



COLONY AND PROTECTORATE OF KENYA

Department of Agriculture
Annual Report
1932

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Annual Report of the Department of Agriculture

FOR THE YEAR ENDED 31st DECEMBER, 1932

Introduction

Part I of this report deals with administrative matters, current economic problems of the agricultural industries, statistics relating to these industries taken from the 1932 census, and legislation bearing on them enacted during the year. Part II records the work of the Department associated with the plant industries; Part III that associated with the animal industries. Part IV is in the nature of appendices to the report, covering (a) a report on the locust campaign; (b) records of staff; (c) records of rainfall at representative stations.

The necessity of awaiting the completion of the annual census (1st March to 28th February) accounts, as in past years, for the late appearance of this report.

Part I.—Administration

ANNUAL REPORT OF THE DIRECTOR OF AGRICULTURE

STAFF.

The principal staff changes are recorded in Part IV of this report.

In the retirement of Mr. J. Walker, O.B.E., M.R.C.V.S., Chief Veterinary Research Officer, the Colony has lost an officer who has rendered valuable and distinguished services to its animal industries over a period of fourteen years. Mr. Walker has been succeeded by Mr. R. Daubney, M.Sc., M.R.C.V.S.

Owing to the necessity for economy in 1931, the posts of five Agricultural Officers were left in abeyance and on becoming vacant a further three posts remained unfilled during that year. Six of these posts were filled in 1932. Two of the appointments were temporary and were terminated at the end of the year, when further economies were required by the Government. Four posts of Agricultural Officers under Native Services remain vacant at the opening of 1933.

The difficulties experienced by all branches of the agricultural industry intensified the increasing demands for services from the Department. It has not been possible to meet many of these demands, particularly those involving travelling and the extension of investigational work. With the filling of vacancies in the posts of Agricultural Officers it became possible to further the organization, outlined last year, of agriculture in the native reserves. This took form particularly in the delegation to two officers of the duties of a senior Agricultural Officer for the two important Provinces, Kikuyu and Nyanza—a badly-felt need in view of the impracticability of supervision by the hard-pressed administrative officers at headquarters.

The volume of work at head office hardly permits of the important duty of inspection of field services. In 1932, for example, in addition to normal administration and the direction of the locust campaign, the urgent problems which arose in respect of maize rates and railage quotas, wheat shortage and protection of flour mills, the negotiations for framing a Coffee Industry Bill and bringing into existence a Coffee Board, the inquiries of Lord Moyne and Mr. Roger Gibb, the pressing demands of the Expenditure Advisory Committee, the demands on the Department of a host of other Committees, the re-organization of the Board of Agriculture and the inquiries undertaken and reports prepared for it—to specify only the principal partially extraneous matters of the kind that crop up every year—took up a great deal of time which the Department is only too glad to give to these matters, but it must be recognized that a sacrifice is involved unless the need of a first-class staff is met.

Increased demands for the advisory services of the Senior Coffee Officer, coupled with the extension of his investigational work, necessitated the transfer of the Plantation Inspection Services, with the administration of the Coffee Regulations, from his charge to that of the Senior Entomologist. This had been under consideration for some time, but had been deferred because these inspection services had been given almost entirely to coffee.

Locust Campaign.—The Assistant to the Director, Mr D. L. Blunt, continued in charge of the locust campaign during the year, and I desire to record that the success achieved and the economy with which the campaign was conducted was in large measure due to the ability and energy of Mr. Blunt. I would also take this opportunity of expressing my thanks to Honorary Locust Officers, Administrative Officers, all ranks of the King's African Rifles and others concerned with the campaign for their great efforts and assistance, which were freely given, in combating the menace and making a success of a most burdensome task.

Mr. Blunt's report on the campaign will be found in Part IV of this report.

FINANCIAL.

Statements of Expenditure and Revenue for the fiscal year under review are given below :—

EXPENDITURE	Amount Originally Sanctioned	Amount Expended
	£	£
"A" ADMINISTRATIVE AND GENERAL—(including total cost of Headquarters Staff) ..	13,472	11,993
Expenses, Board of Agriculture and Committees	1,000	438
Grant to Kenya Agricultural Society	250	250
Contribution to Amani Institute	2,023	2,028
Contributions to Imperial Bureaux of Entomology and Mycology	450	450
Contribution to Imperial Scheme for Agricultural Scholarships	647	532
Contribution towards Veterinary Scholarships..	915	824
Contribution to Colonial Agricultural Service	420	140
Contribution to Imperial Agricultural Bureau	200	200
Contribution to Locust Research	1,000	323
Expenses in connexion with Locust Destruction	5,000	26,434
"B" DIVISION OF PLANT INDUSTRY	15,842	14,093
Subdivisions—		
Native Agriculture	11,172	9,763
Scott Agricultural Laboratories	12,160	11,386
Plant Breeding Services	3,247	2,912
Grading, Conditioning and Cool Stores ..	5,839	5,066
"C" DIVISION OF ANIMAL INDUSTRY.. ..	13,960	11,035
Subdivisions—		
Veterinary Services	32,043	29,902
Animal Husbandry	4,726	4,215
Veterinary Research	25,014	22,669
£	149,355	154,703

From the particulars given in the table above it will be noted that an expenditure of £26,434 was incurred on the destruction of locusts. Not taking into account this sum, which was exceptional, the actual net expenditure of the Department was lower by £16,116 than that of the previous year.

As shown in the following detailed statement, revenue amounted to £25,547 compared with an estimated sum of £19,925 :—

REVENUE	Original Estimates	Actual Receipts
	£	£
Grading, Conditioning and Cold Storage Fees, etc.	3,000	3,342
Fees from Agricultural Chemical Laboratory..	75	139
Sale of Farm Produce and Stock	800	1,208
Sale of Stores	50	145
Veterinary Inoculation Fees, etc.	12,000	17,413
Sale of Sera, Vaccines and Laboratory Products	4,000	3,300
TOTAL AGRICULTURAL DEPARTMENT.. £	19,925	25,547

ECONOMIC CONDITION DURING THE YEAR.

The anticipated revival of trade, and with it revival of prices for staple products, did not eventuate. On the contrary, prices of commodities produced by both natives and non-natives receded to even lower levels than in 1931. Coffee, particularly, which held its own in that year, began to be affected in 1932. Cereal growers and cattle farmers continued to experience the additional hardship of the locust invasion. Because of favourable weather conditions famine was not experienced in any part of the Colony despite the locust invasion, and in most reserves the natives had ample food.

Taking the Colony as a whole the loss caused by locusts was less than during any of the previous years of the recent invasions, but other inimical factors made the year 1932 a more difficult one for farmers than any in the previous agricultural history of the Colony. Costs of production of cereals and other crops were reduced to a point which was not considered possible in former years, yet the majority of the cereal growers experienced the utmost difficulty in keeping their land under cultivation. Losses sustained by producers of maize and wheat during the first two years of the depression had been disastrous in many cases, and with losses from locusts, the depletion or complete exhaustion of working capital and the impossibility of obtaining further financial assistance, a number of farmers were compelled to cease operations, a circumstance, otherwise ruinous, which was eased by the existence of the Kakamega gold diggings. The full extent of the loss experienced by maize growers is not reflected in the census figures for that crop, since losses in 1931 due to locusts, low prices and disease, caused wheat growers to reduce their acreages substantially, and, in the absence of other large scale

crops, to plant a considerable part of this to maize despite its low price, to keep the land from reverting to bush. Thus further losses were inescapable. Maize growers had the additional disadvantage of increased railway rates and restricted transport, to which reference is made later in this report.

Agricultural Credit.

The rapid and severe fall in the prices of commodities produced by farmers has given rise to a considerable disequilibrium between current income and capital commitments on farms. The amount of sale produce required to maintain current interest payments alone has risen to a disastrous extent, and provision for sinking fund is in most cases out of the question.

Throughout the world Governments have endeavoured to sustain agricultural industries through the difficult period of adjustment by every means at their disposal, particularly by means of extension of existing credit facilities.

The Government of Kenya continued to afford such assistance in the field of Agricultural Credit as the general financial situation allowed. Other measures of assistance are described in this report.

Central Agricultural Advances Board.—Funds made available by Government through the Central Agricultural Advances Board have been of the greatest value to the various branches of the agricultural industry. The funds available, though not equal to the demand, met the object for which they were intended and kept in business a number of deserving farmers who would otherwise have been unable to continue.

The Board continued operations, and with the advice of Local Boards loans to the value of £33,403 were approved during the year. The capital at its disposal was £100,000, but the issue of repayments made it possible for the Board to place out on loan from its inception to 31st December, 1932, the total of £152,563. This sum was advanced to some 104 planters and farmers on the basis of short term credit, mainly with the object of bringing crops to maturity.

The Land Bank.—The Land Bank has made a promising beginning in providing long-term credit of a stable character based on equal annual payments covering interest and retirement of principal, spread over a stated term of years in each case. The funds (£240,000) placed by Government at the disposal of the Land Bank, though invested with great caution, were exhausted by July, but it is anticipated Government will find it possible to increase its capital in the near future.

Commitments for the total capital available having been entered into by the end of May, 1932, it became necessary to close the list of applications for loans on 2nd June. During the year the sum of approximately £195,400 was advanced for repayment over periods ranging from ten to thirty years. Of this sum, £79,511 was devoted to the discharge of existing mortgages, £51,007 to the maintenance and planting of crops, including coffee, £17,163 to buildings and bore-holes, £33,269 to the purchase of land and £14,450 to the purchase of stock and implements.

Acknowledgments are made to the Kenya Treasurer, under whose administration the Land Bank and the Agricultural Advances Board fall, for affording the information outlined above.

Both these institutions made free use of the Agricultural Department for information required in judging applications.

Inquiry by Board of Agriculture.—At the instigation of Government the question of providing further credit facilities for agriculture was considered by the Board of Agriculture, which appointed a committee to inquire into the need and advisability of providing facilities for agricultural credits, particularly of a long-term description, additional to the provisions already made under the Land and Agricultural Bank Ordinance, 1930.

The Committee finally presented its report in January, 1933. In their report, which was adopted *in toto* by the Board, the Committee laid stress on the need for a general conversion of farm mortgage loans in the Colony to a lower rate of interest than the prevailing rate of 8 per cent. It was considered that this could be best accompanied by an extended intervention of the Land Bank in the local mortgage credit market. The Committee recommended the provision of a further £750,000 capital, to be drawn upon as required. Among other recommendations were the extension of the Land Bank's operations by provision for advances to co-operative societies, native or non-native, on the security of produce delivered and of buildings and permanent equipment and land ancillary thereto; for issue of short term loans to farmers on adequate security, including the payment in special circumstances of liabilities incurred in farming up to a maximum of £250; the extension of the maximum of ordinary Land Bank advances from £3,000 to £5,000 and of advances to meet existing mortgages from £2,000 to £3,000. It was urged that a broader interpretation on the part of the Land Bank Board

in determining what constitutes an onerous mortgage should be followed and finally that advantage should be taken of the prevailing low rates of interest in the money market to secure further funds in order to reduce the rate charged by the Bank to borrowers. These recommendations will receive the decision of Government early in 1933.

Imperial Preference.

A meeting of producing and commercial interests was convened in March to consider the representations which should be made to the Secretary of State covering commodities to be recommended for Imperial Preference at the impending Ottawa Conference.

In addition to certain general issues the meeting considered in detail coffee, sisal, grain, general produce, sugar, timber, dairy produce, pig products, tea, soda, hides and skins, oil seeds, wattle bark and pulses. Agreement was reached on the recommendations to be made in the case of each of these commodities as to the Colonies and Dominions in which preference for Kenya produce should be sought. The members present at the meeting, representative of all Kenya producing interests and commerce, recognizing that under the Congo Basin treaties the Colony was itself unable to give practical effect by means of tariff discrimination to the principle of Imperial Preference, pledged themselves to use their influence to secure the greatest possible voluntary preference for Empire goods.

As a result of the Ottawa Conference important preferences were granted, in which Kenya produce participates in the United Kingdom, the Dominions and certain Colonies. In particular may be mentioned the following commodities and markets, with the preferences granted: coffee, 1d. per lb. in Canada, New Zealand and South Africa; tea, 2d. per lb. in the United Kingdom; flat white maize, 10 per cent *ad valorem* in the United Kingdom; potatoes and other vegetables, and fruit, 10 per cent *ad valorem* in India and Ceylon; sisal, 10 per cent *ad valorem* in the United Kingdom and India; butter, Sh. 15 per cwt. in the United Kingdom, 10 per cent *ad valorem* in Ceylon; oilseeds, 10 per cent *ad valorem* in the United Kingdom.

The case of sisal fibre presented special difficulties and a meeting with the East African Sisal Growers' Association was arranged to consider these. An anomalous position had previously arisen from the imposition in the United Kingdom of

duties at the rate of 50 per cent *ad valorem* under the Abnormal Importations Act on cordage and twine $\frac{1}{4}$ inch and under in diameter. The rate of duty was later reduced to 15 per cent. A large proportion of East African sisal was exported to the Continent, being there manufactured into twine and cordage and in part subsequently exported to the United Kingdom. The amount of East African sisal exported direct to the United Kingdom was limited, the large majority of its spinning mills being equipped to deal only with Manila hemp and not readily adaptable to deal with sisal. The Canadian spinning mills, while using mainly Mexican fibre, were enabled to export twine to the United Kingdom in competition with the twine manufactured on the Continent from East African fibre.

At the meeting of producing and commercial interests referred to above it had been urged that a request should be addressed to the Dominions and Colonies to impose a substantial duty on all hard fibres, with exemption for fibres of Empire origin, and a duty of 50 per cent *ad valorem* on all cordage and twine of $\frac{1}{4}$ inch diameter and under, with exemption for such cordage and twine manufactured within the Empire provided that it contained at least 60 per cent of Empire-grown fibre. It was further suggested that the question of extending the duties to cordage and ropes of all sizes should receive consideration.

The issues were so complicated that it was decided that the Chairman of the Sisal Growers' Association should proceed to England to lay the case of the sisal industry before the authorities and organizations concerned.

No action eventuated except in the United Kingdom, where an import duty of 10 per cent *ad valorem* on sisal and hard fibres not produced within the Empire was imposed.

Marketing.

Following the enactment of the Co-operative Societies Ordinance in 1932, a small number of important European co-operative associations have been registered. The principal of these is the Kenya Farmers' (Co-operative) Association Limited, which has been in existence for a number of years, exercising a great deal of influence on the cereal industries of the country and with which the Department works in the closest association for the improvement of these industries. Its membership comprises over 90 per cent of the European maize growers and over 80 per cent of the wheat growers of the

entire Colony, and its capable business management has made it a most successful institution. It originated as a marketing association but has extended its activities to the co-operative purchase of supplies, particularly of seeds and fertilizers, but also of farming requisites generally.

The Kenya Co-operative Creameries, Limited, embraces the larger part of the European dairying industry of the Colony and operates creameries at Naivasha, Lumbwa and Nanyuki. An additional creamery is to be erected at Thomson's Falls, following protracted negotiations in which the Department has taken a prominent part. This co-operative association also is a successful institution, and with its capable direction and the expert preparation of butter at its creameries it is becoming well known in the English market as a reliable producer of high class butter. The quality is approximately equal to that of the best New Zealand butter.

The third European co-operative association which has recently been formed and registered, with humble, though nevertheless sound, beginnings, is the Thika Planters' Co-operative Union, Limited. The purpose of this association for the present is purely the co-operative purchase of supplies for its members and it has already drawn into its fold a number of coffee growers from other districts. It appears to be the beginning of a large co-operative movement among coffee growers, which should eventually embrace marketing as well. For the present it can do no more than pool orders. It has no warehouse and cannot therefore stock supplies; but the measure of response to its efforts promises an extension of its activities in the near future.

Of the two native co-operative associations which were endeavoured to be formed and registered last year, to which reference was made in the last Annual Report as not being favoured by this Department, one actually was registered but is shortly to be dissolved, and the other did not reach the point of registration. The organized marketing continues, notwithstanding the failure of the co-operative movement, in the three native districts of the Kikuyu Province to which reference was made last year. The Deputy Director's report will indicate beginnings elsewhere.

BOARD OF AGRICULTURE.

The Board of Agriculture was reconstituted in May, 1932, with the following membership:—

President : His Excellency the Governor.

Chairman : The Director of Agriculture.

Members : The Chief Native Commissioner, the General Manager, Kenya and Uganda Railways and Harbours, the Provincial Commissioner (Coast Province), one other Provincial Commissioner, the Hon. Mr. Conway Harvey, M.L.C., Lt.-Col. M. Maxwell, Lt.-Col. G. W. C. Griffiths, C.M.G., Colonel W. K. Tucker, C.B.E., T.D., Major A. G. Keyser, Capt. E. Caswell Long, Capt. W. Tyson, M.B.E., G. de P. Colvile, Esq., Capt. C. T. Soames, S. Carlin, Esq., Alex. Armstrong, Esq., J. E. A. Wolryche-Whitmore, Esq., P. J. H. Coldham, Esq., Abdul Wahid, Esq., one unofficial member Coast Advisory Committee, with Mr. D. L. Blunt, M.A., as Secretary.

Mr. Mervyn Ray and Major E. Pardoe acted for Capt. E. Caswell Long and Colonel Tucker during a period of absence of the latter from the Colony.

The first meeting was opened on 2nd June, by His Excellency the Governor (the President). Standing Committees of the Board to deal with Plant and Animal Industry matters were formed. These committees replaced the consulting committees which had been formed for each important industry. A special committee to inquire into agricultural credit facilities was also appointed.

During the year there were held two meetings of the Board, one of the Plant Industry Standing Committee, two of the Animal Industry Standing Committee, three of the Long Term Credit Committee and one of a sub-Committee of the Board to consider the steps that could be taken to ensure the security of the maize industry.

Meetings of the Board and the two Standing Committees were called during December, but owing to a meeting of Legislative Council making the attendance of several members impossible, these meetings were deferred until January, 1933.

Among the major questions discussed by the Board and Standing Committees were the following: The administration of the Sale of Wheat Ordinance, the organization of veterinary services, rinderpest policy, sheep scab, Thomson's Falls Creamery, the maize position, future agricultural development, general policy. Additionally, a large number of questions of lesser importance were dealt with.

The report of the Long Term Credit Committee was completed by the end of the year and is receiving the attention of the Government.

It has been made a practice so far as possible to circulate to members in advance of meetings précis and memoranda prepared by officers of the Department and by members introducing particular subjects, on the subjects to be discussed at the meeting. This practice, though throwing a strain on the staff of the Department, has enabled the Board to deal with a greater volume of business than might otherwise have been possible.

The deliberations of the Board and the advice given have been of value to the Department, also to Government, and the relations between the Board and the Department have been cordial and mutually helpful.

The cost to Government of the Board during the six months of its existence amounted to approximately £450, which sum provided for the salary of a stenographer and the travelling expenses and allowances of members of the Board.

ECONOMIC INVESTIGATION.

The general plan of work in the Section of Economics and Statistics as outlined in the previous year's report was continued during the year. A considerable number of matters primarily of an administrative nature, but involving economic issues, were dealt with by the Department during the year and had the effect of retarding the progress of investigational work in the section.

A paper on "Some economic aspects of coffee-growing in Kenya" was read by the Agricultural Economist at the Coffee Planters' Days in July. This followed a survey of coffee estate management to which reference was made in last year's report. Investigations for economizing certain operations continue. Perhaps the one of most immediate interests is increasing the rate of picking. A number of receptacles devised by planters and others have been subjected to test, the object being to discover a method which would enable pickers to retain both hands free for picking, and instead of clutching the cherries in the hand while gathering and placing them in a small receptacle, merely to detach them from the branches and allow them to fall into the receptacle. It was necessary to spend some time training pickers in the different technique required. Certain difficulties were encountered and the results obtained by the end of the picking season were inadequate to form a basis for any reliable conclusions.

An economic survey of dairy farming was commenced during the year, and by the close of the year farm business records had been obtained for some thirty dairy farms. The work will be continued during 1933.

An attempt was made during the year to increase the scope of the information which the Agricultural Census could be made to yield by classifying the schedules according to type of farm business. It was possible in this way to obtain a large amount of economic information. A few items which may be mentioned are the number of occupiers following the different types of farming, the total area utilized by the various sections of the industry; the average area occupied and under cultivation for each type of farm; the native labour; the number of live stock of various kinds, and the number of implements and machinery on farms of the various types. Some twenty types of farm were separately distinguished, the classification being adopted rather with a view to obtaining the maximum amount of economic information than of attempting a "natural" classification of farming types. It becomes possible to construct a picture of the average farm within each type, and although there may be wide divergencies from the average in individual cases, yet the average more closely represents the general run than any other single figure. As an illustration, the figures relating to the grass dairy farm may be cited :—

Average area per farm	.. .. .	3,850 acres
Native labour employed per farm	.. .. .	24 units (full time)
Native labour employed per 100 cows	.. .. .	16 units (full time)

Livestock kept :—

Cows and heifers over 3 years	per farm	..	150
Heifers 1-3 years	.. .. .	..	55
Heifers under 1 year	.. .. .	..	38
Bulls	.. .. .	..	5
Bull calves	.. .. .	..	35
Working oxen	.. .. .	..	24
Bullocks	.. .. .	..	56
Sheep: wool-bearing	.. .. .	..	82
Sheep: native	.. .. .	..	26
Pigs	.. .. .	..	15
Poultry	.. .. .	..	66
Dairy produce sold, in terms of butterfat	.. .. .	..	4,716 lb.
Dairy produce sold, in terms of butterfat	.. .. . per cow	..	32 lb.
Dairy produce sold, in terms of butterfat, per acre occupied	.. .. .	..	1 lb.

Animals slaughtered or sold for slaughter :—

Cattle	.. .. .	per farm	..	16
Sheep	.. .. .	.. .. .	..	9
Pigs	.. .. .	.. .. .	..	13
Wool sold	.. .. .	.. .. .	..	275 lb.

The statistics obtained were too voluminous for publication and are being retained for reference purposes.

AGRICULTURAL STATISTICS.

The thirteenth Agricultural Census, for the year 1st March, 1932 to 28th February, 1933, has been completed and published.

For purposes of reviewing the state of the agricultural industry, use has been made in this report of data obtained from the Agricultural Census Report. For detailed information reference should be made to the latter.

Crop Reports.

The system of forecasting crop production and exports, inaugurated in 1928, was continued during the year with satisfactory results.

The number of crop correspondents, who assisted in this service by submitting monthly estimates, increased to three hundred and sixty-three.

Crop forecasts were published for the months of January, February, July, August, September, October, November and December.

The thanks of the Department are tendered to the Crop Correspondents who regularly submitted monthly estimates, thus enabling the Department to maintain this service, valuable alike to Government, Railways and Harbours Administration, shipping companies, trade and commerce, agriculturists and the public generally.

Imports—Kenya and Uganda.

	1932	1931	1930	1929	1928
QUANTITY					
Wheat cwt.	104,541	2,996	2,742	2,847	3,754
Wheat Meal and Flour ..	37,420	66,844	64,037	63,605	64,742
Ham and Bacon	9	35	114	60	93
Butter lb.	1,120	2,576	4,592	17,136	16,464
Cheese "	5,600	13,664	11,312	31,920	29,344
Ghee cwt.	5,647	5,813	6,553	8,910	8,926
Condensed Milk	7,019	11,434	13,246	14,018	12,170
Sugar "	4,683	6,566	34,891	43,029	80,244
Tea "	204	1,341	3,738	8,094	8,897
VALUE.					
Wheat £	£ 33,700	£ 1,638	£ 2,171	£ 2,530	£ 3,227
Wheat Meal and Flour ..	21,115	36,684	49,158	53,644	57,231
Ham and Bacon	111	313	398	710	848
Butter	81	223	460	1,565	1,624
Cheese	505	1,228	1,117	3,146	2,968
Ghee	14,505	14,891	21,634	37,164	36,372
Condensed Milk	14,687	23,807	31,839	40,310	39,115
Sugar	4,525	6,388	23,791	33,576	68,903
Tea	1,832	11,621	34,793	73,503	81,913
TOTAL £	£ 91,361	£ 96,793	£ 165,366	£ 246,153	£ 292,201

The foregoing table gives particulars of the principal food imports into Kenya and Uganda. The statement is of importance in relation to the development of the agricultural industry, as showing the extent to which local markets remain unfilled by local produce.

It will be seen that the total value of imports of agricultural produce has fallen progressively during the last five years.

Excluding wheat and wheat products, the importation of which was abnormal owing to the local shortage, the value of the more important items of imported supplies enumerated above fell from £231,743 in 1928 to £36,546 in 1932. This decline is due in considerable measure to the reduced purchasing power of the public, but also indicates a greater demand for local produce and an increasing ability of local growers to supply the need.

In the case of tea, sugar, butter and bacon and ham, the imports are now reduced to negligible proportions. The quantity of cheese imported has also declined; much of this consists of fancy varieties and even in this market notable success is being achieved by local produce. Imports of condensed milk also diminished.

The large variety of locally manufactured products is not fully realized by the public. To make these more widely known and to assist producers and retailers to facilitate the marketing of them, the Royal Agricultural and Horticultural Society organized an exhibition of Kenya produce in Nairobi on the 2nd and 3rd February. This was highly successful and fulfilled in a most satisfactory manner the objects for which it was organized. The Department continues to help the cause of substituting locally-grown for imported foodstuffs by means of propaganda and by variety trials of the more important crops.

Exports.

The total value of agricultural exports, the produce of Kenya in 1932, was £1,967,730, a decrease of £59,567 from the previous year. Substantial increases were shown by all commodities except maize, sisal and wool. Notable increases were coffee, £227,404; hides, £23,713; wattle bark and extract, £12,635, and tea, £12,467. In the case of coffee and maize the figures are influenced by the low production of the crop year 1931-32. The rise in prices which occurred towards the end of the year exercised little influence on the export values for the year, and in any case did not extend to coffee, the most important export commodity.

Statistics of Development.

European Agriculture.—As statistical data of native agricultural development are not available, the particulars below apply only to agricultural development by Europeans. Particulars of Indian agriculture are given later. Detailed statistics of production are shown under product headings later in this report.

Acreage, Occupation and Development.—The total area allotted for occupation by Europeans is approximately 7,524,480 acres, of which an area of about 281,920 acres is still available for alienation. Of the area allotted, 5,206,264 acres are under occupation, showing an increase of 7,171 acres as compared with the preceding year. The number of European occupiers totals 2,102, a net decrease of five over the previous year, but it is calculated that changes of occupiers took place on 36 holdings, making the number of new occupiers thirty-one.

The number of Europeans employed on agricultural holdings, inclusive of the occupiers, is returned at 2,789, a decrease of thirty-three as compared with the previous year.

The total area under cultivation is 593,988 acres, giving an average of 282 acres per occupier, as compared with 309 acres for the years 1932 and 1931 respectively. Including land used for stock farming, it is calculated that the area beneficially occupied is, on the average, 1,367 acres per occupier, which shows the extensive character of farming operations in the Colony.

In addition, considerable areas of farms are used by native squatters and employees.

The following table shows the ratio of acreage under cultivation to total area occupied:—

Year	Total Occupied Area	Total Cultivated Area	Total area under arable crops during the year	Total area cultivated but not cropped during the year	Percentage cultivated to occupied land as at 29th February	Percentage cropped to cultivated land	Percentage fallow
*1933	5,206,264	593,983	510,762	83,226	11.41	85.93	14.01
*1932	5,199,093	613,557	519,387	94,170	11.80	84.65	15.35
*1931	5,315,433	650,965	572,339	73,626	12.25	87.92	12.03
†1930	5,111,161	643,644	564,145	79,499	12.59	87.65	12.35
†1929	5,000,643	635,590	570,171	65,419	11.40	89.69	10.31
†1928	4,896,405	592,741	525,421	67,320	11.31	82.64	11.36
†1927	4,737,920	512,543	433,035	74,503	10.82	85.46	14.54

*As at 28th February.

†As on 31st July.

Indian Agriculture.—In common with other nationalities Indian agriculturists experienced an extremely difficult year. The majority of these farmers have settled in the Kibos-Miwani area and sugar-cane has been their main crop. Sugar-cane is highly susceptible to attack by locusts and as losses during recent years have been very considerable, these farmers have become impoverished and have adopted the growing of cotton, maize and pulses, though sugar-growing is maintained.

Efforts were made by them to form a company for the establishment of a sugar factory, but owing to lack of funds this was not possible. In these circumstances it was necessary to continue their crude methods of crushing cane for the manufacture of jaggery. Many, however, continue to dispose of their cane to the Victoria Nyanza Sugar Co.

Particulars of Indian agricultural activities in the Kibos-Miwani area are as follows:—

	1932	1931
Total number of occupiers	55	46
Area occupied (acres)	10,775	14,614
Area under sugar cane (acres).. .. .	4,274	4,470
Area under maize (acres)	1,942	..
Area cultivated, but not planted (acres).. .. .	2,881	3,862
Number of working oxen	1,466	1,444
Number of other cattle	524	490

PLANT INDUSTRY.

Embraced in this Division are the following sections: Native Agriculture (Field Husbandry), including training schools; Scott Agricultural Laboratories, including chemical, botanical, entomological, grassland improvement and experimental work; coffee; plant breeding at Njoro and elsewhere; plant inspection, grading and inspection (imports and exports), grain conditioning and cool stores.

With certain exceptions which were few in number, items of research and experimental work conducted in 1932 and proposed for continuation in 1933, differ but little from those enumerated in full on pages 20 to 25 of the Annual Report, 1931. For this reason the list of work coming under these

heads is not repeated in this report. Where new work has been initiated specific mention is made in the appropriate section. The Deputy Director (Plant Industry) deals with main investigational work in hand on plant industries and the research work of the Animal Industry Division is given in the report of the Chief Veterinary Research Officer.

EXTENSION WORK.

While the primary duties of specialist officers are those connected with research problems and routine matters having a direct bearing upon the needs of farmers and planters, as far as has been possible these officers have conveyed information to the agricultural community by means of publications and lectures at meetings of farmers' and other associations. A list of publications is given later in this report.

Farmers' Days.—For reasons of economy it was decided by the Royal Agricultural and Horticultural Society that no Agricultural Shows should be held during the year. It was, however, desirable to display to the farming communities the results of the Seed Maize Competition, and also to convey to those interests the results of recent experimental work with arable crops. With these objects, in conjunction with the Society, Farmers' Days were held at Nakuru, Kitale and Eldoret on the 4th, 12th and 13th February respectively. The Department staged exhibits and officers delivered lectures on subjects of practical immediate interest. These were the first occasions on which "Days" of this nature have been held in Kenya and the interest and attendances far exceeded anticipation.

Coffee Planters' Days.—These were also inaugurated during the year, the first being held in Nairobi on the 29th and 30th June. Representatives of coffee interests in Tanganyika Territory and Uganda were present and joined in discussions which took place at the conclusion of each lecture. Among the Tanganyika visitors were the Director of the East African Agricultural Research Station, Amani, and the Senior Agricultural Officer, Moshi, who gave the meetings the benefit of their knowledge of the subjects under discussion. At the conclusion of these "Days" a Coffee Conference was held on the 1st and 2nd July. One of the principal items on the agenda was the Coffee Industry Bill, which was presented to Legislative Council later in the year. Other subjects discussed were experimental and research work, legislation, disease, fertilizers and Imperial Preference for Empire-grown coffee.

Native Agriculture.

Detailed records of work done under this head will be found in the reports of the Deputy Directors, Plant Industry and Animal Industry, and it is desired to do no more in the Director's report than draw attention to certain salient problems in this work.

In past years it has been the duty of Agricultural Officers to keep "zone" records of their areas. These records were designed to comprise a close account of the natural features of areas which may be said to be more or less uniform in climatic conditions, hence divisible into agricultural "zones." The agricultural and other economic activities of the natives were also described.

In 1931, as the beginning of a long-range development programme for native agriculture, a comprehensive economic survey of the resources was begun which, assisted by the zone records, has resulted in well defined accounts of the possibilities of these areas. Following these, development programmes for each zone are in course of preparation, in which the products, both for food and for sale, are scheduled, for the concentration of work and propaganda upon these and for continuity in development policy. This is a sound foundation for organized development, but with the Department's present resources development cannot be expected to be rapid.

In its work for crop improvement in the native reserves, the Department has two fundamental and considerable problems to contend with. The three areas to which services are given are the Kikuyu, Kavirondo and Coast Services. The first and second of these, so far as natural conditions go, are in the main highly productive areas with large populations. The Coastal Reserve is on the whole not an area of substantial productivity. In output of tonnage per head Kikuyu and Kavirondo probably rank high amongst African native areas; in value of output leaving the reserves, however, there is an obvious inferiority. This is due to the lack of large areas suited to relatively high-priced crops such as coffee, cotton, groundnuts and rice. Kikuyu and Kavirondo produce large quantities of relative low-priced crops, such as maize, millets, beans and potatoes. They are, except for small areas at the lower altitudes, too high and damp for cotton and groundnuts and suitable for rice only in small localized spots. Fairly extensive areas in these reserves are suited to coffee. Wattle is being increasingly grown and relatively high-priced crops are under trial.

The total output leaving the Kenya native areas is estimated to be approximately 70,000 tons (of which 45,000 tons consists of maize). Tonnage of output is a more correct index of native effort than value of output.

In the Coast Reserves, a very promising beginning has been made with the organization of a cashew nut industry and cotton growing is increasing, but here again there is no large area suited to high-priced crops.

The other important problem facing the Department was stressed particularly in last year's report—that of the urgent necessity of making provision for maintenance of soil fertility in the native farming system wherever shifting cultivation is approaching an end. The end, in fact, has been reached in certain areas and is rapidly approaching in others. The matter is dealt with in the report of the Deputy Director (Plant Industry) and it is desired merely to repeat here the warning given last year that the problem is a most serious one for the Administration, for exhaustion of fertility spells ruin in many directions. The means for avoiding this have been pointed out, but the expenditure of fairly substantial funds (on experimental stations and demonstration small mixed-farming holdings) are involved, as well as the replacement of land fragmentation by consolidated holdings. This last aspect of the matter is receiving the attention of the Land Commission. Meanwhile, it is dangerous to attempt increased production per acre in these areas.

On the animal industry side, the large problem which confronts the Department in certain native reserves is that of overstocking associated with communal grazing. The disinclination of the native to part with his cattle at prices low enough to warrant the erection of meat or fertilizer factories makes this problem a most difficult one and, from whatever angle it is approached, compulsory sale looms as the only solution. It should perhaps be preceded by as powerful an effort as may be possible to influence native opinion in the direction of voluntary sale, but it must be borne in mind that a factory cannot be erected in the expectation that such an effort will succeed.

Native Agricultural Exports.

The estimated values of agricultural exports from the Colony of native origin for the last five years are shown hereunder. As has been stated, this by no means reflects the export from the native areas; by far the greater part of the surplus, probably two-thirds, is consumed in the Colony.

Notable increases in export crops over 1932, despite lower prices, are cotton, simsim (sesame) and wattle bark.

	1928	1929	1930	1931	1932
	£	£	£	£	£
Animals	11,000	10,300	8,600	5,000	3,600
Copra and coco- nuts	23,000	2,500	2,250	1,200	500
Cotton	24,000	24,800	17,200	6,500	8,600
Cotton seed .. ..	..	5,400	5,000	..	500
Groundnuts	19,659	29,500	16,500	6,000	1,200
Maize	50,000	45,000	75,000	..	12,500
Milletts	423	240	2,800	20	100
Pulse and beans	13,000	12,500	14,000	6,000	6,000
Simsim	27,355	27,500	15,200	5,000	23,500
Hides	200,000	220,000	105,000	60,000	86,500
Skins	100,000	87,000	73,000	35,000	15,700
Oils-various	5,000	10,000	6,700	3,200	5,600
Potatoes	7,000	24,000	10,500	13,000	9,000
Miscellaneous	2,000	2,000	2,000	2,000	4,000
Wattle bark and extract .. ..	..	35,000	42,000	71,000	79,500
TOTALS £	482,437	535,740	395,700	213,920	262,100

MIXED FARMING AND DIVERSIFIED CROPPING.

The tendency to change over from single-crop farming (maize or wheat) to mixed farming—the natural process of evolution in a country suited to annual crops, as farming and home-making come to be regarded as a permanency—has received an unfortunate check owing to the depletion of capital resources during the last few years and to prices of crops being below cost of production. It is felt, however, that nothing could have brought home to the farmers in the annual cropping areas the lesson of "safe" farming more than this depression. Nevertheless the lesson has been too costly and the check will prove to have been too prolonged for many of the farmers. The legislation designed to facilitate the change-over, namely, the Fencing and Dipping Acts, though enacted, remain unapplied, for the former involves a Government expenditure which is beyond the present capacity of the country's finances, and the latter has been regarded, perhaps without justification in the case of a fairly large number of farmers, as being of little avail without the application of the Fencing Act. The Land Bank and the Agricultural Advances Board have assisted the change, but in a limited number of cases only, for few of these single crop farmers have been able to

offer the security of a first mortgage in the case of the Land Bank, or even in the case of the Advances Board the expectation of an adequate income for repayment within a few years of the commencement of live stock operations.

Nevertheless, as will be seen from the figures given later in this report, the dairying industry is increasing as satisfactorily as may have been expected and the maize and wheat farmers who were unable to purchase the stock and equipment necessary for dairying are giving for the present greater attention to diversified cropping than has been the case in the past.

For its part, the Department continues to experiment with a large number of green manure crops for improving maize and wheat lands, as well as of new "cash" crops for alternating with the cereals. Many of these latter are too low in price at present to take up any large acreage in place of the cereals, but the proving of them in the different areas has opened up a promising prospect for better and more profitable cropping when prices recover. The subject is dealt with in some detail in the report of the Deputy Director (Plant Industry), and in the bulletins which have been published during 1932 on this field experimental work with crops.

In the report of the Deputy Director, Animal Industry, will be found a useful and interesting account of work for the improvement of native cattle and for increased yields of milk from these, which have an important bearing on the future of the dairy industry of the country for Europeans and natives alike.

WEATHER CONDITIONS.

In most parts of the Colony weather conditions were favourable for the growth of crops and pasture during the first nine months of the year. In consequence yields of crops were good except where losses were caused to cereals by locusts. Partial drought after locust damage was experienced in the Naivasha and Laikipia districts which caused serious shortage of grazing.

Rains which are customary during the third quarter of the year were an average of a month late and in consequence planting of annual crops during the short rains season was delayed.

Acknowledgments are made to the Director of the East African Meteorological Service for records of rainfall, which are given in Part IV.

MAIN CROPS.

This section deals purely with European areas, except for wattle-bark, potatoes and cotton.

The total area under arable crops during 1932-33 was 510,762 acres and the total area under cultivation 593,988 acres. For comparative purposes particulars of acreages of the main crops for the previous years are given, together with percentages of increase and decrease, in the following table :—

	1932-33 acres	1931-32 acres	Increase per cent	Decrease per cent
Maize	164,018	160,546	2.2	..
Wheat	30,114	43,168	..	30.2
Barley	3,025	2,330	29.8	..
Coffee	100,387	98,874	1.5	..
Sisal	139,834	145,660	..	4.0
Tea	12,034	11,258	6.9	..
Coconuts ..	7,839	8,121	..	3.4
Sugar Cane ..	12,088	12,363	..	2.2
Wattle	14,613	13,308	9.8	..
Essential oil plants ..	1,953	1,859	5.0	..

Maize.

The following table showing the acreages and yields of maize in past years is of interest :—

MAIZE AREAS TOTAL YIELD AND AVERAGE YIELD PER
ACRE OVER A PERIOD OF 14 YEARS

YEAR	Acreage Harvested	Total Yield	Average Bags per Acre
		<i>Bags</i>	
1919-20	32,167	317,525	9.87
1920-21	30,846	164,722	5.34
1921-22	57,131	338,837	5.93
1922-23	74,747	517,877	6.93
1923-24	108,556	833,640	7.68
1924-25	129,647	893,108	6.89
1925-26	155,751	926,614	5.95
1926-27	177,987	1,314,643	7.39
1927-28	177,009	1,088,705	6.15
1928-29	204,945	1,099,317	5.36
1929-30	233,973	1,858,556	7.94
1930-31	200,926	1,649,728	8.21
1931-32	160,546	762,622	4.75
1932-33	164,018	1,139,616	6.94

1931-32 *Crop*.—Heavy losses caused by locusts during the 1931-32 season caused very considerable reduction in the

quantity of maize exported early in 1932. Thus only approximately 185,000 bags from that crop were sent out of the Colony during that period. In these circumstances the Railway Administration experienced no difficulty in providing transport facilities, but the financial position of the Railway made it necessary to increase the main line export rate on maize from Sh. 11/20 to Sh. 13/50 per ton as from 1st January.

1932-33 Crop.—The figures quoted above show an increase of 3,472 acres or 2.2 per cent in 1932-33 on the previous year and an increase in average yield of 2.2 bags. It should be noted that the simplified schedule now in use for purposes of the Agricultural Census provides only for the area harvested and does not include areas planted but subsequently destroyed by locusts or from other causes.

Despite low prices, the area planted was estimated to be equal to that of the previous season, and as weather conditions were very satisfactory it became evident that a large exportable surplus would be forthcoming for movement at the end of the year and early in 1933. In addition, it was probable that the cotton crop of Uganda, due for handling in 1933, would be a record one, and that very large quantities of cottonseed would be available for export. At the same time transport of imports up-country had declined. This caused shortage of trucks at up-country stations for transport of low-rated maize and cottonseed to the Coast. Favourable prospects made it essential for the Railway Administration to make arrangements for the movement of these commodities to Mombasa, and of three alternative schemes presented for consideration to the maize industry, that of allocation of tonnage between maize and cottonseed was considered to be the least detrimental to the industry. Hopes were entertained that by the application of the principle of allocation of tonnage these crops could be moved under "non-peak" conditions. On estimates made in May, tonnages allotted were 61,000 tons to cottonseed and 51,000 tons to maize, but as the season progressed it became evident that the exportable surplus of maize would probably reach 70,000 tons. Representations were made to the Railway for an increase of tonnage, especially for early in 1933, but the Railway Administration could not devise a means of meeting their wishes without a further increase in rates. The allocation of tonnage had the effect of forcing export during November and December when maize was insufficiently dry. Hence additional reconditioning charges at the Coast were involved. Low export prices had already reduced the industry to a perilous condition, and in addition to

avoiding these charges, the industry wished to obtain reductions in marketing costs in every way possible. The Railway Administration realized the need, and as a temporary measure storage charges at the Port were reduced. The storage charge of Sh. 1 per ton per week up to 21 days on the expiration of the period of free storage on maize forwarded to the transit sheds, either direct or from the conditioning plant, was reduced to cents 50 per ton, and the storage charge on supplies consigned direct to the reconditioning plant for treatment and while awaiting conditioning after the period of free storage was reduced from cents 4 to cents 2 per bag per week. Additionally, the charge of cents 15 per bag for loading, off-loading and haulage of maize to and from the conditioning plant was reduced to cents 12 per bag.

Government also provided assistance in respect of the 1932-33 crop by a reduction of cents 15 per bag in reconditioning charges, which represented a temporary deferment of provision for interest and amortization on capital invested in the conditioning plant.

In spite of this assistance the maize industry experienced very great difficulty with export conditions. Maize forced on the market in December realized exceptionally low prices and offers of forward sales had to be refused when the railway allotment for a particular month had been completed. Unforeseen circumstances made it possible for the Railway Administration to increase the allotment of tonnage in December, but the notice was too short to allow the industry to take advantage of the offer.

