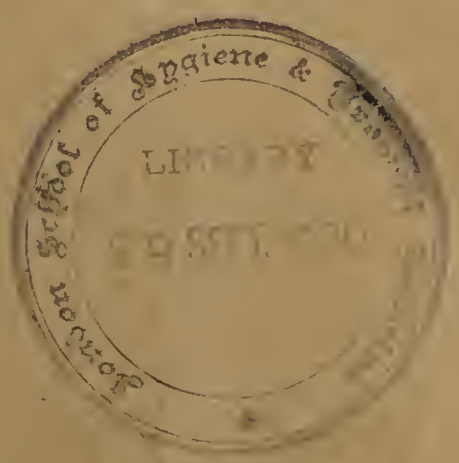
ANNUAL REPORT

OF THE

VETERINARY SERVICES,

SUDAN GOVERNMENT.

1929.



With the compliments of

The Director

Veterinary Service, Sudan Government,

Khartoum.

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(McC. 1145) V. 150 3/30.

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STAFF.

The following staff changes occurred during the year: Mr. A. L. Mullen, Veterinary Inspector, resigned from the Service on 13th July and Mr. J. E. Furney, M.R.C.V.S., was appointed Veterinary Inspector on 3rd November to fill the vacancy thus created.

In the latter half of the year Veterinary Inspectors were permanently posted to the White Nile and The Fung Provinces, and the distribution of the staff on 31st December, 1929, was as follows:—

Name.	Designation.	Province.
Mr. W. Kennedy, D.S.O.	*Director.*	Khartoum.
Captain R. S. Audas, M.C., 4N.	*Assistant Director.*	Darfur*.
Mr. S. C. J. Bennett, B.Sc.	*Vet. Research Officer.*	Khartoum.
(Vacant)	*Asst. Vet. Research Officer.*	
Captain J. Going, 4 N.	*Veterinary Inspector.*	Kassala.
Captain C. P. Fisher	,, ,,	Khartoum.
Major J. R. Ellison	,, ,,	White Nile.
Captain T. Menzies	,, ,,	Darfur.
Captain H. B. Williams, O.B.E.	,, ,,	Kordofan.
Captain L. E. Prichard, O.B.E.	,, ,,	Blue Nile.
Mr. C. W. Pembrey	,, ,,	The Fung.
Mr. C. F. Magnier	,, ,,	Blue Nile.
Mr. W. H. Glanville	,, ,,	Halfa.
Mr. A. B. MacIntyre	,, ,,	Khartoum*.
Mr. J. E. Furney	,, ,,	Kassala.

During the year the Director visited the Blue Nile, Kordofan and The Fung Provinces and toured in Darfur Province for three weeks; the Assistant Director visited the Provinces of Darfur, Blue Nile, The Fung, Kassala, Red Sea and Kordofan, and Major J. R. Ellison, Veterinary Inspector, spent four months touring in the Upper Nile Province. In addition to the above the Assistant Director was engaged in horse purchasing duties at Cairo and Alexandria for ten days in November.

The Veterinary Research Officer was absent from headquarters during the month of February inspecting the Serum Station at Malakal and Mr. A. B. MacIntyre, Veterinary Inspector, was in charge of that station from February 7th until May 22nd.

On the expiration of the Veterinary Research Officer's leave in July he proceeded to South Africa to attend the Pan-African Veterinary and Agricultural Conferences held in August at Pretoria.

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* On temporary duty.

SECTION I.

I. DISEASES OF ANIMALS.

Diseases of Cattle.

Until a few years ago the Arab cattle owners appear to have viewed with grave suspicion any suggestion of interference with their stock by the Veterinary staff. The result was that the existence of disease was rarely reported until after an outbreak had assumed such proportions that the Veterinary staff was unable to exercise effective control over it. Instances also came to notice where reports of heavy losses having been suffered from disease were only made when the assessment of herd tax was under discussion. This state of affairs may have arisen as the result of the imposition of irksome quarantine measures in the past the object of which was not apparent to the cattle owners, but, whatever its origin, it rendered the task of disease control incredibly difficult if not impossible.

Under present conditions in the Sudan disease control measures can only be applied effectively provided the cattle owning tribes appreciate their value and are prepared to render all necessary assistance to the Veterinary staff in carrying them out. The first essential step is to obtain the confidence of the people concerned and it is gratifying to record that there is every indication of considerable progress having been made recently in this direction. This is evidenced mainly by a greater willingness on the part of owners to report the existence of disease in the hope that veterinary assistance will be forthcoming to inoculate or vaccinate their cattle with a view of reducing their losses to a minimum.

This welcome change of attitude is probably attributable to a variety of causes chief of which are, undoubtedly, the provision of motor transport for the Veterinary staff, and the provision of adequate supplies of a protective serum against cattle plague and of a safe and effective culture vaccine against contagious bovine pleuro-pneumonia. The use of motor transport permits of Veterinary Inspectors keeping in closer touch, than was formerly possible, with the conditions obtaining throughout the large areas they are in charge of, and enables them to proceed rapidly, with supplies of serum and vaccine, to outbreaks in outlying districts. Time saved in this way is of the greatest value in dealing with outbreaks of epizootic diseases.

The marked success that has attended the free use of cattle plague antiserum and of culture vaccine against contagious bovine pleuro-pneumonia, in combating outbreaks of these diseases, has probably been the most potent factor in removing the feeling of distrust of veterinary measures from the cattle owners' minds.

It is interesting to record that, with the increased authority granted to Native Councils, indications are not lacking that these bodies are beginning to appreciate their responsibilities in connection with the control of diseases of livestock. Requests have been received from various districts for selected natives to be given a training in veterinary work and to be returned afterwards to their

respective areas where they would be responsible to the tribal authorities for the detection and control of outbreaks of disease. If tribal veterinary organizations of this kind could be created throughout the cattle-raising areas of the country, not only would the task of disease control be greatly simplified, but a closer liaison between the Veterinary Service and the cattle owners would be established which could not fail to have far-reaching and beneficial effects.

The cattle industry of the country is menaced by the widespread existence of cattle plague and contagious bovine pleuro-pneumonia and, consequently, the energies of the Veterinary Service are mainly devoted to the task of controlling these diseases as far as it is possible to do so with the means at present available. The numbers of outbreaks recorded in 1929 show increases over those reported in 1928 of fifty-two per cent. in the case of cattle plague and of eighty-seven per cent. in the case of contagious bovine pleuro-pneumonia. It is impossible to assign true values to these figures as apparent increases are as likely to be the result of increased willingness on the part of cattle owners to report disease as to be due to an actual increased incidence of disease.

In consequence of the large numbers of cattle which were presented for treatment the demands for serum and for vaccine were much greater than had been anticipated and it is greatly to the credit of the Veterinary Research Officer that, despite shortage of staff and other difficulties, he contrived to maintain adequate supplies to meet all requirements throughout the year.

Cattle Plague (Rinderpest).

During the period under review seven hundred and ninety-five outbreaks of cattle plague came under notice involving a total of one hundred and twenty-four thousand cattle ; of these, twelve thousand seven hundred head died and over thirty-seven thousand were treated with cattle plague anti-serum. The average mortality was 10.25 per cent. The losses suffered varied greatly in different outbreaks, the worst results being recorded where large nu bers of cattle, susceptible to the disease, were involved and where the disease had existed for some time before assistance was sought. More than half the total losses were recorded in Kassala and The Fung Provinces but the provinces of White Nile, Darfur and Kordofan also suffered severely.

Reference was made in the report of last year to an extensive outbreak which occurred in November on the Kassala-Fung provincial boundary, affecting the cattle of both Provinces under conditions which were particularly favourable to the spread of the disease. Upwards of thirty thousand head of cattle were ultimately involved and the losses suffered were exceptionally heavy. The outbreak originated in the Butana which is a common grazing ground for cattle from both Provinces for some months during and after the rains. Arrangements have been made to avert a similar catastrophe in future by detailing Veterinary police to accompany the nomad Arabs on their annual migrations to the Butana.

In the Blue Nile Province eighty-seven outbreaks, involving nine thousand six hundred and fifty head of cattle, occurred during the year. An excellent intelligence system, coupled with motor transport and good roads, enabled the Veterinary staff to deal so promptly and effectively with these outbreaks that the total number of deaths amounted to only four hundred and forty—an average mortality of four and a half per cent.

Cattle plague came under notice on several occasions in cattle awaiting export to Egypt but in all cases the disease was effectively controlled by the use

of serum with little or no interference with trade. Fifty cattle died or were destroyed on account of cattle plague in the quarantine stations at Khartoum North, Wadi Halfa and Port Sudan as compared with seventy-one last year.

