhal exudate may be blood stained.

The condition varies in degree in the different animals examined. Lesions of this nature were found as follows: Ileum 58 per cent. and jejunum 47 per cent. of cases.

Caecum: Varying degree of hyperaemia of the mucosa were found in 26 per cent. of cases.

Colon: A catarrhal condition similar to that found in the jejunum and ileum was occasionally found.

Abomasum: This organ usually shows hyperaemia and thickening of the folds of the mucosa in varying degrees. 83 per cent. of cases examined showed hyperaemic changes. Occasionally a few small circular or linear ulcers may be present near the pyloric orifice, but their occurrence is not common.

The Reticulum, Omasum and Rumen show no pathological changes.

Brain: Slight injection of the vessels of the pia mater is usually present. The subarachnoid fluid is found present in quantities varying from 5 cc. to 100 cc. The meninges are often so tense that when punctured the fluid escapes in a spout.

Nasal Chamber: Injection of the Schneiderian mucous membrane is common.

Bone Marrow: Normal.

Bones: No visible pathological change has been noticed.

It will be seen that there are no lesions shown on post-mortem examination, on which a definite diagnosis of Lamziekte could be based. Hyperaemia of the kidneys and abomasum, and the catarrhal condition of the small intestines are the only lesions which occur with

any degree of regularity, and even with these lesions present a definite diagnosis would be impossible without reference to the history and ante-mortem symptoms.

Symptoms and post-mortem report of a typical case of Lamziekte. Acute form.

Cow 1337. 4 *years old.*

This was the first animal which contracted the disease in a fatal form at Smithskraal. The animal was killed in the last stages, and organs, etc., were used for inoculation purposes.

History and Symptoms.

The animal was noticed dull and not feeding well on March 10th, 1911. Slight irregularity in gait was noticed, but no characteristic symptom of Lamziekte was shown. The animal was noticed to rise and lie down frequently, and seemed disinclined to walk for any distance.

Later the characteristic movements of an animal affected with Lamziekte became apparent. On the following day the beast was unable to rise. There were signs of attempts to do so around the place where the animal was found. On being lifted no attempt was made to use the legs. Respirations were normal, pulse was normal. Temperature 100° Fahrenheit. Faeces soft. Muscular reflex in the limbs was unaltered. Head was carried well. Eyes bright. Animal attempts to gore anyone who approaches. The animal was placed on a wagon and brought to the homestead. Later: Animal drank well. The tongue was limp, but the animal was able to retract it completely into the mouth after it had been pulled out. Complete loss of muscular power in the fore and hind legs was present. Animal was propped up on the brisket and left for the night.

12*th March*, 1911. 6 *a.m.*—The animal was lying on its brisket. Head on ground propped up by the nose. Animal seems unable to lift the head, or hold it up when lifted. Eyeballs retracted deeply into their sockets. Temperature 98·6° Fahrenheit. Pulse and respirations normal.

Microscopic examination of the blood gave negative results. Animal was then slaughtered.

Post-mortem Report.

Condition, very good.
Peritoneal cavity, 150 cc. clear fluid.
Pleural cavity, 100 cc. „ „
Pericardial cavity, 200 cc. „ „
Lungs, collapsed. Left lung showed slight hypotasis.
Parenchyma of right lung normal.
Bronchial glands, normal.
Trachea, empty.
Heart. Epicardium normal.
Right Ventricle. Fluid blood in the cavity. Endocardium normal. Left ventricle empty.
Endocardium showed a few subendocardial extravasations and petechiae on the walls and septum.

Liver. Slightly swollen. Capsule tense. Section rather soft. Gall bladder distended with normal bile.

Spleen. Capsule tense. Organ slightly enlarged. Pulpa normal in consistence and appearance.

Kidneys, normal.

Urinary bladder contains about 1 litre of normal urine.

Messenteric glands, normal.

Portal glands, normal.

Rumen: *Reticulum and omasum,* normal.

Abomasum showed slight hyperaemia and thickening of the mucosa towards the pyloric orifice, Contents fluid.

Duodenum: Mucous membrane very much thickened, pale yellowish-brown in colour, no hyperaemia was present. The surface of the mucous membrane was covered with a thick mucoid viscid material resembling pus in appearance. Contents of the gut were similar in character.