The Railway incurs extra cost under peak traffic conditions and proposes a substantially higher peak traffic rate. Unfortunately, the peaks of the Uganda cotton and the Kenya maize traffic coincide, and to handle both at the same time involves the use of extra railway equipment and staff. On the other hand, spreading the maize traffic over a longer period involves deterioration in quality during storage and loss of the usually better market in the early months of the year. Hence it will be seen that both the maize industry and the Railway Administration, in so far as handling the crop is concerned, experience extremely trying conditions which may not be relieved while large quantities of maize are forthcoming for export.

Wheat.

For various reasons, including the presence of locusts and incidence of disease, there was a serious decline in the acreage of wheat reaped. The acreage planted but not reaped owing to

destruction by locusts is not recorded in the simplified schedule now in use for the Agricultural Census. The area harvested was 30,114 acres, a decrease of 13,054 acres from the preceding year. The average yield was 2.11 bags per acre. The total production was 63,498 bags. This is considerably below the probable requirements for domestic consumption and a continuance of importation of wheat will be necessary if mills in the Colony are to retain their trade connexions.

The acreage harvested and the production in each of the past five years is shown in the following table :—

YEAR	Acreage Harvested	Total Production
	<i>Acres</i>	<i>Bags</i>
1928-29	82,951	223,141
1929-30	63,217	293,468
1930-31	63,851	194,337
1931-32	43,168	66,362
1932-33	30,114	63,498

Wheat Milling.—Statistics of wheat milling operations were called for in respect of the period 1st March, 1932, to 26th February, 1933. 121,906 bags of wheat were milled and produced, 41,067 bags of fine flour and 51,314 bags of "Atta." The loss in milling (bran, pollards, etc.) averaged 24.2 per cent. Twenty-four mills, capable of milling a total of 80 bags of wheat hourly, were in operation during the year.

Early in the year it became apparent that the yield of wheat, in consequence of reduction in planting and damage by rust and locusts, would fall short of the milling requirements of the Colony. Normally wheat cannot be profitably imported for milling owing to the stronger competitive position of imported flour. The milling industry, already experiencing considerable difficulty, was faced with the prospect of closing down for a few months, discharging its employees and relinquishing markets on the Coast and elsewhere, which had only been developed after a long struggle.

In order to support the industry during the critical months until local supplies of milling wheat became available, Government decided as a temporary measure to refund the customs duty paid on a specified quantity of wheat, to be imported by the Agents under the Sale of Wheat Ordinance under licence from the Director of Agriculture.

The quantity of wheat in respect of which customs duty was to be refunded was limited to the estimated amount of the shortfall below milling requirements, and to the period 1st April to 31st December. By arrangement with the Railway Administration such wheat was transported on the Railway at the country produce rate.

Assurances were given that the milling industry would make every effort to maintain prices of flour on East African markets at the then existing level and to continue to supply the coastal markets in Kenya and Tanganyika. These undertakings were carried out.

The shortfall was originally estimated at 4,500 tons, but subsequent local damage to the new crop in the early districts and the continuance of wet weather in certain important districts, diminished the amount of local wheat available for milling before the end of the year and made it necessary to import a further 1,500 tons, making 6,000 tons in all.

Wheat Pool.—The Sale of Wheat Agency, acting on the advice of the Wheat Advisory Board, disposed of farmers' deliveries to local mills and other purchasers. To local mills, prices ranging from Sh. 17/50 down to Sh. 6 were fixed according to grade. In respect of wheat milled for coastal and certain other markets rebates on flour were allowed ranging up to Sh. 1 per bag. The total amount allowed as rebates out of the 1932-33 local "pool" was £3,066, equivalent to cents 83 per bag over the whole of the season's delivery. In addition, £3,471 was allowed in respect of wheat carried out from the previous season's "pool."

The Agency handled 74,196 bags of wheat from 1932-33 deliveries, together with 48,831 bags carried over from the previous year. In addition, 46,896 bags of wheat were imported from overseas and disposed of to mills. A levy of Sh. 2/32 per bag on all wheat imported and supplied to mills was made and the proceeds, amounting to £5,441-15s. used as a reserve out of which to allow rebates in respect of imported wheat milled for coastal and certain other markets.

As a result of the operations of the Agency the net returns received by growers for wheat delivered ranged from Sh. 15/07 to Sh. 12/57 per bag according to grade. The average price received by growers was Sh. 13/73 per bag. The "Established Charges" of the Agency against the 1932-33 "pool" amounted to £2,641-17-21 or cents 71 per bag.

A sum of £5,346-18-22, being a part of the profit made on realization of the 1931-32 over-carry, was transferred to a "Wheat Equalization Account" to be used as a reserve against possible overpayments on account of deliveries of wheat. This course was adopted on the advice of the Wheat Advisory Board, for the reason that in the ordinary way any overpayments which might be made in any season would not be recoverable from non-members of the Kenya Farmers' Association.

Barley.

The supply of barley grown in 1930-31 was not equal to the demand, and in 1931-32 the area harvested was 3,025 acres compared with 2,330 acres during the previous season. Total production amounted to 15,845 bags compared with 7,126 bags for the 1930-31 crop.

Coffee.

The area planted with coffee continues to increase, the acreage at 28th February, 1933, being recorded at 100,387 acres, an increase of 1,513 acres for the year.

Various factors contributed to a reduction of 32 per cent in the quantity produced during the 1931-32 season, compared with that of the record year of 1930-31, but that record was passed during the crop year under review, when 303,998 cwt. were produced. This represents an advance of 79 per cent or 133,907 cwt. over that of the previous year. Exports during 1932 amounting to 276,041 cwt., value at £1,214,292, compared with 245,991, valued at £986,988 in 1931.

Monthly average prices per cwt. for Kenya coffee in London during the year 1932 were as follows:—

	<i>Sh. d.</i>		<i>Sh. d.</i>
January	103 2	July	59 7
February	105 9	August	64 5
March	92 6	September	81 7
April	74 8	October	74 9
May	65 6	November	71 6
June	58 3	December	71 1

The average prices of Kenya coffee in the United Kingdom showed substantial increases over the corresponding months of 1931 until the last two months of the year, when a rapid decline set in. The average prices realized in November and December were 8/6d. and 22/- respectively below the corresponding months of 1931. The weighted average price for the year, however, reached 85/-, as compared with 74/- in 1931, 77/- in 1930 and 116/- in 1929.

Top prices for A's ranged up to 152/- in the early months of the year and up to 124/- in the later months.

The considerable amount of work undertaken by the Department for local coffee merchants to make possible the entry of Bukoba and Uganda coffee on the Nairobi market came to naught, as practically none of these coffees were brought in for sale after the success of the investigational work allowed the Department to grant permits for such entry subject to treatment.

Coffee auction sales at Nairobi were begun by one merchant and were moderately well supported.

Coffee Industry Ordinance.—It was mentioned in the preceding report that a Bill to establish a Coffee Board for the advancement and control of the industry, mainly connected with improvement of marketing and the expansion of markets, was published for general information in April, 1931, but was not found acceptable to the Coffee Planters' Union.

During 1931, the Bill was again brought under review, and after consultation with numerous influential representatives of the industry an amended draft bill was presented to a Coffee Conference on the 1st July. This draft included provision for exemption of native coffee plantations (when established) from payment of the proposed coffee planters' licence fee of Sh. 30. Non-native coffee growers were unable to agree with this policy and the Conference proposed the deletion of this clause. To avoid delay in the establishment and operation of the Coffee Board provided for in the Bill, prior to passing of the Bill by Legislative Council, nominees for the Board were elected at the Conference. At a meeting of nominees held shortly after the Conference it was explained that the growing of coffee by natives would be allowed only under strict supervision and then only in the first instance in certain areas on a limited scale.

Though dissenting from the principle of coffee-growing by natives, the industry accepted the main provisions in the draft Bill, which was passed into law on 31st December, and came into operation on 18th January, 1933. The Ordinance provides for the formation of a Coffee Board representative of planting and trading interests with two members from the Agricultural Department. All growers (other than in a native reserve) and dealers in coffee are to be licensed annually. The Governor is empowered to impose a levy not exceeding Sh. 1

per cwt. on coffee produced in and exported from the Colony. The proceeds of the levy, together with the proceeds from dealers' licences, are to form the funds to be administered by the Board, for purposes defined in the Ordinance.

Full details of the coffee services of the Department during the year will be found in the report of the Senior Coffee Officer.

Sisal.

Despite low prices the output of sisal fibre was increased from 14,674 tons in 1931 to 17,369 tons in 1932, but the quantity exported decreased by 609 tons compared with the previous year. Quantities and values of exports in 1931 and 1932 were 15,994 tons and 15,388 tons, and £232,564 and £186,575 respectively.

Prices continued to decline and reached the low figure of £12-3s. as compared with £14-5s., the lowest in 1931. In these circumstances it was natural that planting was discontinued. According to the Agricultural Census the area under three years of age declined by 17,713 acres, or 32 per cent below the figure for 1931.

Manufacture of Sisal Bags.—During the year considerable attention on the part of Government and private interests was devoted to the possibilities of the local manufacture from sisal fibre of sacks and similar articles extensively used in the Colony. A syndicate had previously been formed to promote the scheme. Sacks for trial were manufactured in Belfast and trial shipments of coffee, maize, groundnuts and sisium were arranged by the Department with exporting firms. The Department also communicated with representatives of importing interests in Great Britain, and with shipping companies. Preliminary reports of tests are decidedly encouraging and the investigations are being pursued.

To obviate any possibility of dumping by oversea suppliers of jute sacks in an effort to retain the East African market, Government decided to safeguard the position of the proposed manufacturing industry without imposing a burden upon agricultural industries using sacks. This was done by prohibiting the sale within the Colony of jute sacks at a price less than the lowest price quoted by the Bengal Chamber of Commerce for such bags, plus the costs of transport, landing and cognate charges. It was made compulsory to obtain a licence for manufacture from the Governor in Council, the object being to control competition.

Improved Extraction.—During the year a grant was obtained from the Colonial Development Fund for the construction of decorticating machinery of a type designed for the extraction of a larger percentage of fibre from the leaves at lower operating costs. This machinery was made in the United Kingdom, and sent to Kenya, where it is undergoing trials which promise to be successful.

Tea.

This industry is making rapid progress. By 28th February, 1933, the area planted was 12,034 acres, compared with 11,258 acres the previous year. The production of prepared leaf increased from 1,500,249 lb. in 1930 to 2,421,056 lb. in 1932-33. Of this quantity 928,704 lb. was exported in 1932 compared with 480,848 lb. in 1931. During the same period the consumption in Kenya rose from 1,099,401 lb. to 1,513,184 lb.

The areas selected for this industry are proving to be admirably suited to the crop and further extension may be anticipated when the value of tea rises with better world prices. The industry has already brought large capital sums of money into the Colony and provides a market for maize and other produce grown by both Europeans and natives.

Sugar.

Prices of sugar remained extremely low. In addition to this handicap the industry suffered considerable loss caused by locusts. The amalgamation of producers in Kenya provided a certain degree of stability of local prices, but nevertheless new planting was not undertaken on any scale and the total area, which was reduced considerably in 1931, continued to decline and was 12,088 acres compared with 12,363 the previous year. Cutting and crushing of cane increased, and resulted in a total out-turn of crystalized sugar of 106,320 cwt. compared with 104,700 cwt. in 1931. Exports of sugar declined from 21,196 cwt. in 1931 to 16,046 cwt. in 1932. Exports to Uganda also decreased and were 29 cwt. only compared with 2,293 cwt. in 1931. This was due to greater production in Uganda.

Wattle Bark.

The last few years of effort in the Kikuyu Reserve for increasing production and improving the export product are now

bearing fruit as revealed by exports of wattle bark and extract. Quantities and values for 1932 and previous years are as follows:—

EXPORTS

1932		1931		1930		1929		1928	
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
<i>Cwts.</i>	£	<i>Cwts.</i>	£	<i>Cwts.</i>	£	<i>Cwts.</i>	£	<i>Cwts.</i>	£
WATTLE BARK									
236,545	78,811	192,368	67,203	131,160	44,680	63,342	25,336	101,619	39,112
WATTLE EXTRACT									
9,809	7,055	6,073	6,028	16,729	18,400	27,777	28,310	20,284	22,478

In addition to the benefit derived from the sale of bark, natives, who are the principal growers, also receive considerable gain by sale of the wood as fuel and as timber for building. The tree also serves as a nitrogen restorer for the soil, and yields of maize particularly are improved by it. During former years Europeans at the higher elevations established considerable acreages of wattle, but when maize and other crops became remunerative, wattle received less attention. This interest was revived considerably in 1932, and the production of wattle bark extract, which languished in 1931, has been actively resumed as a result of the entry into the industry of a firm of long standing and experience in production and marketing.

Further efforts were made by the Department to improve the quality of bark exported, and legislation was introduced obliging buyers to take out a licence which is subject to revocation on convictions under the Rules controlling purchase or disposal of unsuitable bark.

Potatoes.

As already stated, locusts and decline in values of cereals caused farmers to investigate the possibilities of other crops. In 1931 the Agricultural Economist obtained detailed information on markets and marketing of potatoes at ports bordering the Indian Ocean and Red Sea, and especially in Bombay. This information was published in a bulletin and was instrumental in encouraging the planting of an increased acreage of potatoes by Europeans in 1932. Weather and other conditions were favourable for the growth of the crop and expectations were held of a good market in Bombay. There was

reason to believe that potatoes would become an important crop in settled areas. Good yields were obtained, but unfortunately for the growers, the Bombay market suddenly slumped in the export season and the export proved to be unprofitable. Quantities and estimated values of potatoes from European and native growers during the past seven years have been as follows :—

YEAR	Quantity Exported	Value
	<i>Cwts.</i>	<i>£</i>
1932.. .. .	68,130	15,336
1931.. .. .	49,723	13,258
1930.. .. .	45,018	11,133
1929.. .. .	82,755	27,050
1928.. .. .	57,296	16,990
1927.. .. .	43,105	10,036
1926.. .. .	44,919	10,999

Without doubt this experience will result in reduction of acreage planted in 1933, but if selling organization, packing and other market requirements are given adequate attention there is no doubt that potatoes will continue to be a very useful sideline in some districts in normal years, and the returns obtained in 1932 should not be taken as a final indication of the possibilities of the crop. It is known that in the past a profitable market has existed for considerable quantities in India, Ceylon, the Anglo-Egyptian Sudan and other eastern territories, which market has been supplied mainly by countries in Southern Europe. Empire preferential duties are now in force in India and Ceylon. When conditions become more nearly normal and purchasing power returns in these territories, potatoes should again become a profitable export crop and every effort should be made to obtain a footing in the market even though present returns may be unattractive.

Linseed.

Owing to low prices and locusts, the need for rotation of crops and other considerations connected with maize and wheat, linseed received considerable attention in warmer cereal areas where it has been grown with success for several seasons. Analyses have shown that the oil content of the seed is satisfactory. Increased production and the demand for feeding cake by the dairy industry justified the erection at Molo of a small private crushing plant for the extraction of oil. Sunsim and groundnut feeding cake manufactured in the Colony in the past has contained an excess of oil, but linseed cake was satisfactory in this respect. Therefore linseed cake prepared by this Molo plant was in demand by dairy farmers. In fact,

demand far exceeded supply, but the output was restricted by the small demand for the oil itself. Considerable stocks of imported oil were held by merchants during the year, but subsequent to their disposal local oil should find a market within the Colony and at a later date export markets in adjoining and other territories.

Should this mill be able to deal as well with castor and other oilseeds its operation should be of great value to the agricultural community.

Essential Oils.

During the past four years this industry has made substantial strides. Quantities and values of exports have been as follows :—

Year	Quantity gallons	Value
1932	4,433 ..	£ 9,355
1931	1,226 ..	8,091
1930	1,295 ..	3,375
1929	314 ..	1.9

Several kinds of oil are exported, of which the principal are cedarwood and geranium oils. The Senior Agricultural Chemist has introduced numerous species of plants which have been multiplied and distributed for trial or multiplication. In the near future the Colony should be in a position to produce a considerable range of oils for the large perfumery and other trades in Europe and the United States of America.

Cotton.

Mention should be made of the progress of native cotton-growing in the Nyanza and Coast Provinces.

In the Nyanza Province the yield of the 1931-32 crop was 2,166,352 lb. of seed cotton, which was nearly equal to the record output of 2,256,497 lb. of the 1928-29 season. Further progress was made in 1932 when the area planted exceeded that of 1931. As weather conditions were favourable and insect pests less prevalent for the 1932-33 crop, it was anticipated at the end of 1932 that an increased yield per acre would be obtained.

In the Coast Province output from the 1931-32 crop was 627,883 lb. which was a record for this area. Efforts to increase the area planted and the output in 1932 were successful, as by the end of the year 978,024 lb. of seed cotton had

been bought by ginnerers. As the buying season extends into the early part of the following year, the crop will be well over one million pounds. The quality of lint was improved by the introduction of new seed in 1931, and several new varieties were under trial, the best of which will be bulked and distributed as soon as their value is proved.

ANIMAL INDUSTRY.

This Division embraces the administration of the Diseases of Animals Ordinance, Veterinary Services, Veterinary Research and Animal Husbandry. As in the case of the Plant Industry, reference should be made to the report of the Deputy Director (Animal Industry) and the reports of the subdivisions.

The investigation and control of disease continue to render benefits to stockowners which are much appreciated. The services of the Department relating to Animal Husbandry have been in great demand by European stockowners. Considerable progress has been made in these directions. There still, however, remains vast scope for the advancement of the industry through better methods of herd and farm management, greater appreciation of the benefits to be derived from improvements in selection and breeding practice and a greater knowledge of the preparation of animal products.

Progress continues to be made in marketing organizations and further outlets for animal products are being investigated.

The work of the Division in the native reserves has shown commendable progress, both in the production of marketable animal products and the placing on the local markets of a considerable number of live stock, following the relaxation of quarantine restrictions as the result of successful disease control measures.

The production of a good quality ghee has been stimulated and in consequence of the increase in production a local selling agent has been appointed with the object of standardizing the quality of the article and finding markets outside the Colony.

The supply of meat on hoof from native reserves has never been so large; it is so great that the markets in Kenya are glutted with supplies and the prices of live stock have fallen to very low values.

The better preparation of hides and skins has received much attention, with the result that a higher selling price has been obtained to the benefit of the native.

Live Stock.

Native live stock are dealt with in the report of the Deputy Director (Animal Industry).

The following table shows the numbers of live stock owned by Europeans during the last five years:—

	*1929	*1930	†1931	†1932	†1933
Cattle—Total	218,390	226,661	236,895	248,279	259,188
(a) Breeding Stock ..	115,777	129,311	135,530	147,095	152,594
(b) Other Cattle ..	102,613	97,550	101,365	101,184	106,594
Horses	2,258	2,265	2,263	2,196	2,346
Mules	632	543	492	442	426
Donkeys	1,235	1,225	951	974	1,047
Sheep (wool-bearing) ..	210,912	207,237	218,845	202,456	203,372
Sheep (native)	24,556	23,703	27,507	32,751	36,134
Goats	3,926	2,540	2,972	2,312	2,441
Pigs—					
(a) Breeding sows ..	3,103	2,738	2,691	2,449	2,704
(b) All others	14,638	14,632	12,539	11,261	11,927
Poultry	35,766	44,844	49,153	62,629	57,037

* As at 31st July.

† As at 25th February.

Cattle.

The total number of cattle of all breeds in the possession of Europeans as at 25th February, 1933, was 259,188, an increase of 10,909, or 4.39 per cent over the figure for the previous year, but a slightly lower rate of increase than that which occurred in 1932 when the rate was 4.8 per cent. The increase extended to all classes of breeding cattle, working oxen and bullocks. The figure for bullocks has risen from 33,159 in 1932 to 37,941 in 1933 due no doubt to decreased consumption of meat consequent upon the necessity of curtailing household requirements during the present depression.

The total numbers of pure-bred cattle showed increases in all classes with the exception of cows and heifers over three years, in which there was a slight decrease. Pure-bred bulls and bull calves showed a combined increase of 9 per cent.

Sheep.

Wool-bearing sheep have maintained their numbers and of native sheep on European farms a steady increase is recorded.

Pigs.

Pigs showed an increase of 921, of which 255 were breeding sows. In the absence of an export trade in pig products this rise in the number of breeding sows is to be deprecated.

Slight increases in the numbers of horses and donkeys are to be noted.

Poultry.

The number of poultry stands at 57,037, a decrease of 5,592. This is probably due to severe culling of breeding stock in an initial attempt to improve the industry.

Animal Products.

The following is a comparative table of the animal products sold by Europeans during the last five years:—

	Milk (Whole)	Cream	Butter fat.	Butter	Cheese	Ghee	Wool	Eggs
	<i>gal.</i>	<i>gal.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>dos.</i>
1932-33	1,138,743	73,387	923,042	350,405	155,525	47,110	721,542	86,785
1931-32	1,018,868	77,063	675,910	285,320	111,582	96,471	813,662	..
1930-31	1,101,704	145,796	614,790	312,694	131,168	114,527	654,846	..
*1929-30	1,027,375	287,657	(a)	371,675	108,875	116,117	393,258	..
*1928-29	791,452	212,914	(a)	290,905	145,609	5,215	939,619	..

* In respect of the period 1st August to 31st July.

(a) Included in cream.

The production of whole milk, butter fat, butter and cheese show substantial increases over the preceding year, amounting to 11.8 per cent, 36.6 per cent, 22.8 per cent, 39.4 per cent respectively. The sale of cream declined and there was a decreased production of ghee amounting to 51 per cent. The total output of dairy products has risen to a higher level than ever previously attained, notwithstanding the widespread destruction of grazing by locusts in 1932 and previous years.

In confirmation of the increased production of dairy products the statistics of dairy commodities produced by local creameries during the year show corresponding increases.

YEAR	Total quantity of milk received from Farmers	Quantity of butterfat received from Farmers	Products manufactured therefrom		
			Butter	Cheese	Ghee
	<i>Gallons</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
1932-33..	183,754	1,243,356	1,428,471	92,933	29,404
1931-32..	167,043	864,516	1,069,043	69,723	19,416
1930-31..	118,688	1,033,877	1,207,295	79,247	55,953

The Butter Levy Ordinance operated satisfactorily throughout the year. The financial assistance rendered to the export trade amounted to Sh. 152,554, or 17 cents per pound on 897,382 lb. of butter exported. This bounty enabled the Co-operative Creameries to maintain their payment for butter fat at an average figure of 84 cents per pound. While this figure was undoubtedly low owing to the fall in export prices, dairy farmers in the Colony were able to continue their operations without undue stress.

In the absence of this bounty the position would undoubtedly have become embarrassing and the young and rapidly developing dairy industry would have received a severe check. The levy on local sales therefore has worked to the material advantage of the industry.

The production of wool amounted to 721,542 lb., a decrease of 11.6 per cent on the previous year and an increase of 10.3 per cent on the 1930-31 figure.

Nairasha Farm.

Investigational and experimental work connected with Animal Husbandry was continued by the Rowett Research Institute at this Government institution, and particulars are given in the report of the Officer in Charge.

Drought conditions prevailed throughout the year, rendering the work particularly difficult and resulting in a decrease in the financial balance compared with that of the previous year. Live stock in hand at the commencement of 1932 was valued at Sh. 71,094 and at 31st December an increase in value of Sh. 5,631/15 was shown.

At the beginning of the year there was a balance of Sh. 17,999/92 standing to the current and deposit account of the farm. At the end of the year the balance had increased by Sh. 2,036/22 to Sh. 20,036/14.

It should be noted that expenditure does not include the salaries of the two research workers and no charge is made for rent or interest on capital.

STUD BOOK.

The Royal Agricultural and Horticultural Society did not publish a further volume of the East Africa Stud Book during 1932. It is anticipated that Volume 6 will be published early in 1934.

It is with great regret that I have to record the death of Mr. J. H. D. Beales, who had been the Editor of the Stud

Book since its inception. The position which the Stud Book has reached to-day is largely due to Mr. Beales' careful and zealous work in the compilation of the first five volumes. Mr. M. F. Hill has been appointed as Editor in addition to his duties as Secretary.

In response to requests, a "Return of Mares" for the season 1931-32 was compiled by the Secretary and published in May. This publication, which received widespread commendation and is of considerable value to breeders of horses, will be compiled again for the season 1932-33. Useful contributions towards the expense involved have been received from the Owners', Breeders', and Trainers' Society of Kenya and from the Pony Breeders' Society of Kenya.

The Committee is considering the possibility of the institution of a scheme of milk recording. It is hoped that progress will be made with this during 1933.

The Department continues its close association with the work of the Stud Book. The Director of Agriculture is *ex officio* Chairman whilst the Chief Veterinary Officer and the Live Stock Officer are nominated members of the Committee.

The balance to the credit of the Stud Book Account at the end of the year was Sh. 899/36.

GRADING, INSPECTION, CONDITIONING AND COOL STORES SERVICES. *Financial.*

Owing to the serious reduction in the quantities of produce submitted for grading and reconditioning in 1932 compared with previous years, revenue was reduced very considerably. Every means of reducing expenditure was exercised, but in spite of most rigid economy outgoings exceeded revenue by the sum of £113-18-2. Thus the total of £315-9-6 standing to the credit of the combined account of the Grading and Conditioning Services on 31st December, 1931, was reduced to £201-11-4 at the end of 1932.

The decline in the quantities of commodities received at the Cool Stores which occurred in 1931 continued in 1932, and revenue was reduced accordingly. The balance sheet for the year showed a loss of £1,516-11-4 at the end of 1932.

Plant Import Inspection.—The increase in the number of packages submitted for inspection each year since the commencement of the service was arrested in 1932, there being a

decline of 6,989 packages compared with 1931. In all 11,753 packages of plants, fruit, bulbs and seeds, having a declared value of £21,044, were passed into the Colony, and 84 packages, valued at £173, were passed in transit to Uganda and Tanganyika.

Grading and Conditioning Services.

Maize.—For various reasons, of which the most serious was loss by locusts, only 346,429 bags of maize were graded compared with 1,124,464 bags in 1931. This represents a decrease of 69.19 per cent. Export certificates numbering 40 were issued for 220,975 bags of maize, and 29,363 bags for which certificates were not essential were shipped to local ports. The report of the Chief Grader contains particulars of the numbers of bags of the various grades.

Wheat.—Owing to decrease in the acreage planted and to the incidence of locusts, no wheat was exported.

Potatoes.—Regulations governing the export of potatoes were amended during the year, and revised rules came into operation on the 1st July. The quantity graded exceeded that of 1931 by 43.7 per cent and amounted to 61,462 cwt. It was estimated that approximately 30 per cent of this quantity was produced by European growers who entered this trade on a larger scale and in a more organized manner than in previous years. The quality of the potatoes was very satisfactory.

Beans.—There was a satisfactory increase in the number of bags graded, which was 5,708 compared with 236 in the previous year. Beans are assuming an important part in exports.

Conditioning Plant.

The new conditioning unit was completed during the year. This made it possible to treat 2,500 bags in a working day of 24 hours with the two plants, compared with 1,500 previously with only one plant.

Maize.—The number of bags of maize treated was 52,963, of which 52,102 were wet and 861 affected with weevil.

Beans.—Wet and weevily beans to the number of 813 bags were handled. Experiments in the drying of wet and slightly weevily beans were conducted at the conditioning plant with satisfactory results. The costs were found to be in excess of those for maize or wheat. Further experiments will be made in 1933.

Cool Stores.—As stated above the decrease in quantities of commodities stored during 1931 continued during the year. A comparative table showing quantities of the various commodities stored during the year and since the inception of this service are shown in the report of the Chief Grader and Inspector.

LABOUR.

The average number of men, women and children (almost entirely Africans) employed on holdings in the European areas for the last seven years are shown in the following table :—

Year	Men	Women	Children	Casual daily labour	Total
1932 ..	79,749	3,506	14,610	7,160	105,025
1931 ..	76,604	3,260	15,330	5,926	104,120
1930 ..	89,856	3,337	19,393	7,574	120,210
1929 ..	90,633	3,971	18,124	13,157	125,885
1928 ..	85,082	4,249	15,304	6,062	110,697
1927 ..	83,000	4,654	17,295	9,371	114,320
1926 ..	76,838	4,802	15,428	5,006	102,074

No significant change occurred in the statistics of labour employed in agriculture. The average number of monthly units employed showed a slight increase over the figure for the previous year. Slight increases occurred in Kiambu and Thika (Fort Hall), while decreases occurred in Kericho and Kisumu-Londiani. The number of children employed decreased somewhat, but the number of women increased.

AGRICULTURAL LEGISLATION.

The following legislation affecting agricultural industries was promulgated during the year :—

ORDINANCES :—

- Branding of Stock (Amendment) Ordinance, 1932.
- Butter Levy (Amendment) Ordinance, 1932.
- Chattels Transfer (Amendment) Ordinance, 1932.
- Coffee Industry Ordinance, 1932.
- Co-operative Societies (Registration) (Amendment) Ordinance, 1932.
- Fencing (Amendment) Ordinance, 1932.
- Land and Agricultural Bank (Amendment) Ordinance, 1932.
- Sisal Bag Industry Ordinance, 1932.
- Stock Traders Licence (Amendment) Ordinance, 1932.
- Suppression of Rabies Ordinance, 1932.

RULES :—

- Under the Agricultural Produce Export Ordinance (Chapter 93 of the Revised Edition) :—
 - Agricultural Produce Export (Potato) Rules, 1932.
- Under the Branding of Stock Ordinance (Chapter 159 of the Revised Edition) :—
 - Proclamation regarding marks or designs.
- Under the Butter Levy Ordinance, 1931 :—
 - Butter Levy (Amendment) Regulations, 1932.
- Under the Crop Production and Livestock Ordinance, 1926 :—
 - Wattle Bark Marketing (Amendment) Rules, 1931.
 - Wattle Bark Marketing (Amendment) Rules, 1932.
- Under the Diseases of Animals Ordinance (Chapter 157 of the Revised Edition) :—
 - The Diseases of Animals (Amendment) Rules, 1932.
 - The Diseases of Animals (Amendment) (No. 2) Rules, 1932.
 - The Diseases of Animals (Prevention of Rabies) Rules, 1932.
 - Directions and Conditions for Movement of Cattle, etc., to or from Native Areas.
 - Notice regarding the Importation of Animals from Tanganyika Territory or Uganda Protectorate.
- Under the Diseases of Plants Prevention Ordinance (Chapter 155 of the Revised Edition) :—
 - Diseases of Plants Prevention (Amendment) Rules, 1932.
 - Diseases of Plants Prevention (Coffee) Rules, 1932.
 - Amendment of Schedule of Charges of Government Cool Stores, Mombasa.
- Under the Statistics Ordinance (Chapter 31 of the Revised Edition) :—
 - Sisal Industry Statistics Regulations, 1932.

LIBRARY.

In addition to the publications given under the sections dealing with Plant and Animal Industries, the following were published :—

- Annual Report of the Department of Agriculture, 1931.
- Agricultural Census, 13th Annual Report, 1932.
- Crop Reports : January, February, and July–December, 1931.
- Report on the Experimental Small-holding at the Scott Agricultural Laboratories.

Owing to the reduction in the library vote, it became necessary to reduce the number of periodicals obtained for the Head Office and Station libraries. The field stations are very poorly equipped with both works of reference and periodical agricultural literature.

The facilities afforded to subscribers for the loan of the books were utilized to an increasing degree, and many farmers visiting Nairobi now make a point of perusing recent numbers of agricultural journals in the library.

The Director of Agriculture, Mr. Alex. Holm, C.B.E., proceeded on leave pending retirement before the preparation of this report and for this reason the report is signed by the Deputy Director (Plant Industry) on his behalf.

It is not possible to convey in full the tribute which Mr. Holm has deserved from his staff. It must suffice to say that the loss of his able guidance and direction of the staff's activities, as well as of his personal interest in their welfare, will be felt most keenly. Mr. Holm has received exceptional tributes of the warmest nature from the agricultural communities, the Government and his staff for the distinguished services he has rendered to the Colony.

H. WOLFE,
for Director of Agriculture.

Part II.—Plant Industry

REPORT OF THE DEPUTY DIRECTOR (Plant Industry)

ADMINISTRATION.

The Deputy Director (Mr. H. Wolfe) was on leave for six months during the year, and Mr. Blunt, Assistant to the Director, acted as Deputy during his absence.

Some disorganization of services was still felt during the first half of the year because of services given to the locust campaign coupled with the previous year's reduction in staff, though the latter was made up during the year.

Much in the way of advisory services is now rendered by the specialist and field staff of the Department, but work of a most varied nature remains in the hands of the Deputy Director. The commercial interests in Kenya, largely concerned with crop products, make use of the Division as a bureau of commercial and economic information; administration of the varied and expanding services of the Division also requires unremitting attention; so that there is not as much time or opportunity left for the travelling and inspection work which is so necessary for maintaining real contact between administrative and field staff. It is a matter for serious consideration as to how correspondence can be lessened both for the reason given above and to relieve a hard-worked clerical staff substantially depleted in numbers in recent years, while the work has been expanding.

Disease Control.

At the beginning of the year the inspection services were placed under the direction of the Entomological section. These services include not only general plantation inspection, for which the Plantation Inspectors were transferred to this section, but also the administration of all Rules and Regulations dealing with the importation of plants and seeds, the movement of plants within the Colony, and the issue of all permits in connexion with the rules under the Diseases of Plants Prevention Ordinance.

A Committee of three was formed to correlate the work on the control of pests and diseases and to advise on these services, the members being the Senior Entomologist (Chairman), the Senior Mycologist and the Senior Coffee Officer.

Lack of uniformity in the regulatory services for plant importation in the East African territories has been felt for some time, but action for remedying this is now under way and a conference for the purpose is likely to assemble at Amani in the near future.

The work covered by the Division falls under three main headings :—

- (1) Specialist services.
- (2) Agricultural services in European areas.
- (3) Agricultural services in native areas.

SPECIALIST SERVICES.

These services are rendered by the Entomological, Botanical, Chemical, and Plant Breeding sections, which cover a wide range of crops and problems connected therewith, and by the section dealing solely with the manifold problems of coffee-growing. In approaching the problems connected with crop improvement and pest and disease control, it is manifestly necessary that officers of different sections should co-operate and pool their special knowledge and skill in endeavouring to reach a solution and it is pleasant to be able to record a marked spirit of team work among the specialist staff. Much evidence of this will be found in their reports.

Centralized or team-work research is made possible by the concentration of the headquarters of the specialist services at the Scott Agricultural Laboratories, on the outskirts of Nairobi, and opportunity might be taken here of mentioning that some 60 acres of the Laboratory grounds are devoted to field investigational work, chiefly for the specialist services and particularly for coffee, under the control of an Experimentalist, but also for the assistance of crop industries in the neighbouring highland districts. A minor centre of specialized investigational work is at Njoro, where a station established for wheat-breeding has become a field plant-breeding and experiment station with a staff of two Plant-breeders, a Mycologist and an Agricultural Officer.

The reports of the officers in charge of the specialist services appear later in this report. In the résumé of the investigational work for the improvement of crops which immediately follows, this work has been classified under crop titles.

Work for the Improvement of Crops.

Coffee.—Work performed in connexion with coffee falls naturally under two heads of biological and cultural, although there is a fundamental inter-relationship between these.

The three most serious insect pests on coffee during the year were the Capsid bug (*Lygus simonyi*, Reut.), the coffee bug (*Antestia linneaticollis*, Stal.), and the common coffee mealybug (*Pseudococcus lilacinus*, Ckll.). The Capsid bug was present throughout the Kikuyu Province, but the warm, dry conditions of the lower areas and favourable flowering conditions generally kept it in check.

A preliminary detailed investigation into the use of pyrethrum-kerosene extract spray against the Capsid bug was concluded, and comparison of sprayed and unsprayed blocks in an experiment indicated a fifty per cent increase in yield of cherry due to spraying, and that, as during the experiment the bugs were not present in large numbers, with a serious infestation the yield on unsprayed blocks would be considerably less. *Lygus simonyi* is present in the Koru area, but has not been recorded in Sotik-Kericho where, however, twelve other species of capsids were collected.

Hand-picking, poison-baiting, and pyrethrum spraying were in use during the year against *Antestia*, but none of these methods, as applied, was completely adequate. Research continued into the problem of the control of this bug, and in the wetter areas investigations resulted in the production of a paraffin-pyrethrum-soap-emulsion spray which proved an effective control for areas where water is readily available. This spray proved effective also against the Sotik capsids.

Investigations continued into the effectiveness of different types of banding as a means of controlling mealy bug infestations and trials have been made of cheaper and simplified banding. "Melanoid", a bituminous paint, is largely used as a grounding for ant-repellents, but is not officially approved owing to its liability to crack in the course of time, thus permitting the repellent access to the tree itself with serious results in cases where the repellent is able to damage the bark. The type of band where the repellent, whether Kresotow or banding grease, is prevented from coming into contact with the bark is safest. Every effort has been made to ensure uniformly reliable consignments of Kresotow, and arrangements have been made for a narrower fraction to be taken during distillation, which is also to be confined to the winter months to secure an oil free from crystals.

The importance of Leaf Miner moth (*Leucoptera coffeella*, Staint.) has increased greatly during the past two years and there is observational evidence that both poison

baiting against *Antestia* and pyrethrum-extract spraying against *Lygus*, by poisoning the parasites of this moth, are factors favourable to its increase.

Coffee Berry Disease experiments have taken a prominent place during the year, but in spite of considerable efforts to find more satisfactory means of control, no outstanding advance was achieved. There has been some measure of control with copper sprays. No relation between soil and the incidence of the disease has been discovered. The most promising long range policy for the future prevention or control of this disease appears to be the building up of resistant types or strains. Towards the end of the year the Department acquired the lease of part of a farm in Sotik to be devoted entirely to Coffee Berry Disease investigations and two officers were seconded exclusively for this work.

The interaction of Bordeaux Mixture on the coffee tree and certain physiological diseases, such as yellowing, leaf fall and chlorosis, are being studied by the Chemical section.

The important cultural work on coffee dealing with such investigations as vegetative propagation, root growth, methods of planting, pruning and stumping is fully described by the Senior Coffee Officer in his report and need not be further considered here, while certain aspects of the soil problems of the Colony as related to coffee growing are discussed in the report of the Chemical section.

Successful experiments were conducted at the timber conditioning plant of the Public Works Department, Nairobi, on the treatment of coffees grown outside this Colony, to ensure freedom from all stages of *Stephanoderes*, with a view to bulking or otherwise handling such coffees in Nairobi.

Maize.—The maize industry is so depressed owing to low prices that unremitting attention has been given to improving yields per acre by any and every economic means. Improved planting and culture methods recommended in the past are gradually being adopted and experiments were conducted in various directions during the year towards maintaining and improving soil fertility. Green manuring and fertilizer trials were prominent amongst these experiments. Attempts to breed strains of maize which will remain of a high yielding type whilst possessing resistance to disease—particularly *Fusarium* diseases and *Helminthosporium turcicum* (White Blight)—were continued and this is now the chief part of the Division's work on maize. Examination of in-bred lines indicates that attainment of resistance to White Blight seems to

be in sight but a similar success with *Fusarium* diseases is likely to be more difficult. The presence of soil and climatic conditions very favourable to these diseases may prove too severe a handicap. Nevertheless the results of the Maize Seed Competition, continued again this year, showed that much can be done towards improving yields by a rigorous selection only of seed free from disease and of a resistant type. A report of this valuable competition appears in Bulletin No. 3 of 1933, and it is of great importance to all maize growers to appreciate the reason for the same seed from Njoro gaining first prize both at Njoro (7,000 ft.) and at Kitale (6,000 ft.). The reason was because the farmer responsible for selecting the prize-winning seed is known to spare no pains in selecting only that type of cob which is recommended as being free from and resistant to disease. The result was that he not only won in his own district, but beat all local competitors in a district of somewhat dissimilar climatic conditions.

Muratha maize, which was bred at the Scott Agricultural Laboratories, continued to show great promise in districts unsuited to the ordinary flat white type which continues to be grown in the best maize areas. Muratha seems certain to give very respectable yields in districts of lower rainfall requiring an early maturing maize.

Wheat.—As a result of continuous cropping of wheat on the same land at the higher altitudes "Take-All" became a serious disease during the year and caused a considerable reduction in yields. In order to avoid severe losses in future, farmers will have to rotate wheat with crops of a non-graminaceous type. Take-All and Black Chaff of wheat were further investigated during the year but the chief work on wheat continued to be the breeding of strains resistant to the rusts occurring at the different altitudes.

It is pleasant to be able to record that investigations made during the year indicate that considerable successes appear to be in sight. It will be remembered that a few years ago wheats had been produced resistant to all four physiologic form of Stem rust, fairly resistant to Yellow rust and suitable for the medium and higher altitudes. Unfortunately they were of poor milling quality. This defect appears to have been overcome in the new hybrids. Though the wheats are only just emerging from the hybrid stage a few strains are resistant to all four physiologic strains of Stem rust (including K.2) and are so far adequately resistant to Yellow rust at least up to an altitude of 8,500 ft. As far as can be judged by eye, the milling

quality seems good. The grain is inclined to become starchy at the highest altitudes, but looks incomparably better than that of the earlier wheats. If these wheats turn out as good as they promise they should put wheat growing at the medium and higher altitudes on a sound footing in a few years' time.

With regard to short season wheats for the lower altitudes, somewhat similar progress can be recorded. Wheats of superior grain and much better yielding capacity to Kenya Standard have been bred. In common with Kenya Standard they are resistant to three out of the four physiologic forms of Stem rust. It is, however, moderately susceptible only to K.4; this is because Kenya Standard was used as one of the parents before form K.4 was discovered. It is impossible to say how often form K.4 will appear, but the wheats are no more likely to be destroyed by stem rust than was Kenya Standard. The other objection to this latter wheat, namely, great susceptibility to leaf rust, has also been overcome in the new wheats.

Other Cereals.—A test of the efficiency of Granosan and du Bay Ceresan used as dust treatments of barley seed for the control of covered smut was carried out during the year. While of the ears from untreated seed a percentage of the order of 2.5 was completely destroyed by smut, the treated seed gave entirely clean ears.

Beans.—Trials were carried out at the tinber seasoning plant of the Public Works Department, Nairobi, with a view to finding a successful method of conditioning beans, to destroy the bean beetle (*Bruchus*). A combination of temperature and humidity was found which enabled the complete destruction of the beetle without impairing the appearance or the germination capacity of the beans.

Following this successful trial it was decided to test the suitability of the conditioning plants at the Coast for this bean beetle treatment. It was found that the old conditioning plant was successful in completely destroying beetles, but the percentage moisture content was reduced by only about $1\frac{1}{2}$ for each treatment, with the result that if beans with a moisture content of over 16 per cent were handled, three treatments would be necessary to reduce it to the legal limit for export. $13\frac{1}{2}$ per cent. The results indicate that it would be an economic proposition to condition sun-dried beans for the destruction of beetles but not, as in the case of maize, to condition consignments for reduction of moisture content, for export. Further work is proceeding in connexion with this problem of ensuring clean, dry consignments for export.

Potatoes.—Work on the multiplication and isolation of virus-free potatoes continued, and field observation indicated that the virus-free condition was being maintained.

Groundnuts.—Further investigation into the destructive wilt disease of this crop at the Coast was made this year. Artificial cultures made from the roots of affected plants produced a number of different fungi of which the most noticeable were *Fusarium* spp. Attempts in Nairobi to reproduce the disease by various methods of inoculation were only partially successful, and it would appear that special conditions of some sort not fully understood are a prerequisite of infection.