The consolidated returns of outbreaks of rinderpest for the past three years are given below but, as previously stated, it is considered impossible to assign true values to these figures for purposes of comparison :—

	Number of outbreaks reported.	Number of cattle involved.	Number of deaths recorded.
1927	340	62,657	8,629
1928	523	91,603	7,137
1929	795	124,406	12,743

The requirements of cattle plague anti-serum for 1929 had been estimated at fifteen hundred litres and arrangements were therefore made to produce this quantity at the temporary serum station at Malakal, commencing at the end of December, 1928. Delays unfortunately occurred in obtaining the number of cattle required at Malakal and before fresh supplies of serum became available the small stock which had been carried forward from last year was exhausted. To meet this emergency the Veterinary Research Officer produced a few thousand doses in Khartoum and, although the production costs were thereby increased, the results were most satisfactory and a very difficult period was successfully tided over. The serum station was closed down towards the end of May by which time, altogether, seventeen hundred litres of serum had been produced. Over fifteen hundred litres of serum were issued during the year leaving a small balance of one hundred and fifty-seven litres to be carried forward to next year.

Considerable difficulty has again been experienced by the Upper Nile Province authorities in obtaining the cattle required for serum production next year. Some cattle were collected in July with the intention of herding them in the vicinity of Malakal until required but, unfortunately, an outbreak of cattle plague occurred amongst them with somewhat disastrous results and it is feared that it will not be found possible to commence operations as early in 1930 as has been planned.

The provision of permanent buildings and quarters at Malakal, which has been approved, will remove some of the difficulties and hardships experienced in producing the country's serum requirements and, with the appointment of a whole-time Veterinary Inspector to the Upper Nile Province, which has also been approved, little difficulty should be experienced in future in maintaining the required supply of cattle.

Contagious Bovine Pleuro-Pneumonia.

Although the total losses recorded this year from contagious bovine pleuro-pneumonia amount to less than twelve per cent. of those recorded from cattle plague, this disease is rightly regarded by all stock owners as a most serious one on account of its insidious nature and of the lengthy period over which it causes losses if left to run its natural course in a herd. Contagious bovine pleuro-pneumonia caused considerable losses during the year particularly in the Provinces of Darfur, Kassala, Kordofan and White Nile and the number of deaths recorded amounted to thirteen hundred and forty head as against nine hundred and sixteen in the previous year.

The heaviest losses occurred in Darfur Province where, unfortunately, the culture vaccine supplied from Khartoum could not be used in every outbreak

owing to the difficulty experienced in delivering it in out-lying districts before it had lost its potency. Many of the cattle involved there were treated by the natives themselves but the results were not encouraging as the casualties resulting from the crude native method of inoculation were almost as heavy as those from the natural disease.

In Kassala Province the disease was mainly confined to the herds of the Beni Amer tribe. It would appear that the cattle of the Beni Amer in Eritrea are heavily infected and it has so far proved to be an extremely difficult task to prevent to and fro movement across the border between the two sections of the tribe. This year the task of controlling movements of cattle was rendered more difficult by the fact that all available police were withdrawn at a critical period of the year for duty in connection with locust control.

The position in Kordofan Province shows a marked improvement as only three hundred and eighty-five deaths were reported this year as compared with six hundred and seventy-seven last year.

Thirty-nine cases of contagious bovine pleuro-pneumonia came under notice during the year among cattle awaiting export to Egypt as compared with forty-six cases last year.

The demand for culture vaccine was again much greater than in the previous year and the resources of the Veterinary Laboratory were often fully taxed to meet it. The output of this product has increased during the last three years from over nine thousand to over twenty-eight thousand doses. Only in one case were the results following the use of this vaccine reported to have been in any way unsatisfactory and, when the large number of animals which have now been treated with it is considered, it can certainly be said to provide the safest and most efficacious means yet discovered for controlling outbreaks of contagious bovine pleuro-pneumonia.

Foot-and-Mouth Disease.

Although this disease is known to exist in the Sudan its manifestations are usually of such a mild character that cattle owners do not regard it as a serious condition and rarely report its presence.

Anthrax.

No case of anthrax in cattle has come under notice during the past three years. It should not be inferred from this, however, that the disease is non-existent in this country. In the past attention has been directed to anthrax through its occurrence either in cattle or sheep which happened to be under close veterinary supervision or in the human subject as the result of handling or eating the flesh of a diseased animal.

Trypanosomiasis.

Occasional reports have been received during the past two years of the suspected occurrence of trypanosomiasis in cattle in the Gedaref district of Kassala Province but it was only in November of this year that positive evidence of the existence of the disease was forthcoming.

Trypanosoma vivax and T. congolense were found in blood smears from cattle at Um Senebra and in Gedaref township and, according to the cattle owners, about fifty per cent. of infected cattle usually succumb. The presence

of tse-tse fly has been reported by the Game Department on the Rahad River where it forms the Kassala-Fung provincial boundary (immediately South of the thirteenth parallel), and other centres are suspected to exist in The Fung Province.

In Kosti township, White Nile Province, an outbreak of trypanosomiasis (T. vivax and T. congolense) occurred in November among cattle awaiting export to Egypt and upwards of a hundred head were slaughtered in consequence. These cattle were purchased from the Selcim, Tagali, Ahamda, Shanab and Galhak districts, but some of them had been in Kosti for nine months before showing symptoms.

In the Blue Nile Province an outbreak of trypanosomiasis came under notice in a fairly large herd of cattle at Shigaeli in Makwar district.

Piroplasmosis.

A pure-bred Ayrshire bull, imported by the Sudan Government in November, contracted theileriasis within three weeks of arrival in the country and succumbed to the disease. Details of this case are given in the appended report of the Veterinary Research Officer.

Bovine Lymphangitis.

A case of bovine lymphangitis came under notice in a bull in the Nuba Mountains during the year and examination of material forwarded to the Veterinary Research Laboratory revealed the presence of an organism indistinguishable from Actinomyces farcinicus.

Apparently this condition is not uncommon in the district in which it was noticed but it is not reported to be a cause of serious loss.

II. DISEASES OF CAMELS.

The exceptionally heavy rainfall experienced in the Central Sudan this year rendered much larger areas of the country unsuitable for camels, during and after the rains, than is usually the case. There was a marked increase in the number of blood-sucking flies which transmit the camel trypanosome (T. soudanense) from infected to healthy camels and these flies extended further northwards than usual. It is not surprising therefore that a relatively higher mortality was recorded this year among police and other Government camels.

The camel-owning tribes generally do not appear to have suffered any losses of note during the year and this may be attributed largely to the fact that they kept their herds on the grazing grounds in the north during the period when their southern grazing grounds were infested with Tabanidae.

The total losses suffered among camels for which forage allowance was drawn amounted to 460 in 1929 as compared with 326 in 1928—an increase of over forty per cent. Of these losses 123 and 82 respectively were due to trypanosomiasis.

The losses from trypanosomiasis among army camels amounted to 6.1 per cent. of the total losses from all causes and the following table, compiled from figures kindly supplied by the military authorities, enables a comparison to be made with previous years :—

	Total losses from all causes.	Losses from trypanosomiasis.
1927	126	27
1928	127	7
1929	114	7

Three hundred and eighty-seven camels suffering from trypanosomiasis were treated with "Naganol" during the year and it is interesting to record that sixty-eight of these belonged to Sheikhs and notables who willingly paid for the treatment. Uniformly good results were again reported, following the use of "Naganol" provided the disease was diagnosed before the animals had become debilitated. The necessity of diagnosing this disease in the earliest stages possible will therefore be apparent, not only from the point of view of returning animals to work with the minimum delay, but also from the point of view of eliminating infection rapidly from a troop of camels.

The method of diagnosis commonly used to supplement microscopic examination of blood smears has been, until recently, one known as the formol-gel test which relies on the occurrence of a reaction when a small quantity of formalin is added to the serum of an infected camel. This method, while possessing considerable value, was not considered to give entirely satisfactory results and, during the past two years, the problem of finding a better method has been carefully studied at the Veterinary Research Laboratory with, it is gratifying to record, marked success. Details of a new method of diagnosis, the mercuric chloride test, and of the results so far obtained with it, are to be found in the appended report of the Veterinary Research Officer.

There is little of interest to record in regard to diseases of camels other than trypanosomiasis ; fewer cases of mange occurred among Government animals than in previous years ; a few deaths from prussic acid poisoning came under notice in the Blue Nile Province as a result of eating immature dura ; contagious necrosis of the skin was responsible for a considerable number of camels being rendered temporarily unfit for duty during the rains in Kordofan and Darfur Provinces, and a few cases of rabies were reported from Darfur Province.