Jejunum and Ileum showed a condition similar to that which was found in the duodenum.

Caecum. Contents were fluid. The mucous membrane normal.

Colon, normal.

Bone marrow of femur, unaltered.

On opening the spinal meninges in front of the atlas a jet of clear subarachnoid fluid escaped.

Cranial cavity. Brain showed slight injection of vessels of the pia mater. About 20 c.c. of subarachnoid fluid still remained in the meninges.

Schneiderian mucous membrane, normal.

Diagnosis: Acute Lamziekte.

Recovery and Relapses.

The percentage of cases which recover from the disease vary on different farms, and on the same farm at different seasons. Thus we sometimes find that a farmer who has for some time imagined that he has been successfully treating cattle affected with the disease will find that his so-called "specific" loses its effect and practically all the animals which contract the disease succumb.

Recovery may be rapid and may be complete within 14 days from the commencement of an attack or may be prolonged, the animal showing altered movements and keeping in poor condition for months. Recovery in the acute form is very rare if the animal has been down for more than 24 hours. In the sub-acute or chronic form recovery may occur after 2 to 3 months, the animal slowly regaining the use of its legs, dragging itself around in search of grass for a considerable distance, and rising eventually with assistance, or rapid recovery may take place and the animal be found standing and able to walk for short distances.

Relapses are the rule. An animal which has had one attack of the disease will contract it more readily the second time and will show more acute symptoms than were visible during the previous attack. Very seldom does an animal survive a second attack, and the third attack, with rare exceptions, is fatal.

Differential Diagnosis.

Many diseases may be confused with Lamziekte. In the affected area the tendency on the part of the farmers is to call all sickness among cattle "Lamziekte." A microscopic examination of the blood is always essential. In Lamziekte the blood is not markedly altered, and bacteria or protozoa are never found. It is only in the initial stage that difficulty may occur as to diagnosis. In this case by driving the animal for some distance the characteristic gait will become more apparent and diagnosis will be facilitated. Absence of prolongation of the claws, bony enlargement, pain and tenderness in the feet, will exclude Stijfziekte. As there is no rise of temperature in Lamziekte, the thermometer will serve to differentiate it from febrile diseases.

During the latter stages and at post-mortem the history of the animal is the best guide. The lesions found at the autopsy vary so much in occurrence ain in intensity that it is impossible to form a diagnosis from these alone, and without previous history we are only able to arrive at a diagnosis of Lamziekte by a process of exclusion of other possible diseases.

Experimental Work Carried out in Connection with Lamziekte on Farm Smithskraal, Orange Free State During 1911-12.

By D. T. Mitchell, M.R.C.V.S.

Experiment 1. Subcutaneous inoculation of body fluids and emulsions of organs from an animal which was killed in the last stages of an attack of Acute Lamziekte. (*Cow* 1337.)

History. The animals used for these experiments had been running on the farm Gannavlaagte (a healthy farm), for some months and were brought to Smithskraal on January 20th, 1911, tied up in a kraal near the homestead and fed with bran, mealies and hay from a healthy area. Water was obtained from a borehole and supplied to the animals by hand.

(1) *Ox* 1285. 1 year old.
Treatment. Injected subcutaneously on March 12th, 1911, with 100 cc. defribinated blood behind left shoulder.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

(2) *Ox* 1286. 1 year old.
Treatment. Injected subcutaneously on the 12th March, 1911, with 10 c.c. pericardial fluid and 10 c.c. pleural fluid behind left shoulder.
Animal was kept under observation until 3rd May, 1911.
Result: Negative.

(3) *Ox* 1287. 1 year old.
Treatment. Injected subcutaneously on the 12th March, 1911, with 20 cc. urine behind left shoulder.
Animal was kept under observation until 3rd May, 1911.
Result: Negative.

(4) *Heifer* 1288. 9 months old.
Treatment: Injected subcutaneously on the 18th March, 1911, with 10 cc. emulsion of brain and 10 cc. subarachnoid fluid behind left shoulder.
Animal was kept under observation until 3rd May, 1911.
Result: Negative.