The results from collection and subsequent sowing of seed from apparently resistant plants of one variety at Kibarani (Coast) indicated that there was probably some inheritance of resistance and in future seed will be collected from individual plants showing resistance and sown separately. It is hoped that by using proper breeding methods a wilt-resistant type may be produced at the Coast.

Cassava.—Several varieties of Cassava have been tried at Kibarani with a view to testing their yielding capacity and their resistance to Mosaic, a disease which enormously depreciates the yield of this crop in the coastal belt. One or two lightly yielding varieties show some resistance and a beginning has been made with a study of its inheritance and with propagation from cuttings with a view to isolating pure strains of resistant varieties previous to crossing them with strains of higher yielding but susceptible varieties, such as Binti Athman. It is hoped that in time high yield may be combined with resistance to Mosaic in one variety. Studies are also being made of the method of infection and of the vector concerned, in order, amongst other things, that artificial infection may be resorted to in due course in breeding plots.

Essential Oils.—Cedar wood oil has now become a regular article of export and an intensive study of this oil has been commenced in order to ascertain if the variations noted are normal or abnormal. Several new strains of geranium have been introduced, and while the oils from two of these are already very promising, five of the strains have been multiplied in order to provide enough oil for examination. A sample of local peppermint oil, submitted to the Imperial Institute, was most favourably reported upon, the value assigned to the oil being appreciably higher than the average American oil. It has thus been possible to encourage the planting of peppermint to such an extent that oil will probably be exported

during 1933. The peppermint at the Scott Agricultural Laboratories became infested with a root mealy bug which prevented any issue of planting material therefrom; but no record of peppermint being infested elsewhere has been received. Japanese peppermint has been introduced and has grown well at the Laboratories. Lemon grass is a promising crop for the warmer zones, as it appears that, although it is eaten by locusts, cuts may be made during the wet season every five or six weeks. The oil has received a very favourable report and would command a premium over the standard oil. In connexion with the essential oil work, a miniature still has been erected which has increased the oil production and enabled the Chemical staff to learn some of the practical difficulties of distillation.

Pyrethrum.—As far as is known this crop was first tried in Kenya in 1928 by Mr. Gilbert Walker, a settler near Nakuru. Specially selected seed was obtained by the Department from Harpenden in 1929 and planted at the Scott Agricultural Laboratories for multiplication and issue for trial elsewhere. Immediately the value of pyrethrum-kerosene emulsion for combating insect pests on coffee became realized as a result of the Entomological section's experiments, large quantities of pyrethrum came into demand. This was imported in the form of concentrated solutions and powders, principally the former.

Tests of samples of the tried flowers by authorities in Britain showed that the toxicity of Kenya pyrethrum was equal to that of any other source of trade supply and numerous local tests are still conducted by the Entomological and Chemical sections to check toxicity.

Following publicity by the Department in 1931, increasing interest in the crop began to be shown. The Nairobi value of imported powder was approximately Sh. 2 per pound and as the local product was fresher and had a greater toxic value, Sh. 2/50 per pound was demanded and obtained. It was estimated that the requirements of coffee planters in East Africa were equivalent to 100,000 lb. of flowers per annum, which it is believed will absorb the local production of 1933 and a considerable part of that of 1934.

In view, too, of the increasing oversea demand, prospects for the industry appeared to be most favourable. Considerable extension of planting took place as a result of the Department's organization of seed-supply in substantial quantities. It was realized that in the absence of organization among

growers there might be disadvantageous competition in disposal of the flowers for local use, thus causing excessive fall in price. Also for oversea markets it was essential to export flowers of high quality packed according to the requirements of buyers. The necessity for reducing export costs to a minimum will make shipment of large consignments essential, and entails the bulking of supplies. For these reasons a Pyrethrum Growers' Association was formed on the growers' own initiative.

The necessity for maintenance of quality was realized at the outset. Quality depends chiefly upon the use of seed of strains of high toxic value. It was evident that seed of inferior strains might be imported, and at the end of the year legislation for the control of importation of seed was in hand for introduction early in 1933.

Sugar Cane.—Sugar cane mosaic disease re-appeared in Kisumu-Londiani district after apparent freedom for nearly three years. The outbreaks were very small and received prompt action. Further issues of mosaic-resistant varieties were made to this area and all importations from the neighbouring native reserves prohibited.

Pasture Improvement.—The work on grassland improvement has been severely handicapped during the year by repeated invasions of locusts. Investigations designed to provide fundamental information on which to base schemes for improved pasture management and the establishment of cultivated grasslands in some areas have, however, been continued. A record of this work will be found under the Botanical section's report and a bulletin (No. 1 of 1933) by Mr. D. C. Edwards, who is in charge of the work, was published during the year.

Soils and Manures.—A study has been made of the available phosphates in the Kikuyu red loams. By the recognized methods of chemical analysis a content of the order of 0.001 per cent of "available" phosphate is present in these soils, a quantity which will be removed by a normal crop of maize. Preliminary work has shown that as the available phosphate is removed it is rapidly replaced from the soil reserves. Work upon the nitrogen status and a study of the water status of soil under bare fallow have been begun. Up to now it has been found that at the Scott Laboratories, at the end of the rains, a bare soil contains less water than soil under a cover crop, it dries up more rapidly and at the end of some months both soil and subsoil are drier than the soil under the cover

crop. Certain items of long-range work bearing upon the regulation of soil acidity and humus accumulation have been started in conjunction with the Plant Breeding section.

The Soil Chemist has made several journeys in connexion with soil survey and soil classification. The areas covered are the Kavirondo Reserve, including the Kano Plains, parts of the Trans Nzoia, Koru-Songhor, and Makuyu-Ithanga. The data accumulated have enabled a great deal to be marked up on the soil map of Eastern Africa, discussed at the Conference of Soil Chemists held in May at Amani.

Details of the survey of the lime resources of the Colony have been published in bulletin form, but it is of interest to record that it was also found that there are large and widespread deposits of low-grade phosphates, which doubtless will later become of importance.

The supplies of local manures have been extended by the utilization of the Nairobi Municipal abattoir by-products and the exploitation of the guano deposits on certain of the coastal islands.

Plant Introduction.—Important results are now being obtained from the systematic plant introduction service begun in 1931 and several of the imported varieties are now finding their way into general cultivation. This work falls particularly under the control of Mr. D. C. Edwards by whom the summary which follows has been prepared.

The total number of species and varieties of plants of which records are now being kept is 427. Each of these introductions is under trial in several areas which experience somewhat similar climatic conditions to those from which it was imported. During 1932, 172 species and varieties were issued for trial and 353 reports were dealt with.

Exchange relations have now been established with countries in most parts of the world and it is desired to express appreciation of the ready way in which authorities in these countries have responded to requests for planting material. Special mention should be made, in this connexion, of the Bureau of Plant Industry of the United States Department of Agriculture. It is often impossible for Kenya to fulfil the demands of these exchange relations as completely as would be desired as, in many cases, plants which are not under cultivation are concerned and the facilities for botanical exploration and the collection of material are small. Countries

to which material has been sent during the year include the United States of America, Australia, Russia, Java, Egypt, Cyprus, South Africa, Tanganyika, Uganda and Seychelles.

The results of the year's work may be summarized as follows:—

Food Crops.—Haricot bean (*Phaseolus vulgaris*) varieties have not fulfilled the early promise which they gave, but the Japanese variety at certain centres in the Trans Nzoia has continued to give moderately good results and is being multiplied. These beans appear to be particularly susceptible to "rust" in Kenya at higher altitudes and under more humid conditions. Of the Lima beans (*P. lunatus*), the "Small Lima" from the U.S.A. is the only one which can be said to have given promising results during the year, but the Madagascar Butter bean is now well established in highland areas which are not too cold or humid, and the Dutch White Runner bean also continues to be successful. *P. acutifolius* (Tepary bean) has been very successful in trials at the Coast. Amongst mittets, the awned variety of *Pennisetum typhoideum* from Tanganyika has given outstandingly good results at the Coast and is recommended for distribution. Two varieties of maize, Durum from Australia, and Yellow Menado from Java, also appear to be valuable introductions in that area. Of the imported species of *Sorghum vulgare* tried, Bonganhilo from Tanganyika and Dwarf Hegari from America are the only two which have given good results. These varieties were grown in the coastal area. A considerable number of *Pisum* varieties were tried at several highland centres and the following may be mentioned as promising, Canada Field pea from America, Harrison's Glory, P.B.I./P.27, P.50, Dun and Admiral Beatty received from the Institute of Agricultural Botany, Cambridge, England. Of these the best seem to be P.B.I./P.50 at the higher altitudes, and Canada Field pea at the lower. One variety of *Carica papaya* (Paw-Paw) imported from the Panama has given good preliminary results at the Coast. Several tropical fruit trees have been successfully established in that area. These are *Achras sapota* (Sapodilla), *Anona squamosa* (Custard apple), *Artocarpus incisa* (Bread fruit), *Citrus aurantium*, *Terminalia catappa*, *Eugenia jambos*, and *Anona muricata*. Two varieties of *Inomoca batatas* (Sweet potato), Calabash Leaf, and Early Butter, obtained from Rhodesia and established in the coastal area, bid fair to be valuable introductions. Disappointing results were obtained from trials of all varieties of *Arachis hypogea* (Groundnut) and *Persea gratissima* (Avocado pear).

Green Manure and Cover Crops.—Of the many species and varieties tried, *Canavalia ensiformis* obtained from the Gold Coast has continued to give good results at both high and low altitude centres, *Centrosema pubescens* is favourably reported on from the coast area, *Dalea alopecuroides* and *Crotalaria retusa* from Njoro, *Crotalaria kirkii* from Bukura and *Tithonia diversifolia* from Nairobi. Particularly at the higher altitudes *Crotalaria* varieties are slow to get away in the seedling stage. This failing, coupled with their low percentage germination, makes them an unsatisfactory crop requiring too much weeding and tending in the early stages of growth. A variety of *Cajanus indicus* (Pigeon pea) named New Era, bred for even ripening and introduced from Hawaii via Trinidad is worthy of special notice, but chiefly for pulse production. From the coastal area it is reported to be decidedly superior to the local varieties at present in use. Many varieties of *Glycine hispida* (Soya bean) were tried at high altitude centres and the results were poor with the exception of Oootan as a green manure crop, and Haberlandt and Dixie as pulse crops. Several varieties of *Vigna sinensis* (Cow pea) were also tried at both high and low centres. Rlington was the most successful at the Coast, but several varieties do well at 6,000 ft. in the Rift Valley. The varieties of *Pisum sativum* tested at Njoro as green manure crops appear to have suffered from disease to a large extent.

Forage and Fodder Crops.—Amongst introductions in this group, favourable reports were received on the "Hubam" variety of *Melilotus alba* (Sweet Clover) and Hairy Peruvian Lucerne. Good reports on one or other of three species of *Lespedeza* from America (*L. striata*, *L. stipulacea* and *L. sericea*), were also received from the high altitude stations, but the different centres did not agree in this matter.

Oil Bearing Plants.—Successful establishment of West African oil palms (*Elaeis guineensis*) has been reported from the coastal area. Three varieties of *Helianthus annuus* (Sunflower) were successful at Kilima Kiu, the Coast and Njoro, but lack of a suitable market appears to be an obstacle to the further progress of this introduction. *Carthamus tinctorius* (Safflower) made excellent growth in the Njoro and Trans Nzoia area, but at Njoro the crop was largely destroyed by insect pests. At the Coast, *Carum copticum* has been successfully established and gives promise. Several varieties of linseed were grown at the Njoro centre and of these the following have been reported on favourably: Morocco, Persian Gulf, La Plata, Latvia, and No. 12 (Indian variety).

Miscellaneous Crops.—In this group the following are worthy of note: Western Dark tobacco has produced good results under moderately low rainfall. The leaf is reported as good for snuff production. *Crotalaria juncea* (Sunn hemp) is very promising as a green manure at the Coast and investigations into the quality of the fibre produced are in progress. The most important of the introductions included in this group is pyrethrum (*Chrysanthemum cinerariaefolium*). Trials of Harpenden, Swiss and Japanese strains are well under way at a number of centres at the higher altitudes and with few exceptions reports are encouraging. During the year distribution of seed has been made to a considerable number of farmers. The fact that pyrethrum can be grown successfully in Kenya is established and it appears that, while trials as to its suitability to different localities are in progress, attention should be devoted mainly to selection work particularly in the direction of even ripening qualities. At the Scott Agricultural Laboratories, Nairobi, there is a marked lack of these qualities.

AGRICULTURAL SERVICES IN EUROPEAN AREAS.

Rift Valley and Trans Nzoia Provinces.

In the interests of economy, as an account of the field investigational work is every year published in bulletin form so as to give farmers earlier information than could be given through the medium of an Annual Report, the reports of the Agricultural Officers in the European areas are not included in the Annual Report of this Department, which would, however, be incomplete without some reference to the valuable investigational work in progress. Were it not for the bulletins, an account of the work would take the corresponding place under this heading which the provincial reports take under the Native Agricultural section.

The work covers those areas of the Colony with a prolonged rainy season as distinct from the areas east of the Rift Valley with two short and well defined rainy seasons per annum. It also covers a wide range of altitudes (5,000 ft. to 9,000 ft.) and consequently of climates as well as soils, and serves large areas besides those in which the actual experiment stations and plots are situated.

The Plant Breeding Station at Njoro (7,000 ft.) is the main experiment station, where some 25 acres are devoted to this work, in addition to the work on cereal breeding (chiefly wheat). Mr. N. D. Spranger, carried out most of this work

as well as other duties. The experimental work of this station serve particularly the large Uasin Gishu Plateau area, Ravine and Londiani as well as Njoro.

Similar work, based on the same station, was carried out by Mr. R. J. Benstead on plots on Mr. Whitmore's farm at Rongai and at West Molo on Captain Soames' farm. Both plots were chosen to deal with areas quite distinct from each other and from Njoro and somewhat different experiments are therefore in progress on these two farms. The plot at Rongai is sited at about 6,000 ft. altitude and serves much of the large maize-growing areas of Nakuru, Rongai and Lower Molo. The plot at West Molo is at about 9,000 ft. and serves the cereal-growing and stock areas of Upper Gilgil, Molo, Mau Summit, Timboroa and Kipkabus.

Similar work again was carried out by Mr. A. C. Maher on several plots in the Trans Nzoia district, all at about 6,000 ft. altitude and serving that district in particular. One group of experiments was distributed over several areas, on which the soils, though all of a rather acid light sandy loam in type, varied slightly in fertility, namely, on Mr. Gibson's, Captain Elmer's and Messrs. Barnes Brothers' farms, on the last of which the owners carried out most of the work themselves. The other main plot is at Sabwani Estate (owned by Estates and Investments, Ltd.) on which the soil is a medium heavy loam of different origin from the sandy type. The maize breeding was done at Kibonet Estate, also owned by Estates and Investments, Ltd. It is hoped to concentrate the work on the sandy soils in one Government plot in future. During Mr. Maher's absence on leave from May to December the work was carried on by Mr. P. Booth, with the assistance of Mr. G. Gamble, Laboratory Assistant, who remained on to assist Mr. Maher on his return.

Other than the work on cereal breeding discussed in the Senior Plant Breeder's report, the investigational work carried out by these officers consists of hundreds of statistically arranged plots designed to investigate the best methods of improving and maintaining soil fertility by means of green manuring, rotations and other methods. A number of systems of green manuring are being tried as well as a large number of different green manures. Methods, amounts and frequencies of application are under investigation on soils of different types and under varying climatic conditions.

Crop trials are an important feature of the work and a large number of varieties of different cash and cover crops, as well as green manure crops, have undergone test, sometimes statistically. Extensive trials have been made of several varieties of Soya beans, haricot beans, Lima beans (including Madagascar butter beans), field peas, marrowfat peas, cow peas, Crotalarias, clovers, Lespedezas, lucerne, sunflowers, linseed and many miscellaneous crops.

Other work which has already contributed much to improvement in farming methods and increase in yields per acre has been the censuses of maize fields and the spacing experiments with maize, the latter also in association with green manure crops, interplanted. The maize seed competitions have also given valuable information in the same direction. Results obtained from investigations conducted along these lines have been followed by their application to other crops during the year.

The thanks of the Department are due to those owners of land and their managers on whose land the experimental plots are situated and to whose ready help and co-operation so much of the success of the work can be attributed.

A detailed discussion of the experiments in progress will be found in Bulletins Nos. 2 and 3 of 1933, which will be supplied to oversea inquirers on request.

An account of the services for Coffee in the European areas is rendered in the report of the Coffee section; similarly in respect of the specialist science services.

AGRICULTURAL SERVICES IN NATIVE AREAS.

The main directions in which the services of this Division are given for native agricultural development are as follows :—

- (a) Improvement of crops and plant produce.
- (b) Propaganda for increased production.
- (c) Development of new industries.
- (d) Organization of marketing.
- (e) Agricultural education.

Work for Improvement of Crops and Produce.

In respect of crops, the foundation for the work of improvement, namely, the experiment station, is lacking. The pressing need for stations for the three main native areas has been emphasized in previous reports, but the present financial

position of the country will not permit of these. With the paramount necessity of the introduction of a simple system of mixed farming in these reserves, the experiment station becomes all the more important. Such stations in Nigeria are playing a most useful part in introducing mixed farming among the native tribes. Kenya should not lag behind in this, not merely progressive, but essential and urgent development of safe and sound farming among natives.

The experimental work and native training in Kikuyu and Nyanza is still dependent upon the Scott Agricultural Laboratories and Bukura respectively, and for the Coast Province the work at Kibarani continues, but the field work of these for the native areas is practically confined to simple variety trials with plant introductions and to a few cultural experiments. A little work of the same kind is carried on, in the absence of central suitable Government Experiment stations, on Local Native Council Seed Farms, by the Agricultural Officers for the districts.

Local Native Council Seed Farms.

The reasons governing the Department's policy for the establishment of Local Native Council Seed Farms were fully discussed in last year's report, and it is satisfactory to record that in general the position of seed farms established during the last two years has been consolidated and they have become accepted institutions in the economic life of the reserves. In one district where the land question is acute, it was unfortunately found necessary to relinquish a farm, and in one or two others, small uneconomic plots are being abandoned and the work concentrated on the larger central farms. It cannot be denied, however, that particularly in Kikuyu Province the farms are at present quite inadequate for the population they are intended to serve, their size being limited not so much by the funds as by the actual shortage of land.

In a country where shifting cultivation has been the tradition and where, owing to increase in population and decrease in acreage per household, it is necessary to modify this system, the seed farm is of importance in demonstrating green manuring for increasing yields. Thus at Fort Hall, in a piece of old land which has been bearing poor crops of maize, Black Mauritius beans were planted in 1932 and proved very successful in giving heavy tonnage of green matter per acre, completely covering the land in one season. It is

easy again to demonstrate on a broad scale the benefits of the application of farmyard manures and of methods of stopping soil wash. Organized demonstrations of this kind are given.

A final aspect of considerable importance is the pride which Councils take in large well-kept farms, which afford definite ocular evidence that something is being done for them, and that substantial returns are being obtained for the expenditure voted by them for agricultural services.

In the following table it has been found convenient to include the expenditure on Forestry services with that of Agriculture, as these services both under the charge of the Agriculture, as these services are closely linked and are in fact in some districts both under the charge of the Agricultural Officer. With a steadily falling total revenue, the total expenditure on these services has increased by over 40 per cent over three years, indicating clearly the interest taken by Councils on agricultural development, the increases in expenditure in Kikuyu Province and Machakos district being particularly noteworthy.

Organized seed distribution from these farms has begun; tables for this are given later in this report.

TABLE SHOWING (a) TOTAL REVENUE; (b) EXPENDITURE ON AGRICULTURAL AND FORESTRY SERVICES—FOR ALL NATIVE COUNCILS DURING THE LAST THREE YEARS.

Council and Province	1930		1931		1932	
	Revenue	Expenditure on Agriculture and Forestry	Revenue	Expenditure on Agriculture and Forestry	Revenue	Expenditure on Agriculture and Forestry
	Sh.	Sh.	Sh.	Sh.	Sh.	Sh.
Digo	24,225	6,091	30,654	6,209	16,695	5,835
Giriama.. ..	45,123	4,222	45,052	4,624	39,514	5,351
Teita	20,857	2,331	52,472	1,967	14,774	2,464
COAST	90,205	12,704	123,178	13,020	70,963	13,650
N. Kavirondo ..	229,231	23,031	229,279	22,928	220,431	19,571
C.Kavirondo ..	155,560	10,649	107,971	9,742	167,247	16,896
S. Kav. (K-N)	48,537	3,443	66,622	9,491	57,424	11,674
S. Kav. (L-A) ..	70,643	2,966	65,266	4,179	69,574	3,895
S. Lumbwa	10,368	..	10,414	1,115	29,061	1,305
NYANZA	514,339	40,114	479,812	47,515	563,737	53,341
Nardi	71,600	5,788	32,196	14,175	23,738	7,967
Elgeyo	54,122	7,539	23,671	5,058	..	..
Marakwet	14,441	2,324	7,050	1,565	19,232	4,732
NZOIA	140,163	15,651	62,917	20,828	42,970	12,719
Baringo I	25,834	2,602	16,285	1,727	..	..
Baringo II	1,600	..	3,682	..	11,609	4,749
RIFT VALLEY	27,634	2,602	20,167	1,727	11,609	4,749
Kiambu	71,152	6,315	64,562	8,442	70,797	14,013
Fort Hall	71,376	9,932	72,903	10,963	84,967	18,247
S. Nyeri	75,716	12,881	75,219	29,138	71,958	12,916
Embu	9,590	1,000	33,547	1,999	19,211	2,944
Meru	29,644	6,650	54,605	7,966	32,956	18,334
KIKUYU	257,478	36,778	300,136	58,508	279,909	66,454
Machakos	128,914	17,382	123,066	25,433	124,259	33,259
Kitui	94,790	3,440	64,055	2,671	54,440	4,179
UKAMBA	223,704	20,822	187,121	28,304	178,699	37,438
Narok	28,282	1,852	23,044	48	31,192	..
Kajiado	45,702	..	41,988	..	39,407	293
MASAI	73,964	1,652	65,032	48	70,599	293
W. Suk	6,435	..	7,213	..	4,089	442
Turkana .. ..	..	..	2,561	..	2,664	..
TURKANA	6,435	..	9,774	..	6,753	442
TOTAL	1,333,942	130,523	1,253,637	169,950	1,225,459	129,066

Seed Issues.

Departmental expenditure on seed issues was again curtailed, and with the increasing supplies of main crops available from seed farms or purchased through the Department by Local Native Councils, the Department used its resources to a greater extent in issuing comparatively small quantities of various seeds for extended trial purposes and as seed supplies for farms and schools. Increasing attention is being given to the issue of fruit trees, and many stations now have citrus nurseries where budded trees are available for issue. Numbers of issues of drought resistant food crops were made to districts in the Northern Frontier and Turkana Provinces where small settled communities give an opportunity to keen Administrative Officers to make agricultural progress.

The following three tables indicate the more important seed issues made during the year:—

SEED ISSUES—NATIVE RESERVES. FROM DEPARTMENTAL FUNDS.

Seed	Unit	Coast Province	Ukamba Province	Kikuyu Province	Nyanza Province	Nzoia Province	Rift Valley Province	Turkana Province	Northern Frontier Province	Total
Maize, White	bag	30	..	50	..	..	..	..	..	60
Maize, Yellow	..	20	..	..	..	..	58	2	5	65
Sorghum	..	4	..	..	..	..	..	..	..	4
Buckwheat	..	..	..	..	..	..	5	..	..	5
Rice	..	..	½	..	..	..	..	..	..	..
Field peas	..	..	4	..	1	..	..	..	..	5½
Beans, Canadian Wonder	..	4	4	20	27	40	..	1	2	92
Potatoes	..	..	12	30	57½	..	..	..	4	103½
Vegetable seeds	.. lb.	1½	5	3	4	..	..	..	¾	14¼
Groundnuts	.. frasila	33	39	..	..	..	..	2	2	76
Simsim	..	26	..	5	..	..	..	..	2	33
Fruit trees	.. No.	250	..	6	2,300	..	..	100	..	2,656
Cassava cuttings	.. lb.	..	612	..	..	..	..	200	..	812

SEED ISSUES—NATIVE RESERVES. FROM LOCAL NATIVE COUNCIL FUNDS.

Seed	Unit	Province					Total
		Coast	Ukamba	Kikuyu	Nyanza	Ritt Valley	
Maize, White	bag	..	49	174	179	..	402
Maize, Yellow	..	5	..	..	..	32	37
Sorghum ..	..	4	..	..	50	15	69
Eleusine millet	..	..	..	..	..	67	67
Rice .. ..	..	..	..	..	..	1	1
Field peas ..	..	..	10	..	25	..	35
Beans .. ..	..	..	15	37	46	..	98
Pigeon peas ..	..	5	..	..	..	9	14
Cotton	ton	..	..	..	..	1	1
Wattle seed ..	lb.	..	..	..	600	..	600
Potatoes ..	bag	..	31	39	387½	..	457½
Yams .. ..	..	..	..	..	..	18	18
Vegetable seeds	..	74	5	..	116½	9	204½
Fruit trees ..	No.	..	24	30	43	..	102
Groundnuts ..	frasila	..	35	..	..	100	135

SEED ISSUES—NATIVE RESERVES.
FROM LOCAL NATIVE COUNCIL SEED FARMS.

Seed	Unit	Province		
		Coast	Ukamba	Kikuyu
Maize, White ..	bag	..	..	171
Maize, Yellow	14	..	..
Potatoes	383
Beans	3	114
Peas	2
Millet	3	..	..
Cowpeas	22	..	..

In addition to the bulk issues tabulated above, smaller quantities of various other crops such as Tepary beans and Sorghums, tried on seed farms, have been issued for further trial or bulking. Ukamba has one and the Coast two, small seed farms, recently opened.

Legislative Control; Inspection of Produce.

One of the important means by which the Department controls and improves the quality of produce is by the promulgation of rules from time to time under the Crop Production and Live Stock Ordinance, whereby the Director has power to inspect and control the type of crop planted and the quality of produce offered for sale. Under this Ordinance the Department administers the following Rules:—

Groundnut (Marketing) Rules, 1929.

Wattle Bark Marketing Rules, 1930.

Wattle (Production) Rules, 1931.

Simsim (Marketing) Rules, 1930.

Maize (Marketing) Rules, 1930.

These Rules are made applicable to the whole country or to certain areas only according to circumstances, and in conjunction with propoganda in the native reserves, they are having a marked effect on the quality of the produce concerned.

Maize in Kikuyu Province shows a marked improvement in quality over that of a few years ago, particularly in uniformity of colour and reduction in the proportion of undeveloped grains in the samples offered for sale. Very little other than white flat maize is now seen in the Kikuyu Reserve. The quality of groundnuts improved in Nyanza as an immediate result of the promulgation of the Groundnut Rules. Special attention has been given to the improvement of wattle bark during 1932 and Mr. Gibson of Messrs. Gibson & Co., the appointed agents to various native marketing organizations has, in another connexion, expressed the following opinion concerning the quality of bark offered during the year:—

“Thanks to the unremitting efforts of the Agricultural Officers concerned, coupled with those of our buyers, and also to the system of inspection (involving the rejection of badly prepared and immature bark), the general level of quality now being tendered to us shows a real improvement on what was formerly known (and penalized) as East African fair average quality.”

The effectiveness of these Rules depends largely on the strictness of the inspection, and Agricultural Officers are unable, owing to pressure of other work, to give the close attention to this that is desired. The scope for this service is great and it is felt that the time has arrived when, to take the fullest advantage of this system of control for improvement in quality, it would be desirable to employ subordinate officers for the service.

Further control is exercised by the Department through the Grading and Inspecting Services at the Coast, whose work is dealt with in detail in the report of the Chief Grader and Inspector. The grading service now covers the following native crops: maize, potatoes, beans. Wattle bark is to receive inspection before railage: cotton in present circumstances cannot receive attention other than occasional examination for observance of the Rules providing for separation of clean from dirty cotton.

Concentration of Soil Fertility.

This, as indicated in last year's report, is the main technical problem confronting the Department in this section

of its work, and with a steadily increasing population, the problem becomes more serious. With a scanty population, the system of shifting cultivation is possibly the best in the circumstances, and the fertility of the soil is naturally regenerated by the land being allowed to revert to bush for a period of several years after cultivation. This is now in many parts of the country impossible, and land, if rested at all, is brought back into cultivation before it has fully recuperated. A possible assistance to the solution of this problem is to be found in the anticipated trend of population from the heavily populated areas to those where more land is available. It is unfortunate that this direction is exactly opposite to the economic call which brings population towards the townships, and, in particular, Nairobi.

The Department actively continues to demonstrate, by means of model smallholdings, the advantages to be derived from mixed farming, and, by propaganda in the reserves, stresses the importance of the conservation of soil fertility by the use of farmyard manures, rotations, regeneration by wattle, the prevention of waste by the use of composts, and the planting of old lands to grass rather than allowing reversion through the cycle of weeds to a poor quality bush. There are increasing signs that this form of permanent cultivation is attracting the attention of the more advanced members of the community, but the formation of fifteen-acre or twenty-acre smallholdings is greatly handicapped not only by the actual scarcity of land in some areas but also by the traditional system of land inheritance, involving excessive land fragmentation. The bringing about of a change of attitude which would allow of an alteration in native custom is the responsibility of the Administration. It is, as part of the larger problem of land tenure, receiving the attention of the Land Commission.

In some areas of the Colony, soil deterioration has passed the stage when merely conservation of fertility is required, and in Machakos the Department has devoted considerable attention to the actual reclamation and reconditioning of eroded lands. Some account of this work will be found in the Ukamba Province report. Here again, while the Department is able, by means of demonstration areas, to point out the seriousness of the case and to illustrate the methods and value of reclamation, the great task itself is a matter for the native population to tackle, either individually or through their Councils, by systematic planting, controlled grazing and reduction of stock. The last named is probably the most

difficult to effect and depends upon the control of stocking and grazing either by legislation or by individual ownership of grazing rights together with fencing of pastures. So long as grazing is communal there will be little incentive to the individual to reduce his stock. Until this can be effected, restoration of eroded pastures by reconditioning can be only a palliative.

PROPAGANDA FOR INCREASED PRODUCTION.

The Agricultural policy of this country calls for continued efforts towards increased production. This aim has received considerable stimulus during recent years from the presence or threat of locusts, and in endeavouring to safeguard their food supplies, the native population has responded willingly to the call for a greater production of food crops. With the low commodity prices prevailing, and the reduced labour demand, many of the highland reserves which are unable to grow exportable cash crops—cotton or simsim, etc.—depend for their prosperity to a considerable extent on the production of a surplus of such low-priced crops as maize, beans and potatoes which are consumed locally. In the absence of a highly developed statistical section, and with the small staff available for agricultural work in the reserves, it is impossible to compute with accuracy the production in the reserves, and the extent of the export therefrom. The following figures are, however, an approximation of the latter, and will serve to indicate the extent to which the reserves are contributing to the development of the country, an extent which is not, for the reason above stated, directly reflected in the export returns of the Colony.

Table showing the estimated quantities of certain produce export from the Reserves but consumed in Kenya in 1932.

Commodity	Quantity
Maize	42,000 tons
Pulse	5,000 „
Potatoes	1,000 „

Intensive propaganda is conducted each year in an endeavour to increase the production of cotton both in Nyanza and on the Coast. In this work the Administration and this Department co-operate closely. The figures below reflect the extent at which response is accorded to this propaganda. Besides the actual encouragement given by the Departments

concerned, the ginners devote considerable attention to stimulating the production in the areas in which they operate. Perhaps the best propaganda lies in the fact that many natives are encouraged to take up the cultivation of this and other cash crops by seeing the financial results of their neighbours' efforts.

Table showing the total amount of seed-cotton bought during the last five seasons.

	Nyanza	Coast	Total
	lb.	lb.	lb.
1928-29..	2,259,497	202,700	2,462,197
1929-30..	1,270,000	510,000	1,780,000
1930-31..	918,967	29,500	948,467
1931-32..	2,166,352	627,786	2,794,138
1932-33..	3,940,764	1,032,826	5,023,590

1930-31 was a bad year for cotton, which failed over considerable areas, and with the low prices obtaining since then, the rapid increase in output is a tribute to the energy and enthusiasm of the officers concerned.

Another product the importance of which has been stressed greatly in recent years, is wattle bark. As a result of propaganda originating in 1923, large areas of the Kikuyu Province are now under wattle. The activities connected with the marketing of the bark are dealt with in detail later.

DEVELOPMENT OF NEW INDUSTRIES.

A new industry which promises to be of considerable importance is developing in the Coast Province, where, in 1931, steps were taken to build up an export trade in cashew nuts. This crop grows very well on the Coast, but has hitherto received little attention. Several thousands of seedlings have been grown and issued during the last two years, and towards the end of 1932, arrangements were made for the organized collection and purchase of nuts. Although the season was not very favourable, nuts were brought in in encouraging quantities, and in 1933 it is expected that a plant for the shelling and treating of these nuts for export will be installed at Kilifi. Legislation will be introduced to control the industry.

Considerable quantities of rice are imported into Kenya Colony each year and efforts are being made to establish rice-growing on some scale locally, though very few parts are suited to this. Trials have been carried out with numerous imported and local varieties, of which Halkaduwi from Ceylon

and Unyengwa from Tanganyika Territory appear to be the most promising in the highlands. The great potential rice-producing area of the Tana River is as yet undeveloped, but following a joint medico-agricultural survey held in October, it is intended that this area should receive attention and be encouraged to produce a large surplus of this crop.

ORGANIZATION OF MARKETING.

A progress report on the marketing schemes organized during the last two years will be found under a relevant paragraph of the Kikuyu Province report, which follows. It will be seen that the system has established itself in spite of the fact that prices were so low that attention could be given only to one export product. Officers testify to the good results experienced particularly in the raising of prices for this product (wattle bark), but also in the improvement of quality and in the feeling of confidence engendered in the natives by their own, Government-supervised, organizations. The actual details of organization have differed somewhat in the three districts in which it has been introduced. In 1931 two co-operative societies were formed but have, as was anticipated, not succeeded as such, and the system has become resolved into the simple form of marketing in association which the Department desired and which the third district has consistently followed.

Agricultural Officers have devoted much time to the organization and supervision of the marketing at the ten buying stations, and it is satisfactory to be able to record definite progress in improvement of quality and expansion in volume of bark brought to the godowns. There is no doubt that when export of other relatively low-priced products (maize, beans, potatoes, etc.) once again becomes profitable, the scope of the organized marketing will be extended.

In other parts of the country opportunities are being found to bring about organization in marketing. In Machakos, for instance, native traders have been encouraged to form themselves into syndicates whereby some of the advantages of co-operation in the sharing of overheads and transport costs may be obtained. On the Coast, the collecting and marketing of cashew nuts has been developed on lines similar to those followed in the cotton industry. The Agricultural Economist is to investigate the possibilities of organized marketing in the Kavirondo Reserves, as a result of which the ways and means of introducing it will receive the joint attention of the Department and the Administration.

AGRICULTURAL EDUCATION.

Extension work in the reserves has continued on normal lines during the year, although it has been found necessary, on the grounds of economy, to reduce the establishment of Native Agricultural Instructors. Reference has already been made to the important propaganda carried on by officers for marketing, increased production, improvement of crops and conservation of fertility. The establishment of native Agricultural Committees has proved of great value in maintaining close contact between the Agricultural Officer and the leaders of the population and these committees are enabled, with his assistance, to formulate and discuss proposals for the advancement of their communities and to put these forward to the Local Native Councils either for the provision of funds or for legislative control as is found necessary.

Native Agricultural Schools.

The methods of training at the Department's two native schools at the Scott Agricultural Laboratories and Bukura have continued with but a few alterations in detail. Several changes in European staff were unfortunately necessary at the Scott Agricultural Laboratories during the year, but at Bukura leave movements necessitated only one change.

The Scott Agricultural Laboratories School was again full to capacity, sixty apprentices being in residence during the year, recruited from Kikuyu Province, Machakos and Voi. This school has now been established for ten years, the numbers in residence having increased steadily from twenty-one to sixty, while 123 trained men have been sent out, of whom nineteen left this year. The normal hours of work consist of ten hours instruction in school and thirty-five hours practical work in the field weekly. Eighteen boys sat for the Elementary "B" School Certificate examination of whom eight obtained a pass. Twelve sat for the Primary School "C" Examination, but only two passed.

At the Bukura School, which was opened in 1925, fifty-four boys were in residence, drawn from the reserves of Nyanza and Nzoia Provinces. Twenty-two boys sat for the Elementary "B" School Certificate Examination of whom ten passed. Twenty-three were sent out trained, bringing the total to seventy-seven. Of these twenty-three, fifteen had obtained the Elementary "B" School certificate and ten had sat for the Primary School "C" Examination, but had failed to pass. One Agricultural Instructor passed the Primary "C" Examination.

The following table summarizes the nature of the employment obtained by apprentices who have completed their course of instruction at the two schools during the last three years :—

Nature of employment	1925-29	1930	1931	1932
<i>Scott Agricultural Laboratories :—</i>				
Native Agricultural Instructors	43	10	6	10
Forestry	2	2	..	..
Educational work	4	4	1	1
Alliance High School	1	..	3	1
European farms .. ..	..	1	1	..
Other work	11	..	..	1
Returned to Native Reserve	6	3	3	6
<i>Bukura School :—</i>				
Native Agricultural Instructors	24	4	9	11
Educational work	2	..	1	1
European farms .. ..	..	1	..	..
Other work	2	1	..	2
Returned to Native Reserve	5	1	4	9

Details of years prior to 1930 will be found in previous Reports.

PROVINCIAL REPORTS

KIKUYU PROVINCE.

STAFF.

District Staff.—The Province is divided into three areas for the purposes of the work of the Department and each area has one Agricultural Officer attending to its needs.

In the latter half of the year the work of the Agricultural Officer, Embu and Meru, was confined to Embu District as it was found that the value of a few visits at Meru at long intervals was not commensurate with the expense incurred by travelling. The South Kikuyu district suffered three changes of Agricultural Officers during the year, the Fort Hall and South Nyeri area one change.

Provincial Staff.—Late in the year it was found possible to take a step the necessity for which was described in last year's report, that is, the posting of a senior officer to provincial headquarters as Agricultural Officer in Charge Province, and in November, Mr. W. G. Leckie, on his return

from leave, was stationed at Nyeri in that capacity. This officer now directly controls and co-ordinates all the native agricultural work in the Province.

SEASONAL CONDITIONS.

Taken as a whole the weather conditions throughout the year were normal, no extremes of drought or rainfall being experienced. The long rains were good, being well distributed over the growing season. The short rains were somewhat late in starting and towards the end of October some anxiety concerning the season was felt. The precipitation during November and December was, however, good and the season was on the whole satisfactory.

CROPS.

As far as the weather was concerned, the year was a good one for all types of crops. Considerable damage was, however, sustained through locusts, and the threat of further damage, combined with the lateness of the short rains, caused a slight reduction in the area planted under cereals. The steady improvement in the quality of maize continues to be evident, and an increasing number of cultivators select their seed in the field. This, allied to systematic issues of good seed from the seed farms, ensures that this improvement will be continued. Stalk-borer has done but little damage, but White Blight is very prevalent at the higher elevations.

The bulrush-millet continues to be the dominant short rains cereal in the northern parts of the Province, while sorghums are important as a long rains crop. Selection of millets and sorghums is being undertaken together with trials of imported varieties. The Tanganyika awned bulrush-millet has been tried successfully and is finding favour on account both of yield and of its resistance to bird attack.

Wheat is grown to a very small extent, the continued activities of locusts during the last few years making inadvisable much effort in establishing this new cereal. Considerable work has, however, been done towards introducing rice in the low parts of Embu district where drainage of swamps with controlled irrigation makes possible its cultivation, and where, owing to the erratic rainfall, millets are an uncertain crop, and food shortage occurs from year to year. Halkaduwi, a rice from Ceylon, has proved successful, and the good results obtained have led several of the more advanced natives to take up its cultivation.

Apart from supplying local requirements, English potatoes at present should not be grown as a cash crop at elevations below 5,500 feet or preferably 6,000 feet. It is becoming increasingly difficult to dispose of surplus potatoes and large quantities, for which no market could be obtained, were on hand at the end of the year. As a result of the continued issues of good quality seed potatoes, particularly Kerr's Pink, the standard of quality in some locations is high, and should the export market revive, several of these higher areas will be able to take an active part in supplying it.

Yams, sweet potatoes, Colocasia and cassava continue to be grown in large quantities, and have proved their worth as a food reserve in times of locust infestation. The first named is passing out of cultivation in the southern parts of the province owing to mealy bug. The sweet potato is important for consumption by both humans and stock, and cassava has been firmly established in the low-lying areas of uncertain rainfall, and is also to be found generally throughout the province. Vegetables are more widely grown for local consumption, and considerable areas of onions are grown as a secondary cash crop. Large quantities of vegetables were sent during the year from the Dagoretti Division of South Kikuyu to the Nairobi markets, but very low prices were realized.

Wattle bark has proved a great asset to natives during the year as a cash crop and largely increased areas have been planted with Black Wattle in all districts. Considerable energy has been devoted to raising the standard of the bark exported from the province and, by means of instruction, propaganda, inspection and prosecutions under the Wattle Rules, the quality of bark has been greatly improved. Maize continues to be the main export crop from the reserve and the natives are realizing the value of good appearance and uniformity in bringing higher prices. The improvement in this respect is most marked. The introduction of Muratha maize has begun to contribute to this.

MARKETING.

In last year's report it was recorded that two co-operative societies had been formed in South Kikuyu and Fort Hall respectively, while in South Nyeri, a marketing scheme was devised whereby an agent was appointed to handle all produce bought at Local Native Council godowns. The Fort Hall Society was not registered and was dissolved during the year, its place being taken by a simpler marketing scheme similar to that in Nyeri. This is found to be working satisfactorily. In South Kikuyu the Society was registered and has operated

successfully throughout the year. Here again, however, it is considered that when its liabilities are paid off the Society might be dissolved and a simpler organization take its place.*

Owing to the difficulty of finding outlets for maize, beans and potatoes as a result of the depression, the bulk of the produce handled has been wattle bark. Prices fluctuated during the year, but in the latter months a stable price was reached. Whatever form the selling organization has taken, the results of the year's workings, which are evident in a closer approach of prices to true market value, a great improvement in quality and a general feeling of confidence among participators, have proved in no uncertain manner the need for such organized marketing, and its value to the community.

There is a definite and growing tendency on the part of the native producer and trader to support the buying organization established at the Local Native Council godowns, as shown by the following figures of wattle bark handled under the marketing schemes in the three districts during the year :—

	<i>Tons</i>
South Nyeri 	80
Fort Hall 	159
South Kikuyu 	564

Of this total, 748 tons were dealt with in the last five months of the year. (A large increase on this tonnage is already evident in the early months of 1933.)

Little is to be recorded under this head in respect of Embu and Meru districts, which, while commodity prices remain at their present low level, are too far from the railway and markets for the economic export of produce. In this respect, however, it is encouraging to note the increasing use by native traders and producers themselves of economical forms of transport such as ox carts and pack donkeys. There is considerable export from the district by these means of such crops as pigeon peas, millets, and certain beans, for native consumption in neighbouring districts. This particular trade does not lend itself to organized marketing.

SEED FARMS AND SEED ISSUES.