The histories of three camels which developed rabies in Darfur are accurately known and were as follows :—

One camel, bitten on 23-1-29 by a dog suspected to be rabid, developed symptoms on 22-2-29 and died on 28-2-29. The other two camels were bitten by a dog suspected to be rabid on 26-3-29; one died on 5-5-29 and the other on 2-9-29 both showing clinical symptoms of the disease. In the three cases mentioned the camels' brains were forwarded to the Wellcome Tropical Research Laboratories and found to be positive to rabies.

III. DISEASES OF EQUINES.

African Horse-Sickness.

It was feared that the exceptionally heavy rainfall which was generally experienced in the Central and Northern Sudan in 1929 would be associated with a very heavy mortality from African horse-sickness but, although the reported losses were in excess of those recorded last year, they could not be considered

abnormally heavy. The returns of the casualties caused by this disease among horses and mules of the Government service during the last three years are as follows :—

	Horses.	Mules.	Total.
1927	42	67	109
1928	24	16	40
1929	27	44	71

In Kordofan Province the Messeria and Homr tribes report that their losses from this disease were exceptionally light but full reports are not yet to hand from the horse-owning tribes in Darfur Province.

The loss of three Government stallions, namely, Hunting Harry (English thorough-bred), Abu Warda (Arab) and Mandub (Arab) from this disease is recorded with regret.

Epizootic Lymphangitis.

Epizootic lymphangitis was again responsible for heavy losses among Government animals as the following returns show :—

	Horses.	Mules.	Donkeys.	Total.
1928	14	42	5	61
1929	22	46	1	69

The heaviest losses occurred in The Fung, Khartoum and Kordofan Provinces and it is hoped that the steps which have been taken in these Provinces to control the disease will result in a marked diminution in the number of cases reported in future.

Very few cases of epizootic lymphangitis were reported from Darfur Province and the ponies belonging to the Homr tribe in Kordofan Province are singularly free of the disease. The Messeria tribe, however, still suffers heavy losses.

Trypanosomiasis.

Two cases of trypanosomiasis in horses, one due to T. brucei and the other to T. congolense, were reported from the Nuba Mountains, Kordofan Province, and a case of T. soudanense was recorded in a donkey at Gedaref, Kassala Province.

Tetanus.

Tetanus was diagnosed on clincial grounds in a mule at El Obeid and the diagnosis was subsequently confirmed at the Veterinary Research Laboratory from material (pus) collected from the sick animal.

IV. DISEASES OF SHEEP AND GOATS.

A disease of sheep and goats, resembling the disease known in South Africa as heartwater, is reported to occur in Kassala Province, in the Gash valley and delta, but an opportunity to carry out a thorough investigation of the condition has not so far presented itself.

Foot-rot in sheep was very prevalent in Southern Darfur and in White Nile Province during and just after the rains and caused heavy losses in some flocks.

Two outbreaks of contagious pleuro-pneumonia of the goat were reported from The Fung Province.

V. DISEASES OF DOGS.

Cases of disease in dogs, suspected to be rabies, were reported from Kordofan, Upper Nile, Darfur, Red Sea, Kassala, The Fung, White Nile and Khartoum Provinees during the year and rabies was definitely diagnosed in material forwarded to the Wellcome Tropieal Researeh Laboratories from Darfur, Kassala, White Nile and Khartoum Provinces.

Rabies must now be considered to be enzootic throughout that part of the Central Sudan lying West of the Nile and, as the disease appears to be prevalent in Abyssinia and Eritrea, there is a constant danger of its introduction to the Eastern and South-eastern Sudan.

An outbreak occurred in April in El Fasher, Darfur Provinee, among dogs owned by British offieials and was the cause of considerable alarm and inconvenience. Two eases occurred in Omdurman, one on August 30th and one on December 15th. In White Nile Province the disease was definitely diagnosed in dogs at Kosti in January and again in August. One case came under notice in a horse in Kassala.

In all cases where the existence of rabies was suspected immediate steps were taken to ensure the destruction of stray and ownerless dogs in the vicinity and, in some areas, the poisoning of hyaenas and jaekals was carried out.

A further reference to this disease will be found in the portion of this report which deals with diseases of camels.

Veterinary Hospitals.

The number of animals which received treatment at the Veterinary hospitals in Khartoum and Wad Medani during the year were as follows :—

	In-patients.	Out-patients.
Khartoum	1,417	522
Wad Medani	542	2,555

The returns of the shoeing forge attached to the Khartoum Veterinary hospital show that 4,731 horses and mules were shod as against 5,160 in the previous year.

SECTION II.

TRADE IN LIVESTOCK AND LIVESTOCK PRODUCTS.

I. EXPORT AND IMPORT TRADE.

Cattle and Sheep.

The total numbers of cattle and sheep exported during the period under review were 10,412 cattle and 15,079 sheep. The number of cattle exported shows a decrease of 702 head on last year's exports but the number of sheep shows a slight increase. The local supplies of cattle and sheep were well maintained during the trading season and there was no interference with trade due to outbreaks of disease. Owing to good rains grazing and water were plentiful and the condition of the cattle was better than usual. From all reports it would appear that trading conditions were satisfactory and quite a profitable business was done.

Further details of the trade in cattle and sheep are given in the following tabulated statements :—

A. Numbers and values of cattle and sheep exported during the last four years.

Year.	Cattle.	Sheep.	Valuation at port of export.
1926	15,884	19,073	£E. 125,115
1927	13,460	14,158	,, 86,691
1928	11,114	13,961	,, 75,732
1929	10,412	15,079	,, 84,045

B. Numbers of cattle imported during the last four years.

Year.	French Equatorial Africa.	Eritrea.	Abyssinia.	Total.
1926	3,331	756	3,971	8,058
1927	1,844	805	573	3,222
1928	1,029	127	1,511	2,667
1929	2,834	290	1,743	4,867

C. Origin of cattle exported during the past two years.

Province.	1928	1929
Darfur and Kordofan	7,656	7,764
White Nile	1,129	784
Upper Nile	684	847
Bahr el Ghazal	74	—
Blue Nile	60	—
Khartoum	436	122
Berber	1,050	895
Red Sea	25	—
Total	11,114	10,412

D. Average market prices and numbers of cattle sold in El Obeid market during the last four years.

Year.	Number of cattle sold.	Average price £E. m/ms.
1926	7,268	3.536
1927	6,855	2.981
1928	7,034	3.338
1929	7,675	3.355

Camels.

According to reports the export trade in camels to Egypt this year was quite as good as usual. In the absence of reliable statistics of the trade it is difficult to draw any comparison of real value but the number of camels for which export permits were issued in Kassala Province was 9,000 head as compared with 6,935 last year. In Khartoum Province export permits for 755 camels were issued so that the total number exported was certainly not less than 10,000 head. It is difficult to hazard a guess as to the actual numbers of camels which find their way on to the markets of Upper Egypt from the Sudan but an Egyptian merchant, who has recently closely studied the trade in these markets, considers that a fair estimate would be in the neighbourhood of 14,000 head per annum.

The Veterinary Inspector, Kassala Province, reports on the trade as follows:-

"Although prices were said to be lower than were obtainable last year a large number of camels has been exported. The bulk of the trade is still in the hands of the Rashaida. Fat female camels are being purchased for £E.8 to £E.9 and it is stated that the same animals fetch £E.14 to £E.15 in Upper Egypt. The average loss in weight on the journey to Assuan is estimated at about 100 lbs."

In addition to the trade with Egypt 1,450 camels were exported from Darfur Province to French Equatorial Africa as compared with 1,801 in the previous year.

From the foregoing it would appear that the total value of the camels exported annually may be estimated to be in the neighbourhood of £E.100,000.

Mules.

Three hundred and twelve mules were imported from Abyssinia during the year, as compared with three hundred and eighty-five last year.

Hides And Skins.

The following tabulated statement, compiled from the Customs returns, shows the exports of hides and skins, and their values, for the last five years:-

	Hides. Tons.	Skins. Tons.	Total Value £E.
1925	462	601	98,714
1926	428	821	126,431
1927	1,067	932	155,285
1928	2,309	880	298,623
1929	1,328	1,013	185,898

Hides.

Towards the end of 1928 the demand for hides from abroad slackened and local prices consequently showed a downward trend. It was hoped that this trade depression would prove to be of a temporary nature but unfortunately this hope was not realized. The market reports published by the Sudan Chamber of Commerce show that, early in 1929, the demand from abroad practically ceased and, during the year, the local prices fell from about £E. 68 per ton to about £E. 45 per ton—a decline in value of approximately 35 per cent. Reports from abroad stated that tanners were holding large stocks of tanned leather for which there was little or no demand and the stagnation of trade was attributed to the large percentage of substitutes for leather now used all over the world. In the writer's opinion the cause of the depression should also be attributed to the large quantities of hides which were attracted to the world's markets from remote territories as a result of the high prices obtaining in 1928.