(5) *Cow* 1289. 2½ years old.
Treatment: Injected subcutaneously on the 12th March, 1911, with 10 cc. bile behind left shoulder.
Animal was kept under observation until the 3rd May, 1912.
Result: Negative.

(6) *Heifer* 1291. 2 years.
Treatment: Injected subcutaneously on the 12th March, 1911, with 10 cc. emulsion of mesenteric glands behind left shoulder.
Animal was kept under observation until 3rd May, 1911.
Result: Negative.

(7) *Heifer* 1292. 2 years.
Treatment. Injected subcutaneously on the 12th March, 1911, with 10 cc. emulsion of spleen and 10 cc. emulsion of bone marrow behind left shoulder. Animal was kept under observation until 3rd May, 1911.
Result: Negative.

(8) *Ox* 1293. 1 year.
Treatment. Injected subcutaneously on the 12th March, 1911, with 10cc. emulsion of liver behind left shoulder. Animal was kept under observation until 3rd May, 1911.
Result: Negative.

(9) *Heifer* 1295. 3 years.
Treatment: Injected subcutaneously on the 12th March, 1911, with 10 cc. emulsion of mucosa and sub-mucosa of jejunum, behind left shoulder. Animal was kept under observation until the 3rd May, 1911.
Result: Negative.

(10) *Bull* 1296. 1 year.
Treatment: Injected subcutaneously on the 1st March, 1911, with 10 cc. emulsion of lung behind left shoulder. Animal was kept under observation until the 3rd May, 1911.

Result: Negative.

Experiment II. Drenching experiments with materidl from Cow 1337 *killed in the last stages of an attack of acute Lamziekte.*

(1) *Cow* 1297. 4 years.
Treatment: Drenched with contents of abomasum, ileum and jejunum on March 12th, 1911.
Animal was kept under observation until 3rd May, 1911.
Result: Negative.

(2) *Heifer* 1299. 1 year.
Treatment: Drenched on March 12th, 1911, with one litre emulsion of ileum and jejunum with contents.
Animal was kept under observation until 3rd May, 1911.
Result: Negative.

(3) *Heifer* 1301. 1 year.
Treatment: Drenched on March 1st, 1911, with 1 litre of fæces.
Animal was kept under observation until the 3rd May, 1911.
Result: Negative.

Experiment III. Intralymphal Inoculation of body fluids and emulsions of organs from an animal which was killed in the last stages of an attack of Acute Lamziekte. Cow 1340.

(1) *Ox* 1286. 1 year.
NOTE: Used in Experiment No. I. (2).
Treatment: Injected on the 3rd May, 1911, into the right prescapular gland with 10 cc. peritonial fluid.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

(2) *Ox* 1287. 1 year.
NOTE: Used in Experiment I. (3).
Treatment: Injected on the 3rd May, 1911, into the right prescapular gland with 20 cc. urine.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

(3) *Heifer* 1288. 9 months.
NOTE: Used in Experiment I. (4).
Treatment: Injected on 3rd May, 1911, into the right prescapular gland with 10 c.c. subarachnoid fluid and 10 c.c. emulsion of brain.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

(4) *Cow* 1289. $3\frac{1}{2}$ years.
NOTE: Used in Experiment I. (5).
Treatment: Injected on 3rd May, 1912, into the right prescapular gland with 10 c.c. bile.
Animal was kept under observation until 17th October, 1911.
Result: Negative.

(5) *Heifer* 1291. 2 years.
NOTE: Used in Experiment I. (6).
Treatment: Injected on 3rd May, 1911, into the right prescapular gland with 10 c.c. emulsion of bronchial, mediastinal and messenteric lymphatic glands.
Animal was kept under observation until 17th October, 1911.
Result: Negative.

(6) *Heifer* 1292. 2 years.
NOTE: Used in Experiment I. (7).
Treatment: Injected on the 3rd May, 1911, into the right prescapular gland with 10 c.c. emulsion of spleen.
Animal was kept under observation until 11th August, 1911.
Result: Negative.