Eleven Local Native Council seed farms were in operation at the beginning of the year, but that at Fort Smith in South Kikuyu was abandoned after the long rains, owing to claims

* Since writing this report this proposal has been implemented and the Society dissolved.

by *githaka* owners. This district is now the only one in the province without a farm, but it is anticipated that one will be opened in 1933 in another situation. Of the other ten farms, two are scarcely more than demonstration plots, while the remaining eight total about 160 acres. These farms are serving an excellent purpose, but they are hopelessly inadequate for the population of 800,000 which they are expected to serve. The difficulty in obtaining land remains, particularly in those areas where the improved seeds are most required, the closely-settled areas. Seed issues are made according to considered schemes of progressive replacement of poor seed with good, location by location.

Run in conjunction with the seed farms are vegetable and tree nurseries, and poultry establishments. Encouragement of afforestation and the maintenance of fuel and building supplies are important lines of work and link up through the wattle bark industry with the work of the Agricultural Officers. Tree nurseries to the number of eleven in Fort Hall, South Nyeri and Embu districts are maintained by Local Native Council funds; from them during the year 180,000 tree seedlings, mostly of *Encalypts* with some *Cypress* and ornamental trees, were issued, free or at a nominal charge.

EXPERIMENTAL WORK.

Mixed Native Planting versus Separate Planting.

This demonstration at the Scott Agricultural Laboratories has been concluded after five season's results have been obtained. The average yields obtained over the five seasons were as follows :—

	<i>Mixed native planting</i> lb. per acre	<i>Separate planting</i> lb. per acre
Maize ..	1,536	1,734
Wheat ..	1,004	1,030
Beans ..	689	949
Potatoes ..	4,896	6,506
Peas ..	497	918

In addition to the increased yields obtained from the method of separate planting, an important advantage is the greater rapidity with which all operations are carried out. An amplified experiment has been laid down based in a calculated range of spacings, from this statistically analysible results may be obtained.

Muratha Maize versus Native Maize.

Muratha maize, hand-selected, yielded 16 bags per acre. Native maize, unselected, yielded 7 bags per acre.

Muratha maize was originally selected from native stocks, with a view to obtaining a short season, high-yielding strain. This demonstration was intended to show the increased yield obtainable from selected seed.

On the seed farms at officers' district headquarters, and in special cases on others, crop trials are carried out, in an endeavour to find crops of economic value which will stand transport costs, or of better yielding capacity and food quality for local consumption. Amongst the latter which have met with success are the awned bulrush millet, Halkaduwi rice from Ceylon, Malindi rice from the Coast, Bonganhilo sorghum from Tanganyika, Early Red and Dwarf White Milo sorghums.

Linseed and simsim have been known to produce good yields in Embu for some time, but it is difficult to get natives to take up non-food crops. Cotton is promising in Emburere, but further trials, and careful consideration of the problems of population and transport are needed before extended growing and the establishment of a ginnery can be embarked upon. Another promising introduction into the low dry country is the spineless cactus, while trials of drought-resistant fodder trees are also being made.

ANIMAL HUSBANDRY.

Little progress is to be recorded under this head. The natives of this province make little economic use of the many cattle and small stock they possess, but an endeavour has been made to encourage a greater use of ox and donkey transport. No serious epidemic of disease has occurred, but rinderpest, anthrax and East Coast fever take their yearly toll. Grazing was scarce during part of the year owing to the ravages of locusts; towards the end of the year the pastures recovered.

Work for the improvement of poultry continues. Pens are established at the Scott Agricultural Laboratories, Embu, Meru and Kerugoya, from which issues of pure-bred Rhode Island Red poultry are made. This work, which has continued for some years, is having marked effect on the native breed, particularly in South Kikuyu.

Continued progress has been made in the better preparation of hides. Additional hide drying sheds were erected during the year, and a steady premium has been obtained for

shade-dried hides, resulting in increasing interest among the natives. Organized instruction was started in Embu, where the Local Native Council employs a trained instructor solely for this work. In spite of difficulties connected with transport and marketing, this development has received steady support.

GENERAL PROGRESS.

Agricultural progress in this province has been overshadowed during the year by the constant presence of locusts, and the shortage of staff has prevented much attention being given to the northern districts. Marked progress has, however, been made in the improvement of marketing conditions, as shown by the establishment of systems of marketing in association, and the quality of the produce from the reserves is steadily improving; in the case of wattle bark and maize, the improvement has been substantial. Seed farms are definitely established as necessary parts of the organization of the reserves and native authorities are showing greater interest in agriculture by the increasing funds devoted to its needs, and by the formation of district Agricultural Committees. Swamps have been successfully cleared and drained in Embu district and rice is now established in cultivation there, although as yet on a small scale.

As work becomes more developed and appreciated, officers find more and more scope for their activities, and they and their work are becoming increasingly recognized as an essential and integral part of the economic life of the reserves. The following report of the Agricultural Officer, Fort Hall, may well be quoted in respect of the changing outlook amongst natives so far as the work of the Department is concerned :—

“It can be said that 1932 was a year of outstanding agricultural progress in Fort Hall district, while in South Nyeri steady progress was made. The most important improvements have been in wattle bark, maize, hides and skins.

It is gratifying to record also the calls made upon the time of the Agricultural Officer by Kikuyu of all types anxious to obtain advice and assistance with their crops. Whilst on *safari* the officer has a full day's work to do, a change indeed from the splendid isolation forced on him a few years ago when any attempt to help the population brought only sullen answers and suspicious looks and produced the wildest rumours as to his intentions, from the Kikuyu.”

UKAMBA PROVINCE.

It was found possible this year for the Department to take a more active part in the agricultural development of this province, and throughout the greater part of the year an Agricultural Officer has been stationed at Machakos, while Kitui has received attention and advice from the Agricultural Officer, Fort Hall, who has visited the district from time to time. As, however, it is not yet possible to station an Agricultural Officer at Kitui, this report deals only with Machakos district.

STAFF.

Mr. E. L. Bradford was, by reason of his former agricultural training, seconded from the Grading and Inspection Services for the post of temporary Assistant Agricultural Officer, Machakos, from 16th February to 22nd October, when he was relieved by Mr. R. E. T. Hobbs, a recently appointed Agricultural Officer who had graduated from Trinidad.

SEASONAL CONDITIONS.

Rainfall was well distributed throughout the reserve during the year and conditions were favourable for crop growth. The short rains, which are the main planting rains, were rather late in arriving but were very good when they did come.

CROPS.

The April maize crop was very late in maturing, and had to be harvested during the long rains. Yields were fair but the quality remarkably poor, the seed being very mixed in type. A small area only was planted in April and that which escaped locust damage yielded well. Maize planted in November promised excellent yields throughout the reserve.

Fair yields of millets were obtained from the March crop and that planted in November should yield well. The millets grown are of very poor quality and fresh seed of improved varieties is required.

Sorghums are not so widely grown as in former years, chiefly owing to the fact that they have little market value and have therefore been replaced by maize. The climatic conditions are, however, well suited to sorghums, and good yields are obtained.

Beans were in most cases planted too early in the rains, resulting in attacks by rust and leaf disease, with consequent poor yields. Other pulses were successful and good yields of cow peas and pigeon peas were obtained.

MARKETING.

No marketing arrangements such as exist in Kikuyu Province have yet appeared in Ukamba, and trade follows the usual channel of the Indian Bazaar. An endeavour has, however, been made to interest native traders in each locality in associated marketing; they have been urged to combine and sell their produce in bulk instead of individually. No society or other definite trading organization had been formed by the end of 1932, but in response to the encouragement given by the Agricultural Officer an association of traders has been brought into being early in 1933. The experience in the neighbouring districts of Kikuyu Province will be valuable in guiding the development of associated marketing in Ukamba on sound lines.

SEED FARMS AND RECONDITIONING.

A seed farm of 40 acres was opened in March, three-quarters being put under cultivation during the year. The following crops have been planted for seed bulking and subsequent distribution: Muratha maize, Kerr's pink potatoes, Canadian Wonder and Mung beans, field peas, cow peas and pigeon peas.

A citrus orchard has been laid out with Washington Navel orange trees, and a nursery established for raising Rough lemon seedlings as stocks for budding.

Considerable time has been devoted to starting the work of reconditioning, which has become very necessary through the deterioration of pastures, due to overstocking and erosion. An area of 200 acres of steep, badly-eroded land was selected for the purpose, and part of this has been contour-trenched, Black Mauritius beans being sown along the trench banks, and bad gullies have been supplied with wash-stops. Stock was kept off this area which was then planted with indigenous grasses and exotic drought-resistant forage plants, and these are now establishing themselves, while the contour ditches have successfully held up wash. It is anticipated that the whole area will be replanted early in 1933. When this area has been reconditioned, a second area in another location will be similarly dealt with. This work is intended as a demonstration, the actual reclamation of large areas being left to the natives themselves, who, it is hoped, will not need much encouragement to follow up this work.

In connexion with the work of reconditioning, a nursery was established to supply fodder plants, trees and wash-stop grasses to the reconditioning schemes, as well as to interested

natives. Amongst the important crops planted in this nursery are Mexican daisy, spineless cactus, napier, woolly-finger, Bermuda and crested Canadian wheat grass, Kudzu vine and Black Mauritius bean, while drought-resistant fodder trees and shrubs have also been planted.

EXPERIMENTAL WORK.

An area has been set aside on the Seed Farm for crop trials and selection work. Two varieties of upland rice (Ambari and Munias) and one of swamp were planted, the Munias rice being the most promising. Rye germinated well, but suffered later from waterlogging. Linseed made successful growth. Western Dark Nyassa tobacco was also successful, but at present the natives prefer their own varieties for the manufacture of snuff. Sinsim and groundnuts gave unsatisfactory results on the farm, but extended trials are being made of these export crops in various parts of the district, at the lower altitudes.

Local varieties of sorghum and millet, reputed to be early-maturing and drought-resistant, have been planted for selection purposes.

Three small plots were established at bush schools. These plots, although small for seed-growing, are of great value in this district, where climatic conditions vary to such an extent, in determining the types of crops suited to the various locations and in selection work on local varieties. They also serve as object lessons at the schools, and demonstrations and lectures in connexion therewith have been given to the pupils.

ANIMAL HUSBANDRY.

A series of poultry pens of Black Australorps was established at the Seed Farm for the purpose of raising stock to start pens at bush school plots. During the year, however, all animal husbandry work was handed over to the Veterinary Officer, Machakos, whose work is referred to in the report of the Division of Animal Industry.

GENERAL PROGRESS.

Machakos has been for four years without an Agricultural Officer. It is not easy, therefore, to make a comparative report on the general progress of the district during the year, and no definite advance can be indicated. A promising start has, however, been made, and work has been placed on a sound and well-organized basis. Cash crops, such as groundnuts and sinsim, have been introduced; a valuable demonstration

of the methods of reclamation work in the eroded areas is being conducted, the improvement of marketing conditions, and tentative proposals for some form of marketing in association are under consideration, and a general programme of development is being prepared which with continuity of policy should yield some tangible results in the near future. Ukamba Province, with a population of 370,000, an area of 23,300 square miles, and a wide range of climate, holds many problems, two of which alone—the conditioning and reclamation of eroded areas and the improvement of the food supply in the more arid areas—will require constant attention over a period of years before their solution is reached.

NYANZA PROVINCE.

STAFF.

Provincial Staff.—The normal staff in the past has been one Agricultural Officer for each of the three reserves (North, Central and South Kavirondo) and one Agricultural Officer for the Bukura Farm and School (which serves the whole province as well as certain adjoining provinces). This staff was maintained intact during the year.

During the time that Mr. Lyne Watt was at Bukura he exercised general supervision over agricultural matters of the whole province and on his return from leave in December he was posted to Kisumu Provincial headquarters as Agricultural Officer in Charge Province.

SEASONAL CONDITIONS.

Partial drought was experienced in South Kavirondo in July and August and the long rains were nearly a month late in commencing in North Kavirondo, but with these exceptions weather conditions were very favourable for the production of crops. In many locations the long rains were in excess of those of normal years and the short rains were satisfactory.

CROPS.

Locusts were a menace throughout the year, and caused considerable damage to crops. Fortunately the loss was not as great as in 1931, but their presence had the effect of causing the people to decrease the areas planted with cereals and to increase the acreage of beans, sweet potatoes, cassava and other crops less susceptible to attack. Losses caused by locusts in 1931 caused partial shortage of foodstuffs in South Kavirondo, particularly towards the Lake shore during the

early part of the year, but famine relief measures were not necessary. Without doubt the extensive planting of root crops as the result of propaganda during both 1931 and 1932 relieved the situation very considerably. Due to partial shortage of supplies prices of foodstuffs advanced, and Sh. 8 to Sh. 11 was demanded for maize in South Kavirondo in locations at a distance from the railway or Lake.

Although not shown by export returns, the production of maize equalled that of normal years and there was an increase in the area planted with other cash crops, such as beans, groundnuts, simsim and cotton. It is probable that this increase was due in part to the fact that owing to the depression fewer labourers were employed in settled areas and therefore fewer natives left their reserves.

In addition to improvement in quality, increase in the variety of crops grown was most noticeable, and should have a beneficial influence on the health and prosperity of the people. Further supplies of maize seed were available for distribution, and in addition supplies of seed potatoes, and seeds of fruits and vegetables, such as cabbage and tomatoes, were obtained from funds supplied by Local Native Councils. The latter crops are becoming increasingly well known and popular. The development of the Kakamega goldfield should provide a market and give incentive for production of these and of main staple crops for consumption by both Europeans and Africans.

Cotton: 1931-32 Crop.—As forecast in the 1931 report, the season was very successful and resulted in the production of 2,166,352 lb. of seed cotton compared with 918,967 lb. for the previous season, an increase of 136 per cent. The 15th January was the date declared for the opening of buying, but as operations in Uganda did not commence until a week later and natives wished to know Uganda prices before selling in Kenya, small quantities only were offered for sale in the first instance. Prices averaged about Sh. 10 per 100 lb. at gineries, with small fluctuations at buying centres. Compared with those obtained in years past prices were low and not encouraging to growers, but as, owing to disease, stock do not thrive in some of the cotton areas, the cotton crop is now regarded as the main source of revenue. Owing to low over-sea values there was no tax on ginned cotton.

As in years past some cotton was taken over the Uganda border, but with the co-operation of administrative officers of Uganda the quantity was but small.

Cotton: 1932-33 Crop.—Weather conditions were very favourable during the planting and growing seasons and at the end of the year there was every indication that the output of the previous successful season and the record one of 1928-29 would be exceeded.*

In some instances ginners were late in delivering seed at distribution centres in North Kavirondo, but planting commenced in good time in June and continued throughout July and August and in some parts was extended until September. At the end of December, June plantings looked most promising in most locations, though in some parts it was probable that July sowings would give equally good results.

Cotton was grown on a small scale in years past in lake-shore locations of South Kavirondo, but for various reasons production declined and ceased. It was considered advisable that an effort be made to resuscitate the industry and seed was distributed. The people failed to realize the value of the crop and as the seed was planted late when the best of the rains had ceased the yield was small. It remains to be seen if further experience will enable the people to establish cotton as a permanent cash crop.

Seed supplied free of charge amounted to 104 tons in North Kavirondo, 38 tons in Central Kavirondo and 20 tons in South Kavirondo.

SEED FARMS AND SEED ISSUES.

There are three farms in the province, located at Kakamega, Maseno and Kisii for North, Central and South Kavirondo respectively.

The acreages so far brought under cultivation are not as large as desired, but will be increased as funds from Local Native Councils and departmental sources permit. In addition to their normal functions these farms have provided sites for nurseries for the propagation of planting material of numerous kinds of fruit and other trees. Owing to reduction of funds, quantities of seed purchased for distribution were reduced, but distribution from seed farms to some extent made up for this. Particulars of distributions will be found in the three tables on seed issues.

As the staff of the Forest Department is inadequate to deal with afforestation in all native reserves, Agricultural

* Subsequent to the preparation of this report, a final return of 3,940,764 lb. of seed cotton bought was received. The previous best crop (1928-29) was 2,259,497 lb.

Officers have given considerable time and attention to the raising, distribution and planting of trees such as wattle, gum and cypress for the provision of fuel, building material, wind-breaks and for other purposes. In supplying local requirements for fuel some locations have been completely denuded of the indigenous trees.

EXPERIMENTAL WORK.

Duties such as locust destruction measures, the management of the production of cotton and the encouragement of production of foodstuffs having precedence over experimental work in this Province, the possibility of work of this nature on any considerable scale was not possible. Nevertheless trials of crops and methods new to the area were given every attention possible in the circumstances. At Bukura some 40 species and varieties of crops were planted as new trials or for verification of previous results. An important feature of this work is the selection and trials of crops already in the possession of natives, the comparative yielding capacity and other characteristics of each of which are not known or are not fully realized by them. As an example of work of this nature, it may be mentioned that a variety of sorghum grown in a location in North Kavirondo where it is known as "Ik'umba" appears to possess characteristics giving it a greater degree of immunity to attack by locusts than is possessed by other varieties. It is probable that this variety might be grown with advantage on a large scale in other parts of the province if this characteristic is proved.

Considerable attention has been devoted to trials of cotton varieties, and two varieties introduced from Uganda (S.G. 27, 15, 13 and S.G. 29) give promise of producing yields in excess of those of local strains. Samples of the undermentioned successful U/4 strains in Tanganyika (derived originally from Barberton, Transvaal) were received and are still under trial:—

U/4/4/2; U/4/4/10; U/4/26/4; U/4/64; U/4/64/7;
C. 15; Z. 14; H. 17; H. 67; Z. 9. Seed also of Over-the-top, a variety from Nyasaland is under trial.

ANIMAL HUSBANDRY.

In years past improvement of native poultry by the introduction of Rhode Island Red cockerels into native reserves has met with considerable success. This work was continued and some 280 cockerels and pullets were raised and distributed from Bukura. At the same time instruction in poultry keeping was given by Agricultural Officers and native Instructors.

Although progress is slow the number of shade-dried hides offered to buyers increased, and it is possible to record steady improvement in quality.

Exports of ghee from Kendu Bay, Homa Bay and Karangu averaged about 2,000 tins a month.

GENERAL PROGRESS.

The province suffered severely from locusts during the year and there was considerable food shortage owing to the succession of partial losses of crops. It was not found necessary to institute famine relief measures, but the disorganization of supplies affected the development of the province to a certain extent.

A marked increase in the production of cotton is again recorded, the 1931-32 crop being nearly as large as the record crop of 1928-29 while the 1932-33 crop has considerably exceeded it.

It was decided to restart cotton cultivation in South Kavirondo, and seed was distributed there in June and July. Increased acreages are recorded as being under groundnuts and simsim, and the development of the Kakamega goldfields has afforded a stimulus to increased production of locally saleable foodstuffs in North Kavirondo. Over the whole province, a greater variety of crops is grown and the quality of produce, both plant and animal, exported from Nyanza has improved.

The response to the services of the three Agricultural Officers in the Province is becoming more and more marked and this is due not merely to the efforts of these officers themselves but also to the whole-hearted and energetic support of their efforts by the Administrative Officers.

COAST PROVINCE.

STAFF.

It has not yet been found possible to station more than one Agricultural Officer in this province and Mr. N. Humphrey has been in charge throughout the year, stationed at Kilifi. His work, apart from purely provincial matters, is confined to Digo and Kilifi districts and Malindi sub-district. Assistance was afforded during the first quarter by the secondment from the Grading Services of Mr. F. B. L. Butler, who was formerly engaged in agricultural work in the Department.

SEASONAL CONDITIONS.

The rainfall for the year was well above average but the distribution was again very uneven. The long rains were late as in 1931, and the month of May extremely wet with twenty-one consecutive days of rain at Kilifi. The September rainfall was also unusually heavy.

The short rains were late and at one time it was thought that they would fail. Actually, however, once started, they were the best on the Coast for some years and continued into the New Year.

CROPS.

Excellent crops of maize were obtained in the long rains in the Sabaki Valley, but in other areas the excessive rain caused yellowing and reduced yields. Locust damage was sustained in Digo and Kilifi, and parts of Malindi. As indicated above the short rains were late but the crop prospects late in the year were very promising except in the dry parts of Duruma.

Good crops of bulrush millet were grown but the sorghum crop in Samburu was disappointing owing to insufficient rains.

The rice crop was good particularly at Vanga and other parts of the Digo coast. Pulses were in general rather below average owing to heavy rain at the ripening stage. The cultivation of cassava has extended and there is a growing demand for those varieties which are proving the best at the Kibarani station. Sweet potatoes have received a stimulus as a locust-proof crop, but are still not grown as extensively as they might be, some tribes regarding them with disfavour.

The heavy rains in the early part of the year were welcomed in the sugar plantations. Some damage by locusts was sustained by the canes and mealy bug has also been a serious trouble.

Coco-nut plantations continue to improve in general appearance, but yields have not improved equally. Natives continued to plant coco-nuts and they are steadily increasing in numbers in the Giriama Reserve. There has been little incentive to produce copra under present conditions but a fair market for the unhusked nut has been found in Mombasa.

Extended sowings of simsim in the long rains on the Kilifi-Malindi coast strip gave excellent yields and the crop is gaining in popularity. Prospects for the short rains crop are good.

The sisal industry has remained under the shadow of the depression, and the general care of estates continued to suffer.

Cashew nuts grow extremely well on the Coast, but they have hitherto not been exported. Arrangements were made towards the end of the year for the crop to be bought with a view to testing the market, and although the wet weather was not altogether favourable, nuts were being brought in in good quantities. Meanwhile organized planting, started in 1931, continues and several thousand seedlings have been grown and distributed by the Department. Legislation controlling the industry will be introduced in 1933. The industry promises to be a valuable one for the Coast.

Cotton Crop: 1931-32.—This crop proved to be a record for the Coast, the final figures being:—

Seed Cotton bought	.. 1st Grade ..	570,946 lb.	
	2nd Grade ..	56,940 lb.	
	Total ..	<u>627,886 lb.</u>	
		lb.	Bales of 300 lb.
Ginning Return:—			
Lint: "A" quality ..	174,145	590	
"B" quality ..	17,215	57	
Total ..	<u>191,360</u>	<u>637</u>	

The ginning out-turn was 30.5 per cent and the proportion of 1st to 2nd Grade was not unsatisfactory.

Cotton Crop: 1932-33.— As a result of concentrated efforts on the part of officers concerned, considerably extended planting of cotton was effected this year. The season was not so favourable as in 1931, and yields per acre were lower. The buying returns indicate a big advance on the previous record crop, the end of the year figures being:—

Seed Cotton bought	.. 1st Grade ..	891,917 lb.
	2nd Grade ..	86,117 lb.
	*Total ..	<u>978,034 lb.</u>

The bulk of the crop was bought at Sh. 9 per 100 lb. (1st grade) but towards the end of the year the price fell by Sh. 1. The quality of lint has been much improved by the introduction of new seed in 1931, but it is necessary to continue the work already begun with new varieties in order that the process of improvement may continue.

* Subsequent to the preparation of this report a final return of 1,082,826 lb. of seed cotton bought was received.

MARKETING.

The opening of new cotton buying posts and the marketing of cashew nuts on lines similar to that of cotton were the only notable developments to be recorded under this head. This type of controlled marketing is of great importance to the Coast where the native is not yet ready for marketing in association, and where yet some control is desirable.

COMMUNICATIONS.

The gradual improvement of the Takaungu deviation has been carried out and in due course this should be an all-weather road. The opening of a motor track to the Tana was an event of importance, and a pontoon across the river and a road to Lamu have rendered through communication possible during the dry season.

SEED FARMS AND SEED ISSUES.

The Kwale Seed Farm was enlarged to 20 acres during the year. No further increase is proposed with the present staff, owing to the difficulty of adequate supervision. Adequate space for enlargement is, however, available. The Gotani Farm was also extended to 20 acres and further extensions are being made. A five-acre plot at Malindi was started in the short rains for the bulking of Muratha maize. Facilities are available for extension when desired for further work on maize and cotton.

From these farms the following seed issues were made during the year: Yellow maize, 14 bags; bulrush millet, 3 bags; cow peas, 22 bags. In addition, from Local Native Council funds were issued 4 bags of Kavirondo sorghum and 5 bags Yellow maize. The main seed issue of the year was that of 55 tons of cotton seed, 9 tons of which were issued in Kilifi and the remainder in Malindi.

EXPERIMENTAL WORK.

As in 1931, experimental work has been carried out mostly at the Kibarani Experiment Station which was increased in size and now covers eighteen acres.

Native Crops.

Maize.—Following the excessive yellowing and stunting of maize in May, a trial was laid down to compare the growth of maize on broad low ridges and on the flat. Observations towards the end of the year indicate that the plants on the ridges are the most vigorous. Further trials are being made. Trials of yellow and white varieties indicate that Yellow

Menado is still the best for the less fertile areas, while for the more fertile a heavier yielding type of white maize is desirable. Further trials with Durum, Guam and Muratha are to be carried out.

Sorghums.—Five varieties from Kavirondo, two from Tanganyika, and five from America were tried this year. Only one of the American varieties—Dwarf Hegari—was at all successful and proved an extremely quick-growing variety. Bonganhilo, from Tanganyika, was successful, while all the Kavirondo varieties gave good yields and are comparatively unattacked by birds. Their bitter taste is not in their favour, but the white varieties, Ik'umba and Ik'umba Inzibichiti, are only slightly bitter and are recommended for bulking.

Bulrush Millet.—The Tanganyika awned variety continued to give satisfactory results, and selection is being done in an endeavour to obtain a strain in which the awned character is fixed.

Cassava.—Trials have continued with reference to resistance to Mosaic disease. Aipin Mangi from Java, hitherto free, became infected during the year, but Binti Athman, although showing signs of heavy infection, appeared to be able to make good growth and to crop well in spite of it. A new variety from Malindi has been obtained which shows greater resistance than any of the others under trial, and appears to be a quick and heavy cropper. Comparative trials to include this variety are under preparation.

Groundnuts.—A new variety from West Africa was completely killed by Wilt disease. The Kavirondo variety gave the same result as last year, and though there is reason to think that there is some resistance, it cannot be said that any advance has been made.

Simsim.—Two trials of black and yellow simsim were carried out. Individual plants of the latter appear to bear more heavily than the former, but the yellow variety is delicate in its young stage.

Pigeon Pea.—The New Era has proved a valuable introduction and is a great improvement over the local type.

Tepary Bean.—This bean continues to prove successful and is being bulked for the drier areas.

Cotton.—A variety trial was carried out this year with the following varieties: Old Malindi; N. 17, from Uganda, which was issued in Malindi in 1931; S.G. 29 from once-grown Uganda seed; Over-the-top, imported from Nyasaland.

The first three were duplicated in one-tenth acre plots, planted 3 ft. 6 in. by 1 ft. 6 in. and half at 3 ft. by 1 ft. 6 in. The vigour of Over-the-top was noticeable throughout the season.

The following yield results were obtained :—

Variety	Yield in lb. per acre		
	1st Grade	2nd Grade	Total
Old Malindi ..	800	315	1,115
N.17	695	160	855
S.G.29	610	290	900
Over-the-top—			
3' 6" spacing	800	310	1,110
3' spacing ..	730	290	1,020

Examination of the seed cotton confirmed the poor quality of Old Malindi, while Over-the-top and S.G. 29 both showed better quality than N. 17.

The time of planting experiment was continued on the lines of 1931, six plantings being made, the middle two giving the best results, but again the season was abnormal, the early planted cotton suffering from excessive rain in May. The trials will proceed for several seasons.

Green Manure and Cover Crops.

Last year's trials were continued. *Canavalia obtusifolia* made excellent growth, but seed is difficult to obtain. *C. ensiformis* is only of value on the better soils but seeds freely. *C. aspalatia*, intermediate between *obtusifolia* and *ensiformis*, appears to combine the advantages of both, and is worthy of further trial. Other successful trials include those of *Centrosema pubescens*, *Pueraria phascoloides*, *Tephrosia candida*, and the New Era pigeon pea (*cajanus indicus*). An indigenous *Tephrosia* (*T. Vogelii* (?)) from Rabai, tried for the first time this this year, is doing well and is also reported to be a fish poison of some merit.

Other Crops.

Sunn Hemp was again tried as a possible fibre crop. Growth was very much more satisfactory than last year and a sample of rotted fibre was produced. Sunflowers continued to do well but their future depends on obtaining a suitable market. Linseed and Thymol were tried and the results justify further trials with acclimatized seed. New varieties of Kapok have been introduced and some varieties are growing well.

GENERAL PROGRESS.

The organization of services outlined in last year's report has been developed as far as facilities allow, but the limitation of staff and funds prevent rapid progress.

In Digo district a maize planting campaign was carried out in one location. In spite of some locust damage, the results were satisfactory. The organized marketing of cashew nuts was started in the Digo Reserve. Some hesitancy was evinced at first, but the advantages were fully explained and a good start has been made with a potentially valuable industry. The district as a whole made a distinct forward movement, but it is still very poor and is sadly in need of profitable cash crops.

Cotton was re-introduced into the Coastal area of Kilifi district where it has been regarded with disfavour in recent years owing to low prices. With general depression its cultivation has become more attractive and the opening of local buying stations stimulated further interest. General propaganda also resulted in an extended cultivation of simsim, and food crops in various parts of the district.

In Malindi sub-district it was decided to concentrate on one main objective, namely a cotton campaign, in order to achieve a lasting result. The campaign proved quite as successful as had been hoped, and the result, indicated in the figures quoted above, marks a great step forward in the general development of the province. The present ginnery may now be regarded as firmly established, the industry's position consolidated and the way clear for extensions over a wider area. The stimulus of the cotton campaign also reacted favourably on other crops. Maize exports from Malindi have been the highest for a decade, and the cultivation of simsim and other crops has been extended. Malindi has thus been able to weather a year of great depression with less distress than many areas. An air of optimism is replacing that of apathy and with a continuation of effort and some revival of commodity prices, the future of this sub-district can be considered bright.

A joint medico-agricultural survey of the lower Tana River was carried out in September by Dr. A. R. Paterson and Mr. C. O. Oates.

During the year the Coast Advisory Committee of the Board of Agriculture was formed with the Agricultural Officer as Secretary, and three meetings were held. This Committee should prove a valuable factor in the development of the Coast generally.

With the present staff extension of activities is limited, and much of the province must be left without attention. The policy of concentrated effort has been justified and should be pursued, but there is little doubt that any development of the present organization in the direction of increased services could be followed rapidly by results of the greatest value.

PUBLICATIONS.

Bulletins and Press articles, etc., emanating from the Division of Plant Industry were as follows:—

Entomological Section.

By T. J. ANDERSON, M.A., etc., *Senior Entomologist*:—

“Preparation and Application of Kerosene-Pyrethrum Sprays against *Antestia* and *Lygus*” (Entomological Leaflet No. 1).

By R. H. LE PELLEY, Ph.D., etc., *Entomologist*:—

“Coffee Capsid Bug (*Lygus simonyi*, Reut.), and the Use of Kerosene Extracts of Pyrethrum for the Control of *Lygus* and *Antestia*,” also “A Note on the Rational Application of Control Measures for Certain Insect Pests of Coffee.” (Bulletin No. 22 of 1932.)

“*Lygus simonyi*, Reut., A Pest of Coffee in Kenya.” (Bulletin of Entomological Research, Vol. XXIII, 1932.)

“*Lygus simonyi*, Reut., Causing Abortion of Coffee Buds, and the Problem of its Control.” (Communication to the British Association for the Advancement of Science, delivered at York, on September 2nd, 1932.)

“On the Control of *Antestia lineaticollis*, Stal., on Coffee in Kenya.” (Bulletin of Entomological Research, Vol. XXIII, 1932.)

“On the Pest-status of Certain Coffee-feeding Insects, with records of Some Insects Newly Recorded from Coffee in Kenya.” (Journal of the East Africa and Uganda Natural History Society, No. 40-41, April, 1932.)

By H. C. JAMES, Ph.D., etc., *Entomologist*:—

“Coffee Mealy Bug Research.” (Bulletin No. 18 of 1932.)

“The Control of *Asterolecanium* (The Fringed Scale of Coffee),” (Bulletin No. 23 of 1932.)

“Banding for Coffee Mealy Bug Control.” (Bulletin No. 24 of 1932.)

Botanical Section.

By J. McDONALD, D.F.C., B.Sc., F.L.S., *Senior Mycologist*:—

“The Major Coffee Diseases.” (Bulletin No. 20 of 1932.)

“The Preparation of Bordeaux Mixture Spray.” (Mycological Leaflet No. 11.)

“Coffee Bean Disease.” (Mycological Leaflet No. 12.)

“Seed Treatment against Covered Smut of Barley.” (Mycological Leaflet No. 13.)

“Mosaic Disease of Sugar Cane, Progress of Eradication Campaign.” (Press article.)

“Striga Weed in Nyanza Province, Report on the 1932 Eradication Campaign.” (Press article.)

By C. A. THOROLD, B.Sc., *Mycologist*:—

“Plant Diseases in the Coast Province.”

Chemical Section.

By V. A. BECKLEY, M.C., M.A., A.I.C., *Senior Agricultural Chemist* :—

“Some Factors in the Manuring of Coffee.” (Bulletin No. 16 of 1932.)

“Stills for the Production of Essential Oils” (and by T. L. McCLELLAND, M.C., *Plant Inspector*). (Bulletin No. 25 of 1932.)

“*Kuhifadhi Unono wa Mashambani*” (“Maintaining the Fertility of the Soil.”)

“Cotton Seed and Oil Cakes as Manures.” (Press article.)

By G. H. GETHIN JONES, M.Sc., *Soil Chemist* :—

“Some Notes on the Soils of the Trans Nzoia.” (Bulletin No. 8 of 1932.)

“Memorandum on the Lime Resources of Kenya Colony, with Special Reference to Future Requirements and the Economy of Transportation.” (Bulletin No. 12 of 1932.)

“Coffee Soils of Kenya and their Cultivation.” (Bulletin No. 21 of 1932.)

“Bat Guano Deposits in Elgon Caves—Their value as Manure.”

Plant Breeding Section.

By THE STAFF OF THE PLANT BREEDING STATION and THE AGRICULTURAL OFFICER, KITALE :—

“Notes on Some Cash Crops and Green Manure Crops at Njoro and in the Trans Nzoia, 1931.” (Bulletin No. 3 of 1932.)

“Field Experimental Work and Crop Production Studies in 1931.” (Bulletin No. 7 of 1932.)

By G. J. L. BURTON, M.C., B.A., *Senior Plant Breeder*, and C. MAHER, B.A., A.I.C.T.A., *Agricultural Officer* :—

“Further Studies on Improvement of Maize Yields in Kenya Colony.” (Bulletin No. 4 of 1932.)

By R. J. LATHBURY, M.A., *Acting Senior Plant Breeder* :—

“Take-All Disease of Wheat.” (Press article.)

Coffee Section.

By A. D. TRENCH, *Senior Coffee Officer* :—

“Coffee Seed Selection.” (Bulletin No. 10 of 1932.)

“Soil Wash.” (Bulletin No. 11 of 1932.)

“Hot and Cold Disease.” (Bulletin No. 14 of 1932.)

“Green Manure and Cover Crops.” (Bulletin No. 15 of 1932.)

By A. D. TRENCH, *Senior Coffee Officer*, and S. GILLETT, Dip. Agric. *Agricultural Officer* :—

“Coffee Pruning.” (Bulletin No. 13 of 1932.)

By A. D. TRENCH, *Senior Coffee Officer*, and T. L. McCLELLAND, *Plant Inspector* :—

“Bordeaux Spraying with Particular Reference to the Leaf Berry Fall of Coffee.” (Bulletin No. 17 of 1932.)

By S. GILLETT, Dip. Agric., *Agricultural Officer i/c Scott Agricultural Laboratories* :—

“Vegetative Propagation; Its Value in the Improvement of Permanent Crops and the Possibilities of its Application to Coffee.” (Bulletin No. 19 of 1932.)

Agricultural Economics.

By V. LIVERSAGE, B.Sc., M.Sc., N.D.A., *Agricultural Economist* :—

“The Marketing of Potatoes.” (Bulletin No. 5 of 1932.)

“An Economic Study of a Group of Coffee Estates in Kiambu.”
(Bulletin No. 9 of 1932.)

General.

By W. G. LECKIE, B.Sc., *Agricultural Officer* :—

“The Growing of Wattle and Production of Wattle Bark in Kenya.” (Bulletin No. 1 of 1932.)

“Wattle Mine Props.” (Press article.)

By JAMES SCOTT, B.Sc., A.I.M.M. :—

“Report of Investigation into Supply of Limestone, particularly for the Nzoia Province.”

“Report of Proceedings of Coffee Planters' Days and Coffee Conference, 1932.”

CONCLUSION.

In the report of this Division last year, which was the first after my appointment to Kenya, I paid tribute to the marked qualities of zeal and efficiency displayed by the staff of the Division, and I desire to express my appreciation this year of their unremitting efforts, beyond what is usually regarded as necessary by hard-worked officials, to assist the the crop industries through accumulated trials so severe and disheartening in the third, and probably the worst, year of the depression.

H. WOLFE.

Deputy Director (Plant Industry).

ENTOMOLOGICAL SECTION

REPORT OF THE SENIOR ENTOMOLOGIST

STAFF.

The following officers constituted, for the whole year or part of the year, the staff of the Entomological Section of the Department of Agriculture :—

- T. J. Anderson, M.A., B.Sc. (Edin.); Senior Entomologist.
- H. Wilkinson, A.R.C.Sc., F.E.S., F.L.S.; Entomologist.
- H. C. James, Ph.D., B.Sc., N.D.A., N.D.D.; Entomologist.
- R. H. Le Pelley, Ph.D., B.Sc., A.R.C.Sc., D.I.C., F.E.S.; Entomologist.
- F. B. Notley, B.Sc., A.I.C.T.A.; Entomologist.
- H. Naismith Jones; Plantation Inspector.
- C. D. Knight; Plantation Inspector.
- T. L. McClelland, M.C.; Plantation Inspector.
- H. R. H. Stone; Plantation Inspector.
- G. S. Powell; Plantation Inspector.
- E. Cottingham; Plantation Inspector.
- H. L. Bolton; Insectaries Manager.

The Senior Entomologist returned from leave on the 15th of January.

Mr. Wilkinson, who had been Acting Senior Entomologist, conducted a series of experiments in the treatment of foreign coffees. He went on leave on the 16th of April and returned on the 18th of November. He was seconded, from the 1st December, for a period of three years, to take charge of the coffee berry disease investigations in the Sotik area.

Dr. James has, for the whole year, been engaged in work connected with mealy bug control.

Dr. Le Pelley, until he went on leave on the 15th of June, continued his work on *Antestia* and *Lygus*.

Mr. Notley, who had been investigating the leaf-eating caterpillars of coffee and the incidence of *Antestia* and *Lygus* in the Sotik Area, was transferred to the Entomological Laboratory, Scott Agricultural Laboratories, on the 1st of December.

Mr. Naismith Jones returned from leave on the 30th of June and was posted to the Nyanza Province to take charge of the campaign, instituted by the Senior Mycologist, against *Striga hermonthica*. He has also been engaged in inspection work in connexion with mosaic disease on sugar cane and inspection of plantations generally. On Mr. Knight's return, Mr. Jones was transferred to the Kikuyu Province.

Mr. Knight went on leave on the 4th of April and returned on the 15th of December, when he relieved Mr. Naismith Jones in the Nyanza Province.

Mr. Powell, who had been stationed in the Nzoia Province, resigned at the end of March.

Mr. Cottington was engaged in place of Mr. Powell and carried on the inspection work in the Nzoia Province until the 1st of December, when he was transferred to the Sotik area to undertake vegetative propagation work in connexion with the coffee berry disease investigations.

Mr. Stone, who had been in charge of the Sotik-Kericho area, was not re-engaged on the termination of his agreement.

Mr. McClelland was Insectaries Manager until the first of April, when he was transferred to Head Office to assist the Senior Coffee Officer. Until the end of the year, when the work was discontinued and the post abolished, the work was carried on by Mr. Bolton.

On the last day of the year, therefore, the personnel of the Section was reduced to the Senior Entomologist, three Entomologists and two Plantation Inspectors, with a native staff of three.

TRAVELLING.

28,321 miles were travelled by the staff, by car, on Government service.

LABORATORY AND ADMINISTRATIVE SERVICE.

2,872 letters have been dealt with.

420 specimens of insects, damaged plants, etc., have been examined and reports submitted.

49 parcels of locusts were examined on behalf of the officer-in-charge, locust control.

157 applications for permits to import plants have been amended or approved and the necessary permits issued.

130 consignments of plants and seeds for export have been examined and certificates granted.

Over 1,000 packages of plants and seed, arriving by post, have been examined. This is in addition to the plant import inspection done by the Senior Inspector, at the Coast.

PUBLICATIONS.

Eight bulletins and articles were published during the year (*see* general list).

TREATMENT OF FOREIGN COFFEES.

At the request of several coffee merchants, experiments were conducted on the treatment of coffees, grown outside the boundaries of the Colony, to ensure freedom from all stages of *Stephanoderes*, with a view to bulking or otherwise handling such coffees in Nairobi.

The experiments were designed by Mr. Wilkinson and were carried out by Mr. Wilkinson and Mr. W. D. Arnot, B.Sc., who was in charge of the timber conditioning plant of the Public Works Department. Thanks are due to the Director of Public Works for permission to use the kilns for this work.

After several trial runs, temperature and humidity were so adjusted that all stages of the insect could be destroyed without detriment to the appearance and liquoring of the coffee.

Several consignments were so treated but for reasons, which had nothing to do with the success of the treatment, the quantity of coffee sent to the kilns by trade interests did not come up to expectations.

Details will be found in Mr. Wilkinson's report.

INSPECTION SERVICES.

At the beginning of the year the inspection services were placed under the direction of the Entomological Section. This service includes not only general plantation inspection, but also the administration of all Rules and Regulations dealing with the importation of plants and seeds, the movement of plants within the Colony, the issue of all permits under the Diseases of Plants Prevention Ordinance and the Coffee Rules.

Importation of Plants.—Permits for the importation of coffee seed are issued by the Senior Coffee Officer in order that he may be in a position to know what varieties, etc. are being imported and the areas in which these will be planted. All other permits are issued by this section.

The careful inspection, at the Coast, by the Senior Grader and Inspector has been continued and has led, *inter alia*, to the compulsory re-exportation of apples badly infested with colling moth larvæ. As Kenya is still one of the few places where the pest does not exist, special care is taken to prevent its introduction or, at least, to delay its introduction for as long as possible.

As it is not possible to inspect at Mombasa all importations of seeds and plants arriving by post, those which come to Nairobi are inspected at the General Post Office, where a record book is kept.

Parcels of plants and seeds arriving by Imperial Airways are inspected at Nairobi. It has not been possible to arrange for inspection at Kisumu, which is the principal Air Port of the Colony.

All plants and seeds introduced by the Department are inspected before distribution.

Export of Plants.—The export of indigenous plants is on the increase. Several parcels of bulbs of the Liliaceæ and Amaryllideæ have been sent to private individuals, nurserymen and institutions. These have been examined before export and certificates granted.

Parcels of coffee in parchment, supplied by Nairobi merchants are examined and despatched, accompanied by a certificate of freedom from insect pests.

Import of Foreign Coffees.—Coffee grown outside the boundaries of the Colony, i.e. in Uganda, Tanganyika and the Belgian Congo, passes through in transit, subject to conditions laid down in the Regulations.

Coffee from the Northern Province of Tanganyika is allowed to come to Nairobi for milling or sale, etc., but must be re-exported. As *Stephanoderes* is unknown in that area, kiln treatment is not required.