The following information in regard to the classification of 1,020 tons of hides exported during the year has been kindly supplied by the merchants who handled the consignments :—

	Number of hides.	Total weight Tons.	Percentage by weight.
Fasher flint-dried	79,834	597	58.5
Dry salted	16,467	214	21.0
Fashoda	51,958	209	20.5
TOTAL	1,020		100.0

The average prices offered for "Fashoda" hides in Omdurman market during the past four years were £E. 42.9 per ton in 1926, £E.60.5 in 1927, £E. 82.7 in 1928 and £E. 48.2 in 1929.

The average weight of the hides exported during the year was 6.44 kilogrammes.

The only imports of hides of any consequence were 612 camel loads from French Equatorial Africa as compared with 813 camel loads in 1928.

Skins.

The trade in skins was, as usual, somewhat depressed during the summer months but for the remainder of the year the demand from abroad was good and prices were well maintained. The average prices offered locally for sheep skins were P.T. 25 for selected slaughter-house skins and P.T. 17 for other qualities. The quantity of sheep skins exported was 859 tons and the average weight per skin worked out at 1.83 kilogrammes.

The average prices of goat skins were 65 m/ms. for light weights and 88 m/ms. for heavy weights. The quantity of goat skins exported was 154 tons and the average weight per skin worked out at 0.64 kilogramme.

The exports of skins for the year were greater than those recorded in any previous year.

Samn or Maslee. (Clarified butter.)

The following tabulated statement, showing the exports and imports of samn during the last three years, has been compiled from the Customs returns:-

	1927		1928		1929	
	Tons.	Value. £E.	Tons.	Value. £E.	Tons.	Value. £E.
Exports..	79	7,158	181	16,409	261	22,493
Imports..	58	4,394	15	941	24	1,941

A considerable quantity of samn was imported from French Equatorial Africa via Gencina this year which is not included in the imports shown above but, in spite of this, it is believed that the exports of this product have increased during the past two years out of all proportion to the imports. Attention is being directed to this trade in the hope that it will be found possible to encourage cattle owners to exercise greater care and cleanliness in making samn and thereby increase the demand for it from abroad.

II. INTERNAL TRADE.

Meat Supplies.

The following statement shows the number of animals slaughtered for food in ten of the larger towns during the past three years:-

	1927	1928	1929
Cattle	21,627	27,601	22,599
Sheep	167,923	142,444	166,362
Goats	9,152	8,650	13,230
Camels	2,284	2,712	2,467

The following returns of animals slaughtered in Blue Nile Province give an indication of the amount of meat consumed, particularly in the Gezira area, during the year :—

Market.	Cattle.	Camels.	Sheep	Goats.
Wad Medani	3,195	1,056	22,096	289
Makwar	771	72	3,200	595
Hag Abdulla	70	82	1,083	48
Hosh	915	155	1,766	—
Gedeidim	600	130	1,100	289
Hassa-Heissa	767	400	9,103	2,265
Messalamia	860	550	8,974	2,400
Halawin	970	646	8,500	2,260
Nayil	703	604	7,723	1,475
Rufaa	124	354	2,906	—
Kamlin	100	10	2,037	200
Managil	500	15	415	50
Totals	9,575	4,074	68,903	9,871

When these returns are compared with those for last year it is found that, while there was a decrease of 2,223 in the number of cattle slaughtered, the number of camels increased by 783 head, the number of sheep by 25,434 head and the number of goats by 8,947 head. Some 14,000 sheep and 8,000 cattle were drawn from Provinces West of the Nile to supply the meat requirements of the Gezira.

A return of the animals slaughtered during the year by licensed butchers in Gedaref and Kassala districts, Kassala Province, is as follows :—7,245 cattle, 16,041 sheep, 9,243 goats, and 580 camels. These figures show increases over those of last year of 1,485 cattle, 843 sheep, 8,951 goats and 141 camels.

SECTION III.

IMPROVEMENT OF LIVESTOCK.

Cattle.

The lines on which action has been taken to improve the cattle in Southern Darfur and Southern Kordofan during the past eighteen months are, briefly, the encouragement of a system of exchanging herd bulls with a view of infusing fresh blood into herds in which intensive in-breeding has been practised for many years, and the elimination of as many inferior bulls as possible by castration. The cattle-owning Arabs are a very conservative people, particularly in regard to anything connected with the breeding and management of their cattle, and it was realized that any innovations introduced must depend for their success on receiving the whole-hearted support of the people. When the reasons in favour of exchanging herd bulls, and the system which it was proposed to adopt in order to effect these exchanges, were explained to the Baggara they received general approval, and it was only when the bull exchanges came to be carried out that the various difficulties to be overcome began to be realized. As a result of the experience gained during the past eighteen months it has been decided that no good purpose would be served by continuing on the lines originally adopted and the scheme has therefore been dropped, at any rate, for the present. It is hoped, however, that it will be found possible in the near future to tackle the problem afresh on lines more acceptable to the people concerned. Every opportunity has been taken to demonstrate the safety and simplicity of the bloodless castrator when used on young bulls and, as this method of operating appears to appeal to the cattle owners, arrangements have been made to issue a certain number of the necessary instruments to selected and trained tribesmen.

The improvement effected in the Government dairy herd at Khartoum North by the use of imported bulls becomes more noticeable every year. The herd now consists of 91 head made up as follows :—

16 half-bred cows, 3 quarter-bred cows, 31 native cows, 14 half-bred heifers, 21 half-bred yearling heifers, 3 three-quarter-bred heifer calves, 1 three-quarter-bred two-year-old bull and 2 half-bred bull calves. The effect of the infusion of imported blood into the herd, coupled with improved methods of feeding and management, is reflected in the returns for the last three years showing the average milk yield per cow per annum. In 1927 this average was 265 gallons, increasing to 329.75 gallons in 1928 and to 373.56 gallons in 1929. A young Ayrshire bull was imported in November for use with this herd but, unfortunately, he died of piroplasmosis (T. dispar) a few weeks after arrival and before any use could be made of him.

In order to decide definitely whether improved cattle will thrive in the Upper Nile Province or not the experiment commenced about two years ago is still in progress and a further consignment of four young half-bred Friesian bulls were despatched to that Province in December for distribution. During the year a young half-bred Friesian bull was despatched to the Bahr el Ghazal Province for use with the dairy herd at Wau and another young bull was issued to the Nazir of the Rizeigat tribe, Southern Darfur.

Horses.

The horse improvement scheme is now in its fifth year and it is satisfactory to be able to report that the progress made continues to be highly encouraging. During the next horse purchase tour a number of cross-bred young horses should be forthcoming. This will be the first crop of cross-breds and it is hoped that their superiority over the indigenous animal will be as great as was anticipated when the scheme was inaugurated. A considerable number of cross-bred fillies have been brought up for service during the year and the resultant three-quarter-bred foals should be seen at the next horse shows.

Financial authority was obtained early in the year to purchase twenty more Arab horses from Egypt, and sixteen of these have now been obtained. When the balance has been procured and distributed all urgent demands will have been met.

The following extract from a report by the Assistant Director of Veterinary Services gives some details of the year's work : —

"**Darfur Province**—It is in the horse breeding districts of this Province that the scheme is meeting with the greatest success—the contributing factors being the suitability of the country, the amenability of the people and the general interest displayed by all concerned. It has been found that the best results have been obtained by the sedentary tribes. Owing to the conditions under which the nomads live they cannot bestow the same care and attention on the young stock as their more sedentary neighbours ; further, owing to the risk of African horse-sickness it has not been found possible to supply imported sires to the nomadic tribes during the rains and consequently their mares can only be mated with such sires during the horse show season. Approval has been obtained for the provision of more stabling at Nyala and when these stables are completed it will be possible to accommodate fifteen horses there during the rains.

"**Kordofan Province**—The number of horses, mares and foals paraded this year at the Homr horse show at Muglad was 1,400, an increase of 200 over the figures for the previous year. The Homr are very anxious to improve their horses but the conditions generally obtaining in their country are not too favourable. The advantages to be obtained from maintaining a supply of sires of improved breed for this tribe will, it is considered, be mainly political. One Arab and three country-bred stallions were stationed at Muglad during the year.

"At the Messeria show held at Abu Zabad 800 horses, mares and foals were paraded, an increase of 200 over last year. The most interesting class was that for foals by Government sires which attracted 73 entries. It was found possible at this show to purchase 37 horses, all of good type, for Government service and for private individuals.