(7) *Ox* 1293.
NOTE: Used in Experiment I. (8).
Treatment: Injected on the 3rd May, 1911, into the right prescapular gland with 10 c.c. emulsion of liver.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

(8) *Heifer* 1294. 1½ years.
NOTE: Used in Experiment I. (9).
Treatment: Injected on 3rd May, 1911, into the right prescapular gland with 10 c.c. emulsion of kidney.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

(9) *Heifer* 1295. 3 years.
NOTE: Used in Experiment I. (10).
Treatment: Injected on 3rd May, 1911, into the right prescapular gland with 10 c.c. of emulsion of mucosa and sub-mucosa of jejunum.
Animal was kept under observation until 17th October, 1911.
Result: Negative.

(10) *Bull* 1296. 1 year.
NOTE: Used in Experiment I. (11).
Treatment: Injected on 3rd May, 1911, into the right prescapular gland with 10 c.c. emulsion of lung.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

Experiment IV. *Further drenching experiments with material taken from Cow* 1340 *killed in last stages of Acute Lamziekte on the 3rd May*, 1911.

(1) *Cow* 1297. 4 years.
NOTE: Used in Experiment II. (1).
Treatment: Drenched on 3rd May, 1911, with contents of ileum and abomasum.
Animal was kept under observation until 16th October, 1911.
Result: Negative.

(2) *Heifer* 1299. 1 year.
NOTE: Used in Experiment II. (2).
Treatment: Drenched on 3rd May, 1911, with 1 litre emulsion of ileum and jejunum with contents.
Animal was kept under observation until 17th October, 1911.
Result: Negative.

(3) *Heifer* 1301. 1 year.
NOTE: Used in Experiment II. (3).
Treatment: Dreched on 3/5/12 with one kilo of faeces mixed with water.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

Experiment V. Further inoculation experiments with material taken from animals killed for inoculation purposes in the last stages of Acute Lamziekte.

(1) *Heifer* 1288. 9 months.

NOTE: Used in Experiments I. (4) and II. (3).
Treatment: Injected on the 11th August, 1911, into the subcutaneous tissue behind left shoulder with 30 c.c. subarachnoid fluid (from cow 1304).
Animal was kept under observation until 13th November, 1911.
Result: Negative.

(2) *Heifer* 1292. 2 years.

NOTE: Used in Experiments I. (7) and III. (6).
Treatment: Inoculated on the 11th August, 1911, with 20 grammes of bone marrow (in emulsion), into the subcutaneous tissue behind the left shoulder.
Animal was kept under observation until 13th November, 1911.
Result: Negative.

(3) *Cow* 1335. Aged.

History: Tied up in kraal on 13th November, 1911.
Treatment: Inoculated under the meninges covering the right cerebral hemisphere with 3 cc. subarachnoid fluid on 12th December, 1911.
Animal was kept under observation until the 5th January, 1912.
Result: Negative.

Experiment VI. Feeding experiments with contents of Rumen of cattle killed while affected with Lamziekte.

(1) *Ox* 1300. 14 months.

History: Tied up in kraal on January 20th, 1911.
Treatment: (*a*) Fed with dried contents of rumen of cow 1340 mixed with bran from 13th May, 1911 to 18th May, 1911.
Quantity eaten, 12 pounds.
(*b*) Fed daily with dried contents of rumen, mixed with bran from various cattle which were killed while suffering from Lamziekte from 18th May, 1911, to 16th July, 1911.
Total quantity fed 180 lbs.
(*c*) Fed with 25 lbs. weight of dried contents of rumen mixed with bran from cow 1304 on 24th August, 1911.
This animal was kept under observation until 13th November, 1911.
Result: Negative.

(2) *Cow* 1773. 6 years.

History: Tied up in kraal 12th July, 1911.
Treatment: Fed on 8th December, 1911, with 7 lbs. of contents of rumen of cow 1343 which had been sun-dried.
This animal was kept under observation until 5th January, 1912.
Result: Negative.

(3) *Cow* 1776. 5 years.

History: Tied up in kraal 12th July, 1911.
Treatment: Fed on 8th December, 1911, with 8 lbs. of contents of rumen from ox 1281 which had been dried in the shade.
This animal was under observation until 5th January, 1912.
Result: Negative.

(4) *Cow* 1770, 6 years.