Coffee from Bukoba or Uganda is allowed to come to Nairobi for the same purposes, but must be consigned direct to the kilns and treated before being handed over to mills or merchants. This coffee must also be re-exported and not sold locally.

THE MORE SERIOUS PESTS OF THE YEAR.

Antestia, *Lygus* and mealy bug are again recorded as the most serious pests on coffee, while cutworms and locusts have been responsible for very serious damage to maize, wheat and cereals generally.

Information regarding the work done on these pests and the methods of control recommended will be found in the reports of the Entomologists who have been in charge of this work.

T. J. ANDERSON.

MR. WILKINSON'S REPORT

During the month of January, I was stationed at the Scott Agricultural Laboratories as Acting Senior Entomologist. I proceeded to England on leave on the 16th April and returned on the 18th November. On my return from leave I proceeded to Sotik to take charge of Coffee Berry Disease investigations.

From February to the end of March I was engaged on the problem of eliminating the menace to the coffee industry of Kenya should foreign coffees be allowed freedom of movement on the Nairobi market. Primarily this problem appeared to be that of controlling the insect pest, *Stephanoderes hampei*, Ferr., in imported coffees, though actually greatest difficulty was encountered in preventing colour change from taking place in coffee during treatment.

The usual control methods are :—

1. Fumigation.
2. Vacuum fumigation.
3. Heat.

Nos. 1 and 2 on investigation were ruled out on account of expense, handling, apparatus required, etc. and as being uneconomic in this country. No. 3 finally proved to be practical and economic.

It was found that all stages of the insect, *S. hampei*, within the coffee bean could be killed by the application of heat, 120° F. or 48.8° C. for half an hour, but in the process the coffee beans were so altered in appearance as to be almost unmarketable. At the outset it should be stated that the coffee to be treated was in the finished marketable state, with or without parchment, and any appreciable loss in weight, or any unfavourable colour change taking place as a result of treatment, meant a consequent reduction in value. Therefore, before treatment could be said to be successful, neither loss in weight nor colour change must have taken place in the final product. After many experiments this position was arrived at.

As a result it may be stated with confidence that subject to certain treatment on arrival, foreign coffees of any description may be granted the same freedom of movement within the Colony as is granted to Kenya coffees, without in any way endangering the good name of such coffees or the valuable coffee industry of Kenya.

Briefly the process is as follows : Coffee as it arrives in the double bag is placed in a timber drying kiln and subjected to varying increases of temperature and degrees of humidity until the temperature in the centre of the bag reaches 120° F., 48.8° C., when this temperature is maintained for half an hour.

The temperature of 120° F. for half an hour was found to be the minimum temperature and time necessary to kill all stages of the insect, *Stephanoderes hampei*, Ferr. During the process the varying temperatures and degrees of humidity have to be so calculated and regulated that the temperature of the coffee beans is always higher than the temperature recorded by the wet bulb thermometer and is thus above the dew point; in this way moisture condensation upon the coffee beans is prevented. This is most important because should moisture condense upon the beans the final product will have the appearance of having been wetted and will be reduced in value. Also, the degree of humidity at any temperature must be such that drying-out of the coffee is prevented.

The schedule calls for increasing temperature and increasing humidity as the run proceeds. These changes are secured by hand adjustment of the thermostats from time to time.

In treating a consignment of ten tons of coffee beans in this manner it was found that thirty-three hours elapsed before the temperature of 120° F. was obtained in the centre of the bag in the coolest part of the kiln; the temperature recorded in the centre of the bag in the hottest part of the kiln was 124° F. At no time was the temperature at the surface of any bag allowed to go above 138° F. (59° C.). While cooling, the coffee should remain in the kiln for at least twelve hours to avoid change in colour taking place. After closing down operations and allowing cooling to take place it was found that the temperature in the centre of the bags remained at 120° F. for a period of twenty-one hours, and sixty-seven hours elapsed before the temperature at the surface and centre of the bags became equal.

The present scale of charges made by the Public Works Department is Sh. 40 per day per kiln with a minimum charge of three days, i.e. Sh. 120. At this rate the cost of treatment of one ton of coffee per full kiln is Sh. 12. It is the writer's opinion that if these experiments were carried further the cost per ton of coffee could be considerably reduced.

I should like to place on record my appreciation and thanks to all who so kindly loaned consignments of coffee for these experiments and who carried out numerous roasting and liquoring tests of coffee after treatment.

My thanks are especially due to Mr. Arnot, B.Sc., engineer in charge of the timber drying kilns, to whom the success of these experiments is due.

KILN DRYING OF BEANS.

Experiments with Canadian Wonder beans infested with weevil (*Bruchus*) were carried out as above and all stages of the insect were killed. The beans underwent no change in appearance and germination was not impaired. Germination tests were made using treated and untreated beans and the following results obtained:—

Untreated weevil-infested beans: Germination 29 and 32 per cent.

Treated weevil-infested beans: Germination 29 and 33 per cent.

The percentage germination being low, it was considered advisable to repeat the above experiments, using fresh and uninfested beans.

On the 9th of March a consignment of fresh beans, uninfested with weevil, was treated in the kilns in a similar manner to the above. On the 15th March, 200 each of treated and untreated fresh beans were set in soil for germination. The results are given below:—

UNTREATED BEANS			TREATED BEANS		
Planted 15th March ..	100	100	Planted 15th March..	100	100
Per cent germination			Per cent germination		
23rd March ..	94	99	23rd March ..	92	94
Per cent germination			Per cent germination		
25th March ..	95	99	25th March ..	96	99
Average after 10 days..	97%		Average after 10 days	97.5%	

The mere heating of beans, to kill insect life, has not been successful, due to overdrying and consequent splitting of the beans. Treatment as above, with regulation of temperature and humidity, overcomes this difficulty and the powers of germination remain unimpaired.

Thus the export of beans free from living weevil may be guaranteed.

Favourable reports have been received from England on exported consignments of treated beans and tests are being made to find if the yield resulting from the sowing of treated beans is satisfactory.

H. WILKINSON.

DR. JAMES'S REPORT

BANDING FOR COFFEE MEALY BUG.

The trials of numerous devices and preparations which have been received mainly from commercial sources designed to cheapen and simplify mealy bug bands have been carried out with the double object of effecting improvements and protecting planters.

The application of a special brand of bituminous paint known as Melanoid direct on the bark of coffee trees to form a grounding for ant-repellents has become rather widespread during the year. This brand of paint has not been proved to be toxic to plant tissue and it certainly economises grease to an important extent, but unfortunately it has come to be regarded in some cases as a complete protection to the tree, no matter how poisonous the nature of the repellent may be. Melanoid, however, is unable to afford such protection, since cracks in the paint eventually occur through which the repellent penetrates, and if the latter is of a lethal nature serious consequences may ensue.

Hence a coating of Melanoid or any other brand of paint yet tested is not regarded by the Department as sufficient protection from ant-repellents which may be poisonous and planters should not conclude that because Melanoid is in popular use it has been officially recommended.

Undoubtedly the type of band where the repellent, whether Kresotow, castor oil or banding grease, is prevented from coming into contact with the bark is by far the safest and the small extra expense necessitated by its use should not be a temptation (at any rate on plantations of the single-stem type) to use cheaper and riskier alternatives.

However, despite the lack of official approval of the use of Melanoid there is no need for planters to ignore the fact that the application of banding grease on a coating of this brand of paint has a distinct advantage over its application direct on the bark.

Another abuse of Melanoid has to be recorded, where the paint has been applied from the ground level up to the point where the band is normally placed in the hope that it would prevent cutworm damage to young coffee trees. Almost needless to say, a large number of trees were killed on the areas so treated.

A large number of brands of banding greases have been tested and most of them possess the requisite properties of this type of ant-repellent, but it has been considered inadvisable to recommend the application of any of them direct on the bark, since the brands which have been longest in use occasionally do damage.

The number of banding greases now on the market is considerable and planters who prefer this type of repellent should thoroughly test brands with which they have not had previous experience.

The application of the brand to be tested to the young foliage of coffee will give indications as to whether it contains substances which are immediately and demonstrably toxic, but this can only be regarded as a guide to prevent the application of a grease which will be immediately harmful.

With regard to work on the quality of Kresotow, every effort has been made to ensure uniformly reliable consignments and a revised formula for its manufacture has now been drawn up by the Senior Agricultural Chemist after personal consultation with the manufacturer's chemists in England.

The writer has carried out what proved to be very satisfactory field trials with the two best samples supplied by the Solignum Company and a consistently high quality product now seems to be assured.

It is relevant to point out here that the tar product known as "ant exterminator" failed both as a repellent applied in the same manner as Kresotow and as an effective destroyer of ants' nests (*Ph. punctulata*) when poured into them.

Trials of mixtures of castor oil and Kresotow have been conducted and a mixture of these two repellents in equal proportions gave excellent results and can be thoroughly recommended.

Thallium salts proved an effective poison against *Ph. punctulata*, but they are too expensive and dangerous for field use.

Wollman's salts, an organo-arsenical preparation, was also tried extensively against *Ph. punctulata*, both in the form of a powder which was incorporated in the soil around ant-infested trees and by spraying it on the soil in aqueous solution, but no marked success was obtained.

A powdered extract of Kresotow called Carbazol also gave negative results against *Ph. punctulata*.

Poison baits containing chemicals with what was hoped would prove to be odours of an alluring nature, proved to be useless.

Termites, or white ants, seem to become increasingly troublesome on banded areas and their control has become necessary on some plantations. In the case of species which are not controllable by the excavation of the nests and the removal of the queens, the fumes of burning sulphur and arsenic should be pumped into the nests and after the poisonous fumes have dispersed the nests should be opened up and the queens removed. Species which build small nests near the surface of the soil in pieces of decaying wood or in the bases of small woody plants should be destroyed by working paradichlorobenzine into the surface layer of the soil over areas where the nests are numerous.

COFFEE MEALY BUG AT NYERI.

The epidemic species of coffee mealy bug (*P. lilacinus*, Ckll.) was identified at Nyeri from specimens sent in last October by Mr. T. L. McClelland of the Coffee Section of the Department. Hitherto this species had only been recorded from the Nairobi-Fort Hall area.

Fortunately the worst species of mealy bug ant (*Pheidole punctulata*, Mayr.) has not yet been detected in the area, but a sub-species of *Acathelepis capensis*, Mayr. (a small black ant) is sufficiently active to necessitate banding in several cases.

Several important species of mealy bug predators which greatly assist in making banding a successful operation in the Nairobi-Fort Hall area occur also at Nyeri and there seems no reason to doubt that banding will be equally efficacious there. The species of predators observed were:—

Hyperaspis senegalensis, Muls.

Scymnus guttigera, Sic.

Leucopis africana, Mall.

CAPSID BUG (*Lygus simonyi*).

Whilst Capsid bug undoubtedly occurs in the lower areas (circa 5,000 ft.) of the Nairobi-Fort Hall district, it was hoped that the warmer and drier conditions which normally prevail in them would prove to be an important check. To a considerable extent these hopes have been realized and the bulk of Capsid infestation during the year occurred in the higher areas.

A very high percentage of planters in the lower areas have to band annually for mealy bug and they were naturally anxious as to whether Capsid bug was likely to prove a serious menace, not only on account of the actual cost incurred in controlling it but also because there is just a possibility that the necessary sprayings might destroy mealy bug predators to an important extent.

Only one case has been reported where the control measures for mealy bug and Capsid appeared to have clashed in some degree and it now seems probable that they will not do so to an important extent although possibly another season's experience is necessary for complete assurance on this point.

The only harm extensive spraying of coffee trees with pyrethrum extract may have done is to increase to a quite noticeable degree the incidence of species of leaf-miner, presumably by the destruction of their parasites, but even in this case proof that spraying is the only potent factor at work is not conclusive.

The wide distribution of *Lygus simonyi*, Reut. in East Africa suggests that the species is indigenous and it seems likely that wild host plants remain to be discovered. Moreover its somewhat sporadic distribution among the coffee districts of Kenya may be explained by the absence of wild food plants in those districts where it does not occur on coffee.

Whilst on a visit to Kampala the writer was informed by Mr. H. Hargreaves, the Entomologist of the Department of Agriculture, Uganda, that he had observed *Lygus simonyi*, Reut. feeding on a species of *Canthium*, sp. nr. *nitens*. Since the genus *Canthium* belongs to the same natural order as coffee, namely Rubiaceæ, it is just possible that its food plants are confined to this order.

Species of *Canthium* are numerous in the flora of Kenya and a systematic search is being conducted, since the possibility of facilitating its control by the destruction of possible wild hosts in the vicinity of plantations is feasible.

A dust called Derrisol, containing the insecticidal principle of *Derris* spp., was tested against *Lygus* and *Antestia*, without success. This result was expected in the case of *Antestia*, since extracts of *Derris elliptica* have been tried at Amani in the form of a spray against this pest and proved ineffective even when applied in very high concentration.

THE FRINGED SCALE OF COFFEE (*Asterolecanium*).

The writer has made a study of the bionomics of this pest. Only one species of internal parasite, named *Metaphycus lounsburyi*, How., has been detected and its incidence is often greatly reduced by an active hyper-parasite, *Perissopterus buschii*, How., so that it is seldom able to effect complete biological control. Nevertheless, the control value of internal parasitism is much more important than that of predators.

Hence it is frequently necessary to resort to spraying for the control of this pest and Orthol K is recommended at a strength not greater than 1 in 25 and not less than 1 in 33. Two applications usually suffice and the interval between them should be not less than a fortnight and not more than six weeks.

The second application of the spray is always necessary to destroy the progeny of the eggs which are protected by the horny resistant test and the cuticle of the mother scale.

Spraying should be performed towards the end of the rainy season. The reason for this is that great reproductive activity is occurring at this time among the scales on the older bark and an abnormally large number of individuals are in the vulnerable mobile stage.

However, the facts that the cumulative controlling effect of parasites and predators is not so important as it was once hoped it might prove to be, and that Orthol K is more effective than the sprays which were formerly used, enable greater freedom to be exercised than formerly in the selection of the time of spraying.

Nevertheless, in choosing a time for this operation, it is well to bear in mind the fact that the incidence of parasitism is always highest towards the end of the dry season and that the pest is in its most vulnerable stage about the end of the rainy season.

DR. LE PELLEYS REPORT

The three most serious insect pests in Kiambu during the period January-June were *Antestia*, *Lygus* and mealy bug.

Lygus simonyi, Reut. was generally spread throughout the district and did some damage on all farms. Favourable flowering conditions throughout the year enabled good crops to be obtained in most cases, despite the presence of *Lygus*, but on plantations where thorough pyrethrum spraying was undertaken crops were considerably increased, and in cases crops of well over one ton an acre were obtained on large areas. Unsprayed blocks showed that such crops could not have been obtained with *Lygus* present in numbers and uncontrolled.

Antestia lineaticollis, Stal. did severe damage and caused very serious loss in the district during the year. Hand-picking, poison-baiting, and pyrethrum spraying were the control methods employed, and none of these, as applied, was completely adequate.

Mealy bug (*Pseudococcus lilacinus*, Ckll.) was serious on some estates in the district, including some estates in Upper Kiambu, over 6,000 ft., where attacks attended by *Pheidole punctulata* were sufficiently severe to necessitate banding of the trees, which has usually been unnecessary in the district hitherto. Careful banding has in general been adequate to prevent the most severe loss.

Leaf-miner moth (*Leucoptera coffecella*, Staint.) was present in severe infestations on a number of plantations. Its importance has increased greatly during the past two years, and it can no longer be considered a negligible factor in coffee growing. There is considerable observational evidence that the application of poison-bait against *Antestia*, by poisoning the parasites of the moth, is a factor which assists the induction of an outbreak. Where other conditions are favourable to the increase of the moth, the destruction of its parasites may well be, and indeed has actually appeared in a number of cases to be, the cause of its serious increase. No really efficacious control measures against this insect exists, and little can be done at present to reduce infestations when once they have begun.

The experimental work during the year was chiefly in conclusion of the detailed preliminary study of the pyrethrum-kerosene extract spraying method. The conclusion of a field experiment showed that the proportion of crop on the sprayed block to that on the unsprayed was as 3 is to 2, or 26 cwt. and 17 cwt. per acre respectively. The numbers of *Lygus* on

the unsprayed block at no time during the experiment rose above 30 to a tree. Had they done so the yield of the unsprayed block would necessarily have been lower. A detailed paper on this spraying method was prepared early in the year, which will be published in the Bulletin of Entomological Research sometime in 1933.

Research into the bionomics of and poison-bait control for *Antestia* was begun during the first months of the year, and some preliminary results of interest were obtained, from which it was clear that further research into the control method is necessary in this country.

I left Nairobi to proceed on leave on 14th June and had not returned at the end of the year.

RICHARD H. LE PELLEY.

MR. NOTLEY'S REPORT

I remained at the Sotik Station until December, when I was transferred to the Scott Agricultural Laboratories, Nairobi.

Work continued on the bionomics and parasites of *Metadrepana andersoni*, Tams. An interesting point emerged in that the larvæ passed through either five or six instars: this is not a sex difference, but depends possibly on temperature. A brood of ten, hatched from eggs laid by the same female at the same time, gave the following figures for the length of each stage:—

	Egg	1st instar	2nd instar	3rd instar	4th instar	5th instar	6th instar	Pupa	Total
Time in days	9.0 9.0	5.0 5.5	4.9 5.0	4.7 4.0	6.1 4.5	10.0 5.0	.. 8.0	13.3 12.5	53.0 53.5

Eight larvæ passed through five larval stages, and two passed through six stages; the total number of days from the time the egg was laid until the time the adults emerged being practically the same in each case. Both the larvæ which passed through six stages produced female moths, but the other eight produced four males and four females.

For comparison some unpublished figures obtained by Mr. Anderson, working in Nairobi, are given.

	Egg	1st instar	2nd instar	3rd instar	4th instar	5th instar	6th instar	Pupa	Total
Time in days	8.20	4.00	4.86	4.86	4.71	5.28	5.00	13.80	50.71

It seems likely, though it has not been proved, that a higher average temperature induces the larva to go through six larval instars instead of five. The shortest recorded time from egg-laying until the emergence of the adult was 39 days. The average differs with the sexes, being 50.25 days for males and 52.75 days for females. The largest number of eggs recorded as laid by a single female was 568 during twelve days.

Metadrepana andersoni has been reported as feeding on *Sesbania*, spp., *Calpurnia aurca*, *Grevillea robusta* and maize, but caterpillars which were given leaves of these plants only all died without attempting to feed on them. It is probable that if the caterpillars seen on these plants were actually *M. andersoni*, they had merely strayed there.

Sixteen parasites and two predators were obtained from the caterpillars and pupæ of *Metadrepana*, and have been sent to the British Museum for identification, but the determinations are not yet to hand.

Considerable work has been done on the control of *Antestia*. This work proceeded along three lines of investigation :—

- A.—An investigation into the tropisms of *Antestia*, particularly as they could be influenced by external factors.
- B.—Collection and breeding of egg parasites of *Antestia*.
- C.—Investigation of sprays and baits to control *Antestia*.

This work was particularly necessary owing to the prevalence of *Antestia* in the Sotik area, and the failure of the recognized control method, arsenite-molasses baiting, to cope with outbreaks.

The investigation of the tropisms of *Antestia* failed to produce any results which might help in control, whilst after a consideration of the bionomics of *Antestia* it was realized that any control measure, to be really effective, must be directed against the nymphal and adult forms of the insect. *Antestia* eggs could be parasitised to an extent of well over 95 per cent, and often are so in the field, without producing any diminution of their numbers. Egg parasites are of enormous importance in checking great increases in numbers of *Antestia* in the field, but are not likely to be effective in reducing an outbreak once it has occurred.

Investigations into sprays and baits to control *Antestia* led to the production of a paraffin-pyrethrum-soap emulsion spray which proved effective, and had various advantages over

the paraffin-pyrethrum extract spray in a district where water was readily available. A paper has been prepared upon this spray which it is hoped will be published shortly. The spray has been shown to be effective against the species of Capsid present in the Sotik-Kericho area also.

A whale-oil soap preparation which has been recommended in the past, but has not found favour with the planter, was shown to be ineffective against *Antestia*.

Capsids have caused considerable damage to coffee blossom buds in the Sotik-Kericho area. *Lygus simonyi*, Reut. has still not been recorded from the area, though present in the Koru area. Several other species of Capsidæ have been shown to do similar damage, and a total of twelve species have been taken on coffee in the district, and sent to the British Museum for identification. The distribution of some of these species has been in part worked out. In two of the most prevalent species apparently the factor determining which shall be present in numbers is shade or absence of shade, whilst a third species, which causes considerable damage, is only present in the Janji area and the most northern farms at Sotik, and may possibly be spreading. As a whole Capsids seemed to be present in much greater numbers this year than last.

An *Aleyrocanthus* species (undetermined) was discovered on coffee. It occurs on the underside of leaves and occasionally on green cherries. The appearance is that of a minute, highly ornamented jet black scale. It causes a slight swelling on the underside of the leaf, and when present in numbers may give the upper surface a blotchy appearance. When it is present on the cherry it inhibits the formation of the red colour on ripening over a small area, causing a blotchy appearance of the cherry which has been called "measles." It is widely distributed in the Kericho-Sotik area and may be present over a much greater area. It does not, however, affect the cherry, and even heavily infected leaves do not fall from the tree, so that it is not considered a pest.

The coffee leaf skeletonising moth mentioned in the Annual Report for 1931 was identified by the British Museum as *Epiplema dohertyi* Warr. (Fam. Uraniidæ). This also is a very minor pest on coffee.

Since the change of station to the Scott Agricultural Laboratories, work has commenced on the cytological effect of pyrethrum on the insect, and also on the biological method of comparing the strengths of various pyrethrum extracts. This work is still in progress.

F. B. NOTLEY.

CHEMICAL SECTION

REPORT OF THE SENIOR AGRICULTURAL CHEMIST

STAFF.

The Senior Agricultural Chemist returned from leave on 1st April. Mr. McNaughtan, Laboratory Assistant, was absent on leave from 5th February to 29th August. Mr. J. W. Phillips, Junior Laboratory Assistant, proceeded on leave prior to termination of appointment on 23th December. The vacant post of Agricultural Chemist was held in abeyance. Although for the greater part of the year the section was short-staffed, there was no decrease in the volume of work.

SUMMARY OF WORK DONE.

Inward letters	...	...	...	777
Outward letters	...	...	...	857
Reports on samples, etc.	...	...	...	579
Personal interviews, about	...	...	...	600
Total samples examined	...	...	...	1,376
Revenue from analytical work	Sh.	2,780/50		
Travelling, about	...	...	...	4,000 miles

The correspondence dealt with has remained about the same as last year. There has been a decrease in the number of reports issued due to the fact that in many cases it has been found preferable to combine the report with advice in the form of a letter. The number of visitors has averaged about two a day; although personal interviews do take up a good deal of time subjects can be more fully discussed than by letter, and such visits are in the long run a saving.

ANALYTICAL WORK DONE.

CLASSIFICATION OF SAMPLES RECEIVED AND EXAMINED

	Out-standing 31-12-31	Received	Examined	Refused	Out-standing 31-12-32
Dips .. ..	..	503	490	13	..
Soils	165	314	393	1	80
Manures	2	96	93	..	..
Feeding Stuffs ..	3	10	12	1	..
Coffee .. ..	..	53	26	..	27
Toxicological ..	..	111	97	14	..
Kresotow .. ..	..	9	9	..	..
Wireworm Remedy ..	..	22	22	..	..
Essential Oils ..	..	69	64	..	5
Tannins .. ..	..	2	2	..	..
Miscellaneous ..	31	137	158	..	10
	201	1,331	1,376	34	122

The Chemical Section is not a revenue-producing Section, although facilities are provided to the public to have certain analyses performed. The fees for such work for private individuals during the year totalled about Sh. 2,800. The major part of the work of the Section is investigational, concerned with the development of the agricultural industries of the Colony and as such does not produce direct revenue.

The Chemical Section although officially in the Division of Plant Industry does a great deal of work on behalf of the Division of Animal Industry. For this reason the report is divided into two parts dealing with two phases of the chemical work.

DIVISION OF ANIMAL INDUSTRY.
RESULTS OF ANALYSES OF DIP WASHES

EXTENT OF ERROR	1929		1930		1931		1932	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Within 1 per cent ..	39	6.5	32	5.5	49	8.9	29	6.0
Between 1 per cent and 5 per cent	98	16.3	67	11.6	91	16.8	100	20.6
Between 5 per cent and 10 per cent	107	17.8	107	18.5	102	18.9	102	21.0
Between 10 per cent and 20 per cent	168	23.0	142	24.5	136	25.2	111	22.8
Over 20 per cent	187	31.4	231	39.9	163	30.2	144	29.6
	599	..	579	..	540	..	436	..

The number of dip samples examined has decreased again. The percentage of those inexcusably or dangerously incorrect has also decreased. These decreases are certainly due to an increased use of dip testers by owners. If the amount of iodine solution supplied for use in dip testers is any criterion of the use of dip testers, we may conclude their employment has increased tenfold during the last four years.

There is one point worthy of attention in this connexion. There are three varieties of dip testers in use in the Colony, each requiring an iodine solution of special strength. Unless, when a fresh supply of iodine solution is ordered, details of the nature of the tester are given the wrong solution may be supplied.

Toxicological.

There has been a considerable increase in the number of toxicological samples received. Many of these are directly ascribable to the locust campaign, but too many are due to

carelessness. One series of samples, all positive, pointed to very strong local poisoning of soil. Eventually it was discovered that the owner of the stock had thrown away some 20 lb. or 30 lb. of sodium arsenite where stock could get it. In Kenya we have become so familiar with arsenic, that its intensely poisonous properties are overlooked. The writer is convinced that all arsenicals in Kenya should be unmistakably coloured and also mixed with some strongly odoriferous material.

Among the toxicological samples were the carcasses of two starlings suspected of being poisoned by eating locust hoppers that had been killed by sodium arsenite bait. Both carcasses contained arsenic; the fact that the crops of both birds were empty pointed to acute arsenical poisoning. The birds probably ate poison bait. Observations in all parts of the world have shown that poisoned hoppers have little or no effect upon birds, practically all cases of death have been due to the birds eating poison bait and not poisoned locusts.

Feeding Stuffs.

Practically no analyses of pasture have been made this year, nearly all the analyses have been of concentrates. A sample of locally-produced linseed cake was analysed and found to compare most favourably with British linseed cake. A new supply of protein concentrate is available in locally-produced meat meal and bone and meat meal. These are manufactured under conditions that give sterile products, admirably suited to feeding purposes.

Wireworm Remedy.

Twenty-two lots of wireworm remedy produced at the Veterinary Research Laboratories were analysed as a regulatory service.

DIVISION OF PLANT INDUSTRY.

Soils and Manures.

The writer attended a conference of East African soil chemists at Amani in May. The proceedings of the conference have been reported elsewhere. Arising out of the conference was the preparation of a soil map of Eastern Africa. This has been started and already a good deal of the Highlands has been mapped according to the dominant soil suites. The scale of the map is 1:2,000,000, which is very suitable for the delineation of dominants, but does not permit of any detailed mapping. Data are being accumulated, but it is not yet possible to produce any detailed map of the Colony. Soil survey *quâ* soil survey must be a secondary consideration, the time is not yet ripe for such work in Kenya.

The work on nitrification mentioned on p. 148 of the Annual Report for 1931 has been extended. Mr. McNaughtan, while on home leave, spent several months at the Rothamsted Experimental Station, where he studied methods for the determination of ammonia and nitrates in soil. The experience he has thus gained will be utilized in prosecuting the research into the movement of nitrates in the soil and studies of nitrification.

The remainder of the report under soils and manures is contributed by Mr. G. H. Gethin Jones, the Soil Chemist.

During the first quarter of the year, owing to the absence of the Senior Agricultural Chemist on leave, the Soil Chemist devoted much of his time to the general work of the Chemical Division. Subsequently the number of soil samples outstanding from the previous year was reduced from 165 to 80, while during the year a further 307 soil samples, making a total of 398 for the year, were dealt with. An analysis of this figure shows the following classification of laboratory work involving soil analysis; 45 samples were analysed for private individuals; 40 samples were analysed in connexion with investigations into coffee berry disease; 42 samples dealt with liming and green manure experiments, and 102 dealt with laboratory work on a series of profile samples representing the water and nitrogen status of coffee soils under different surface coverings. Most of the remaining soil samples dealt with investigational work on the nutrient content of soils from different areas and more representative soil samples collected for soil survey purposes. In all cases these latter samples have been collected during "advisory" tours; the soil survey samples have not yet been analysed.

Work done for individuals which is chargeable usually involves the determination of reaction value, total nitrogen, and available phosphates and potash: such reports are accompanied by considered advice for the treatment of the land.

The major portion of the work done is investigational in character, dealing with the immediate problems of the conservation of fertility and crop production. This work may suitably be reported upon under the following separate paragraphs.

Further work has been done on soils with relation to the incidence of coffee berry disease. Periodical analyses of profile samples for the liming and manurial plots showed that hardly any phosphate had been leached below a depth of some nine

inches within two and a half years of heavy phosphate applications. Again, in the limed plots the p.H value of different top-soils had been adjusted from 5.2 to 5.8 in one case, and from 6 to 6.5 in another, with further slight adjustments in the immediate subsoil. However, it was not possible to correlate the incidence of this disease with the varied soil conditions in these plots: the latter are being continued.

The phosphate status of the Kikuyu red loams, with special reference as to what constitutes available phosphate to the plant, presents interesting problems. By the conventional methods of soil analysis, these soils show abnormally low values for "available" phosphoric oxide. A record of over a hundred such analyses shows that in the great majority of cases this value varies between .0010 per cent and .0020 per cent, which is only about a tenth of that in other soils of average fertility. However, these lateritic soils are able to produce similar average crops which remove from the soil in one season about the whole of the "available" phosphates as indicated by soil analyses. Some preliminary work on such soils shows that the initial small amount of available phosphates removed by extraction with 0.5 N. nitric acid is rapidly replaced by about a similar amount which passes from the unavailable into the available form. It appears that these soils are able to liberate fresh supplies of available phosphates from the soil reserves at a sufficient speed for the successful continued growth of the crop which it is carrying. This work, with special reference as to what happens to added phosphates, will be continued.

Work on the natural water content of a typical coffee soil under various surface coverings has been carried out on profile samples taken at monthly intervals. At the close of the long rains the top-soil in areas of soil mulch had 22 per cent moisture as compared to about 26 per cent in areas under various leguminous cover crops and green manures. Later, during dry weather the top-soil of clean areas and where niger oil (green manure) had been turned in, rapidly lost moisture to about 15 per cent and then remained at about this level, whereas the subsoil moisture only fell from about 19 per cent to 17 per cent, thus leaving the subsoil moister than the top-soil. In areas carrying vigorous growing cover crops of black Mauritius bean and *Glycine javanica* the top-soil moisture dropped from 26 per cent to 20 per cent and the subsoil dried to about 18 per cent; thus the top-soil continued to have more water than the subsoil. During the continued growth of these crops in fairly dry weather the top-soil moisture fell to 17 per cent and

thus remained appreciably more moist than the corresponding fallow soil. It appears that under the prevailing conditions at the Scott Laboratories a bare soil surface holds less water than a soil under a cover crop at the end of the rains and then dries up rapidly, whereas the cover crop conserves more moisture in the top-soil and retains more water for at least six months. The most outstanding results of these trials is the marked efficiency of a grass mulch in conserving both top-soil and subsoil moisture: where the conservation of soil moisture is considered necessary in areas where it will not be interfered with by white ants, a grass mulch has been proved to be most efficient for this purpose. In this case, the trees appeared to be much more vigorous in the grass mulch areas than elsewhere. This work is being continued so as to cover a sequence of varied climatic conditions.

The soil samples collected for moisture determination were also used for the estimation of total nitrogen throughout the soil profile in those areas carrying different surface coverings. It is as yet too early to expect any significant fluctuations in the soil nitrogen content, but the initial figures obtained give a good picture of the distribution of the soil nitrogen. A total of some thirty-six analyses showed that there is a marked uniformity in the nitrogen content of this soil at the same depths wherever samples were taken. Soil samples representing the soil zones 0"-9", 9"-18", 18"-36" and 36"-54" were found to have an average total nitrogen content of the order of .20 per cent, .15 per cent, .10 per cent and .08 per cent with very close agreement wherever the profile samples were taken. This shows only a gradual falling off in total nitrogen with depth; the humified organic matter in these well-aerated sub-soils must liberate appreciable amounts of available nitrogen to the feeding roots of plants, which are fairly plentiful within this range of depth. These deep lateritic soils exhibit many very valuable soil characteristics.

Investigational work has been initiated in conjunction with the Plant Breeding Station on long range soil research work to seek experimental evidence on such matters as the application of lime required to adjust the p.H. value of different soils by any given amount, and the extent of the natural losses of lime when the humus content and p.H. value of the soil are maintained at different levels. It is also hoped to arrive at an approximation of the most economic p.H. level and humus level for different soils: that is, a measure of the soil reaction and the intensity of green manuring to be aimed at in the arable farming areas.

Some empirical work is being continued on pot cultures with coffee with a view to correlating mineral deficiencies with certain characteristic tree and leaf symptoms. A single tree grown in an average coffee soil is making much more vigorous growth than any others, even better than in the "complete" sand culture. Monthly measurements are taken of the growth throughout the year. Systematic root excavation work on a three-year old tree showed the roots to penetrate to a depth of over eight feet in a well-aerated subsoil. The upper fibrous root system, which tended to be confined to the darker topsoil, showed a dense mat of fibrous roots radiating out to about six feet from the tree, thus distributing themselves over the whole surface of the land. This confirms the need for the uniform broadcasting rather than the strip or circle application of fertilizers in mature coffee.

In conjunction with the officer in charge of grassland improvement, grassland manurial experiments have been laid out at three Government veterinary centres where different soil and climatic conditions obtain.

Soil Work and Soil Survey.

Towards the end of the year, in company with the Agricultural Officer for Nyanza, a four-weeks' tour was made throughout the Kavirondo Reserve. This reserve, which covers over five million acres was found to have very varied soil types and climatic conditions under which a wide range of tropical crops could be grown. There are extensive areas of well-drained, deep lateritic loams, black cotton soils, light granitic soils, deep lacustrine and alluvial soils and swamp soils. The immediate problem in this reserve is the checking of soil deterioration. There are large areas of truncated soils where the old surface soil has been washed away leaving the land almost bare or supporting a very thin bush. In the low-lying areas of unconsolidated light alluvial soils alongside the lake, the problem is that of sheet wash and gully erosion due to the sudden onrush of water from the almost bare granitic hills which at one time formed the old lake cliffs. The scarcity of an indigenous flora to occupy the fallow land after the crop has been harvested results in much water and wind re-assortment of the surface soil, with the result that the remaining soil becomes more sandy and in turn can only support a very poor soil covering. This progress of soil deterioration towards a more desert type is accelerated as long as the surface soil remains unprotected. Among the immediate and long range methods of control great importance must be placed on

getting the natives to adopt better methods of soil culture. Special attention has been paid to the agricultural possibilities of the Kano Plains, which consist of an inland delta of some 200,000 acres of very rich soil where development is handicapped by the periodical flooding of the land. The immediate needs are the canalization of some of the rivers and the education of the native into better cultivation methods. In the distant future, with a greater concentration of peasant cultivation, this large area of high inherent fertility may well become one of the most productive areas in the Colony.

Three tours have been carried out in the settled areas. Two weeks were spent in going over some 10,000 acres of the typical maize lands of the Trans Nzoia, special attention being given to the humus, lime and phosphate status of the soil. The typical red, sandy loams have a p.H. value of 5.8 to 6.2 in the top-soil which usually becomes very slightly more acid with depth. Generally speaking, the Trans Nzoia light reddish soils are in need of comparatively small dressings of lime and phosphates for the successful growth of maize and the associated leguminous green manure crops; the latter being essential for the maintenance of the humus and nitrogen status in these light soils. A brief tour in the high rainfall coffee districts of Koru, Songhor and Nandi showed the great need of maintaining the organic matter content of the top-soil as an insurance against the lack of available nitrates during the prolonged rains. In the fairly dry and warm areas of light soils of Makuyu and Ithanga it was found that the soil-water conditions were less unfavourable than what one would expect; the deep soil forms a very good reservoir and is more effective in retaining moisture than one would expect. Boma-manuring and leguminous green-manuring showed very marked beneficial results.

Further work of the classification of the soils of the Colony has continued during advisory tours, special attention being paid to the climatic factor in soil formation.

During the year under review work has been done on the lime resources of the Colony, and on numerous samples of local guanos and abattoir by-products. The analyses carried out include some 45 limestones, 12 guanos and 6 abattoir by-products.

The distribution of the limestone deposits, bearing in mind the quality and quantity of material and the nearness to a railway station shows that suitable and almost unlimited supplies of limestone occur in three localities within the Colony.

which are fairly central for the railway dispersion of the ground material to the adjoining districts. There remains the Trans Nzoia district with its 200,000 acres under cultivation, for which it appears that there is no near source of good limestone within the Colony. However, an almost unlimited supply of good limestone occurs at Tororo Hill just over the boundary in Uganda, and unless local supplies can be found later it would appear that economical supplies can only be obtained from this source. With the present railway facilities the most handicapped areas are the Trans Nzoia, Nandi, Sotik and Laikipia in that a large amount of road transport would be necessary. The survey of lime resources revealed the important information that the Colony has vast and widespread reserves of low-grade phosphatic limestones; the calcium carbonate content varies from 15 per cent to 85 per cent and the phosphoric oxide content from 1 per cent to 4 per cent. It remains for the industrial chemist of the future to find means of economically concentrating this phosphorus from its present dispersed form. In the meantime, a certain amount of mineral phosphate is added to the soil whenever lime from this source is put on the land.

Increasing interest has been shown in the development of local supplies of guanos. Eight analyses of coastal bird guanos showed this material to range in composition from a concentrated nitrogenous and phosphatic guano (11 per cent nitrogen, 13 per cent phosphoric oxide) and others with over 20 per cent phosphoric oxide down to very inferior sandy material with less than 5 per cent of phosphoric oxide only. These initial strippings are bound to be very varied due to the different amount of leaching which the deposits have undergone, but it is likely that the proper control of these guano-bearing islands in areas of very low rainfall should provide limited annual supplies of a very suitable nitrogenous and phosphatic organic manure. Other sources of local manures are the accumulated deposits of bat guano that occur in many parts of the Colony. The average analysis of such material shows it to contain 4 to 5 per cent nitrogen and 5 to 8 per cent phosphoric oxide. This material occurs as a fairly dry powder, not unlike well-rotted bonna-manure, but as it is about 15-20 times as rich, limited amounts of not more than one ton to the acre need be applied. As much of the nitrogen occurs in the form of chitin, it would be but slowly rendered available in the soil.

More recently, the Nairobi Municipality have established a plant for the preparation of organic manures from the waste

products of the abattoir. They are successfully turning out limited quantities of bone and meat meal containing about 7 per cent nitrogen and 13 per cent phosphoric oxide, and blood meal containing about 12 per cent of nitrogen. Although the present output of these valuable organic manures is small, it is the beginning of the utilization of waste products. The methods employed may be well extended to reduce the overstocking of certain native reserves.

Coffec.

Although the number of coffee samples received is small, this must not be taken as a measure of the time devoted to coffee. These samples are of coffee, leaves, beans, etc., taken in the course of special investigations. Very many of the samples of soil, manure, etc., refer particularly to the coffee industry.

The effect of Bordeaux spraying in mitigating or preventing leaf-fall in coffee has raised the question of the reason for the effect and an investigation into the distribution of copper in the coffee bush has been commenced. The work on this has been considerably delayed by the need to ascertain the most suitable method of estimating the minute quantities of copper present in leaves or coffee beans or in the rain water from sprayed trees. After some weeks' work a suitable technique has been evolved and work is proceeding.

The methods used during 1932 for introducing copper into the tree were found unsatisfactory for a number of reasons and other methods have had to be worked out. It is hoped during the coming year to complete the investigation and to reach, from the chemical side, some conclusion regarding the reasons for the effect.

On his way back from Amani, the writer spent a day and a half at Moshii, where the opportunity was taken to discuss the nutrition of coffee with Mr. Wakefield and Mr. Saunders, of the Tanganyika Department of Agriculture. Their ideas regarding the root functions and the root systems of both coffee and cover crops were distinctly novel. Applying their ideas to Kenya conditions, particularly to the Kikuyu lateritic red loams, has opened a field of most profitable work. Although the hypotheses of Messrs. Wakefield and Saunders may be proved, as far as Kenya be concerned, to be unsubstantiated, they will have been of immense value to us in that they have opened new lines of thought; they have already led to a number of new items of research.

A fresh set of experiments in the investigation of a special type of chlorosis has been laid down at Kyambu. The preliminary experiments have indicated that iron salts may ameliorate the condition. Although it may be possible to ameliorate the condition the real reason still remains to be found. An identical chlorosis is often seen on the young shoots from a stumped tree. Probably this type of chlorosis is a symptom of more than one physiological disturbance.

The Kresotow (for coffee mealy bug) position is much improved. As a result of a number of interviews with both the manufacturers and the suppliers of Kresotow a position has been reached which will ensure a uniform product. The difficulty in the past has been that the quantity required has not been sufficient to warrant the erection of special stills for the production of the oil. As a result of these interviews an arrangement has been made that although the present types of still are employed a narrower fraction is taken. Also, in order to secure oils free from crystals, Kresotow will only be made during the winter months. An alternative supply has also been secured. Two samples from this have been critically tested and found to be absolutely satisfactory.

Essential Oils.

During the year one essential oil has changed from an occasional article of export to one of regular export. This is cedarwood oil. As a result of propaganda work on the London market, a demand for the oil has been created and towards the latter part of the year it was quoted in the London market reports under the designation of Empire cedarwood oil.

Cedarwood oil in Kenya varies considerably. Some samples will contain a large proportion of solid crystalline material, cedrol. Others will be free from any. Some oils are very dark brown in colour, others are pale yellow. This variation is disturbing to the overseas markets; therefore an investigation has been commenced upon the variations and the nature of the oil in order to ascertain if the variations are normal or accidental. Any statement made now would be premature.

At the beginning of the year the writer was able to secure in South Africa plants of a most promising strain of geranium. Another promising strain has been obtained from France through Kew. In addition six other strains have been obtained from various other sources. Five of the strains have been multiplied during the year so that at the next cutting it will be possible to distil enough oil for analysis. The three other strains have yet to be multiplied.

Peppermint has grown fairly well at the Scott Agricultural Laboratories, but has been attacked by root mealy bug and woolly aphis. No report has been received from anywhere else in the Colony of such infestations. No issues of peppermint from the Scott Agricultural Laboratory plots were therefore made after the infestation was found. Arrangements have been made whereby intending growers could obtain suitable planting material from certain growers at a nominal fee. Locusts, too, ate the stems, dropping the oil-containing leaves to the ground.

A sample of local peppermint oil was sent to the Imperial Institute for report. This was very favourable, the value of the oil being rather higher than the average American oil. Further samples have been distilled and the composition found to remain very constant.

In suitable districts cultivation has increased considerably so that, in the course of the coming year, production of peppermint oil on a fair scale may be expected. It will be essential during the next few years for successive samples from each area to be analysed, in order to ascertain if, as has been suggested, there is a falling-off in quality.

Japanese peppermint, a plant producing an oil different from ordinary peppermint, has been introduced from the Amami Agricultural Research Station. It has grown very well indeed at the Scott Agricultural Laboratories and appears to be a most promising crop for altitudes below that at which true peppermint flourishes. The oil is very rich in menthol, which crystallizes as soon as the oil cools.