"Excellent stabling has been erected at Nahud for two horses and at Abu Zabad for four.

"**Khartoum and Shendi Districts**—Racing provides the chief stimulus to horse-breeding in these districts. The conditions in the area irrigated by the Government pumping scheme at Shendi are favourable to horse breeding but, generally speaking, the cost of keeping mares and of rearing foals makes it more of a rich man's hobby than a profitable industry. 110 mares were served by Government sires at Khartoum and 70 were served at Shendi during the year.

"**Distribution of Stallions**—The following list shows the distribution of Government stallions as at 31st December, 1929:

"**Darfur Province**—Oberto, Tom Bowling and No Joke (English thoroughbreds), Diamond Jubilee (Egyptian Country-bred), Kiolan, Allahom, Atbara, Baccarat, Talab, Monarch, Assad Karim, Paper Money*, Escort*, Rafdan*, El Nazir*, El Sheikh*, Nasr-el-Din*, El Butt*, Cinders*, Fil-fil*, Tigre Royal*, and Gambeil* (Arabs), Gamil, Fagir and Ziada (Sudan Country-breds).

"**Kordofan Province**—Farad, Nahud, Irrigation*, Mutamad*, Dalgum* and Morgan* (Arabs), Muglad*, Azab and Helbawi (Sudan Country-breds).

"**Khartoum and Shendi**—Viaduct* (English thorough-bred), Melik, Ein-el-Shems*, El Bagh*, Sapper, Faisir* and The Omda* (Arabs).

"During the year four stallions died in Kordofan, two in Khartoum and one in Darfur; "Lulu" was destroyed at Muglad towards the end of the year and "Talisman" was cast and sold.

"The thoroughbred horses "Tom Bowling", "Oberto", "No Joke" and "Viaduct" are all in excellent condition and are getting a high percentage of mares in foal. "No Joke" has many good foals to his credit. It is realized that the produce of these horses is not likely to withstand native conditions as well as the indigenous stock. These horses, therefore, are only mated with mares of good quality belonging to men who are in a position to bestow the necessary care and attention required in the rearing of highly bred offspring."

Camels.

There is nothing of interest to report under this heading.

Donkeys.

With a view of improving the breed of donkey in the Gezira area, Blue Nile Province, five donkey stallions were purchased by Government and distributed to selected tenants in the area. There are many big riding donkeys of excellent type in the Gezira but high service fees are usually charged for the use of good sires and this prevents the owners of mares of inferior type from mating them with a good stallion.

A Government donkey stallion was posted at Nahud during the year and his services are in good demand.

Mule Breeding.

Early in the year funds were approved to carry out a hinny breeding experiment in Southern Darfur. The object of the experiment is to ascertain what proportion of the hybrids, produced by crossing native donkey mares with a good type of local pony stallion and reared under the same conditions as the local donkey, will prove to be suitable for Government requirements. This experiment, which is now in progress, should provide some interesting results.

Sheep.

The following extract from a report rendered by the Chief Inspector in charge of the Gezira Research Farm and kindly forwarded by the Director of Agriculture and Forests, gives some details of the sheep-breeding experiments in progress there :—

* Denotes horses put on the list during 1929.

"The two merino rams have now survived Gezira conditions for eighteen months. One developed a skin disease but made a good recovery and both are now in fair condition. The first year they clipped sixteen rotls of wool per head but only ten rotls in the second year. They seem to stand the heat surprisingly well considering the amount of close wool they carry.

"The cross-bred lambs look particularly well. Their fleece is much shorter than the pure bred Merino and contains a large amount of hair. They mature earlier than the native sheep and are more compact and better shaped. It is intended to cross the cross-bred ewes again with the Merino rams and to issue the resultant ram lambs to Gezira tenants.

"Mr. Niall of Melbourne, Australia, has kindly presented to the Department two Border Leicester rams, born and bred in Northern Australia, as he considers they would give better results than Merinos.

"These rams arrived safely in November."

Poultry.

Some valuable importations of pure-bred fowls were made by private individuals during the latter part of the year, notably, two pens of White Leghorns, one pen of Black Leghorns and one of Rhode Island Reds from England, and one pen of White Leghorns and one of White Wyandottes from Alexandria, Egypt. Several incubators were also imported by private individuals from England and the United States of America.

Excellent reports have been received from the provinces in which improved birds have been distributed, and quite large flocks of half-bred fowls are to be seen particularly in the vicinity of Atbara, Kassala, Gedaref, El Obeid, Nahud and Singa as well as in the Gezira area.

SECTION IV.

MISCELLANEOUS.

Grazing and Water.

During the first six months of the year grazing was very scanty in all the Northern districts of the country but exceptionally good rains fell from June onwards throughout the Central Sudan with the result that, during the latter half of the year, conditions were more favourable from a stock breeding point of view, than they have been for some years. Swarms of locusts appeared with the rains and considerable damage to crops was done by them in certain areas but the grazing was not appreciably affected. A report from the Red Sea Province in October stated that good rains had fallen in the Hadendoa and Western Amarar country especially along Khor Arba and the fringe of the plain at the foot of the hills as far North as Jebel Eigrim. North of this point and Westwards, as far as the Nile, rains were poor and the Tamarab and Atbai plains had very little.

Livestock in the Gezira Area.

The practice of harvesting and stacking the forage crop grown on the irrigated area has become general throughout the area and, with judicious management, this supply should suffice to maintain the livestock of the tenants in good condition until the rains break. Some time will elapse, however, before the tenants will fully realize the necessity of holding ample reserves of forage until the rains arrive for, by the end of March, owing to overstocking in December and January, it was found that forage supplies were giving out.

With a view of affecting some improvement in the breed of cattle and in the common type of donkey and sheep in the Gezira area funds were granted by Government for the purchase of ten native bulls, ten native rams and five donkey stallions of the rider type. The donkey stallions required have been purchased and issued to selected tenants who draw forage allowance for them on the understanding that they will be properly looked after and held available for the free service of donkey mares in the neighbourhood. Four of these stallions served 65 mares before the end of the year. Of the bulls required only a few have so far been obtained but it is hoped to procure the balance in the near future. These bulls, and the rams referred to above, will also be issued to selected tenants.

A few notes on the sheep breeding experiments which are in progress at the Gezira Research Farm are to be found in the section of this report dealing with the improvement of livestock.

Through the kindness of the Manager, Sudan Plantations Syndicate, a motor horse ambulance, provided and maintained by the Syndicate has been placed at the disposal of the Veterinary Inspector, Blue Nile Province. By this means sick horses are brought in for treatment to the Veterinary Hospital at Wad Medani. The provision of this ambulance has greatly facilitated the work of the Veterinary Inspector.

The diseases of animals returns for the Blue Nile Province show that 446 deaths from cattle plague and three deaths from contagious bovine pleuro-pneumonia occurred during 1929 as compared with 1,390 and 32 respectively in 1928.

Veterinary Inspectors have now been posted to The Fung and White Nile Provinces and the veterinary supervision which will thereby be rendered possible in these Provinces in future should prove of great value in preventing the spread of disease to the Gezira area.

The Second Gezira Livestock Show was held at Wad Medani on January 29th and was a great success. The various classes were well filled and the exhibits showed, both in quality and numbers, a marked improvement on the 1928 show.

Government Forage Allowance.

The regulations governing the issue of Government forage allowances underwent revision during the year and a new scale has been drawn up which is considered to be a great improvement on the old one.

Belgravia Dairy.

The quantities of dairy produce sold from the Government dairy at Khartoum North during the year were as follows : Fresh milk 12,856 gallons, fresh cream 232 gallons and fresh butter 3,028 lbs.

Buildings.

Structural improvements are in progress at the Belgravia Dairy and a satisfactory water supply has been laid on by an extension of the Khartoum North pipe line. The improvements referred to consist in the provision of a large, airy milking shed and of a steam sterilizing plant for dairy utensils, milk bottles, etc.

Extra stabling accommodation was provided for Government stallions at Nyala, Nahud and Abu Zabad during the year.

Acknowledgments.

It is again a pleasure to record an appreciation of the assistance that has been rendered to the Veterinary Services, during the year, by Provincial staffs and by all other Departments and Services, when called upon. This assistance has always been freely and promptly given and has contributed, in no small measure, to any success that has attended the efforts made to control disease and to improve the breeds of livestock.

(Sgd). **W. KENNEDY,**

Director, Veterinary Services,

Sudan Government.

APPENDIX.

REPORT

of the

Veterinary Research Officer.

ANNUAL REPORT

OF THE

VETERINARY RESEARCH OFFICER,
SUDAN GOVERNMENT.

1929.

A. STAFF.

Veterinary Research Officer.