History: Tied up in kraal on the 13th November, 1911.
Treatment: Fed on 8th December, 1911, with 6lbs. contents of rumen from heifer 1,322 which had been dried slowly in the shade and damped occasionally to retard drying.
Animal was under observation until 5th January, 1912.
Result: Negative.

(5) *Cow* 1331, 2½ years.

History: Tied up in kraal on the 13th November, 1911.
Treatment: Fed on the 8th December, 1911, with 7lbs. of fresh content of rumen of cow which died as a result of Lamziekte.
This animal was under observation until 5th January, 1912.
Result: Negative.

Experiment VII.

Feeding experiments with bones of cattle which were affected with Lamziekte and were killed or died as a result....Animals were forced to eat all the material supplied by withholding other food. Crushed bones were given mixed with mealie meal.

(1) *Cow* 1754, 7 years.

History: Tied up in kraal 3rd June, 1911.
Treatment: Fed on 29th June, 1911, with 3lbs. of crushed bones from a cow which died of acute lamziekte on the 17th June, 1911. On 30th June a further ration of 7lbs. of crushed bones from same animal was fed.

Result: Animal was noticed off feed at 6.30 p.m. on 4th July The following day paralysis of the tongue was present with difficulty in rising. On walking the animal showed symptoms of disturbances of equilibrium, staggering gait, plaiting of the legs, and after walking about 20 yards collapsed on the ground. Death occurred at 11 a.m. on 6th July, and a diagnosis of death from absorbtion of sceptic material in the bones fed was made. (Bones were taken from this animal, crushed and fed to cow 1,753 without result.)

(2) *Cow* 1753, 7 years.

History: Tied up in kraal on 3rd June, 1911.
Treatment: (a) Fed on 11th July, 1911, with 2lbs. of freshly-crushed bones from cow 1,754. (b) Fed on the 17th July, 1911, with 3½lbs. of crushed bones from cow 1,754. (c) Fed on 24th November, 1911, with 14lbs. of freshly-crushed bones of cow 1,343.

This animal was under observation until the 29th December, 1911. She calved on 27th November, 1911, and on 2nd December, 1911, had an attack of diarrhœa, after which she lost condition rapidly and died on the 29th December, 1911.

Result: Post-mortem showed lesions of nephritis present. Death was due to debility.

(3) *Cow* 1755, 8 years.

History: Tied up in kraal on 3rd June, 1911.

Treatment: Crushed bones from cases of lamziekte were fed to the animal as follows:—

11/7/11, 2lbs. crushed bones from cow 1,276.
17/7/11, 3lbs. crushed bones from cow 1,276.
25/8/11, 5lbs. crushed bones from cow 1,304.
31/8/11, 5lbs. crushed bones from cow 1,304.
16/9/11 10lbs. crushed bones from cow 1,304.

Result: Animal was off feed and sick on 17th September, 1911. Symptoms resembling Lamziekte appeared on 1st September, 1911, on which date 6lbs. of bones fed on 16th September had been eaten. Animal commenced to recover on 20/9/11, and a few days later was again normal.

Further treatment: Fed on 24th November, 1911, with 10lbs. crushed bones from cow 1,322.

Result: Animal was noticed stiff in front and off feed on 20th December, and on the following day was unable to rise. On 22nd December the animal was again able to rise, and on same day acute diarrhœa was noticed. This diarrhœa ceased on the following day, and the animal's movements were normal on this day.

(4) *Cow* 1775, 6 years.

History: Tied up in kraal 12th July, 1911.

Treatment: Fed with crushed bones from cattle affected with Lamziekte as follows:—

24/8/11, 10lbs. crushed bones from cow 1,304.
15/9/11, 10lbs. crushed bones from Mr. Leo's cow.
24/11/11, 15lbs. crushed bones from Mr. Leo's cow.

Bones fed on the two last-mentioned dates were collected on the veld from the carcase of a cow which died of Lamziekte some months previously,

Animal was under observation until 5th January, 1912.

Result: Negative,

(5) *Cow* 1758, 6 years.

History: Tied up in kraal 13th November, 1911.

Treatment: Fed on the 24th November, 1911, with 11lbs. of crushed bones from a cow, the property of Mr. Leo, which died of Lamziekte.