A sample of lemon-grass oil was submitted to Messrs. Lever, Ltd., for report. The Kenya oil, when properly prepared, is pale yellow, with a cleaner odour than the Cochin oil. For these reasons Messrs. Lever, Ltd., would be prepared to purchase Kenya lemon-grass oil at a premium over Cochin oil. The determination of the annual yield of oil per acre was interfered with by locust attack, but now we have a well-established plot which will permit of an accurate record being kept. The growth on the plot has been very rapid, during the rains or while the soil is still moist, cuts may be made every five or six weeks. The yield of oil is very satisfactory. It most certainly would be worth while cultivating in the warmer parts of the Colony.

Preliminary work upon a number of essential oil plants has been done during the year. A number of exotics have been introduced and are now under trial.

Until recently all the essential oils produced in the laboratory have been distilled from a two-gallon still using a petrol can as the steam generator. While such an outfit does allow one to obtain oils, the quantity is small and the cost is high, also one does not learn anything of the difficulties of distillation on the large scale. There is now in use a miniature outfit consisting of a coal fired boiler, a still of 20-gallons capacity and a double cone condenser. Larger quantities of oil are obtained and some of the difficulties of large scale distillation have been learned.

General.

The Soil Chemist attended the Farmers' Days held at Nakuru, Eldoret and Kitale, at which he delivered lectures and staged exhibits.

The two senior members of the Section read papers at the Coffee Planters' Days and assisted at the demonstrations. These meetings, on account of the close interest shown, were thoroughly enjoyed besides being of great value.

During the year four bulletins and three articles were published.

The writer wishes to record his appreciation to the Imperial Institute for the great assistance given and the interest shown in the development of new crops in Kenya, especially essential oils.

Finally, the thanks of the writer are due to the staff of the Section who, though reduced in number, enabled the Section by their unremitting efforts to maintain the output of work.

V. A. BECKLEY.

BOTANICAL SECTION**REPORT OF THE SENIOR MYCOLOGIST****STAFF.**

The staff of the section consisted of the following: —

J. McDonald, Senior Mycologist.

C. A. Thorold, Mycologist.

D. C. Edwards, Agricultural Officer in charge of Grassland Improvement and Plant Introduction.

F. W. Evans, Junior Laboratory Assistant (returned from leave on 25th January).

Mr. Thorold was stationed at Njoro where his main work consisted of cereal disease investigation in co-operation with the staff of the Plant Breeding Section. The other members of the staff had their headquarters at the Scott Agricultural Laboratories, Nairobi.

PUBLICATIONS.

Eight bulletins, leaflets and articles (*see* general list).

CONFERENCES AND FARMERS' DAYS.

I attended the Coffee Planters' Days and the Coffee Conference on 29th and 30th June and 1st and 2nd July and read a paper on coffee diseases at the former.

Mr. Thorold staged mycological exhibits and was in attendance at the Farmers' Days at Nakuru, Kitale and Eldoret on 3rd, 12th and 13th February respectively and lectured on wheat and maize diseases at the last-named. He also prepared an exhibit and lectured on diseases of Coast crops at the Field Day held at Kibarani on 23rd July.

INVESTIGATIONAL WORK.

Coffee.—Coffee berry disease has again been the main consideration throughout the year. In spite, however, of considerable attempts made in various directions, it cannot be claimed that any substantial advance towards the control of the disease in the most seriously affected districts has been achieved.

Field experiments with a number of different sprays have given erratic results. In general, however, there has been some measure of control with copper sprays, although this has varied in degree from good to almost nil on different plots.

No benefit appeared to be derived from sulphur sprays which were tried. Results with a simsim oil-soft soap-emulsion were inconclusive on the official plots, largely owing to lack of crop by which to judge effects, an unpredictable consequence of certain treatments which these particular plots had received in the previous season. A planter who carried out sprayings with this emulsion in the latter half of the susceptible period considered, however, that some benefit had been derived from its use.

A considerable amount of work was carried out at the laboratories in attempts to arrive at some explanation of the lack of uniformity in the field spraying trials. In the course of experiments with films of three different copper fungicides on glass plates, it was found that spores of the coffee berry disease fungus applied in suspension in drops of water did not germinate in contact with the spray. In the case of simsim oil-soft soap-emulsion at the strength used in the field, little or no fungicidal effect was apparent when it was tested by the same method. It may perhaps be that any beneficial effect from the use of this emulsion observed under field conditions was due to a "waterproofing" effect, causing water containing coffee berry disease spores to run off the berries.

The above work was supplemented by a number of tests of the toxicity of rain water collected from sprayed berries. Observations made so far show great variations in toxicity between samples taken at different times and no clue to the cause of this variability has yet been discovered.

The third and final annual dressings of potash, phosphate and lime were applied to the previously treated plots in Kericho and Sotik in February. Up till July, no appreciable effect of these treatments, begun twenty-eight months previously, could be detected from a general inspection of the plots. It must be stated, however, that, for various reasons, no crop of a size which would facilitate observations has been borne on the plots since the experiment has been sufficiently advanced to permit the making of comparisons.

Work on methods of vegetative propagation has been in progress during the year.

Field observations during 1932 support the idea that severe attacks of berry disease in certain areas may be associated with overabundance of nitrogen or possibly of an unbalanced relationship between nitrogen and some other food material. It has been noted on numerous occasions that bushes with

exuberant growth of foliage are often the most severely attacked by berry disease. In one particular instance, where heaps of farmyard manure had been dumped along the edge of a coffee plantation and left unspread for some months, the nearest trees showed marked increase in attack by berry disease compared with those out of range of this effect.

Observations on the incidence of coffee berry disease have been made for the last two seasons on adjacent blocks of different varieties of coffee in a plantation in Sotik. The history of these two blocks, one of which consists of the Mocha variety and the other of Blue Mountain, has been the same since the planting of the seed so that accurate comparisons have been possible. These have shown a marked advantage, as far as resistance to berry disease is concerned, in favour of the Blue Mountain variety which has remained almost free from the disease while the neighbouring block has contained a quite noticeable degree of infection.

There can be little doubt that the soundest policy to adopt for the future prevention or control of berry disease lies in building up plantations of resistant bushes. This, indeed, may prove to be the only final solution of the problem in those areas where conditions strongly favour the parasite.

In July the opportunity afforded by the visit to this country of Mr. W. Nowell, Director of the East African Agricultural Research Station, was taken to obtain his advice on future policy in regard to investigations on coffee berry disease. For this purpose I accompanied Mr. Nowell on a brief tour in Sotik and Nandi Escarpment areas. As a result of his recommendations, Government has now leased part of a plantation in Sotik to be used entirely for work on coffee berry disease and two departmental officers have been seconded exclusively to duties connected with the experiments which are being started there. One of these officers has special experience in methods of vegetative propagation of coffee.

The connexion between the fungus *Nematospora coryli* Pegl., antestia infestation and the occurrence of coffee bean disease (not to be confused with coffee *berry* disease) was mentioned in last year's report. In June, 1932, a second species of *Nematospora*, namely *N. gossypii*, Ashby and Nowell, was isolated from diseased beans from antestia-infested bushes at the Scott Agricultural Laboratories, Nairobi. Some preliminary work was carried out in co-operation with Dr. Le Felley,

Entomologist, to discover whether these fungi could also be carried by the capsid bug, *Lygus simonyi* Reut. Results so far suggest that such transmission does not occur in Kenya.

Wheat.—Tests of samples of wheat stem rust obtained from various districts at different periods of the year revealed that all four physiologic forms of *Puccinia graminis tritici* already discovered in Kenya were present in one area or another. No new form was discovered in 1932. Studies carried out with Form K4 in an attempt to identify it with one or other of the hundred forms known in other parts of the world point to the likelihood that it is new to science.

A test carried out with a sample of stem rust received from Iringa, Tanganyika Territory, in September, showed that the form present was that already known in Kenya as K3. It is hoped to have the opportunity of examining further samples from that country in the future.

Investigation into the possible connexion between the rust on indigenous barberry (*Berberis Holstii* Engl.) and wheat stem rust has been continued as opportunity offered during the year. In a collection of rusted barberry leaves made in April, a teleutospore stage was found arising in some of the uredo pustules. The rust forms now recorded on this host in Kenya are two types of aecidia, pycnidia in association with one of these only, uredo and teleuto spore pustules. The Imperial Mycological Institute, reporting on the uredo stage, stated that it is probably new to science.

Further attempts to transfer infection from the barberry to wheat by means of aecidiospores from both types of aecidia failed, although a proportion of the spores was known to be in germinable condition.

The evidence obtained during 1932 strengthens the opinion that the two rusts are unconnected.

The following passages are extracted from Mr. Thorold's report on his investigations on wheat diseases in 1932 :—

" *Take-all* has now increased to an alarming extent and in severity in the Mau Summit-Molo area, whilst the disease is also known to be present in Londiani and Lumbwa districts. It is quite certain that this disease is a limiting factor in wheat production at the higher altitudes (from about 7,500 feet upwards) wherever the land has had continuous crops of wheat for several years. The causal fungus (*Ophiobolus graminis*) cannot remain

for long in the soil in absence of cereals or grasses as hosts, and it is imperative that a system of rotations or clean fallow be introduced into wheat farming in those districts in which the disease is present or liable to occur. . . . Further investigation on Take-all disease will aim at finding the length of rotation necessary to render infected land safe for the growing of wheat, and subsidiary to this, to discover what grass weeds are most likely to harbour the disease.

Black Chaff.—During the year, field and pot experiments have been carried out to investigate the way in which the disease is carried and whether there is infection from the soil or only from the seed. These experiments have not yet given conclusive results, and are being continued.

Stem Rust.—An attempt was again made to produce artificial rust infection in the field. The inoculation of the "surrounds" with Form K2 and K4 was carried out with the assistance of the staff of the Plant Breeding Station. Fairly good infection with Form K4 was obtained, but quite the reverse with K2, which would appear to support the view that particular seasons only are favourable for the spread of this form, as expressed recently by the Senior Plant Breeder (Department of Agriculture Annual Report, p. 190, 1931).

Yellow Rust.—A certain amount of experimental work has been done on artificial infection of wheat seedlings with yellow rust at Njoro. Successful inoculations have been obtained, but this would probably not be the case except during suitable times of the year.

A study has been made of temperature and humidity conditions in wheat plots, with a view to investigating the conditions favourable or otherwise, for yellow rust infection. I would like to take this opportunity of expressing gratitude to the Director, British East African Meteorological Services, for providing instruments and charts used in this work.

Continuous records of temperature and humidity were kept by placing recording instruments amongst the wheat in the cage at Njoro, and comparable records were also kept at Molo in a wheat plot and for these latter I am extremely grateful to Capt. C. T. Soames and Mr. A. J. Pell Smith for the work involved in obtaining these charts.

Root Diseases and Foot Rot.—A few cases of root disease in wheat and barley were examined, and the associated fungi isolated and kept for purposes of comparison with other isolations.

A soil inoculation experiment was carried out to compare the virulence of several *Fusarium* spp., and of *Helminthosporium sativum*, on the growth of wheat. This showed that under the conditions of the experiment, the *Helminthosporium* caused less harm to the wheat than the *Fusarium* spp. Further experiments will need to be carried out in order to prove definitely the relative virulence of these soil fungi."

Maize.—Towards the end of 1932, a farmer in the Hoey's Bridge area reported considerable damage to his maize, which he suspected to be due to a flowering-plant parasite. Specimens of the latter proved to be *Alectra communis* Hemsl., a plant closely related to *Striga*, the destructive parasite well known to maize growers in certain other districts. One species of the genus *Alectra* is also already known as a parasite in Kenya, *A. Vogeli* Benth. having been recorded as attacking leguminous crops in part of Embu district.

By washing out roots and examining them under the microscope, it was definitely established that those of the *Alectra* were connected by means of suckers to other roots. In spite of several hours spent in the intricate work of trying to trace the latter back to main roots of the maize plants under examination, this was never successfully accomplished. In all cases the roots to which the *Alectra* plants were attached proved to be fragments. There is, however, no reasonable doubt that these fragments were detached pieces of maize roots, possibly rendered unusually fragile by attack by the parasite. They were always intermingled with the maize roots and no other plants having roots of comparable size were present.

While poorness in the crop examined in the Hoey's Bridge area seemed very definitely associated with the presence of the *Alectra*, maize seen elsewhere when the same weed was present in quantity did not appear to be suffering at all. In such cases it was at least doubtful whether the root systems of many of the weed plants were in intimate contact with those of the maize or any other host plant.

Mr. Thorold reports as follows on his work on seedling blight of maize :—

“ *Seedling Blight*.—Much experimental work has been done in an investigation of the conditions under which fungi such as *Fusarium moniliforme* and *Gibberella saubinetii* are most harmful to maize in its early stages. The conditions which have been investigated include high and low temperatures and different types of soil (soil from Njoro and from the Trans Nzoia), and the effects of different degrees of humus content of the soil on seedling blight. Most of these experiments have so far been carried out only on a small scale and various practical difficulties have been encountered so that conclusive results have not yet been obtained. Whilst the above experiments have studied the conditions under which maize is most susceptible to attack, other work has been done on the equally important problem of resistance. In the study of factors conferring resistance an examination has been made of the anatomical features, such as condition of the cell walls, of seedlings grown under both high and low temperature conditions, and of seedlings grown from seed of different degrees of kernal “ starchiness ”.

One of the problems met with in inoculation experiments has been the difficulty of obtaining maize seedlings free from the ear-rotting fungi which occur inside the grain, and often from apparently disease-free cobs. Any simple means of ridding maize seed of such fungi is likely to be of greater practical value than merely meeting the requirements of mycological investigation. Treatment of the grain in hot water at approximately 65°C. for ten minutes, followed by surface sterilization, produces a high percentage of disease-free seeds without seriously affecting germination or seedling development, but it is not yet known whether the treatment is detrimental in the later stages of growth.”

Barley.—A test was carried out by Mr. Thorold at Njoro of the efficiency of Granosan and Du Bay Ceresan used as dust treatments of barley seed for the control of covered smut. Twelve rows (Nos. 1-12) were planted, using seed previously treated as follows :—

Rows Nos.—

- 1, 2, 7 and 8 : Treated with Du Bay Ceresan.
- 5, 6, 11 and 12 : Treated with Granosan.
- 3, 4, 9 and 10 : Controls, untreated.

The average number of ears harvested per row was approximately 2,700. Those from seed treated with Ceresan or Granosan were completely free from smut, while those from untreated seed contained 2.0, 3.2, 1.7 and 3.3 per cent respectively destroyed by smut.

Potatoes.—Interest in this crop has waned somewhat with the fall in export prices. Messrs. Hemphill and Barker, of Mau Summit, nevertheless, kindly consented to continue the multiplication under isolated conditions of the potato varieties of which virus-free "seed" had been obtained in the previous year. Field inspections during the growing season indicated that the plants had maintained their virus-free condition. It has not yet been possible, however, to make laboratory tests with tubers from the resulting crop to confirm this.

Groundnuts.—A destructive wilt disease of this crop at the Coast was briefly mentioned in last year's report.

Microscopic examination of affected plants showed the roots to be heavily invaded by one or more fungi and artificial cultures made from such roots produced a number of different fungi of which the most noticeable were certain species of *Fusarium*. Attempts to reproduce the disease artificially by inoculation with such fungi all failed.

Soil was obtained from affected patches at the Coast and was used to raise groundnut plants in pots at Nairobi. This procedure also failed to induce disease.

When seeds from diseased groundnut plants were planted in pots, four out of the six seedlings which were produced developed shrivelling and decay at ground level. From one such plant a *Fusarium* sp. was isolated and used later to inoculate the soil in one of two pots, each containing five groundnut plants. The soil in the two pots was from a diseased patch at Kwale but was sterilized before use. The plants at the time of inoculation were ten weeks old and the soil in each pot was gently disturbed without injuring the roots. One pot was then merely watered with sterile, distilled water, while a pure culture of the *Fusarium* was added to the water applied to the second pot. Between sixteen and thirty days afterwards all five plants in the latter collapsed in spectacular fashion while those in the former remained quite healthy. The *Fusarium* was afterwards reisolated from four out of the five diseased plants.

When the two plots were later replanted with three healthy seeds each, those in the uninoculated pot quickly produced vigorously growing plants. Only one seedling emerged in the second pot and its subsequent growth was very poor.

Attempts to repeat the successful soil inoculation experiment, using the re-isolated *Fusarium*, have since invariably failed. It would appear, therefore, that, assuming that the fungus used in the Nairobi experiments was one concerned in the Coastal wilt disease, special conditions of some sort not fully understood are a pre-requisite of infection.

Messrs. Miller and Harvey have recently described a wilt of groundnuts, due to *Fusarium martii* var. *phaseoli* in Georgia and, at my request, have been good enough to supply seed of a variety resistant to this wilt for trial in the affected coastal areas.

Other Diseases.—Other diseases which have occupied the attention of Mr. Thorold or myself have included the following: Bacterial blight of beans, which appears to be due to *Bacterium medicaginis* var. *phaseolicola*, not to *B. phaseoli*; suspected "leaf crinkle" of cotton; the locust disease (*Empusa grylli*), attempts to grow the causal organism of which were again unsuccessful; an internal disease of potato tubers which appears to be "Spraing"; linseed rust (*Melampsora lini*), a new record for Kenya. An attempt is being made to obtain linseed varieties, resistant not only to this disease but to wilt also, from America, for trial.

ADMINISTRATION.

Sugar Cane.—Considerable further issues of sugar cane varieties immune from or resistant to mosaic disease were issued to growers in Kisumu-Londiani district. These have been mainly P.O.J.2714, 2725, 2727 and 2878, the policy being to encourage the growing of such varieties as a safeguard against the possible recurrence of mosaic disease. The larger growers have made such rapid progress in the multiplication of these varieties that some hundreds of acres have now been planted from small quantities issued less than two years ago. The first cuttings of these varieties on a field scale are expected to be dealt with at the factories in 1933. These resistant varieties have had about a year's start over certain susceptible canes which have been introduced into Kisumu-Londiani district during 1932.

After nearly three years' freedom from mosaic disease, its reappearance was detected in October in a few small patches of cane in nurseries, all except one of which were owned by Indians. There seems little doubt that "Kampala" cane, reintroduced contrary to the advice of the Department from certain areas of the native reserves, is to blame. The source of these introductions has proved very difficult to trace but prompt action, backed by legal proceedings in two instances, has been taken to ensure eradication of all affected cane while further introduction of cane from native reserves into Kisumu-Londiani district has been forbidden.

Anti-Striga Campaign.—A campaign to enforce the eradication of striga weed in the affected areas of Kisumu-Londiani district was organized for the third successive year. It was found possible to reduce both the period of the campaign and the area requiring systematic inspection. The campaign therefore lasted from 1st May till 30th September only and the number of Honorary Striga Inspectors asked for and appointed was six, compared with eight in 1931. Each of these was permitted to employ one native scout to assist in the inspection of squatter shambas. A Plantation Inspector (Mr. Knight and Mr. Naismith Jones successively during the course of the season) was locally in charge.

The campaign in 1932 ran very smoothly. Although it was found necessary to issue ten official "cleaning-up" notices in cases of neglect, these were generally heeded and prosecution had to be resorted to in three instances only. In each of these a conviction was obtained and a fine was imposed.

At the close of the season's working, the opinions of the Plantation Inspector and six Honorary Inspectors on the value of the campaigns were sought. From the reports received from all these, it was evident that the efforts to enforce eradication of striga during the past three seasons have been most successful. The general opinion is that striga is now much less prevalent than formerly on non-native farms and that on most the cost of labour to keep it under control is now quite small. Fears held in 1929 that striga might ruin maize growing in the area between Kibigori and Koru have now been allayed, although it is appreciated that there must be no relaxation of the routine of striga destruction.

The thanks of the Department for their valuable services are due to those gentlemen who acted as Honorary Inspectors.

Herbarium.—A list of identifications of a second batch of plants collected by Mr. Thorold at the Coast in 1931, received from Kew, contained many names new to the herbarium.

Further collections, made by various officers of the Department during the year, have been forwarded to Kew for naming. These include noteworthy collections made by Messrs. Sunman and Graham during the periods when they were the Agricultural Officers at Embu.

NEW PLANT DISEASE RECORDS.

The following are new plant disease records for the year :—

Coffee.—Bean disease; *Nematospora gossypii* Ashby and Nowell. (Associated with infestation by the coffee bug, *Antestia lineaticollis* Stal.).

Maize.—From vascular bundles. *Cephalosporium acremonium* Fresen.

Wheat.—From root; *Chaetomium globosum* Kze.

Linseed.—Rust; *Melampsora lini* (Lk.) Desm.

Simsim (*Sesamun indicum*).—On leaf; *Cercospora sesami* Zimm.

Bulrush millet (*Pennisetum typhoideum* Rich.).—*Cerebella cenchroides* Subram.

Lemon grass (*Cymbopogon citratus* Stapf.).—Rust; *Puccinia cymbopogonis* Mass.

Digitaria sp. (indigenous grass).—Rust; *Uredo digitariaecola* Thuem.

Cyperus sp. (indigenous sedge).—Smut; *Cintractia axicola* (Berk.) Cornu. var. *minor* Clint.

Clematis sp. (indigenous).—Rust; *Accidium englerianum* P. Henn. and Lind.

ACKNOWLEDGMENTS.

In conclusion it remains to acknowledge the valuable assistance received from the Directors and Staffs of the Royal Botanic Gardens, Kew, Imperial Mycological Institute, Kew, and East African Agricultural Research Station, Amani. Thanks are also due to Dr. C. W. Wardlaw of Trinidad, and Dr. Wallace of Tanganyika Territory, for supplying cultures required by Mr. Thorold for comparative studies in connexion with his work.

J. McDONALD.

REPORT OF THE OFFICER IN CHARGE OF GRASSLAND IMPROVEMENT

TRAVELLING.

Travelling was confined mainly to short journeys by road to Ngong and Machakos at which places experiments are in progress at the Animal Husbandry Centres. Two journeys of considerable length were made, one into the Ukamba Reserve and one into the Northern Frontier Province.

CORRESPONDENCE.

Outward letters 511, inward letters 440. This correspondence was divided between matters concerning grassland investigation and plant introduction.

GRASSLAND IMPROVEMENT.

Work has been continued on the lines indicated in the annual report for 1931, but as the more important experiments will require some years to produce reliable results, in most cases only preliminary information is available. During the year considerable difficulty has been encountered as the result of constant locust attacks. These have retarded the establishment of new experiments and have, in some cases, greatly hindered the production of reliable results from experiments in progress.

Main Problems.—A consideration of the grasslands of Kenya naturally falls under two heads: (1) the natural grasslands which at the moment comprise practically the whole of the land available for grazing; and (2) the cultivated grasslands which are only just beginning to be of importance. The former are utilized mainly by the stock-owning native tribes, but even in the areas of European settlement pasture management has, as yet, progressed little. Cultivated pastures under comparatively intensive management have already made their appearance in European areas of higher rainfall where the dairying industry is growing and these pastures are likely to become of ever increasing importance in such areas. In the former case the main requirement is the development of improved management which will prevent deterioration of the valuable grasslands concerned. Unfortunately, advanced stages of deterioration have already been reached in certain native reserves where over-stocking has become serious. In connexion with the development of small areas of cultivated pasture it is necessary to determine the herbage species best suited for the purpose in various districts which experience different climatic and soil conditions.

As a basis for the whole of this work a study of the individual herbage species has been undertaken. Attention is devoted mainly to the indigenous species as it is believed that it will be possible to isolate from these, plants which will fulfil the requirements of the country better than introduced species. A considerable number of introduced plants have, however, been included in the experiments.

Natural Pastures.—The improved management of large tracts of natural pasture in Kenya depends mainly on : (1) limitation of stock to the carrying capacity of the areas concerned and (2) the possibility of introducing a system of controlled grazing by means of which local over-grazing will be prevented and regular periods of rest for different areas in turn will be provided for. The problem has assumed a serious aspect in some areas, as for instance, the Ukamba Native Reserve, where a continually increasing stock population together with deforestation of the higher land has resulted in the partial destruction of the herbage cover over considerable areas with consequent erosion and in a reduced period of river flow. The difficulty of applying measures under the above heads which will bring about improvement in native areas is evident. Amongst stock-owning tribes wealth is considered in terms of cattle and the marriage customs are based upon the payment of the bride-price in cattle and goats. Under these circumstances it is not surprising that the native cannot be induced to part with stock to an extent that will materially affect the overstocking problem. In addition to these facts the application of methods of disease control have aggravated the position by preventing, in some measure, the reduction in stock normally caused by disease. The introduction of control of grazing is also beset with difficulties in native areas under present conditions, although it is believed that it is not beyond the bounds of possibility. In European ranching the application of methods of controlled grazing should be comparatively simple. The main factors on which the application of improved methods in native grazing areas depends are (a) the distribution of water supplies and (b) the ownership of land. Unless adequate distribution of permanent water supplies can be provided for it is obvious that proper distribution of stock and the prevention of local over-grazing cannot be accomplished. Where any form of private ownership exists either by individuals or groups it may be possible to introduce control of a nature which will permit of the closing of areas bounded by geographical features in rotation, to allow of periods of rest. In this

way an attempt may be made to apply the principles of deferred rotational grazing which have been used with success in the U.S.A. for the reclamation of vast areas of over-grazed range lands.

Cultivated Pastures.—Up to the present, cultivated pastures have played very little part in the stock industry of Kenya but, as has already been stated, they are likely to become of increasing importance in areas of European settlement. In the native reserves, although the development in this direction will obviously be much slower, it is believed that in the thickly populated areas of comparatively high rainfall such as parts of the Kikuyu Reserve, more intensive methods of farming will become increasingly necessary, and that cultivated pastures will play a part in future development. In connexion with more intensive methods of stock farming under European agriculture, two types of cultivated pasture have to be taken into account. One of these comprises areas where a suitable type of herbage already exists such as in high rainfall districts where Kikuyu Grass (*Pennisetum clandestinum*) is dominant. Here the development of cultivated pastures entails merely fencing and the application of intensive methods of grazing and manuring. The other type consists of areas where suitable pastures will have to be artificially established by the propagation of species superior for the required purpose to the natural herbage, or where it is desired to lay down land, originally under arable farming, to grass. So far the former type of pasture is the only one that has made its appearance. In the high altitudes many attempts have been made to establish European species and seeds mixtures but these have not yet proved of any appreciable importance.

Work in Progress.

Experiments designed to provide information on the effects of different intensities of grazing and also of grass-burning on natural pasture have been continued at two centres where the dominant type in the herbage is *Themeda triandra* (Red Oat Grass), while similar experiments to test the effects of different intensities of grazing have been set up in Kikuyu Grass (*Pennisetum clandestinum*) and Star Grass (*Cynodon plectostachyum*) areas. In the last two areas mentioned, the grazing schemes had to be discontinued for the greater part of the year on account of locust attack which so damaged the herbage that no reliable results could be expected.

In connexion with these experiments observations are being made on the seeding habits of the main grasses with a view to utilizing the information in the application of schemes of light rotational grazing such as the deferred method devised in America which has already been mentioned. There is, however, considerable variation in the seasons from one to another and it will therefore be necessary to obtain information in each area where it is proposed to attempt to apply this method.

With the object of determining the most valuable pasture plants and so learning something of the relative value of different types of natural grazing, and at the same time collecting information on those plants best suited for the establishment of cultivated pastures, a study of the individual pasture species has been continued at the Scott Agricultural Laboratories at Nairobi. During the year work was commenced on an experiment intended to provide data on the seasonal yields of herbage and nutrients of a number of grass species which had been selected as the result of palatability tests and from other properties which became evident in the course of these investigations. The lack of suitable land for the purpose and constant locust attack have greatly retarded this work. When the choice has been sufficiently narrowed down it is proposed to conduct trials under actual grazing conditions.

In connexion with the establishment of pastures in European farming areas methods of propagation of the pasture species are important. Although certain stoloniferous grasses can be established from roots and pieces of the runners fairly cheaply, in most cases establishment from seed is the only practicable method. With this fact in view a study of the seeding qualities of the promising pasture species has been continued. As has been previously reported, in the case of the indigenous grasses results have, on the whole, been disappointing. A number of species have given satisfactory results in preliminary work, however, and several grasses have been added to this number during the year. Considerable difficulty has been encountered in obtaining sufficient seed for experimental work in the first instance, and early in the year seed production plots were established. In common with other experiments these suffered severely from locust attack and the initial establishment was in most cases either prevented or greatly retarded.

Preliminary results from the several phases of the work indicate that the most promising indigenous species are as follows: *Pennisetum clandestinum* (Kikuyu Grass), *Cynodon plectostachyum* (Star Grass), *Chloris gayana* (Rhodes Grass), *Panicum coloratum*, *Pennisetum ciliare*, *Amphilophis pertusa* and *Paspalum scrobiculatum*.

The only introduced grass which has given decidedly promising results as yet is *Paspalum dilatatum*, while a strain of *Chloris gayana* from Australia has also given good preliminary results. This latter was originally introduced to Australia from Africa.

The matter of the suitability of species to areas of different climatic conditions in the country is very important. In the above list for instance, Kikuyu Grass and *Paspalum scrobiculatum* are each suited only to limited areas. On this account efforts have been made to establish observational plots of the more important species in various parts of the country.

Fodder Plants.—This name is used here to indicate plants which are suitable for cutting and feeding green to stock or for the making of ensilage. The importance of a supply of green fodder and hay for use in periods of drought is becoming more generally recognized in the European stock-farming of the country and work is in hand to compare both indigenous and introduced plants for this purpose. One of the most promising plants is Elephant or Napier Grass (*Pennisetum purpureum*) which is indigenous in Kenya. Another indigenous grass (smaller than *P. purpureum* but attaining a height of about six feet) which has recently received attention and which shows considerable promise is a *Pennisetum* sp. (nr. *P. polystachyon*).

Distribution of the Herbage Species.—Although travelling has been considerably restricted during the year, observational work of some value was carried out in the Ukamba area and in the Northern Frontier Province. Several collections of specimens were received for identification, the most important coming from Mr. R. H. Cameron, Stock Inspector at Isiolo. During the year, 149 specimens of herbage plants were submitted to the Royal Botanic Gardens at Kew, for identification. Small quantities of seed of some of the more promising plants under experiment were supplied to the East African Agricultural Research Station, Amani, Tanganyika.

Special Reports.

As the result of visits in January, 1931, and March, 1932, a report was submitted on the reconditioning of natural pasture in the Ukamba Native Reserve. A special report was also prepared on a tour in the Northern Frontier Province in December, 1932.

The former report deals with an area in which overstocking and deforestation have resulted in serious erosion of the surface soil over considerable areas and where prompt action is called for to prevent the onset of semi-arid conditions over large portions of the reserve. The causes of deterioration and methods of improvement have already been mentioned under the heading of Natural Pastures.

The latter report gives notes on the vegetational areas traversed during two journeys, one into the country occupied by the Samburu tribe, and the other to Marsabit Mountain about the centre of the Northern Frontier Area. The areas dealt with are in the main semi-arid and the possibilities of improvement were discussed and suggestions were put forward. One of the objects of this latter tour was the collection of drought-resistant herbage species. Material of a number of these was obtained and has been established in nurseries.

D. C. EDWARDS.

PLANT BREEDING SERVICES

REPORT OF SENIOR PLANT BREEDER

Mr. G. J. L. Burton, Senior Plant Breeder, was absent from the Colony on sick leave for a month in March and proceeded to England on sick leave on October 29th.

Mr. R. J. Lathbury, Plant Breeder, was absent on home leave from April 13th to October 20th.

Mr. N. D. Spranger, Agricultural Officer, was on duty for the whole year under review.

Mr. G. Gamble, Junior Laboratory Assistant, was stationed at Kitale from May to the end of the year to assist in the maize breeding work being carried on there.

Mr. Colin Maher, Agricultural Officer, Kitale, gave part-time services in connexion with maize breeding in the Trans Nzoia, and Mr. R. N. Noble, Junior Laboratory Assistant, Scott Agricultural Laboratories, gave part-time services on wheat breeding work.

Mr. R. J. Denstead was employed as Acting Agricultural Officer, Nakuru District, from January 21st to the end of the year with headquarters at the Plant Breeding Station.

Mr. C. A. Thorold, Mycologist, was stationed on the Plant Breeding Station during the whole year and worked in co-operation with the staff of the station on cereal disease investigation.

Several farmers' meetings were attended, at some of which lectures were given. "Farmers' Days" were attended at Nakuru, Kitale and Eldoret. At each of these centres exhibits and the results of the Seed Maize Competition were staged, and addresses given by Mr. Maher and Mr. Lathbury. No Field Day was held at the Plant Breeding Station as it was not considered wise in view of the cost of travelling incurred by farmers and because of the locust menace.

WHEAT AND WHEAT BREEDING.

During the year 1932 the acreage under wheat in the Colony was further reduced, 40,715 acres having been harvested and 79,950 bags reaped. Local milling requirements will again therefore not be satisfied, the shortfall being likely to be in the neighbourhood of 65,000 bags.

The low acreage seeded is again due to the fear of loss from locusts and disease, coupled with the price factor.

The low yields—two bags per acre—may be attributed largely to damage by locusts, the Uasin Gishu area in particular suffering from this pest. With the exception of "Take-all" and, to a lesser degree, rust, diseases have not been unduly prevalent, and the season, while wetter than normal, has been a very fair one for wheat growing. "Take-all" has spread very rapidly in the Molo-Mau Summit district and is responsible for much damage to wheat. This disease must be considered a very serious one in the higher altitude areas. It can and must be eradicated and advice for suitable control measures has been published.

Black Chaff, while again epidemic at Njoro Plant Breeding Station, has not generally done much damage this year. Means of control have so far proved very difficult as it would seem that infection can be both from the seed and the soil. A number of the new hybrid wheats bred at Njoro would appear to show some resistance and it may be that the solution of the problem lies in this direction.

The locust danger will not, it is hoped, be always present, and if the industry can survive until the new wheats are available, the fear of disease should by then be materially lessened. Low prices can only be met by increased yields and in this respect only suitable wheat land should carry the crop. Furthermore it should be remembered that local prices are likely to be satisfactory provided there is no surplus available for export.

The country is still without entirely suitable wheats to grow. Damage by disease is responsible for the low yields of Equator, while Kenya Standard is unsuited to a number of districts. Kenya Governor has yielded well where it has escaped rust.

Among the new wheats grown by farmers in 1932 and of which it was hoped that one or more might be useful as a stop-gap, strain No. B.230.A.14. (L) has done well in the Molo area. This wheat is resistant to yellow rust and its resistance to stem rust is similar to Kenya Governor, that is, it is resistant to form K2, the form generally present in the high altitudes. Ten to twelve bag crops of grade I wheat have been reaped from small fields of ten to fifteen acres. The wheat ripens one-and-a-half months earlier than Equator in the Molo district, and threshes more readily, though its

straw lacks the standing ability of Equator. While it cannot replace Equator from a milling point of view, yet it is a useful "filling" wheat and the mills are prepared to take up to 20,000 bags of it.

Strains Nos. K.2.R.5. (L.2) and N.B.233.H. (L) are not favoured by the millers, who are not prepared to take more than a total of 8,000 bags of the two wheats.

The two strains being multiplied in the Rongai district, B.256.G.1.A. and UX.9.M.1.A.9.D., suffered from locust damage and are not yet in sufficient bulk for large-scale milling tests to be made with them. The former wheat, however, yielded at the rate of $8\frac{1}{2}$ bags per acre at Njoro despite some locust damage.

Wheat Breeding at the Plant Breeding Station, Njoro.—Future prospects of the more promising families can now be discussed. These families are Nos. 112, 130 and 131. An Njoro wheat was used as one parent in each cross, while an English hybrid in the first cross and a selection from Australian Florence in the latter two crosses were the other parents.

Cross No. 112 has in the past been exposed to physiologic forms Nos. K1 and K3 of stem rust and this year showed itself resistant to the new form K4 which was artificially produced in the breeding cage. A number of grains from each culture were also sown at Mau Summit. These plants were exposed to a severe epidemic of form K2 of stem rust, and, as was feared, the majority of cultures proved susceptible to this form. A few cultures however were only slightly attacked and definitely showed some resistance. The degree of infection may be gauged from the fact that the grain from these particular cultures bushelled 62 lb. They were also resistant to yellow rust at 8,500 feet. A few pounds of grain of these cultures have been harvested and seed should be available in bulk in 1937. The grain looks satisfactory though there is a tendency for it to lose some of its hardness at the higher altitudes. These wheats have excellent straw and would appear to possess a capacity for high yields.

Cross No. 130 has to date only been exposed to forms K1 and K4 of stem rust. A number of excellent ear types have been selected from it and the grain is very promising. Both parents of this cross are resistant to yellow rust.

Cross No. 131 was exposed to form K1 of stem rust in 1931, and in the F.3 generation was this year grown at Mau Summit where it was exposed to form K2. A number of

absolutely clean plants have been obtained which also showed themselves resistant to yellow rust. The grain is good.

These three crosses should be suitable for all districts except those with two short rainy seasons such as Machakos.

Of the remaining crosses, a list of which was given in the Annual Report for 1931, Nos. 117, 122, 136, 142, 146 and 58 are being grown on.

Black chaff was again present in the breeding cage. Owing to the severe infection by this disease to which the plants have been exposed for two seasons, it is hoped that those plants which were not affected are really resistant.

It would seem therefore that an important advance has been made with regard to the production of disease resistant wheats suitable for the larger wheat growing areas of the Colony, and that in a few years' time much of the present danger from rust may have been eradicated.

Wheat Breeding at the Scott Agricultural Laboratories.—The position with regard to the stem rust resistance of the hybrids and pure line wheats being grown here has been clarified by the presence of the new form K2 of stem rust this season. This form was first found on Kenya Standard which showed some resistance to it, but a further series of inculcations and field trials have unfortunately shown that this wheat is moderately susceptible to the new form. As Kenya Standard was the rust-resistant parent in all the present crosses it was unlikely that any of the hybrids would show resistance and this in fact is the case. Where K4 infection was severe all the affected hybrids showed susceptibility.

Over a hundred thousand single plants in addition to some 130 multiplication wheats were sown in the long rains. Some of these wheats are excellent yielders and possess some resistance to leaf rust. Their grain qualities are a great improvement over Kenya Standard and they have bushelled up to 64 lb. The best of these wheats will be multiplied in the hope that visitations of K4 rust will be few and far between.

It is impossible to say how often K4 will appear in the field or how severe the attacks by it may be. Perhaps a useful indication is that during all the years Kenya Standard has been grown in the Machakos district, stem rust has only attacked it once and the infection was slight.

With the aid of a new Njoro wheat as one parent, the next step is to breed a wheat for the lower altitudes which is resistant to K4 in addition to other physiologic forms.

The Breeding Cage at Mau Summit.—This cage is used as a testing ground for yellow rust, and form K2 of stem rust is generally present also. It has been found that wheats resistant to yellow rust at 8,500 feet (the altitude of the cage) often show susceptibility when grown at 9,000 feet. The cage is therefore being moved to the Department's experimental plots on Captain C. T. Soames' farm at Molo, at an altitude of 9,100 feet.

The thanks of the Plant Breeding Station are due to Major J. J. Drought of Mau Summit for all his help and assistance whilst the cage has stood on his farm during the past five years.

Physiologic Forms of Stem Rust.—A fourth form of stem rust, K4, found in 1931 at Ulu, has been prevalent at the Scott Agricultural Laboratories during both the long and short rain seasons in 1932. The possibility of new forms of stem rust appearing, to which the present wheats are not resistant, has always been present, and it is unfortunate that Kenya Standard shows susceptibility to this new form. The rust resistant Njoro wheats are however resistant to this new form and it is hoped that they will continue to show resistance to any further forms which may arise in the future.

Form K4 of stem rust has not yet appeared up-country and it is possible that its occurrence may be confined to the lower altitudes and then only at infrequent intervals.

Stem Rust Inoculations.—Large numbers of these inoculations have been carried out in the course of the year with the collaboration of the Mycological Division. Routine seedling inoculations constitute part of Mr. Noble's work and are done under Mr. McDonald's supervision. Mr. Thorold also builds up a yearly supply of all forms at Njoro in order to create artificial infections in the field.

Artificial Rust Infections in the Field.—Further attempts to infect the breeding cage at Njoro and the Scott Agricultural Laboratories were made in conjunction with the Mycological Services. At Njoro a measure of success was achieved with the new form K4 of stem rust, but form K2, whilst present, was not virulent. At the Scott Agricultural Laboratories

there was such a heavy natural infection of form K4 that it was not known with certainty how effective the dissemination of the other forms was.

Mature Plant Resistance.—The following Canadian wheats which in that country possess a mature plant resistance to stem rust, regardless of the physiologic form present, were tried both at Njoro and Mau Summit: Marquillo, Iumillo, Hope, Pentad, H-44-24 x Marquis 586, H-44-24 x Marquis 592, Double Cross x Ceres 720, and Double Cross x Ceres 721. All of these wheats were inculcated as seedlings and found physiologically susceptible to most of the forms present in this country, with the exception of Iumillo, which was resistant.

In the field however, Double Cross x Ceres and Hope have alone shown resistance to the two forms to which they were exposed, namely K2 and K4, and these two wheats will be grown on for further trial in this respect next year.

An issue of two bags of Marquillo wheat was made to several farmers in the hope that this wheat might replace Equator at the high altitudes. Yellow rust destroyed the wheat at 9,000 feet though at 8,000 feet it was not damaged. In one case a fair attack of stem rust was seen, though generally, little stem rust was observed. This wheat should not be grown over 8,000 feet and is likely to suffer from stem rust as it did when tried some years ago. Under good conditions it proved to be a very heavy yielder.

MAIZE AND MAIZE BREEDING.

The season was a good one for maize, and but for locust damage, good crops generally would have been harvested. The continuation of low export prices for maize, however, seriously affected the industry. Low world prices can be particularly disastrous in Kenya since freight and rail charges will always tend to be high. The former is governed by the country's position on the East Coast of Africa necessitating carriage through the Suez Canal to Europe, and the latter by a long and partially barren railway haul to the coast. In this connexion, rail, wharfage and freight charges on maize exported from Kenya amount to at least Sh. 1 per bag more than the corresponding charges on South African maize. With maize worth only Sh. 17 to Sh. 19 per quarter in Europe the Kenya farmer obtains only about 70 per cent of what the South African farmer receives on the farm. The only way to affect these factors in normal times is for the Kenya

maize farmer to grow much higher yields per acre than are obtained in other countries. Higher yields are in fact naturally obtained in Kenya but these can be greatly increased by the use of good seed, good planting and good cultivation. The correct policy would appear to be a gradual change over to mixed farming with maize less in the forefront but better grown.

Soil and climatic conditions in Kenya are so favourable for maize that it would appear the crop must come into its own if tided over the present world wide depression.

Maize Seed Competition.—This competition was again carried out by the Royal Agricultural and Horticultural Society of Kenya assisted by the Department of Agriculture.

Particular mention must be made of the further success achieved this year by Ngata Farm, Njoro, which carried off the honours in both sections.

A detailed account of the competition appears in Bulletin No. 3 of 1933.

Maize Breeding.—At Njoro 74 F.1 lines were planted by Mr. Spranger, who selected and selfed 300 plants, and 38 F.2 cobs have been kept for further use in 1933.

It is hoped that the work at Njoro will result in the production of heavy yielding strains suited to the higher altitudes.

The bulk of the maize breeding work is done in the Trans Nzoia and was continued on Kibomet Estate by courtesy of Estates and Investments, Ltd. The object of the work is the breeding of maize resistant to white blight and *Fusarium* diseases and to maize rust.