Held by myself throughout the year.

Asst. Veterinary Research Officer.

Vacant throughout the year. Mr. A. B. MacIntyre, Veterinary Inspector, was attached to the Laboratory from the beginning of the year until October 2nd and again from December 26th until the end of the year.

Laboratory Assistant.

Mr. P. A. C. Kenny held the post throughout the year.

For approximately seven months during the year I was absent from the Laboratory; from mid-February to mid-March in the Upper Nile Province in connection with cattle plague antiserum production, and from early April until the end of September on leave and attending the Pan-African Veterinary and Agricultural Conferences in Pretoria.

Mr. MacIntyre was absent from mid-February until the end of May in the Upper Nile Province preparing cattle plague anti-serum. From early April until the end of May, Mr. Kenny was in charge of the Khartoum Laboratory.

B. ROUTINE WORK.

The main sections of routine work have been, the examination of specimens submitted for diagnosis, the manufacture and issue of contagious bovine pleuro-pneumonia vaccine, the manufacture of cattle plague anti-serum—issues being made through the Veterinary Stores—and the issue of testing apparatus and Naganol and collection of records in connection with the control of camel trypanosomiasis.

I. Examination of Specimens.

A total of 659 specimens has been examined, exclusive of such as have been examined in connection with Laboratory work, and of entomological and helminthological materials which are always passed on for special examination. The following list constitutes a statement of diagnoses under headings of animal species.

HORSES.		
Epizootic lymphangitis	22	
Pyogenic infections	21	
Piroplasma caballi	4	
Trypanosoma brucei	1	
Trypanosoma congolense	1	
Filariasis	1	
Negative	92	142
MULES.		
Epizootic lymphangitis	46	
Pyogenic infections	28	
Piroplasma caballi	1	
Tetanus (in pus)	1	
Negative	107	183
DONKEYS.		
Ringworm	2	
Epizootic lymphangitis	1	
Piroplasma caballi	1	
Trypanosoma soudanense	1	
Negative	11	16
CAMELS.		
Trypanosoma soudanense	35	
Pyogenic infections	2	
Rabies	1	
Negative	97	135
CATTLE.		
Trypanosoma congolense	3	
Tryp. congolense and Tryp. vivax	3	
Piroplasma bigeminum	2	
Theileria ? sp.	2	
Theileria ? dispar, Piroplasma bigeminum and Tryp. theileri	1	
Actinomycosis	1	
Bovine lymphangitis	1	
Negative	28	41
SHEEP.		
Sarcoptic mange	1	
Negative	1	2
GOATS		
Pyogenic infection	1	
Negative	3	4
DOGS.		
Piroplasma canis	7	
Negative	59	66
FOWLS.		
Spirochaetosis (one turkey)	21	
Negative	32	53
MISCELLANEOUS.		
Giraffe, piroplasmosis	1	
Roan antelope, piroplasmosis	2	
Negative examinations on lion, cheetah, baboon, barbary sheep and various small ruminants and birds	14	17
TOTAL ..		659

A few specimens, chiefly histological, are awaiting diagnosis and will be included in the report for 1930.

II. Notes on Specimens Examined.

(i) TRYPANOSOMIASIS.

Although camels have, as in earlier years, provided the bulk of positive diagnoses the actual number of cases continues to decrease. This is due to the universal use of the formol-gel test by Veterinary Inspectors; practically all the positive diagnoses have been made in material submitted from other sources or in the Khartoum laboratory which examines all local material. The use of the formol-gel test for diagnosis will be further mentioned when considering the control of camel trypanosomiasis.

Both cases of equine trypanosomiasis, one of *T. brucei* and the other of *T. congolense* were from the Nuba Mountains where tse-tse fly and these two species of trypanosomes have been known to exist for several years.

The most interesting specimen was that of *T. soudanense* in a donkey, as this diagnosis helps to fill a gap that has hitherto existed in this country. It is known that in India and in regions of Northern Africa trypanosomes of the *T. evansi* type are commonly found in equidae, but in this country in spite of the widespread distribution of *T. soudanense* and the close association of horses, mules and donkeys with camels no natural infection with this trypanosome has previously been recorded in any animal other than the camel. Certain small scale laboratory experiments had been carried out in this connection before this case was diagnosed but the work has not yet arrived at a stage that would make a report profitable.

There is little of interest in the cases of cattle trypanosomiasis. One case of mixed *T. congolense* and *T. vivax* and one pure *T. congolense* infection were diagnosed at Kosti in Selim cattle, one mixed infection of these two trypanosomes from Yirrol, one mixed and one pure *T. congolense* from Kassala and one *T. congolense* infection in the Khartoum quarantine in a beast from El Obeid.

(ii) PIROPLASMOSIS.

As in earlier years the diagnoses of equine piroplasmosis have been few, the probable reason being the existence of an almost universal immunity tolerance in indigenous animals and those which have been in the country for some time, an observation that might be equally applicable to cattle and dogs, although in the case of the last named it is remarkable that few diagnoses are established in the acute stages among imported dogs under close observation in Khartoum.

There have been four interesting cases of piroplasmosis during the year :—

(a) A large parasite of the *Babesia* type in a giraffe which had died in the Khartoum zoological gardens. Only one parasite was seen but it was very well stained and had the typical colouring of a piroplasm, being large and somewhat ovoid rather than pear shaped. Although no more material could be examined for confirmation there was no hesitation in diagnosing the body as some form of parasite, probably a *Babesia.*

(b), (c) Parasites similar to those seen in the giraffe, but in two Roan Antelope at the zoological gardens. A few parasites were seen in blood smears from the two individuals, which were suffering from some undiagnosed febrile condition. They were treated with trypanblue but died. Unfortunately these two cases occurred during one of my absences from Khartoum and no material was collected for further study.

In any case, it does not seen probable that in any of the foregoing instances the piroplasms were of pathological significance; it is, however, unfortunate that a more thorough study was not carried out.

(d) A case in an imported pure bred Ayrshire bull, the interest lying in the fact that it constitutes the first occasion on which disease has in this country been ascribed to a parasite comparable with *Theileria dispar* of Northern Africa. This case is the one described in the tabulated statement of diagnoses as having *Theileria dispar*, *Piroplasma bigeminum* and *Trypanosoma theileri*, all of which appeared in less than three weeks from the date of importation. The first parasites to appear were *P. bigeminum* accompanied by *Tryp. theileri*, but the former was checked with a single dose of trypanblue and the trypanosome was not seen again. Three days after treatment with trypanblue parasites of the *Theileria* type appeared and were continuously present in the blood in great numbers until death occurred on the seventeenth day from their first appearance. Post-mortem examination revealed lesions characteristic of *T. dispar*, namely, enlarged spleen and lymphatic glands, infarction of the liver (but not of the kidneys) and epicardial ecchymoses. "Blue bodies" were plentiful in the spleen and lymphatic glands, and were particularly numerous in preparations from the infarcted areas of the liver.

In the absence of any precise knowledge of the distribution and species of *Theileria* in the Sudan it is not possible to estimate their possible danger to imported stock. That theileriasis, characterised by the presence of "blue bodies" exists was established a few years ago but, seeing that all the indigenous cattle appear to be tolerant (naturally premunised) and that a negligible number of European cattle has as yet been imported, this class of infection has received practically no attention. Now, however, it is possible to state that among the local species of *Theileria* there is one that conforms closely to that named *T. dispar* in Algeria.

(iii) BOVINE LYMPHANGITIS.

Although bovine lymphangitis is a fairly widespread condition it does not appear to have been recorded in this country until this year. A single specimen of pus was received from the Nuba Mountains with a description of clinical symptoms typical of "bovine farcy". Microscopic examination showed the presence of a branching moderately Gram-positive and moderately acid-fast filamentous organism apparently in a state of purity. No further investigation has been possible as the specimen was received at the end of the year; it is, however, fairly certain the organism concerned is the common *Actinomyces farcinicus*. It was reported by the Veterinary Inspector who sent the specimen that the local cattle owners know the disease quite well; they seem not to have brought it to notice in the past because losses from it are negligible.

(iv) EPIZOOTIC LYMPHANGITIS.

The wide distribution of this disease is best shown by the following table:—

TABLE I.

Pus smears received and positive diagnoses of Epizootic Lymphangitis from individual Provinces.

Province.	Number of smears.	Positive diagnoses.
Khartoum	87	15
Fung	45	26
Kordofan	29	17
Upper Nile	10	4
Blue Nile	9	3
Kassala	4	2
Darfur	6	1
White Nile	5	1
Berber	7	—
Total	202	69

It will be seen that The Fung Province, as in earlier years, has provided the largest number of recorded cases, but the number of cases in other provinces, relatively to the amount of material examined, has been as high.