This animal was under observation until 5th January, 1912.

(6) *Cow* 1328, aged.

History: Animal had an attack of Lamziekte while in the grazing lot, from which it recovered. It was tied up in a kraal on the 13th November, 1911,

Treatment: Fed on the 24th November, 1911, with 8lbs. of crushed bones from a case of Lamziekte (Mr. Leo's cow).

Animal was under observation until the 5th January, 1912.
Result: Animal was noticed sick and off feed on 26th and 27th November, but no further symptoms developed.

(7) *Cow* 1344, aged.
History: Tied up in kraal 13th November, 1911.
Treatment: Fed on 24th November, 1911, with 15lbs. of crushed bones from a case of Lamziekte (Mr. Leo's cow).
Animal was under observation until 5th January, 1912.
Result: Negative.

Experiment VIII. Feeding with suspected plants.

(1) *Cow* 1332, aged.

History: Tied up in kraal 13th November, 1911,
Treatment: Fed on 14th December, 1911, with $1\frac{3}{4}$ lbs. of Lassertia.

Animal was under observation until 5th January, 1912.

Result: Negative.

(2) *Cow* 1338, 4 years.
History: Tied up in kraal 13th November, 1911.
Treatment: Fed on 14th December, 1911, with 20lbs. of a running plant, plentifully distributed around the homestead, *Orthanthera jasminiflora.*
Animal was under observation until 5th January, 1912.

Result: Negative.

(3) *Cow* 1346. Aged.
History: Tied up in kraal 13th November, 1911.
Treatment: Fed on 14th December, 1911, with 20 lbs. of a running plant found on homestead *Orthanthera jasiminiflora.*
Animal was under observation until 5th January, 1912.

Result: Negative.

Experiment IX. Grazing and muzzled experiment.

This experiment was undertaken with a view to ascertaining if the disease was one of ingestion or not. For this purpose 100 animals were taken which had been running for some months previously on the farm Gannavlaagte, Orange Free State, on which up to the time of writing, no cases of Lamziekte have been known to occur. Of these animals 50 were allowed to graze night and day in the veld, these constituting the "grazing lot." The remaining 50 animals were muzzled by day and were herded with the grazing lot. At night these animals were placed in a kraal from which all vegetation had been removed, and fed with material grown on an area where the disease is unknown. Water was supplied to both lots of animals at a small dam, fed from a borehole, the muzzled lot drinking through the muzzles. Owing to the irritation set up by the muzzles and also to the dry food with which the muzzled lot were supplied, a number of deaths occurred from debility, principally among young

cows at calving or soon afterwards, but these and the animals which died in the grazing lot from Lamziekte, were replaced from time to time so as to keep both lots as near the original number as possible.

The experiment was commenced on the 21st January, 1911, and continued until 21st September, 1911, on which date the experiment was discontinued owing to the muzzled lot having fallen off considerably in condition. The cattle were allowed to graze in the veld until 1st October, 1911, when new grazing and muzzled lots were selected. The experiment was then continued without interruption until 5th January, 1912.

Result:

A. *Muzzled lot.*—No deaths occurred in this lot from Lamziekte. Two animals developed symptoms of the disease after being placed in the new muzzled lot selected on the 18th October, 1911. The cases occurred as follows:—

Cow 1,246, aged	Developed symptoms	29/10/11
Cow 1,757, 6 years	,, ,,	30/10/11

i.e. twelve and thirteen days respectively after they ceased to graze on the Lamziekte area. Knowing from experience that the disease requiries to have a certain period which varies considerably before symptoms are visible, and as no further cases occurred, one is justified in concluding that these two animals contracted the disease while grazing on the veld a very short time before being placed in the muzzled lot.