Mr. Maher reports on this work as follows:—

“ The maize was planted in the middle of March. The seed planted comprised 38 F.2 lines and 78 F.1 lines together with a plot of crib-selected seed which had not yet been self-fertilized.

During my absence on leave, the selection and self-fertilizing of plants was carried out by Mr. Gamble, who selfed over 1,700 plants. The number of progeny cobs selected for further work was reduced by Mr. Gamble (and subsequently by myself) on cob characters to 129 F.3 cobs and 257 F.2 cobs. These included cobs selected for

susceptibility to maize rust, white blight (*Helminthosporium turcicum*) and the Fusarium group of diseases for comparison with the resistant lines. The number to be used may be cut down still further before planting.

Considerable resistance to white blight is apparently being achieved in the better lines but the Fusarium diseases constitute a more formidable problem."

CROP TRIALS AND OTHER EXPERIMENTAL WORK.

Reports on this work carried out by the staff at the Plant Breeding Station, particularly Messrs. Spranger and Benstead, appear in Bulletin No. 2 of 1933, compiled by the Staff of the Plant Breeding Station and by Mr. C. Maher, the Agricultural Officer, Kitale. Their work is also referred to in the report of the Deputy Director (Plant Industry).

The thanks of the Plant Breeding Station are due to Mr. J. E. A. Wolryche Whitmore and Captain C. T. Soames, on whose land the experimental plots are sited, and to the Molo and Mau Summit Farmers' Association for their contribution toward the upkeep of the Molo Plot.

Mr. R. J. Lathbury has been largely responsible for the compilation of this report.

G. J. L. BURTON.

COFFEE SECTION

REPORT OF THE SENIOR COFFEE OFFICER

In April the Entomological Section took over the work of the administration of the Coffee Rules and with this the Plant Inspectors were transferred to that section. When this change was made Mr. Bolton was transferred to the Scott Agricultural Laboratories as Insectaries Manager and Mr. T. L. McClelland, who had previously held this post, was appointed a Plant Inspector and transferred to the Coffee Section. For the remainder of the year his duties were mainly connected with assisting me at Head Office and carrying out inspections.

The main work of the Coffee Section may be summarized as follows:—

Administering Coffee Rules (first quarter of year).

Inspections.

Experimental and Investigational work.

Advisory work.

Lectures and field demonstrations.

Publications.—During the year under review six bulletins were published (*see* General List).

Meetings.—I attended twelve meetings convened by the District Associations in the following districts: Songhor, Nandi, Kiambu, Machakos, Kipkarren, Ithanga, Subukia and Nyeri. I also attended several meetings of the Council and the Annual General Meeting of the Coffee Planters' Union; one meeting of the Coffee Consulting Committee; one meeting of the Nairobi District Council in connexion with the pollution of rivers with coffee pulp and washings; three meetings of the Pest Board Committee. I read the following papers at the Planters' Days held in Nairobi on June 29th and 30th: Coffee Pruning, Soil Wash, Green Manure and Cover Crops, Coffee Seed Selection. Mr. McClelland read a paper on Bordeaux Spraying with special reference to leaf and berry fall of coffee.

Two meetings were held at the Scott Agricultural Laboratories, at which practical field demonstrations were given on pruning coffee established on the multiple and single stem systems.

Inspections.—The following is a summary of inspections carried out by the Headquarters staff during the year:—

<i>District</i>	<i>No. of Plantations visited</i>
Fort Ternan	4
Koru	6
Songhor	12
Nandi	9
Kiambu	52
Machakos	4
Nyeri	24
Kipkaren	19
Ngong	1
Nairobi	2
Ruiru	7
Kabete	8
Uasin Gishu	7
Kaimosi	14
Thika	6
Makuyu—Ithanga	6
Doinyo Sabuk	3
Rongai	4
Solai	4
Subukia	14
Limuru	3
Trans Nzoia	15
	Total ... 224

Numerous visits have been made to the Scott Laboratories in connexion with the experimental and investigational work carried out there and discussions with officers of the scientific staff.

Coffee Planters' Days and Coffee Conference.—A detailed report of the proceedings of the Planters' Days and Conference has already been published. I desire to take this opportunity, however, of thanking all those who attended, thus materially assisting in making the meeting a success.

The field day held at the Scott Agricultural Laboratories was an outstanding feature owing to the large attendance and interest shown in the work that is being carried out at this

station. It is desired to acknowledge the assistance of Mr. Stuart Gillett, the officer in charge of the Scott Laboratories.

Pests and Diseases.—As this subject will be dealt with by the Entomological and Mycological Sections respectively, I propose merely to make a few general comments.

Leaf-miner moth.—In Kiambu district, loss of crops and debilitation of trees have been brought about on certain plantations by the ravages of leaf miner-moth. This is most unfortunate as those planters who had adopted spraying with Bordeaux mixture early in the season with good results, had their bushes heavily defoliated subsequently by the pest. In my annual report of 1931 I stated that severe outbreaks of leaf-miner moth occurred that year and that the outbreak coincided with the use of poison bait as a control against antestia. In this connexion opinions vary and definite conclusions can only be reached after more extensive observations and investigational work have been carried out.

Antestia.—Antestia is again responsible for much damage to coffee beans. Its incidence is widespread throughout the Colony. Various control methods are adopted, such as arsenite of soda poison bait, pyrethrum and paraffin spray and hand picking. Some planters favour the arsenite of soda, while others report unfavourably on its effectiveness. Judging by the extent of the damage not only to the coffee beans but to the bushes, the insect may be regarded as one of the major pests of coffee.

Mealy bug (Pseudococcus lilacinus).—The outbreak of mealy bug during the past season, although in certain areas responsible for much loss of crop, has not been generally so severe as in the past. The use of banding grease has been more generally adopted than Kresotow as a control against the attendant ant. Heavy loss of crop was mainly due to the fact that banding was delayed in the first instance. An outbreak of *Pseudococcus virgatus* occurred on a plantation in the Korn area at the beginning of the year. The outbreak was confined to one plantation.

Capsid bug (Lygus simonyi).—The capsid bug has again been responsible for flower abortion, more particularly during the early part of the year. In this connexion it might be of interest to note that reports have been received from a number of planters to the effect that although this pest appears to be quite as prevalent as in previous years, flower abortion has not been so severe. Some planters have even gone so far as to

suggest that spraying with Bordeaux mixture has a deterrent effect on capsid, but while this applies in some cases, in others the results of observations are most conflicting.

Coffec Berry Disease.—Reports go to show that the loss of crops from coffee berry disease has not been so severe as in 1931. It would, however, not be wise at this stage to make statements of a committal nature with regard to the causes of this lesser severity, but at the same time it is of interest to note that there are three factors which should be taken into account and which may have had considerable effectiveness, namely:—

- (a) improved cultural methods;
- (b) an earlier flowering, which means that during the peak period of the disease the development of the bean has passed from the milky to the hard stage and is therefore possibly more resistant;
- (c) a drier season during the peak period.

Bordeaux Spraying.—In general coffee planters are strongly advised to carry out systematic spraying with Bordeaux spray, and more so in those districts where leaf disease is most prevalent and causes considerable defoliation combined with leaf fall. In this respect a word of warning might be given, namely, that the spray mixture must be used as a preventive against leaf disease and not as a cure. In the case of leaf fall the spray should be applied at least six to eight weeks before the season when severe leaf fall occurs. Another point worthy of emphasis is that the spray should not be stinted and should be applied with sufficient pressure to penetrate through the dense foliage.

Manuring.—I am glad to report that planters are paying a great deal more attention to organic manuring, including the growing of green manure and cover crops, than has been their custom in the past, and it is felt that even more can still be done for prevention of the loss of surface soil. In many cases inorganic fertilizers have been applied to soil in poor heart with no appreciable results when it would have been more profitable if the money expended on fertilizers had been used in organic manuring.

The coffee section has again distributed free samples of a wide range of seed of green manure and cover crops. These are accompanied by a form on which planters are requested to report on the behaviour and suitability of the crop for their particular district.

GENERAL.

Coffee Industry Bill.—This receives reference in the report of the Director.

Meteorological Observations.—Several interviews have been held with Mr. Walter, Director of Meteorological Services, in regard to installing at least three meteorological stations in such areas as Scott Laboratories, Sotik and Uasin Gishu. The matter is at present receiving Mr. Walter's attention and he hopes to be in a position to supply the necessary equipment.

Shade.—Mr. S. O. Hemsted, of Soy, who has for many years adopted artificial shade, has erected a cheaper type of artificial shade entirely with wood and eliminating all wire. This naturally reduces the cost considerably. Artificial shade has also been erected on a plantation at Nyeri. This particular plantation has suffered severely in the past from cold and the improvement in the growth of the trees under shade is already most marked.

Shade tree trials are still being observed. Mororowet (Nandi), a semi-permanent tree which has not previously been mentioned in my annual reports is giving very satisfactory results in Kaimosi. It has been suggested for trial in districts where shade is considered imperative. It is a fast growing tree and the shade is easy to regulate.

Observations were made on the effect of Atlas tree killer which was applied to *Grevillea robusta* trees by the Forestry Department early in 1931. These observations were made in November, 1932, and while some of the trees are showing distress I am disappointed with the results in view of the long period it takes before the trees show any signs of dying.

District Experimental Plots.—Arrangements have been made with two planters, one at Doiyo Sabuk and one at Upper Kiambu, to plant up experimental areas of different varieties of coffee. As these two areas have entirely different climatic conditions, the observations on the behaviour of the trees should materially assist in forming an opinion as to the best available varieties for the respective districts.

Coffee Roots.—Observations have been made on a number of coffee roots washed out at the Scott Agricultural Laboratories and in different districts in order to ascertain some knowledge of the coffee root system. In this connexion Mr. Nutman, Plant Physiologist, East African Agricultural Research Station, Amani, paid a visit to the Colony in November.

INVESTIGATIONAL WORK AT THE SCOTT AGRICULTURAL LABORATORIES.

The following annual report is submitted by Mr. S. Gillett, Agricultural Officer in Charge.

Visitors.—Large numbers of planters have again visited us this year. Two pruning demonstrations given by the Senior Coffee Officer during January were very well attended. About two hundred planters, who were attending the Coffee Planters' Days held in Nairobi, visited the Laboratories on the afternoon of the 30th of June and were afforded an opportunity of inspecting the work in progress. All showed the greatest interest and discussion with planters from all districts was of great value to us.

Acreage.—There were seven acres of productive coffee on the estate during the year and a further six acres are being planted up.

Crop.—The average yield off the whole acreage of bearing coffee was 6 cwt. per acre. The young three- to four-year-old trees gave the heaviest returns.

The $2\frac{1}{2}$ acres of eight-year-old coffee grown on the single stem system yielded only 3.8 cwts. per acre, whilst the $1\frac{1}{2}$ acres of multiple stem trees yielded 5.4 cwts. per acre. The table given below compares the yields of single stem versus multiple stem coffee :—

	1929	1930	1931	1932	Average
	<i>Cwt. per Acre</i>	<i>Cwt. per Acre</i>	<i>Cwt. per Acre</i>	<i>Cwt. per Acre</i>	<i>Cwt. per Acre</i>
Single stem	6.8	1.3	4.6	3.8	4.1
Multiple stem	9.0	2.0	8.3	5.4	6.2

These results should be of special interest to a number of planters who criticized what to them appeared to be our somewhat drastic pruning of multiple stem coffee last year. In spite of the heavy cutting back, the advantages of which are discussed below under the heading "pruning", the trees were left with sufficient wood to carry an average crop.

Manuring and Cultivation.—The single stem ($2\frac{1}{2}$ acres), multiple stem ($1\frac{1}{2}$ acres) and Kenya Selected ($1/20$ th acre) plots received dressings of compost at the rate of $7\frac{1}{2}$ tons per

acre during February. The one acre of young Mocha coffee on Plot 23, which is being devoted to spraying experiments, received a dressing of compost at the rate of 10 tons per acre during May. Most plots were planted up with a green manure during the March-April rains.

At the time of application of the manure all plots were fork-hoed to a depth of about 4 inches. Subsequent to this only surface weeding has been carried out.

Pruning.—Routine pruning was carried out on the general plots. Demonstrational and experimental pruning consisted of the following:—

(a) To demonstrate the necessity of cutting away all old primary wood on trees grown on the multiple stem system. For this demonstration one row of sixty-two trees in the multiple stem block did not have their old lower primaries removed. All trees in the block had attained the age when a new cycle of suckers was to be encouraged. During the year the unpruned trees formed a dense mass of vegetative growth on the lower unpruned primaries. The young suckers, which were being encouraged from the base of the stem, were drawn up under a dense canopy. At the end of the year, when it was necessary to remove these old lower primaries to allow the sucker growth to extend, it was found that the growth on them had taken place at the expense of the top young wood and the old stem had to be removed completely, whereby the whippy sucker growth was exposed to the sunlight, resulting in a natural severe setback. The remainder of the block, however, having been pruned well up the old stem, permitted the growth of healthy and hardy suckers from the commencement and also allowed a fair amount of top growth to remain on the old stems for another year to provide a small crop and light shade and protection for the sucker growth.

(b) Heavy pruning versus parrot-perching of neglected trees. The practice of parrot-perching is not recommended and it was desired to show how a tree, which had not been pruned for several years, could be restored by other means. The disadvantages of parrot-perching more than outweigh the advantages (see Bulletin No. 13 of 1932). For this demonstration, four neglected trees were parrot-perched and four were heavily pruned. The term "heavily pruned" denotes the cutting back of primaries to secondary growth, at the same time removing all weak secondaries and tertiaries.

The secondary left as a leader may be whippy but new growth of secondaries and tertiaries will occur during the year, which will be the following season's bearing wood. By this method of pruning, the shape or skeleton of the tree remains unaltered and a certain amount of vegetative growth is left on the tree, thus permitting a more speedy recovery. Although no bearing wood could have been expected on either system of pruning during the current season, at the end of the year the "heavily pruned" trees were carrying infinitely more bearing wood than those which had been parrot-perched.

(c) Spacing trials, in which will be amalgamated experiments on heights of topping, were laid down during the March-April rains. This experiment contains a number of major factors and the results should be of especial interest.

(d) The effect of time of pruning on fruiting: This experiment was considerably spoiled by a heavy infestation of mealy bug on the trees and no results were obtained. It will be repeated.

(e) Stumping: Stumping trees at all months of the year showed that the best time for this operation to be carried out is when the sap is not flowing heavily; it is quite useless to attempt it during heavy sap flow. It is also strongly advocated to postpone stumping until a sucker has commenced growth, thereby enabling the cut to be made correctly in one operation. Otherwise the tree must be stumped and a second cut made after sucker growth has commenced in order to leave the sucker in the correct position. The best position for the sucker is undoubtedly about two inches from the top of the slanting cut. It is imperative that a stub is not left, as when the wood dies back there is a grave risk of the sucker breaking off. Notching or bruising will excite sucker growth but this must be done at the right season. If stumping is to be carried out in February, notching or bruising should be done immediately after the short rains, that is, when the sap is flowing. A number of preservatives were tried on the cut surface, the best of which appeared to be Melanoid paint. It is, however, useless to attempt to apply a preservative to the wound should the stumping operation be carried out when the sap is flowing freely.

Coffee Manuring Experiment.—An experiment was laid down at the beginning of the year, to demonstrate the effect of manuring. Instead of attempting to determine which manures give the greatest return, the results of which would

in all probability apply to areas similar to that on which the experiment has been laid down, the object is to illustrate to planters the condition of the tree caused by the lack of one of the essential plant foods. The lay-out consists of nine plots, each containing forty-nine trees. The design is as below.

Sulphate of ammonia Super-phosphate Sulphate of potash (Lacking organic matter)	Sulphate of ammonia Sulphate of potash (Lacking phosphate and organic matter)	Sulphate of ammonia Super-phosphate (Lacking potash and organic matter)
Control	Sulphate of potash Super-phosphate Leguminous green manure (Nitrogen supplied by legume)	Sulphate of potash Super-phosphate (Lacking nitrogen and organic matter)
Sulphate of potash Super-phosphate Lime (Low in nitrogen, lacking organic matter)	Sulphate of potash Super-phosphate Non-leguminous green manure (Organic matter but no nitrogen)	Boma manure (Complete)

Several years must elapse before the difference between the plots can be expected to be prominent.

Coffee Spraying Experiments.—Extensive spraying trials were carried out during the year and will be continued. Preliminary observations indicated the following conclusions.

(a) That there is no apparent difference to be observed in the effects of either lime, copper sulphate or calcium carbide-copper sulphate as a spray. There are indications, however, that the carbide mixture adheres to the leaves better than the lime mixture, unless a " sticker " is used in the latter.

(b) That spraying should be carried out at least six weeks before control of leaf fall is required.

(c) That the effective period of the spray is limited to a period of, say, five to six months.

(Note.—In all the above cases conclusions have been drawn from the use of $\frac{1}{2}$ per cent strength mixture. It is possible, in fact highly probable, that the use of 1 per cent strength may reduce the period mentioned in (b) and prolong the period mentioned in (c).)

These conclusions have been made as the result of the following trials (in all cases the spray used was lime-Bordeaux $\frac{1}{2}$ per cent solution :—

I. EFFECT ON TREES ACCORDING TO NUMBER OF SPRAYINGS GIVEN.

A.—One block received three sprayings; sprayings applied on 27-1-32, 24-3-32, 30-5-32.

Observations.

17-3-32: No difference between sprayed and unsprayed trees noticeable.

26-4-32: Less leaf fall on sprayed trees than on unsprayed ones.

28-7-32: Very noticeable. No leaf fall on sprayed trees. Heavy leaf fall occurring on controls.

29-8-32: Appearance most marked. Flower buds appear earlier on sprayed trees than on control.

24-10-32: No noticeable difference in time or amounts of flowering as compared with other sprayed blocks or controls.

B.—One block received two sprayings; sprayings applied on 29-3-32, 30-5-32.

Observations.

17-5-32: No difference between sprayed and unsprayed trees noticeable.

1-7-32: Sprayed trees suffering considerably less from leaf fall than controls.

28-7-32: The sprayed trees appear to look as well as the trees sprayed three times and show a great deal less leaf fall than controls.

29-8-32: Appearance almost identical to the trees sprayed three times. Practically no leaf fall. Flower buds appear earlier than control.

24-10-32: No noticeable difference in time and amount of flowering as compared with other sprayed blocks or controls.

C.—One block received one spraying; spraying applied on 30-5-32.

Observations.

28-7-32 : Trees show slightly less leaf fall than controls.

30-8-32 : Little or no control over leaf fall. Flower buds appear in same condition as controls. Spraying obviously carried out too late.

24-10-32 : No noticeable difference in time or amount of flowering as compared with other sprayed blocks or controls.

II. EFFECT ON TREES ACCORDING TO TIME OF SPRAYING.

A.—One block sprayed once on 27-1-32.

Observations.

17-3-32 : No difference between control and sprayed trees. Fairly heavy leaf fall occurring under both.

17-5-32 : Sprayed block shows less leaf fall than control, but difference very slight.

28-7-32 : Same as on 17-5-32.

30-8-32 : Little or no control over leaf fall. Flower buds appear slightly more advanced than on controls.

24-10-32 : No noticeable difference in time or amount of flowering as compared with other sprayed trees or controls.

B.—One block sprayed on 29-3-32.

Observations.

17-5-32 : Less leaf fall occurring on sprayed trees than on controls.

28-7-32 : Sprayed trees show a marked improvement over controls.

30-8-32 : General appearance most marked. Very little leaf fall. This block strongly indicates that whether one or more sprayings are carried out, it is essential that one should be applied during March.

24-10-32 : No noticeable difference in time or amount of flowering as compared with other sprayed trees or controls.

C.—One block sprayed on 30-5-32.

Observations.

28-7-32 : Trees show little or no improvement over controls.

30-8-32 : Little or no control over leaf fall. Spraying obviously carried out too late.

24-10-32 ; No noticeable difference in time or amount of flowering as compared with other sprayed trees or controls.

PRELIMINARY STUDY OF ROOT GROWTH AND ROOT SYSTEMS OF COFFEE TREES.

An attempt was commenced during the year to obtain some idea of the time when root growth is most active and also to obtain some correlation between root growth and aerial growth. The technique employed was not satisfactory and it was not possible to obtain any information regarding the surface feeding roots. Observations did, however, indicate that the lower lateral roots commenced growth towards the end of April and continued at an almost even rate of about 2.5 inches per week until the end of the year. Vegetative growth also continued at an almost even growth from the date recording was commenced until the end of the year. The technique has been considerably modified and it is hoped that in subsequent observations it will be possible to record the growth of the surface feeding roots.

A number of root systems of coffee trees have been washed out at the station during the year, but from the general data obtained it is too soon to commit observations to paper.

The observations made on the root systems of two specific trees will, however, be of interest, especially to planters in the drier areas. Two young trees of three years from planting out, standing almost side by side, were discovered to be behaving quite differently during the period of drought experienced from June to October. Both trees were carrying a good crop, but at the drought continued, one tree (Fig. A) completely collapsed and practically the whole crop yellowed and fell off the trees, whereas the other tree (Fig. B) carried the whole of its crop and at the time when the root system was washed out a heavy flowering was occurring. On washing out the two root systems the explanation for these varying conditions was discovered. In the case of the tree which had collapsed, the lateral surface feeding system was found to be good but owing to the drought conditions prevailing little or

no activity was taking place. The vertical root system on the other hand, was found to be decidedly poor (Fig. A). On washing out the tree which had stood up to the prevailing conditions, it was found that although the lateral surface feeding system was no better, if as good, as the other tree, the vertical root system consisted of a large mass of feeding roots extending down to over eight feet in depth (Fig. B). In addition to the moisture which these roots were able to obtain in the lower moist regions of the soil, it was also discovered by the Senior Agricultural Chemist that there was an appreciable amount of available nitrate present at this depth. The reason for these two great variations in root systems of trees standing side by side and of the same variety is hard to explain unless it is genetical, in which case the importance of the rootstock for dry area coffee growing will be seen to be of the greatest importance.

COFFEE VARIETIES, TREE SELECTIONS AND VEGETATIVE PROPAGATION.

It is necessary to discuss the work done on these three subjects together as they are so closely connected.

Varieties.—A large number of varieties have been introduced during recent years for trial. In the first place, the object of these introductions is to determine whether the variety is suited to the conditions on the estate, and secondly, whether a tree can be produced superior to those now grown by using these varieties for either rootstock or scion material for grafting.

At present the following varieties and strains have been established, some in the field, some still in the nursery beds :—

Mocha	Guatamala	Robusta "Kinawa"
Kents	Columnaris	" "No. 9"
Jacksons	Padang	" "Enaka"
Blue Mt.	Bourbon	Wild Nandi Coffee
Mysore	Marogogipe	San Ramon
Kenya Selected	Stenophylla	Robusta 124-01
Harar	Golden Drop	Wild Iringa Coffee

Tree selections.—In addition to the importation of known varieties for trial, the possibilities of finding outstanding hybrids on our own plantations have not been lost sight of. At the moment some twenty-five different outstanding types have been selected and seed from each of these trees is being propagated in our nurseries. Each tree is given a series letter

for future reference. Amongst the outstanding of these series is that known as Series A, a selection from Kenya Selected. An acre of plants propagated from this series has already been established on the station.

Vegetative propagation.—Work on this has been limited to investigations on technique. The success obtained in the propagation of cuttings has been disappointing; much has yet to be learned. The only really successful method so far has been by the etiolation of sucker growth on the parent stem (*see* Bulletin No. 19 of 1932).

Preliminary investigations on the technique of grafting have been more successful and although successes have not been obtained in the field, the percentage of "takes" on the young plants in the nursery has been good. Work during the year has been purely investigational, as the different varieties required for work as rootstocks were not available. It is hoped, however, that during 1933 a large number of grafts on different rootstocks will be carried out.

COVER CROPS, GREEN MANURES AND MULCHING.

Cover Crops.

Black Mauritius bean still remains the best cover crop yet tried in the open at this station, but a number of more recent introductions have given splendid results in the nursery. Their trial in the field will be carried out during 1933.

The Gotani bean is not now recommended owing to its very brittle top growth and its prolific lateral surface feeding roots.

Glycine javanica continues to make a splendid top growth, but it is feared that without constant cutting back it will seriously compete with the surface feeding roots of the coffee trees, especially in the drier areas.

Salmon-marled Lima bean has given outstanding results and can be classed with the black Mauritius bean. Unfortunately its trial has not as yet been extensive, owing to the small quantity of seed harvested through damage by locusts. The crop produces a dense soil cover and good mulch.

Green Manures.

Njahi (*Dolichos lablab*) is possibly still the best green manure crop for the March–April rains, but is not suitable for planting during the October–November rains. It produces a heavy top growth, with good nodules on the root systems. It is ready to turn under four to five months after planting.

New Zealand grass pea attracted considerable attention as a green manure during the year. It produces a fine soil cover and excellent nodules are produced on the root system. It is ready to turn under about three to four months from planting and can be grown equally successfully at either season of the year.

Field peas are a safe crop to grow during the October-November rains, producing a good soil cover and ready to turn under about eight weeks after planting.

Mixture of Niger Oil and Field Peas. This is a splendid mixture to grow as a green manure during the October-November rains. It is ready to turn under eight weeks after planting. The Niger oil, which gives a heavy weight of green matter, tends to support the field peas, thereby encouraging growth.

Wash Stops.

Mexican Daisy.—This is proving an excellent plant for preventing wash and is recommended generally.

Mulching.

A block of coffee was mulched with grass at the beginning of a long period of drought with outstanding results. It was observed that the mulched trees showed a wonderful improvement over the unmulched ones; that the crop picked off the mulched trees had a healthy appearance and that the vegetation on the trees was a luscious green, whereas the unmulched trees suffered badly from die-back and showed a collapse of cherry due to drought. Samples of roots taken showed that there was more activity under the mulched portion than in the other. It has further been observed that the incidence of mealy bug has been less on the mulched portion.

For mulching, planters are strongly advised to plant up areas of Napier grass (*Pennisetum purpurcum*), which will give a very large amount of bulk material for this purpose annually.

Shade Trees.

The following shade trees are undergoing trial at this station:—

<i>Gliricidia maculata.</i>	<i>Ficus</i> sp.
<i>Millettia oblata.</i>	<i>Cordia holstii.</i>
<i>Dalbergia assamica.</i>	<i>Machaerium tipu.</i>
<i>Mukungu.</i>	<i>Acrocarpus fraxinifolius.</i>
<i>Greillia robusta.</i>	

Coffee Fermentation Tests.

An experiment was carried out on fermenting coffee under water with culture; under water without culture; dry with culture; dry without culture. The following table of results is of interest:—

TREATMENT	Total hours to complete fermentation	Max. temp. during fermentation	Min. temp. during fermentation	Colour of green raw coffee	Order of Placing	
					Roast	Liquor
	<i>Hours</i>					
Under water with culture	50	21.8°C.	16.6°C.	1	1	1
Under water without culture	50	21.6°C.	16.4°C.	2	2	2
Dry with culture	39½	21.2°C.	19.4°C.	3	3	3
Dry without culture..	40½	21.1°C.	19.2 C.	4	3	4

The Department is indebted to Mr. Deutschman, of Messrs. Naumann, Gepp & Deutschman, for kindly reporting on the appearance of the green raw coffee and roast, and on the quality of the liquor.

ARTHUR TRENCH.

SCOTT AGRICULTURAL LABORATORIES

REPORT OF THE OFFICER IN CHARGE

GENERAL.

Revenue.—A total of Sh. 6,726/28 was collected from sale of farm produce, stock and stores, and fees for laboratory services during the year.

Correspondence.—Inward letters, 527; outward letters, 495.

Visitors.—The increasing number of visitors yearly is most encouraging.

Rainfall.—27.78 inches fell during the first six months of the year and 11.96 inches during the latter six months, a total for the year of 39.74 inches. A partial drought occurred from the middle of June until towards the end of November.

Laboratories.—The reorganization of the clerical staff, carried out towards the end of 1931, has proved of great value and much more efficient work is now executed by this section. Scientific officers have been released from much routine work which in the past had fallen on them to perform.

FIELD WORK.

A very trying year has been experienced for all connected with work on the farm. Locusts made their appearance during July and remained with us until November. In addition the partial drought considerably reduced the coffee crop and the work oxen had to be hand fed for over three months, there being no grazing whatsoever.

Fortunately, locusts caused little damage to the wheat crop but the labour was on duty day after day attempting to save the maize crop and certain of the grass plots. Early ripening pulse crops were harvested before any damage was done to them, but the later ones were entirely stripped and little or no seed obtained.

Coffee.—A full report of the experimental work conducted at this station during the year has been included in the Annual Report of the Senior Coffee Officer.

Wheat.—The work carried out on this crop has been fully reported on in the annual report of the Senior Plant Breeder.

Grasses.—Work carried out on the grass plots has been fully reported on by the Officer in Charge, Grassland Improvement.

Muratha Maize.—In spite of considerable damage, a yield of 14.4 bags per acre was obtained on the $3\frac{1}{2}$ -acre selected seed plot. The improvement obtained by the careful selection of this maize over a period of several years has been most marked. A further careful field selection was carried out during the year and a total of twenty-six 200 lb. bags of selected seed was issued to Local Native Council seed farms for further bulking and selection.

Potatoes.—Owing to poor markets, the interest in potato growing is subsiding but it is felt that although a slump year has been experienced farmers should not become unduly pessimistic.

Results over a period of years indicate that our best potato for Kenya conditions is the "Kerr's Pink" and it is pleasing to note that the marketing value is also good. Farmers would be well advised to plant a larger area of this variety.

The work carried out at this station with this crop is designed to test out the relative values of possible varieties over a period of years and also the introduction of new varieties.

The following yields of different varieties obtained over a period of years are of interest :—

VARIETY	YIELD PER ACRE						Average Yield	Position in trials
	1930		1931		1932			
	Long Rains	Short Rains	Long Rains	Short Rains	Long Rains	Short Rains		
Kerr's Pink	<i>T. C. Lb.</i> 3 3 45	<i>T. C. Lb.</i> 4 15 0	<i>T. C. Lb.</i> 5 4 40	<i>T. C. Lb.</i> 2 10 0	<i>T. C. Lb.</i> 4 18 0	<i>T. C. Lb.</i> 5 5 0	<i>T. C. Lb.</i> 4 5 95	2
Great Scot	3 10 0	4 5 0	5 3 31	3 2 0	4 6 0	5 10 0	4 6 5	1
Alannah . .	3 14 39	5 10 0	4 17 26	2 10 0	2 8 0	4 10 0	3 18 38	4
Doon Star	3 4 0	..	5 4 0	2 6 0	4 2 0	4 16 0	3 18 44	3
Abundance	3 11 0	2 5 0	4 10 0	2 8 0	2 6 0	3 6 45	3 1 7	6
The Baron	3 12 67	7 0 0	3 6 70	1 16 0	3 2 0	4 12 90	3 13 38	4

It will be noted that Great Scot heads the list by a small margin from Kerr's Pink. Great Scot is a good yielder but owing to its deep eyes and slightly rough skin it is not a variety favoured by the export market and should not therefore be encouraged. Abundance, a very suitable export variety, cannot on the other hand be recommended, as it is a very "shy" yielder.

Ten of these varieties were subjected to a keeping trial test at the Coast during the early part of the year. The results obtained were as below :—

VARIETY	Date lifted	Date received at Mombasa	Number of days before rotting set in
Kerr's Pink	15-2-32	25-2-32	75
The Baron	15-2-32	25-2-32	92
Doon Star	1-3-32	9-3-32	87
Golden Wonder	2-3-32	9-3-32	82
Great Scot	29-2-32	9-3-32	101
Incomer	10-3-32	31-3-32	83
Abundance	10-3-32	31-3-32	103
Majestic	10-3-32	31-3-32	109
Arran Banner	10-3-32	31-3-32	96
Alannah	10-3-32	31-3-32	77

The Chief Grader and Inspector, who carried out these trials, added: "It is to be regretted that the potatoes could not have been lifted and observed under the same conditions; the later-received varieties have not been subjected to such high temperatures as those received in February". This remark is all important but cannot be overcome owing to the different varieties varying in length of time to maturity. The error due to this factor was to some extent evened out in the field. The Kerr's Pink and the Baron were lifted under ideal conditions, the Great Scot, Doon Star and Golden Wonder were lifted after a fall of rain and the ground was moist; Incomer, Abundance, Majestic, Arran Banner and Alannah were lifted after heavy rains and in a very "green" condition.

Several new varieties were imported in small quantities for trial, but as yet it is too early to form any opinion of them. These included :—

- Sutton's White City.
- Sutton's Glasgow Favourite.
- Sutton's Ben Lomond.
- Sutton's Abundance.
- Sutton's Inverness Favourite.
- Sutton's Perth Favourite.
- Arran Scout.

Lucerne Variety Trials.—Ten varieties have been subjected to yield tests for a period of four years. The results obtained are :—

VARIETY	TOTAL YIELD IN LB. PER ANNUM					Average Yield per Year	Position in trials
	1929	1930	1931	1932	For 4 yrs.		
	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	
Dakota No. 12 ..	5,590	13,366	8,724	12,333	40,014	10,003	7
Dakota Common	8,360	17,392	14,336	2,399	52,437	13,122	3
Cape Province ..	9,340	16,958	13,664	1,305	51,267	12,817	4
Utah	7,780	14,912	12,908	11,357	46,937	11,747	5
Ladak	3,330	5,163	5,152	4,352	18,047	4,512	10
Ladak (F.C.14135)	4,000	5,667	4,450	4,799	18,946	4,736	9
Hunter River ..	10,160	20,309	19,264	16,011	65,825	16,456	1
Kansas Common	8,090	16,729	11,872	9,849	45,540	11,635	6
Hairy Peruvian ..	10,390	18,139	15,650	15,693	59,907	14,977	2
Grimm	5,810	9,377	5,600	5,923	26,715	6,679	8

In all cases weights refer to green matter recorded immediately after cutting. All varieties have been grown under normal conditions, no artificial watering or irrigation being carried out. These results should indicate to farmers the best varieties to select for planting.

Pyrethrum.—It is doubtful whether this station is suited to the commercial production of Pyrethrum. Larger yields can certainly be obtained at higher elevations enjoying ample rainfall. The results of the plot here have, however, indicated some all important factors. In order to obtain the maximum yield per acre the following points must be observed :—

1. The importance of seed selection.
2. The refilling of all gaps caused by losses at planting out.
3. The discarding of all non-flowering plants.

The actual figures obtained from our plot will prove these points :—

1. Number of plants originally planted out ...	3,780
Number of plants surviving	3,192
Loss due to transplanting from nursery bed	588
2. Number of surviving plants	3,192
Number of flowering plants... ..	1,276
Number of non-flowering plants	1,916

3. The actual yield over a period of five months was at the rate of 60 lb per acre.

Had there been no vacancies and had all plants flowered the yield would have been at the rate of 216 lb. per acre, or $3\frac{1}{2}$ times as much.

As regards seed selection, it has been found that certain plants bear much more prolifically than others. Seed from such plants should be collected for subsequent planting. One plant at this station has proved itself outstanding and it is from this that we are endeavouring to multiply up a heavy-yielding strain.

Economic Crops.—The following crops of possible economic value were tried out during the year :—

CROP	Planted	Harvested	Yield per Acre in lb.
White Canadian Wonder Bean ..	30-3-32	2-7-32	966
Boston Bean	30-3-32	24-7-32	675
Rose Coco Bean	30-3-32	28-7-32	1,188
Ohtenashi Bean	30-3-32	14-7-32	612
Pea P.B.I.P/47	2-4-32	5-8-32	346 $\frac{1}{2}$
Pea P.B.I.P/49	2-4-32	7-9-32	211
Pea P.B.I.P/50	2-4-32	5-8-32	903
Pea Koopman's Glory	2-4-32	12-8-32	378
Pea Dun No. 2	2-4-32	18-8-32	880
Field Pea (Common)	2-4-32	22-8-32	1,232

None of the pea crops yielded as heavily as the common Field Pea, but the variety P.B.I.P/50 showed distinct promise as a very quick growing leguminous green manure. Its advantages for this purpose over the common field pea have not been investigated sufficiently for one to be able to state whether it does actually produce a larger amount of green matter but it is certain that its growth is quicker. Trials with this variety will be continued.

Bean crops fared badly owing possibly to too early planting. The bean of most promise is the White Canadian Wonder. It appears to be as good a yielder as the Red Canadian Wonder and is more popular for food purposes with the native.

Plant Introduction Trials.—Thirty-five different varieties—including possible cash, cover and green manure crops, have been tried out during the year. Practically none of these were suited to the local conditions. Exceptions included possible

cover crops such as *Crotalaria alata*, *Centrosema plumieri*, and *Calopogonium orthocarpum*, trials with which are being continued.

Nurseries.—All space in the nurseries has been kept fully occupied during the year. Introduced grasses for trial, propagation of cuttings of geraniums for the Senior Agricultural Chemist's essential oil work, trials of indigenous and imported legumes as cover crops, etc., and a number of indigenous plants for identification have all required considerable space and attention.

Kudzu Vinc.—Further mention is being made of this crop again this year as it is felt that its value in the drier grazing areas has not yet been fully appreciated. The crop continues to give every satisfaction at this station. A plot of about $\frac{1}{4}$ acre on badly washed land was planted up during the March-April rains. By the end of the year the crop had made an almost complete cover. Further soil erosion should be prevented and the land, in addition to being built up again, will provide useful forage for stock.

BUILDINGS.

Cattle Shed for Manure.—Owing to the need for economy, funds would not permit extensive constructional work being carried out. Money was, however, available to erect a large cattle shed in the cattle boma. This example could well be followed by a number of farmers adopting mixed farming practices or with coffee planters. The building, measuring 40 feet by 20 feet, cost approximately £15 to erect. It is large enough to house comfortably twenty to twenty-five oxen. Provided sufficient dry grass, maize stalks, etc., are added when needed there is no reason why between 250-300 tons of good manure should not become available yearly.

STUART GILLETT.

GRADING, CONDITIONING AND COOL STORE SERVICES

REPORT OF THE CHIEF GRADER AND INSPECTOR

Mr. F. B. L. Butler, Grader and Inspector, departed on overseas leave on the 7th May, and returned to duty on the 15th December.

PLANT IMPORT INSPECTION.

The following table shows the number of packages, and values of the various importations of plants, fruits, seeds, etc., in 1931 and 1932 :—

	No. of Packages		Declared Value	
	1931	1932	1931	1932
			<i>Sh. cts.</i>	<i>Sh. cts.</i>
Seeds	1,034	1,274	45,856 15	54,167 29
Fruit	16,272	9,327	143,474 94	66,766 58
Plants	271	227	9,759 64	8,457 42
Fruit Trees	157	133	15,633 69	17,006 15
Tea Seed	636	491	122,450 50	70,430 16
Bulbs	172	296	3,463 88	4,045 00
	18,742	11,753	340,643 80	240,892 60

It will be seen that there was a decrease in the number of packages imported on the previous year's figures of 6,939, being a decrease of 37.20 per cent. This large decrease is mainly attributed to the falling-off in the quantity of fruit imported.

In addition, 80 packages, valued at Sh. 3,170/62 and four packages, valued at Sh. 300, were passed in transit to Uganda, and Tanganyika respectively.

GRADING AND CONDITIONING SERVICES.

The Agricultural Produce Export (Potatoes) Rules, 1927, and the Agricultural Produce Export (Potatoes) (Amendment) (No. 2) Rules, 1927, were revoked, and the Agricultural Produce Export (Potatoes) Rules, 1932, were gazetted with effect from the 1st July.

The principal alterations to the new rules as published were the enforcement of suitable rigid receptacles for potatoes being carried more than seven days' sea journey, and a more

careful description detailing the requirements of seed potatoes for export. The unanimous support of merchants interested in the export of potatoes was obtained prior to the publication of the new Rules.

MAIZE GRADING.

The heavy loss of foodstuffs suffered throughout the Colony during 1931, due to the severe locust invasion, is reflected in the following tables of figures of maize graded. Very little surplus maize was available for export; only 185,537 bags of maize were presented for grading from the 1931-32 season's crop.

(a) Maize Presented Direct for Grading at the Coast.

A total of 289,503 bags of maize were presented direct for grading, and were placed in the following grades:—

GRADE	Number of Bags	Percentage of Total Received
		<i>Per cent</i>
K.2	154,960	53.53
K.2.SW	52,271	18.06
K.3	30,590	10.56
K.3.SW	8,555	2.95
K.8.W	2,228	0.77
K.8.SW.W .. .	1,403	0.48
Total Graded ..	250,007	86.35
Rejected—		
Wet	25,754	8.89
Weevily	7,711	2.70
Musty	60	0.02
Other Causes ..	5,971	2.06
Total Rejections	39,496	13.67
TOTAL RECEIVED	289,503	100.00

The total of 289,503 bags received is a decrease of 71.94 per cent on the previous year's total of 1,031,704 bags. As previously stated 185,537 bags were from the 1931-32 season's crop. The balance of 103,966 bags being from the 1932-33 season's exportable surplus. It should be noted here that a further 38,265 bags were received consigned direct to the Conditioning Plant during October, November and December, including 751 bags treated free of charge in the new conditioning unit.

There is a considerable decrease in the percentage graded K.2 (second grade), as compared with the percentage of the previous year, viz. 68 per cent.

The percentage rejected as wet, 8.89 per cent, is considerably below the average for the last five years (14.7 per cent), but it is necessary to take into consideration the wet maize consigned direct to the Conditioning Plant, which then shows that 16.4 per cent of all maize received was wet.

Maize graded as second grade, SW. shows an increase on the previous year's figures from 13 per cent to 18 per cent, mainly due to the shipments of maize from the 1931-32 season's crop in June and October. During June 46,186 bags of maize were received: of this total 30,847 bags were graded K.2.SW. and 4,448 bags weevily.

A very large increase in the quantity graded K.3 is shown, as compared with 1931, viz., from 3.86 per cent to 10.56 per cent.

Weevily maize was in evidence throughout the year.

A table giving the average moisture content of the rejected wet maize, and the sending station is given below:—

STATION	Number of Bags	Average Moisture Content
		<i>Per cent</i>
Kitale	2,432	13.97
Mau Summit ..	310	13.4
Solai	745	13.73
Koru	521	14.4
Lugari	3,053	13.76
Fort Ternan ..	275	13.0
Lumbwa	500	13.7
Hoey's Bridge ..	966	13.33
Rongai	1,975	14.07
Kampi ya Moto ..	1,157	13.75
Ol Punyata	933	14.0
Njoro	310	13.6
Mile 13½	153	13.4
Mile 22½	312	13.3
Sabatia	1,223	14.4
Turbo	77	14.3
Wet by Rain ..	10,907	—
	25,754	—

Note.—Maize consigned direct to the Conditioning Plant is not included in the above figures.

(b) Maize Graded at the Conditioning Plant.

53,449 bags of maize were graded at the Conditioning Plant after treatment, being a decrease of 37.57 per cent on the previous year's total of 85,610 bags. The following is a table showing grades and relative percentages :—

GRADE	Number of Bags	Percentage of Total
K.2	34,550	<i>Per cent</i> 64.64
K.3	16,844	31.51
K.3.C	845	1.53
K.8.W	933	1.74
Total Graded ..	53,222	99.57
Rejected—Musty ..	227	0.43
Total Rejected ..	227	0.43
TOTAL RECEIVED ..	53,449	100.00

The falling-off in the standard of maize submitted for grading is reflected in the very high percentage of maize, viz., 31.51 per cent graded as K.3, even after enjoying the advantage of cleaning at the Conditioning Plant.