Two interesting cases were recorded, both in mules, one being an infection of the conjunctiva and the other of the nasal mucous membrane.

III. Control of Camel Trypanosomiasis (*T. soudanense*).

Late in 1927 a routine system of control of camel trypanosomiasis was adopted in which the formol-gel test was to be used as the standard diagnostic test and a single dose of ten grammes of Naganol (Bayer 205) given intravenously in aqueous solution, as the standard routine treatment. It was known in instituting this method that the formol-gel test was not entirely reliable, but its accuracy was thought to be in the region of 90 per cent. Further, ten grammes of Naganol was known to be a larger dose than would be necessary in a considerable proportion of cases ; it was, however, the smallest *single* dose that had been found to cause the permanent disappearance of trypanosomes in every case treated.

It was further arranged that all Veterinary Inspectors should send periodical reports to the Laboratory giving details of individual cases, partly with a view of confirming the curative value of the single dose of Naganol but more especially of checking the actual value in the field of the formol-gel test ; with this latter objective in view it was suggested that whenever practicable the formol-gel test should be checked by microscopic examination of the blood.

Up to date records have been received of 525 camels treated, all of which have been cured in the sense that the actual trypanosome infection has disappeared. It has, however, been found that although a "cure" can in this sense be effected in camels even in an advanced stage of the disease, in actual practice it is sometimes uneconomic to do so, owing to the length of time required for a camel in a very emaciated state to recover condition. On this account it is certain that in spite of possessing a remedy capable of curing all cases one will be compelled for an indefinite period to admit losses from trypanosomiasis.

In regard to the usefulness of the formol-gel test under field conditions in the Sudan, analysis of the methods of diagnosis in the treated cases shows :—

(a) By positive microscopic findings only :	11
(b) By positive reaction to the formol-gel test only	250
(c) By positive formol-gel reaction when microscopic examination was negative	211
(d) By positive reaction to the formol-gel test confirmed by microscopic diagnosis	47
(e) By positive microscopic finding when reaction to the formol-gel test was negative :	6
TOTAL	525

In assessing these records it is necessary to consider the limitations of the formol-gel test—which were discussed at some length in my report for 1928. The most serious sources of error, namely, that infected camels may be missed on account of the long period required for a positive reaction to develop, or the fact that it may never develop, cannot be appreciated from the above

classified statement, except possibly from the six cases in which the microscopic examination showed that trypanosomes were present while the reaction to the formol-gel test was negative. The total number of infected camels missed cannot, however, be estimated.

The fact that at any test five or six per cent. of non-infected camels are found to give positive reactions (although not always the same individuals) is not so serious ; the result during the past two years will merely have been that twenty or thirty camels have been treated unnecessarily ; but in any case they have probably been protected against infection for a short time and the Naganol has not been entirely wasted.

The most important figures from the standpoint of field practice are those of the camels in which both methods of diagnosis were attempted. Here, of 264 camels 211 were treated as the result of a positive reaction to the formol-gel test when microscopic examination was negative. Disregarding the small number which were unnecessarily treated, it is certain that at least 200 (say 75%) infected camels were correctly diagnosed by the test when microscopic examination failed to establish a diagnosis. It is probable that this proportion would be applicable to the total.

In conclusion, there is now no doubt as to the certain efficacy of Naganol as a curative agent in camel trypanosomiasis ; although ten grammes is sometimes an unnecessarily large dose, it is nevertheless judged more economic to give this quantity as a routine single dose than to have a number of relapses entailing either a second treatment, or as this is often impracticable, the loss of the camels concerned. Regarding the formol-gel test as a diagnostic method, allowing for its imperfections it can be claimed that during the past two years in cases where it has been checked it has shown itself to be at least four times as useful as microscopic examination alone.

In fact, in our present system of control the only possible improvement can be in the direction of more accurate diagnosis, particularly of cases in the early stages of infection. It is intended to supersede the formol-gel test with the new mercuric chloride test as soon as possible, and it is hoped that this test, which under laboratory conditions has proved itself much better than the formol-gel test, will maintain its superiority when used on a general scale in the field. Further information on this test will be given in the section dealing with research.

IV. Contagious Bovine Pleuro-pneumonia.

The issue of a single dose living culture vaccine has continued and demands for it have continued to increase. The following figures show the rate of increase in demands during the last four years :—

		doses.
1926	(Oct. 1st 1925—Dec. 31st, 1926) ..	4,250
1927	.. ..	9,410
1928	.. ..	17,590
1929	.. ..	28,170

There has been no change in the technique of production ; the principle throughout has been the one established as the result of experiments recorded in the Report for 1927, namely, to use cultures that have been maintained in serum peptone broth for the shortest period compatible with safety. A small preliminary experiment carried out early in 1928 (not yet published) tended to

show that with our present technique six weeks in broth culture with weekly subculturings rendered the virus harmless. Owing to pressure of other work more definitive work on this subject has not been possible but cultures issued as vaccine have been in the main subcultured for periods varying from ten to twenty-six weeks. Actually cultures of seven, eight and nine weeks in artificial medium have been issued to the extent of 3,000 odd doses without ill effects (the only accidents reported have been after the use of cultures of the tenth or older generation) but owing to the incompleteness of the laboratory work it has been considered safer not to issue vaccines as near the limit of safety as those of less than ten generations.

As regards actual field practice the safety of the vaccine must be judged from reports sent by the officers who use it. Without entering into a discussion of individual cases of accident the total number and proportion is as follows:—

No. of doses issued	28,170
No. of abnormal local swellings	120
No. of deaths	29

The number of swellings (which are recorded without any discussion as to causation) has probably been rather larger, since it is not likely that relatively insignificant swellings would be noticed, or if noticed reported on. It is believed, however, that all deaths have been recorded, and these—again disregarding their exact cause, but admitting that if the cattle had not been vaccinated they would not have occurred—amounted to 1.03 per thousand doses issued. It is certain that every dose issued was not injected, but so high a proportion will have been used that the relative number of casualties will be very close to that calculated above.

While realising that a good deal more research is necessary on the question of safety relatively to efficacy it can be claimed that a mortality of about one per thousand is fairly satisfactory.

V. Cattle Plague.

This year again cattle plague antiserum was prepared in a temporary camp near Malakal, but with the knowledge of local conditions obtained in 1928 arrangements were made to supply the whole of the country's requirements for the year.

The work was greatly hindered by the late arrival of most of the cattle required, so that instead of starting work in December or early in January and finishing in April it was necessary to remain until late in May. In consequence the Veterinary Inspector in charge was given considerable trouble by his living camp becoming uninhabitable and his temporary working huts collapsing owing to the rain. In addition it was realised that the stock of serum in Khartoum was nearly exhausted and would be completely expended before supplies could arrive from Malakal, and a small quantity had to be made in Khartoum at far greater relative cost.

Ultimately 1,716.6 litres, or 34,332 nominal (50 c.c.) doses were prepared, exclusive of serum used in the serum station for immunising and testing purposes. This quantity has been just sufficient to supply ordinary demands up to the end of the year, but as it has allowed of no reserve for emergencies it cannot be considered adequate as an annual output. If an early start is made in the next

year or two there should be no difficulty in preparing a year's requirements of serum, assuming its present rate of expenditure, by the middle of April. This should allow the Officer in charge to carry out the work under reasonable conditions and have it finished before rain destroys his temporary buildings.

Regarding the ultimate supply of cattle-plague anti-serum it has been decided to erect permanent buildings at Malakal including a house for the officer in charge. The Governor, Upper Nile Province, who has gone to considerable trouble in connection with the temporary serum stations, has allotted sites for permanent laboratory buildings and a house, construction of the latter having been started during this year. When the permanent buildings are completed the work should be much easier and the production of greater quantities of serum should allow of its more liberal use in the control of cattle plague generally. From a financial standpoint also the erection of permanent buildings should be an economy. The present rate of serum production is perhaps not approaching its limit even under present conditions, and the cost of serum has been approximately calculated at P.T. 4 per "dose" (50 c.c.). It is realised that for the adequate control of cattle plague in the future far more serum will be required. With permanent buildings the work will be less subject to hindrance by adverse climatic conditions, a longer working season will be practicable and the output of serum should be greatly increased with little advance in overhead charges. In addition, research on this disease, which has in the past been almost entirely neglected in this country, can receive some attention.

VI. Miscellaneous.

Among the miscellaneous minor activities of the laboratory that which has taken up most time has been the issue of technical stores, chiefly Naganol and diagnostic materials either for use in the field or for the collection of specimens to be submitted to the laboratory.