B. *Grazing lot.*—The following cases of Lamziekte occurred in the grazing lot:—

(1) *Deaths*:

Cow 1,304, aged	First symptoms appeared	8/8/11
Ox 1,306, 1 year	,, ,, ,,	24/6/11
Ox 1,317, 1½ years	,, ,, ,,	14/3/11
Ox 1,325, 1 year	,, ,, ,,	23/9/11
Cow 1,337, 4 years	,, ,, ,,	10/3/11
Cow 1,340, 6 years	,, ,, ,,	2/5/11
Cow 1,343, aged	,, ,, ,,	21/9/11
Cow 1,767, 8 years	,, ,, ,,	25/9/11

(2) *Cases which recovered*:

Ox 1,314, 1 year	First symptoms appeared	7/3/11
Cow 1,319, aged	,, ,, ,,	23/2/11
Cow 1,328, aged	,, ,, ,,	12/10/11
Cow 1,339, 4 years	,, ,, ,,	9/12/11

These together with the two cases mentioned under the heading of Muzzled Lot, makes up a total of 14 cases, *i.e.*, 28 per cent. of cases of Lamziekte.

Conclusions.—The results of this experiment prove conclusively that the disease is contracted by the animal grazing on the veld, that is, "a disease of ingestion" and also that the disease is not contagious.

During the course of the experimental work at Smithskraal it was noticed that a relatively much heavier mortality from Lamziekte occurred in the cattle belonging to the owner of the farm than in the Government grazing lot. This was unexplainable as the cattle grazed together in the same camp and drank at the same water supply. The cattle belonging to the owner of the farm which grazed in this camp, were milk cows and were driven every day to the kraals on the homestead for the purpose of being milked. As this was the only point of difference in the conditions of the two lots of cattle, it was decided to investigate the matter with a view to finding out if this new factor had anything to do with the difference in mortality. For this purpose the following experiments were undertaken.

Experiment X.

On the 1st October, 1911, three animals were taken from the grazing lot and placed in a small camp of about a rood in extent, situated close to the dwelling house. A botanical survey of this camp had previously been made by the Government Botanist. On 13th November, 1911, three more animals were added to the number, and the experiment was continued until 25th December, 1911. Water was supplied to these animals by hand from a borehole.

During the last few weeks of the experiment it was found necessary to give the animals a daily ration of hay, this material having been obtained from an area free from the disease.

Result.

Two cases of Lamziekte occurred in this camp.

(*a*) Heifer 1,322, 6 months old, developed symptoms on 2nd November, 1911, fourteen days after being placed in the camp and was killed in last stages on 11th November, 1911, for post-mortem.

(*b*) Cow 1,323, aged, developed symptoms of Lamziekte on the 12th November, 1911, twenty-four days after being placed in the camp. This animal showed very mild symptoms for seven days and recovered.

On 5th January, 1912, two groups of cattle were selected from the grazing lot, muzzled lot and the cattle which had been tied up in a kraal, undergoing feeding and inoculation experiments, so that each group should contain as nearly as possible an equal number of animals from each of these three lots, and also an equal number of cows, young heifers and oxen. These groups shall be referred to as the "Camp" lot and the "Werf" lot. The Camp lot was composed of 41 cattle which were allowed to graze in a camp of about 4,000 morgen night and day.

The "werf" lot was made up of 44 cattle. The horns of these cattle were painted so that they could be readily distinguished from the cattle belonging to the Camp lot. These animals grazed with the camp lot by night, and in the morning were brought to the "werf" and placed in the kraals, in which and around which they were allowed to run for about four hours daily. The animals were then returned to the camp, and from there were driven with the camp lot to the river for water, after which both lots were returned to the camp again.

This experiment was continued until 21st July, 1912.

Result.

The following cases of Lamziekte occurred:—

Camp lot.

A. *Deaths.*

1. Ox 1,313, 1 year, developed symptoms ... 12/1/12.
2. Cow 1,769, 6 years, developed symptoms ... 11/2/12.

Werf lot.

A. *Deaths.*

1. Cow 1,273, 4 years, developed symptoms ... 23/2/12.
2. Bull 1,296, 1 year, developed symptoms ... 20/2/12.
3. Ox 1,316, 1 year, developed symptoms ... 24/1/12.
4. Cow 1,339, 4 years, developed symptoms ... 10/2/12.
5. Cow 1,348, aged, developed symptoms ... 14/2/12.

B. *Recovery.*

6. Cow 1,328, aged, developed symptoms ... 10/2/12.

The experiments at Smithskraal were discontinued on March 24th, and were recommenced on the new experimental station at Kaffraria, Christiana District, Transvaal. A report of the further experimental work done there will appear later.