Severals fowls of pure or cross European blood have been treated for spirochaetosis and a few half-bred bulls from the Government Dairy have been immunised against cattle plague and pleuro-pneumonia prior to their distribution to provinces.

Correspondence, particularly in connection with the preparation and issue of products of the laboratory, has greatly increased, and in the absence of a whole time clerk has occupied much of the Laboratory Assistant's time.

C. RESEARCH.

In the Report for 1928 it was recorded that it was becoming difficult to carry out research work owing to increase of routine duties and shortage of staff, in particular owing to the absence of an Assistant Veterinary Research Officer. During 1929 routine duties have still further increased and no addition has been made to the staff, while I have been absent from headquarters for more than half the year. In consequence deliberate research has had to be entirely suspended; certain minor observations have, however, been carried out in connection with camel trypanosomiasis, the following being a brief record.

The Mercuric Chloride Test.

A short description of the mercuric chloride test and some observations on its accuracy were given in this Report for 1928. During 1929 still further observations have been carried out on a small scale, the two aspects receiving particular attention being (i) the determination of a standard technique for adoption when the test is generally employed in the field, and (ii) observations on its accuracy, particularly in regard to the question of whether some non-infected camels may show positive reactions to the test.

1. Technique.

At the end of last year it was provisionally decided that a camel should be considered infected with trypanosomes if one drop of its serum added to one cubic centimetre of 1–20,000 aqueous mercuric chloride solution produces opacity within a few minutes. Possible objections to this decision are (a) that the term "one drop" may be too vague, unless a standard dropping pipette be used, and (b) that the routine use of a 1-20,000 solution of mercuric chloride may result in a certain proportion of wrong diagnoses owing to this dilution being too near to those with which the serum of some normal camels produces a precipitate. In fact it had to be decided whether for general field use it would not be better to use a 1-25,000 solution.

Regarding the first of these, as the result of testing a large number of proved infected and non-infected camels, using drops from pipettes of varying calibres it has been found that the term "drop" is sufficiently accurate ; in fact in the first publication on the test (*Jl. Comp. Path. and Therap.*, 1928, Vol. 41, p.341 ff.) it was shown that a hundred per cent. variation in the size of the drop was permissible and that the adoption of the technique of one drop to one cubic centimetre was a matter of convenience. Further, for field practice it is better to use Pasteur pipettes drawn out from small calibre glass tubing than to employ standard dropping pipettes ; the former are very cheap, can be made, cleaned and sterilised in the laboratory, and can be thrown away when once used, whereas special pipettes would have to be very carefully cleaned and dried after delivering each sample of serum.

The dilution of 1-20,000 aqueous mercuric chloride has also been confirmed by testing a large number of proved infected and non-infected camels. It has, however, been found that there is a risk of obtaining doubtful or faintly positive reactions if serum is removed from the blood clot too soon after drawing the blood sample, especially if an attempt be made to save time by centrifuging freshly clotted blood. Employing the only technique that is likely to be practicable in the field, namely, to allow the blood to clot and stand overnight, the serum being tested next day, it has been found that of 183 non-infected camels the serum of two only has given a faint opacity with the 1-20,000 dilution, and none with the 1-25,000 dilution. In a paper published earlier in the year (*Jl. Comp. Path. and Therap.*, 1929, Vol. 42. p. 118.ff) it was therefore recorded that in order to be certain of detecting infected camels only it would be necessary to employ the 1-25,000 dilution. There is, however, a further practical consideration, namely, the length of time required after the date of infection for the serum of an infected camel to give a precipitate with the higher dilution. As the result of observations recorded in 1928 (see this Report, 1928, p. 39) it seems that while most or possibly all infected camels react positively to the 1-20,000 dilution at the end of a fortnight only half of them do so to the 1-25,000 dilution. Or, for practical purposes, by using the 1-20,000 dilution one may diagnose an occasional non-infected camel (probably less than one per cent. of the whole) as being in the early stages of infection, but by using the 1-25,000

dilution one may miss quite a number of recently infected cases. It is therefore decided that for general use the 1-20,000 solution will be used, subject always to proof (not yet complete, but strongly indicated) that in cured camels the reaction to the test returns to negative within a reasonable time.

2. Accuracy.

The above discussion on technique largely establishes the accuracy of the test. Neglecting, however, the question of the exact dilution of mercuric chloride required the broad requirement of accuracy is that only infected camels shall give definitely positive results and that all of these shall do so. The following analysis of all results obtained in the laboratory during the past four years suffices to settle this point.

Total camels tested of which the subsequent history is known	250
Positive reactors	69
Negative reactors	181

Of the positive reactors 63 were proved infected either by finding trypanosomes in the blood or by subinoculation, and four others were assumed to be infected owing to recovery of condition after treatment with Naganol. The remaining two were known to be free from infection—the two cases discussed under the heading of technique.

Of the negative reactors 78 were proved to be free from infection by subinoculation and all the others were assumed to be free in virtue of their subsequent history being known. Among the 78 in which subinoculation with negative results was practised were two camels giving a positive reaction to the formol-gel test.

Thus, on the point of accuracy the error up to date has been less than one per cent.

3. Mechanism of the test.

In this Report for 1928 it was recorded that with the collaboration of Dr. E S. Horgan of the Wellcome Tropical Research Laboratories blood analyses were being carried out on infected camels parallel with the mercuric chloride test. The work was completed early in 1929 and full details have been published (*Jl. Comp. Path. and Therap.* 1929, Vol. 42, p. 188 ff.). Briefly stated it was found that with an increase in the intensity of reaction to the mercuric chloride test the serum of infected camels showed a progressive increase in the quantity of euglobulin and a decrease in pseudoglobulin, thus behaving almost exactly as human serum in Kala-azar. It was, however, most noteworthy that infection could be detected by applying the test much earlier in the course of infection than analysis could establish an appreciable relative increase of euglobulin. With the recording of this observation it is necessary to bear in mind that in addition to the quantitative changes detected on analysis there may possibly be some specific qualitative changes also.

4. Disappearance of positive reaction in cured camels.

From the practical standpoint it is necessary to know whether a camel, having developed a positive reaction to the mercuric chloride test as the result of trypanosome infection will, when cured, cease to react positively within a reasonable time. If not, old cured cases may be later diagnosed as reinfected, or, if there is not complete reversion to negative reaction it may be necessary to employ a higher dilution than 1-20,000 of mercuric chloride in routine diagnosis.

It is impossible to keep in sufficiently close touch with many cured camels for regular periodic tests to be carried out. A few results have, however, been carried out, and while not numerous enough to warrant a general conclusion they have indicated that the serum of cured camels loses all power to produce a precipitate with the 1-20,000 dilution (12 cases only). Regarding the length of time required still less information is to hand. Only three cured camels have been examined weekly and in these the serum gave negative reactions four, six and ten weeks respectively after cure; of eight others three were negative 45 days after cure and five after 276 days (the only time they were available for retest).

For field purposes, therefore, it may be provisionally concluded that there is little chance of an old cured case being diagnosed as infected unless reinfection has occurred, especially since it is known that immunity after cure persists for a few months.

D. PUBLICATIONS.

During the year two articles have been published on the work done in the laboratory :—

1. BENNETT, S. C. J. The mercuric chloride test for camel trypanosomiasis—*Jl. Comp. Path. and Therap.*, 1929, Vol. 42, pp. 118—126.

2. HORGAN, E. S. and BENNETT, S.C.J. The mercuric chloride test for trypanosomiasis in camels. Mechanism of the reaction.—*Jl. Comp. Path. and Therap.*, 1929, Vol. 42, pp. 188-196.

In addition two general papers were prepared and read at the sixth Pan-African Veterinary Conference at Pretoria.

3. Camel Trypanosomiasis in the Sudan.

4. Contagious Bovine Pleuro-pneumonia—Culture Vaccines.

These papers will be printed and incorporated in the Proceedings of the above-named Conference.

E. SUMMARY.

The year's work may be briefly summarised by stating that routine work has now completely replaced research, a position that is due to increase of routine work without increase in staff. The chief increases of work have been in the preparation of pleuro-pneumonia vaccine and cattle plague anti-serum, and in correspondence, all of which have, at a rough approximation, doubled as compared with 1928. The small amount of work recorded under the heading of research has merely consisted of settling a few details in connection with a test that had already been established in principle.

A whole time clerk has been promised for 1930, whose appointment will relieve the Laboratory Assistant of all clerical duties and will thus relieve the situation in regard to routine work. Regarding research, however, particularly continuity of observation in experiments that require some time for completion, the situation cannot be improved without the permanent appointment of an Assistant Veterinary Research Officer with previous experience of laboratory work.

(Sgd.) S. C. J. BENNETT,
Veterinary Research Officer,
Sudan Government.