(c) Maize Re-Graded.

As in previous years re-grading was confined to maize rejected on account of low quality and second-hand bags, and maize which was under the prescribed weight permitted for export. Only 3,477 bags were re-graded.

The total number of bags graded, 346,429 (total of (a), (b) and (c)) is a decrease of 69.19 per cent. on the previous year's total of 1,124,464 bags.

656 bags were re-bagged and 363 bags re-sewn.

SHIPMENTS.

Forty Export Certificates in respect of 220,975 bags of maize were issued as shown in the following table :—

Certificates	No. of Bags	Description
15	136,034	(K.2) Second Grade.
8	44,805	(K.2.SW) Second Grade. Slightly weevily.
2	9,800	(K.2) Second Grade. Shipped in bulk.
6	22,405	(K.3) Third Grade.
4	6,666	(K.3.SW) Third Grade. Slightly weevily.
1	845	(K.3.C) Third Grade. Treated by heat for the destruction of weevils.
2	183	(K.8.W) Undergrade. White.
2	122	(K.8.W.SW) Undergrade. White. Slightly weevily.

Rule 25. Local Shipments.

29,362 bags of maize were shipped to ports north of Beira, south of Port Said, and the coast of Arabia.

MAIZE GENERAL.

Weather conditions were satisfactory for the harvesting of the 1931-32 season's maize crop. The only rejections on account of excessive moisture during the early months of the year being due to maize wet by rain during transit.

The harvesting operations of the early 1932-33 season's crop were not carried out under such satisfactory conditions, and this factor, together with the early railment of maize, made necessary by the allocation of railway tonnage for carrying the 1932-33 crop, led to the advantages offered under the reduced charges for treating wet maize consigned direct to the Plant being taken advantage of by the growers.

In my Annual Reports for 1930 and 1931 the falling-off in the quality and uniformity of maize presented for grading was stressed. No improvement in this respect has occurred during 1932. The 1931-32 season's crop was noticeable for the increase in the incidence of pink ear rot; the early maize from the 1932-33 crop shows no improvement, and, in addition, grain having a musty germ is much in evidence.

The practice of consigning different growers' maize, of varying grades, in the same truck, is bound to prove a hardship to the careful grower. Many instances have been noted where the whole of a truck has had to be graded "slightly weevily" or "weevily" due to the presence of weevils on the bags of clean and reasonably clean maize.

A somewhat disturbing feature is the number of consignments of maize damaged by rain in transit to the Coast.

It is not considered necessary to comment on the reduction of conditioning charges granted by Government in respect of the 1932-33 season's crop.

WHEAT.

The Agricultural Produce Export Ordinance was applied to wheat in July, 1928. The peak period of export was reached in 1930, when 118,632 bags were presented direct for grading. There was a serious falling-off in the quantity presented direct for grading in 1931; only 34,528 bags being received.

In the year under review, owing to the losses caused by locusts no wheat was sent to the Coast for grading.

CONDITIONING PLANT, KILINDINI.

MAIZE.

A total of 52,963 bags of maize were treated at the Conditioning Plant, consisting of 52,102 bags wet and 861 bags weevily.

Of this quantity only 2,322 bags were from the 1931-32 season's crop.

37,291 bags were consigned direct to the Plant and accepted for treatment.

BEANS.

813 bags of beans were treated.

At the request of shippers, experiments in drying of beans were carried out at the Conditioning Plant.

It was found that beans could be successfully treated; no splitting or damage to the beans occurring, even when subjected to three treatments. Whilst weevils were satisfactorily destroyed by one treatment, it was found that not more than 1.5 per cent of moisture could be extracted from beans at any one treatment.

The erection of the machinery for the new conditioning unit was satisfactorily completed during the year by our own staff, and the necessary tests and adjustments carried out prior to the arrival of wet maize at the Coast. When wet maize of not more than average moisture content is being dealt with, the Plant has now an average out-turn of 2,500 bags per day of twenty-four working hours. In periods of congestion it should be possible to deal with approximately six thousand tons of wet and weevily maize per month.

The through sidings laid down as part of the extension scheme have proved very satisfactory and add to the ease of feeding the plant and despatching grain after treatment.

Advantage was taken of the slack months to re-paint all the machinery parts, framework of buildings, etc. The annual overhaul was made very intense and the whole plant brought up to a high pitch of efficiency.

GRADING OF POTATOES.

Sixty-one thousand, four hundred and sixty-two cwts. of potatoes were presented for inspection and were placed in the following grades :—

GRADE				Number of Cwt.	Percent- age of Total
K.1.	..	..	..	28,167	45.83
K.2.	..	..	..	30,328	49.34
Seed	..	..	..	631	1.03
Rejected	..	..	..	2,336	3.80
				61,462	100.00

The total graded is an increase of 43.7 per cent on the previous year's figures of 42,764 cwt.

The improvement in quality which started during the latter part of 1931, was more than maintained during the year. Whereas in 1931 8.3 per cent were placed in first grade, during the year under review 45.83 per cent were so graded.

In previous years practically all the potatoes railed to the Coast were of native production : during 1932 24,295 cwt. or approximately 30 per cent were received from European growers. The quality of some of the consignments received was very high, whilst there has been a general improvement all round.

Hand-picking was necessary in many consignments of native-grown tubers ; the normal defects being tubers damaged during lifting.

SHIPS' STORES.

Export entries in respect of 3,526 bags, estimated at approximately 5,666 cwt. were passed.

GRADING OF BEANS.

(a) Presented Direct for Grading.

The following table gives the quantities, varieties and grades of beans presented direct for grading :—

VARIETY	K.1.	K.2.	K.2 SW.	K.3.	K.3 SW.	Total Graded	REJECTIONS				Total Received
							W1.	Wet	Other Causes	Total Rejected	
Rose Coco ..	..	224	154	..	2	400	..	1,429	2	1,431	1,831
Canadian Wonder	275	356	30	..	..	641	115	517	66	698	1,339
White Haricot ..	304	..	..	..	..	304	..	..	..	..	304
White Runner ..	160	..	..	..	..	160	..	..	..	..	160
Mixed ..	..	..	..	112	..	112	..	224	..	224	336
TOTAL ..	739	580	184	112	2	1,617	115	2,170	68	2,353	3,970
Percentage of Total	18.61	14.61	4.63	2.82	..	40.73	2.9	54.66	1.71	59.27	100.00

(b) Graded at the Conditioning Plant after Treatment.
Graded after Sun-Drying.
Re-Graded.

	Grade	No. of Bags
K.2	1,215
K.2 SW.	307
K.3	216
Total graded		1,738
Total received		1,738

The actual number of bags (totals of (a) and (b)) was 5,708 bags, as compared to 236 bags in the previous year.

The early consignments of beans were very wet, ranging up to 20 per cent moisture content. Consignments received later in the year were dry and comparatively free from bean beetles.

The quality was lower than in previous years; undeveloped and discoloured beans being present in nearly all consignments. Anthracnose was the cause of damage in certain parcels.

COOL STORES.

The following is a comparative statement of the quantities of commodities deposited in the Cool Stores since the inception of this service :—

COMMODITY	Unit	1932	1931	1930	1929	1928	1927
Fruit	Lb.	103,145	181,793	193,547	155,180	128,399	102,229
Fresh Fish ..	"	100,441	59,541	40,607	31,557	14,196	8,583
Cured Fish ..	Dozen	36,560	43,549	78,171	64,990	50,230	15,178
Cheese	"	9,752	18,325	21,200	4,037	949	3,541
Offal	"	2,760	3,130	4,449	5,523	794	472
Poultry	Dozen	8 $\frac{2}{3}$	27 $\frac{1}{2}$	34 $\frac{5}{6}$	43 $\frac{2}{3}$	10 $\frac{1}{2}$	12 $\frac{11}{12}$
Butter	Cases	5,213	5,098	9,401	2,305	2,484 $\frac{2}{3}$	1,544 $\frac{12}{12}$
						479 lb.	
Beef	Quarters	292	363 $\frac{1}{2}$	324 $\frac{3}{4}$	301	212	211
Mutton and Pork	Carcasses	247 $\frac{1}{2}$	276 $\frac{1}{2}$	325 $\frac{1}{2}$	212	143	80
Eggs	Dozen	4,318	210	£07	270	109	—
Ham and Bacon	Lb.	£71	4,970	19,481	692	266	—
Vegetables ..	"	634	312	140	3,702	8,161	3,979
Yeast	"	1,611	234	125	30	—	—
Miscellaneous ..	"	884	414	14 gal.	572 lb.	8	—
		plants,	serum,	milk	milk 6C		
		game,	cake,cho-		gal. beer		
		milk,	colate.				
		trout	plants				

It will be seen from a study of the foregoing table that there was a recurrent increase in deposits of the more important commodities from 1927 to 1930, the latter year being the peak period. During the last two years a backward tendency is noticeable, except in the case of fresh fish and eggs.

The machinery worked satisfactorily throughout the year and delays due to power fluctuations were negligible.

No. 1 condensers, which were erected with the original plant, were re-conditioned during November and December.

VISITORS.

Many visitors were received during the year, and a greatly increased interest is being shown in the work of the Conditioning Units, the Cool Stores, and the Coffee Curing Works at Kilindini.

ACKNOWLEDGMENTS.

It is with regret that this section of your Department severed its connexion with Mr. Bulkeley, C.B.E., Port Manager, in December. His co-operation and sympathetic consideration, has, in the past, been of great assistance and the thanks of the Department are again tendered to him and his staff for their help and co-operation.

C. L. SILVESTER.

BALANCE SHEET—COOL STORES
1ST JANUARY, 1932 TO 31ST DECEMBER, 1932.

EXPENDITURE							REVENUE						
							<i>Sh.</i>	<i>cts.</i>			<i>Sh.</i>	<i>cts.</i>	
Salaries—									Receipts				
Manager						4,200	00	To Balance Excess Expenditure over Revenue ..			17,822	39	
Superintendent						3,713	33				30,336	91	
European Mechanic						8,290	36						
Asiatic Mechanic						2,500	71						
Clerk						1,545	00						
Electric Power and Water						12,583	21						
Ammonia						1,306	33						
Labour						4,778	33						
Sundries						5,095	16						
Office Rent						125	00						
Travelling Expenses						363	00						
Passages (Proportionate)						1,689	71						
Housing (Proportionate)						1,262	50						
Medical Services (Estimated)						706	66						
						<i>Sh.</i>	48,159	30			<i>Sh.</i>	48,159	30

STATEMENT OF BALANCES AT 31ST DECEMBER, 1932

	Debit		Credit			Ss. cts.	
	Ss.	cts.	Ss.	cts.		Ss.	cts.
GRADING ACCOUNT.							
1st November, 1923 to 31st October, 1924	..	..	5,732	78	Grading Credit Balance at 31st December, 1932	..	186,168 10
1st November, 1924 to 30th June, 1925	..	..	9,138	86	Conditioning Credit Balance at 31st December, 1932	..	119,287 08
1st July, 1925 to 30th June, 1926	3,056	13	..	..	
" 1926 " " 1927	..	..	31,423	50	Total Credit Balance, Grading and Conditioning, at		
" 1927 " " 1928	..	..	8,094	12	31st December, 1932	..	305,455 18
" 1928 " " 1929	..	..	27,553	51			
" 1929 " " 1930	..	..	25,682	31			
" 1930 to 31st December, 1930	..	..	31,918	95	Deduct Refund of four-fifths of Grading and Con-		
1st January, 1931 to 31st December, 1931	..	..	40,672	65	ditioning Charges made in Respect of 1929-30		
" 1932 " " 1932	..	..	9,007	55	Crop	..	301,423 83
	3,056	13	189,224	23	Credit Balance at 31st December, 1932..	..	4,031 35
							£ 201 11s. 4d.
CONDITIONING ACCOUNT							
1st July, 1925 to 30th June, 1926	..	15,909	92	..			
" 1926 " " 1927	..	..	..	23,762 75			
" 1927 " " 1928	..	9,397	31	..			
" 1928 " " 1929	..	..	..	5,634 84			
" 1929 " " 1930	..	..	..	55,127 52			
" 1930 to 31st December, 1930..	..	..	..	68,973 04			
1st January, 1931 to 31st December, 1931	..	..	..	2,381 86			
" 1932 " " 1932	11,285	70	..	..	
	Ss.	36,592	93	155,880	01		

NOTE.—Conditioning Costs, etc. :—

No provision is made in this Statement for Interest Charges or Depreciation or for Capital Expenditure on New Works.

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BALANCE SHEET—CONDITIONING ACCOUNT 1ST JANUARY, 1932 TO 31ST DECEMBER, 1932

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EXPENDITURE				REVENUE					
				Sh.	cts.			Sh.	cts.
Salaries—						Maize—			
Graders and Inspectors				4,200	00	2,535 bags at 60 cents each			1,521 00
Superintendent				3,713	33	13,137 bags at 45 cents each			5,911 65
Mechanics (including Overtime)				2,388	60	37,291 bags at 35 cents each			13,051 85
Clerk				1,545	00				
Labour				7,181	48	Beans—			
Sundry Expenses				7,014	33	705 bags at 60 cents each			423 00
Rent of Siding (18 months)				3,249	99	108 bags at minimum charge of Sh. 200			200 00
Travelling (18 months)				460	60	To Balance Excess Expenditure over Revenue			11,285 70
Passages (Proportionate)				945	71				
Office Rent (Proportionate)				125	00				
Housing (Proportionate)				1,262	50				
Medical Services (Estimated)				306	66				
				Sh.	32,393 20			Sh.	32,393 20

NOTE

Capital Cost of Conditioning Plant (1925)	£	10,743	s.	15
Capital Cost of Conditioning New Boiler (1929)		580		16
Capital Cost of Extension (1931)		2,402		0

£ 13,726 11 No provision is made herein,

BALANCE SHEET—GRADING ACCOUNT
1st JANUARY, 1932 TO 31st DECEMBER, 1932

EXPENDITURE		REVENUE	
	<i>Sh.</i> <i>cts.</i>		<i>Sh.</i> <i>cts.</i>
Salaries—		Maize—	
Graders and Inspectors	11,695 00	296,212 bags at 5 cents each	14,810 60
Clerk	2,472 00	50,217 bags at 1 cent each	502 17
Labour	929 89	Potatoes—61,462 cwt. at 20 cents per cwt. .. .	12,292 40
Sundry Expenses	80 00	Beans—5,703 bags at 5 cents each	285 40
Travelling	186 70	Moisture Tests—two at Sh. 5 each	10 00
Passages (Proportionate)	1,442 57	Expenses of Fumigating one truck of beans .. .	10 00
Office Rent (Proportionate)	125 00		
Housing (Proportionate)	1,533 50		
Medical Services (Estimated)	438 36		
To Balance Excess Revenue over Expenditure .. .	9,007 55		
	<i>Sh.</i> 27,910 57		<i>Sh.</i> 27,910 57

Part III.—Animal Industry

REPORT OF THE DEPUTY DIRECTOR (Animal Industry) AND CHIEF VETERINARY OFFICER

This report, covering all branches of the Animal Industry Division, is presented according to the plan adopted last year, and will be divided into the following sections :—

- (a) Veterinary Administrative and Executive.
 - (i) Settled Areas.
 - (ii) Native Reserves.
- (b) Veterinary Research.
- (c) Animal Husbandry.
 - (i) The Live Stock Industry.
 - (ii) Experimental and Investigational Work at Government Farm, Naivasha (in collaboration with Rowett Research Institute, Aberdeen).

The reports under (b) and (c) are given separately at the conclusion of my own report, by the officers carrying out the services.

There is also included a list of publications from the Division, and a brief outline of research work on animal disease carried out during the year 1932 at the Veterinary Research Laboratory, Kabete, or planned for 1933, additional to the work recorded in last year's annual report.

This report has been considerably curtailed, as compared with previous years, on grounds of economy.

LIVE STOCK INDUSTRY.

The live stock industry is an integral part of the development of this Colony, particularly on the native side, and this industry should not be permitted to remain in its present position.

At this time, it is most desirable that the public should be persuaded of the paramount importance of all matters pertaining to the pastoral industry, since it is important that expressed ideas on policy should be directed towards developing and retaining confidence in the industry as a whole.

In this way, many of those conflicting opinions which go to undermine the confidence of the public may be avoided, to the advantage of the stockowning community.

The unremunerative nature of the live stock and stock products markets precludes a profit, but the solvency of the industry generally is maintained.

An earnest attempt is being made to solve the complex problems connected with supply and demand. Prices have admittedly slightly improved as compared with recent appallingly low figures, but the consumption of commodities has fallen off. So, failing sustained increase in these essential factors, one must look to the alternative of further reduction in costs, and continue what has been done in this direction during the past year.

More organization in the meat and wool industries is necessary, as these young industries must not be discouraged by the lack of facilities for marketing or acquiring the necessary technical advice.

It is realized that these industries are passing quickly through the various stages of development, but good foundations can be laid by the initiation of organized practice.

The desire of farmers to develop mixed farming is increasing, and the advance is deterred by the adverse financial situation. This general desire for the adoption of dairying is reflected in the continued importation of pure-bred stock, increased exports of dairy produce, the serious attempt to import good milking strains, and the improvement in both pasture and feeding in general. While it is admitted this is an improvement in the live stock industry, there still remains a great deal for the stockowners to accomplish in the way of general organization.

TRADE CONDITIONS DURING 1932.

Despite the ravages of locusts in pastoral areas during the past few years, the production of animal products continues to increase in volume, and to a considerable extent this increase is reflected in the export figures for the year. Certain decreases in the import list can no doubt be attributed to the fact that the Colony is now self-supporting in all the major articles of diet.

Butter exports rose from 6,326 cwt. in 1931 to 9,242 cwt. in 1932, an increase of 44.5 per cent. The United Kingdom continues to be the main export market. The Territory of Tanganyika takes second place. A slight increase in the ships' stores trade is recorded, and a small trade with India commenced. In 1932, a start was made in exporting tinned butter, 60 cwt. being dealt with, mostly to Tanganyika Territory.

Ghee.—The ghee trade presents some peculiarities. Exports of high quality ghee increased by 68 per cent to 1,710 cwt., chiefly to Zanzibar and Tanganyika, but the Colony continued to import low quality ghee from Tanganyika at a declared value of Sh. 44 per cwt. This trade has steadily declined during the last three years, and with the increased production of ghee and improved marketing facilities in the Colony these importations will become of yearly decreasing importance.

Wool.—Exports increased in 1932 to 9,529 centals, an increase of 811 centals.

Exports of bacon and ham, cheese, and sheepskins declined in 1932, the markets for these commodities having fallen to a most unremunerative level.

Despite low prices the trade in hides showed a substantial expansion over the previous year, the United Kingdom and other parts of Europe sharing the trade equally, with the United States of America taking an increasing interest.

The inter-territorial exchange of animal products is making a substantial contribution to trade. Apart from the passing through trade in hides and skins, Kenya exported edible products of a value of £30,000 to Uganda and £10,000 to Tanganyika.

The ships' stores trade for 1932 was valued at £7,000. A noticeable increase in the purchase by ships of fresh meat and eggs took place, and there appears to be further scope for development of this trade.

During an exceedingly difficult year, the pastoral interests have, by steady expansion of output, counteracted the influence of lower commodity prices on the Colony's trade, and have made a valuable contribution to the financial stability of the Colony; at the same time, these interests are in a favourable position to benefit immediately from any improvements in the price levels of primary products.

YEAR	Cwt.	Value
1928.. .. .	513	£ 4,917
1929.. .. .	2,631	15,126
1930.. .. .	7,793	53,065
1931.. .. .	6,326	35,618
1932.. .. .	9,242	40,604

Similar figures for ghee and hides and skins are shown under their respective headings.

STAFF AND ADMINISTRATION.

Major H. H. Brassey-Edwards, M.R.C.V.S., Deputy Director (Animal Industry) and Chief Veterinary Officer, proceeded on vacation leave on 5th March, and returned to duty on 20th October.

Captain O. Dixon, M.C., M.R.C.V.S., was appointed Assistant Chief Veterinary Officer as from 1st January.

Captain E. J. Mulligan, M.R.C.V.S., was posted to headquarters for duty as from 1st January until his departure on vacation leave on 11th June.

Mr. J. Walker, O.B.E., M.R.C.V.S., Chief Veterinary Research Officer, Veterinary Research Laboratory, Kabete, was appointed Acting Deputy Director (Animal Industry) and Chief Veterinary Officer, with effect from 5th March, and acted in that capacity until 25th June, when he proceeded on leave pending retirement.

Through Mr. Walker's retirement the stock industry sustained the loss of an ardent research worker, who for a period of fourteen years carried out very valuable work aimed towards the control and eradication of the stock diseases of this Colony.

Mr. R. Daubney, M.Sc., M.R.C.V.S., Assistant Chief Veterinary Research Officer, was appointed Acting Chief Veterinary Research Officer and Acting Deputy Director (Animal Industry) and Chief Veterinary Officer, as from 26th June. He was confirmed as Chief Veterinary Research Officer, Veterinary Research Laboratory, Kabete, with effect from the 7th October, and relinquished the duties of Acting Deputy Director (Animal Industry) and Chief Veterinary Officer as from the 20th October.

This opportunity is taken of placing on record much appreciation of the loyal work carried out by all members of the staff throughout a year of unusual difficulties.

The valuable assistance rendered by officers of the Native Administration is fully and freely acknowledged.

FINANCE.

The revenue collected by the field veterinary staff in respect of inoculation and dipping fees during 1932 totalled £17,422 as compared with £12,116 in 1931. This increase in revenue may be attributed to the increased number of double inoculations carried out, particularly in the Uasin Gishu and Trans Nzoia Districts.

In addition, £257 was collected by the sale of farm produce, ghee, hides and stock from the African Animal Husbandry Centres. The fall in the prices obtained for ghee has resulted in a decreased production during the year under review.

STATEMENT OF EXPENDITURE AND REVENUE, ADMINISTRATIVE, FIELD AND RESEARCH VETERINARY SERVICES, 1922-1932.

Year	Actual Expenditure	Revenue Collected
	£	£
1922 ..	63,209	12,050
1923 ..	51,797	11,067
1924 ..	51,009	18,864
1925 ..	64,769	31,063
1926 ..	68,313	30,036
1927 ..	73,778	27,814
1928 ..	81,184	27,865
1929 ..	93,773	40,542
1930 ..	90,660	31,366
1931 ..	80,071	22,592
1932 ..	63,606	20,678
	£732,169	£273,937

Net expenditure on veterinary services over eleven years £508,232.

1932 is the lowest expenditure figure since 1924.

ANIMAL DISEASE.

In comparison with 1930-31, the disease position is unfavourable this year, and an increase in the number of outbreaks is reported, with the exception of a few of the minor diseases. The chief reason attributed for the increased incidence of disease is the unauthorized movement of native stock, assisted by the presence of large numbers of squatter stock in the settled areas. It has been noted that the prevalence of disease in a district is in proportion to the density of the native squatter stock population.

An increase in the number of outbreaks of rinderpest must be reported throughout the Colony. An extensive outbreak of rabies, affecting canines and small carnivora, has caused much anxiety.

Tick-borne disease in bovines has increased to a great extent in the settled areas, and again epizootic and ulcerative lymphangitis in equines are more prevalent.

Foot-and-mouth disease in a mild form, and anthrax, are reported from most of the native reserves.

Horse-sickness, blackquarter and swine fever have decreased in prevalence.

Rinderpest.

An advance has been made in the methods of the control of rinderpest. The treatment by means of vaccine plus virus has been tried out in the field to a small extent, and in view of the demands by European stockowners a scheduled fee has been gazetted for this service. It is hoped the success of the method will be maintained and proved by means of extended experimental tests, but since the method is at the present time in the experimental stage only and with the evidence available it cannot yet be made an accepted basis for rinderpest control.

The policy of rinderpest control is therefore in a transitional stage, as, in addition to the experimental vaccine plus virus method, the use of inactivated vaccine alone is used extensively by farmers, while the double inoculation form is principally used amongst the native stock.

Unfortunately, the incidence of this disease has increased during the year in the settled areas, as sixty-five fresh outbreaks are reported, as compared with twenty-nine in 1931, thirty-four in 1930, and sixty-six in 1929; and shows the disease has returned to the degree of severity recorded four years ago.

As in former years, rinderpest has been reported from every native reserve, but has been kept in control in the Kajiado district of the Masai Native Reserve, the Machakos district of the Ukamba Reserve, Nandi and Lumbwa Native Reserves, and the North and Central Kavirondo Native Reserves, in a varying degree by the resident staffs, whereas in other reserves the disease has taken its usual toll.

It should be reiterated that in the districts in the settled areas where there are few or no squatter cattle, as the North Nyeri, Laikipia, Naivasha and Molo districts, rinderpest has not been reported, whereas in the Kitale, Uasin Gishu, Lumbwa, Machakos and Nairobi districts, with their vast herds of native squatter stock, the number of outbreaks has increased, and accounts for sixty-three of the sixty-five outbreaks recorded.

The reason for the increased number of outbreaks is the contact, resulting from irregular movements of cattle, between chronic infected herds in native reserves and susceptible stock owned by squatters outside the reserves, as during 1931 no general district inoculations for rinderpest were undertaken by the Department.

The following table shows the total anti-rinderpest double inoculations carried out in the native reserves and settled areas during the past five years :—

	1928	1929	1930	1931	1932	Total
Native areas ..	59,296	65,330	58,626	61,863	53,105	303,320
Settled areas ..	97,185	85,067	73,673	22,731	80,953	364,609
Total anti-rinderpest double inoculations ..	156,481	150,397	137,299	84,594	139,058	667,829

Approximately 50 per cent of the double inoculations carried out in 1932 were in the Uasin Gishu and Trans Nzoia areas, principally amongst native squatter stock.

Contagious Bovine Pleuro-pneumonia.

The incidence of this disease remains satisfactory as far as the settled areas are concerned, but in some of the native reserves it continues to be one of the most important and serious problems confronting the Department, particularly in the Northern Frontier and Masai Provinces.

Much more accurate information is being obtained regarding the distribution of the disease, as a preliminary measure to a vaccination campaign which it is hoped may be carried out in the near future.

East Coast Fever.

The extension of East Coast fever in the non-endemic areas is causing considerable anxiety. There is a definite increase in the number of outbreaks recorded, as compared with last year, although many new dipping tanks have been erected on farms.

This unsatisfactory position may be attributed to a variety of causes, but there can be no doubt that—

- (a) illicit or irregular movements of cattle,
- (b) failure to observe the disease at its onset,

are important contributing factors.

While the majority of stockowners jealously guard their own and neighbouring interests in respect of disease control, others do not sufficiently recognize the necessity for an early diagnosis or prompt application of suppression measures.

A number of farms even still remain without dipping tanks.

It was hoped that the Dipping and Fencing Ordinances would have been made operative during the year, but unfortunately financial requirements were not available.

Hæmorrhagic Septicæmia.

Two outbreaks occurred during the year, the first outbreaks diagnosed in this Colony.

Diseases of Sheep.

Several respiratory diseases of sheep came under observation, in addition to Nairobi sheep disease, heartwater, and parasitic infestations.

These diseases are discussed in the report of the Chief Veterinary Research Officer.

Poultry.

The importation of poultry rules are still under consideration.

Fowl paralysis was diagnosed at the Laboratory in an imported bird. During the year, Kikuyu fowl disease was prevalent.

The disease position in native reserves is discussed under provincial headings.

Sterility.

Each year the problem of sterility is becoming more apparent, and a greater burden on the live stock industry.

Much time and work have been devoted to investigating the causes of sterility from a broad aspect, involving many factors.

The incidence of the disease is great in this Colony, even amongst the indigenous breeds.

Contagious Abortion.

Contagious bovine abortion, vaginitis, and various diseases of the ovaries and fallopian tubes are known to exist to a wide extent, in addition to various nutritional deficiencies.

Rabies.

An extensive outbreak of rabies caused general public uneasiness in both settled areas and native reserves. The Kisumu-Londiani, Molo, Kericho and Sotik settled areas and the Lumbwa, South and Central Kavirondo Native Reserves and contiguous areas were implicated in the outbreak.

The outbreak is believed to have originated in the South Kavirondo Native Reserve, and escapes of rabid animals therefrom spread the infection to the contiguous areas.

The disease has been confirmed both histologically and biologically as affecting dogs and jackals. As the result of bites of rabid animals, several natives have died from the disease, and Europeans and natives have received anti-rabies treatment. Cattle also contracted rabies in that way, and on destruction the disease was confirmed.

The outbreak assumed such alarming proportions that authority was given to embark upon a campaign for the destruction of all uncontrolled canines and small carnivora in the infected areas, and rigorous legislation was introduced for that purpose.

An intensive campaign was thus organized for the destruction of rabies carriers by the laying of poison baits. This campaign is proceeding with satisfactory results.

Great assistance has been given by the Native Administration, Police Officers, Assistant Game Wardens, Europeans, Indian farmers, and by the natives themselves, with the result that the number of rabies carriers has been greatly reduced.

The rabies outbreak has not spread beyond the limits of the areas originally infected.

The numbers of cases of rabies confirmed up to the 31st December are as follows :—

Dogs	...	...	...	...	...	12
Jackals	...	...	...	...	...	9
Bovines	...	...	...	...	...	1

A considerable number must be added to this total, as many suspicious animals were destroyed in such a manner as to render the carcass useless for examination.

The medical authorities report that several natives and Europeans have been treated for rabies throughout the year.

(a) (i) SETTLED AREAS.

SUMMARY OF OUTBREAKS OF DISEASE IN SETTLED AREAS DURING THE PAST SIX YEARS

DISEASE	1927	1928	1929	1930	1931	1932
Rinderpest	73	83	66	34	29	61
East Coast Fever	31	37	32	33	33	76
Pleuro-pneumonia	20	8	4	3	1	1
Blackquarter	22	18	13	93	104	54
Trypanosomiasis	11	6	9	12	10	8
Foot and Mouth Disease	22	7	7	44	20	21
Horse Sickness	8	18	11	20	19	11
Ulcerative Lymphangitis	42	27	23	8	3	9
Epizootic Lymphangitis	7	7	3	3	..	6
Contagious Bovine Abortion	1	9	5	8	29	16
Swine Fever	2	7	..	3	4	1
Anthrax	27	43	20	23	25	25

RINDERPEST SERVICE.

During the year the rinderpest service assisted in district double inoculations in Nairobi, Rumuruti, Uasin Gishu and Trans Nzoia and Lumbwa districts.

QUARANTINES.

The following particulars are furnished in respect of quarantines imposed and revoked during the year, in Settled Areas and Native Reserves, showing comparison with 1931:—

Disease	Imposed		Revoked		Remaining	
	1931	1932	1931	1932	1931	1932
East Coast Fever:—						
Northern "Clean" area	36	46	25	25	63	74
Molo "Clean" area ..	6	12	5	13	14	13
Limuru "Clean" area..	1	..	2	..	2	2
Rinderpest	32	73	33	70	15	18
Trypanosomiasis	12	6	12	8	16	14
Rabies	3	3	1	..	3	6
Pleuro-pneumonia	5	2	5	2	12	12

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE NAIROBI DISTRICT DURING THE YEAR AND THE THREE PREVIOUS YEARS

DISEASE	1929	1930	1931	1932
Rinderpest	45	13	3	13
East Coast Fever .. .. .	..	9	1	3
Bovine Pleuro-pneumonia	1	..	..	..
Anthrax	8	4	3	3
Epizootic Lymphangitis	1	3	..	6
Ulcerative Lymphangitis	9	1	..	4
Horse Sickness	2	5	1	2
Swine Fever .. .. .	..	..	1	..
Blackquarter .. .. .	..	..	6	3
Trypanosomiasis .. .. .	..	4	5	4
Foot and Mouth Disease .. .. .	..	..	1	7
Equine Piroplasmosis .. .. .	..	1	..	..
Hæmorrhagic Septicæmia .. .. .	..	..	..	1

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN
THE NANYUKI DISTRICT DURING THE YEAR AND THE
THREE PREVIOUS YEARS

DISEASE	1929	1930	1931	1932
Rinderpest	4	10	6	..
East Coast Fever	17	10	12	16
Pleuro-pneumonia	2	1	2	..
Foot and Mouth Disease	..	36	5	..
Contagious Abortion .. .. .	..	..	6	..
Trypanosomiasis	1	1	..	2
Heartwater .. .. .	..	..	1	..
Nairobi Sheep Disease .. .. .	..	..	1	..
Blackquarter	3	..	19	1
Horse Sickness	4	8	1	6
Anthrax .. .. .	..	..	..	1

The Nanyuki veterinary district includes the Laikipia administrative district.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN
THE NAKURU DISTRICT DURING THE YEAR AND THE
THREE PREVIOUS YEARS

DISEASE	1929	1930	1931	1932
Rinderpest	3	..	1	3
Pleuro-pneumonia .. .. .	..	..	..	..
East Coast Fever	9	2	12	13
Trypanosomiasis .. .. .	..	..	..	1
Blackquarter	1	6	17	2
Anthrax	5	1	15	8
Foot and Mouth Disease	4	..	6	4
Horse Sickness .. .. .	..	2	1	1
Ulcerative Lymphangitis .. .. .	..	..	1	5
Contagious Abortion	3	..	41	8
Avian Tuberculosis .. .. .	..	..	1	..
Kikuyu Fowl Disease .. .. .	..	..	4	2
Swine Fever .. .. .	..	..	3	1
Redwater .. .. .	..	..	18	9
Anaplasmosis	7	..	25	10
Paratyphoid .. .. .	..	..	2	1
Three Day Sickness .. .. .	..	..	..	3

Uasin Gishu and Trans Nzoia Districts including Kitale.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN
THE ABOVE DISTRICTS DURING THE YEAR AND THE
THREE PREVIOUS YEARS

DISEASE	1929	1930	1931	1932
Rinderpest	1	1	11	24
East Coast Fever .. .. .	..	..	1-	26
Anthrax	4	9	7	9
Blackquarter	9	64	59	42
Anaplasmosis .. .. .	..	..	5	2
Piroplasmosis .. .. .	..	..	2	3
Trypanosomiasis	6	1	..	1
Ulcerative Lymphangitis	7	1	6	..
Foot and Mouth Disease	1	5	10	7
Horse Sickness .. .. .	..	..	6	1
Kikuyu Fowl Disease .. .. .	..	..	27	11
Contagious Abortion .. .. .	..	..	1	..
Pleuro pneumonia .. .. .	..	..	..	1

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE
IN THE LUMBWA DISTRICT DURING THE YEAR AND
THE THREE PREVIOUS YEARS

DISEASES	1929	1930	1931	1932
Sheep and Goat Pox	1	..	..	..
Rinderpest	2	7	5	18
East Coast Fever	6	4	3	8
Trypanosomiasis .. .. .	..	3	3	..
Pleuro-pneumonia .. .. .	..	1	..	..
Contagious Abortion .. .. .	..	2	2	..
Ulcerative Lymphangitis	5	3	..	..
Blackquarter .. .. .	..	6	4	..
Heartwater	1	1	..	..
Horse Sickness .. .. .	..	4	50	..
Anthrax	1	..	..	2
Foot and Mouth Disease .. .. .	..	..	..	2

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE
IN MACHAKOS DISTRICT DURING THE YEAR AND
THE THREE PREVIOUS YEARS

DISEASES	1929	1930	1931	1932
Rinderpest	5	8
Pleuro-pneumonia	1	..	..
Anthrax	1	1
Blackquarter	4	3	1
Horse Sickness	1	..

Mombasa District.

The figures showing the importations during the year of pure-bred breeding and other stock are also shown under the subdivision of animal husbandry.

Stock arriving in Mombasa were as follows :—

(a) From Overseas : 4 horses, 35 cattle, 43 dogs, 39 sheep, 3 camels, 8 poultry, 3 pigs, 8 rabbits, 1 cat, 113 mice and 4 guinea-pigs.

(b) From Up-country :

	1923	1929	1930	1931	1932
Cattle	450	479	548	786	766
Sheep .. ..	..	..	..	595	550

(c) From the Native Reserves of the Mainland by road :

	1923	1929	1930	1931	1932
Cattle	4,963	4,789	4,524	4,678	5,212
Sheep and Goats ..	22,733	23,894	24,014	22,927	23,981
Donkeys	69	42	40	13	..
Camels .. ..	..	..	..	2	3

HIDES AND SKINS INSPECTED FOR EXPORT

	1928	1929	1930	1931	1932
Hides (bundles) ..	8,544	5,219	4,811	5,172	3,525
Skins (bundles) ..	3,184	2,912	1,959	410	429

BRANDING OF STOCK.

During the year, the following brands were issued or otherwise dealt with :—

“S” brands supplied	22
Renewal brands supplied	12
Brands registered	110
Brands transferred	4
Brands cancelled	1

PERMIT SYSTEM.

During the year the following changes took place in the personnel of honorary issuers of permits :—

Remaining 31st December, 1931 ..	137
Remaining 31st December, 1932 ..	140
New appointments	9
Resignations	5
Deceased	1

The opportunity is taken to record appreciation of the valuable assistance rendered by these gentlemen, not alone to the Department, but also to the stock trade in general.

RETURNS FROM THE GOVERNMENT DIPPING STATIONS FOR THE LAST FOUR YEARS

STATION	EQUINES					CATTLE					SHEEP AND GOATS				
	1928	1929	1930	1931	1932	1928	1929	1930	1931	1932	1928	1929	1930	1931	1932
Nakuru ..	36	..	1	41	230	6,974	13,404	1,993	1,826	6,750	15,442	26,997	24,518	29,570	33,817
Gilgil ..	2	1	..	20	..	9,048	9,765	4,049	6,107	3,922	..	..	1,245	..	760
Isiolo ..	121	98	112	134	29	921	..	..	..	..	80,085	55,515	70,295	69,851	68,160
Nanyuki ..	..	2	18	8	..	19,278	25,947	25,631	32,485	29,836	..	..	..	..	..
Rumuruti ..	..	..	..	..	..	1,400	3,115	1,980	4,831	12,772	..	..	1,879	384	122
Eldoret ..	21	16	..	..	..	..	771	1,414	739	..	706	..	..	..	..
Naivasha ..	..	..	..	..	..	..	..	15,256	10,892	13,433	..	..	15,631	15,935	15,278
TOTALS..	180	117	131	203	259	37,621	53,002	50,373	56,880	66,713	96,233	82,512	113,568	115,740	118,137

N.B.—Total number of cattle dips in the Colony=331. Total number of sheep dips in the Colony=103.

During the year 456 dipping fluid samples were analysed by the Senior Agricultural Chemist, free of charge and as a public service. An additional 34 samples were analysed on payment.

VETERINARY QUARANTINE STATION, NAIROBI.

Admissions.

Fifty-four imported bovines passed through the quarantine station during the year; all were imported from Great Britain with the exception of three from South Africa. Of these, nineteen remained over from late admissions in 1931, therefore thirty-five were actually admitted during 1932, of which eight still remained in quarantine at the close of the year.

Two dogs were admitted during the year, and one was still undergoing the prescribed six months' quarantine at the end of the year, the other having been released during the year. The two dogs, two cats (one domestic and one genet), and one Bengal tiger, which remained from 1931, were all released on completing their six months' quarantine.

List of Bovines imported during the year, showing breed and sex.

	<i>Bulls Cows or Heifers</i>	
Friesian	1	2
Ayrshire	8	..
Shorthorn	3	..
Red Poll	1	..
Jersey	3	..
Guernsey	8	4
	29	6
	Total 35	

Mortality.

One Ayrshire bull died suddenly in the quarantine station from acute "quarantine" disease.

Six bovines failed to pass the tuberculin test; four were destroyed during the year and two at the beginning of the current year, the post-mortem examination confirming the presence of tuberculosis in all six. They consisted of three Guernsey bulls, one Guernsey cow, one Ayrshire bull, and one Jersey bull. Four arrived in one shipment early in October and the remaining two in a later shipment in December.

Averages.

The average period of detention in the quarantine station of twenty bulls actually immunized for redwater and anaplasmosis is tabulated, and follows, together with the incubation period and duration of these protozoan diseases. Only eight out of the twenty shown in the table required an intravenous injection of trypanblue to overcome redwater.

Twenty-two cattle, which included all the cows and heifers, were detained the prescribed thirty days for the tuberculin test, of which four reacted to the tuberculin test and were destroyed.

TABLE SHOWING AVERAGE INCUBATIVE PERIOD AND DURATION TO REDWATER, ETC. ON TWENTY CATTLE.

Quarantine No. of Bovine	No. of days elapsing between inoculation and presence of <i>Anaplasma centrale</i>	Duration of reaction to <i>Anaplasma centrale</i>	Number of days elapsing between inoculation and presence of Redwater	Duration of Redwater	Whether Trypan blue given	No. of days elapsing between inoculation and presence of <i>A. marginale</i>	Duration of reaction to <i>A. marginale</i>	No. of days detained in Quarantine	Remarks
166	31	14	15	3	Trypanblue	33	23	179	Imported from S. Africa
167	34	21	21*	1	No	27	30	179	
168	34	14	19*	3	No	43	17	177	
173	32	35	12*	4	No	32	29	180	
174	32	35	12*	4	No	32	16	180	
175	45	18	18	2	Trypanblue	32	16	166	
176	26	23	20	3	No	33	22	199	
177	40	15	14†	1	No	33	16	199	
181	40	27	18	5	No	36	23	146	
182	37	28	22	1	No	34	25	144	
183	41	17	20	3	No	35	13	144	
184	48	22	30‡	1	No	32	21	153	
185	35	21	14	2	No	32	15	154	
186	35	37	15	2	Trypanblue	26	36	168	
187	34	25	11*	3	Trypanblue	33	19	168	
188	33	22	29‡	1	Trypanblue	33	16	168	
189	50	4	22	4	Trypanblue	33	15	164	
194	45	34	17	2	No	42	9	157	
196	41	18	8	4	Trypanblue	29	18	208	
197	36	23	10	4	Trypanblue	34	13	208	
Averages on 20 Bovines	37.45	22.90	17.35	2.65	40%	33.20	19.85	172.40	

* Failed to first inoculation and was re-inoculated for Redwater.

† Failed to first and second inoculations and was inoculated a third time for Redwater.

‡ Probably reacted previously, but parasites not detected until breakdown to Redwater, prior to *Anaplasma Marginale* reactions.

Revenue Collected.

The sum of Sh. 9,358/15 was collected in respect of quarantine fees and inoculation of sera and vaccines to cattle in the quarantine station, of which Sh. 8,872/25 was for quarantine fees, and Sh. 485/90 for charges for inoculations with sera and vaccines.

RESEARCH.

At the Research Laboratory further experiments have been carried out in connexion with the immunization of cattle by the combined vaccine and virus method, and large-scale tests of the safety of the method have been made in the field. The results in so far as the safety and convenience of this technique are concerned have been highly satisfactory. Long-term immunity tests of animals immunized by a closely related method, viz. inactivated vaccine plus attenuated vaccine, in 1927-28, will shortly be made. The technique in question possesses many advantages over the old serum-simultaneous inoculation, and will no doubt prove of the greatest value in the control of this disease.

Foot-and-mouth disease viruses collected in Kenya and Southern Rhodesia have been typed, and the methods of immunization against this disease reviewed, but there is small prospect of devising any practicable method of immunizing cattle.

Investigations into the vecting or intermediary hosts of the viruses of Rift Valley fever and Nairobi sheep disease have been continued, and progress has been made.

A feature of particular interest has been the diagnosis of hæmorrhagic septicæmia in bovines and the preparation of a vaccine.

Rabies diagnosis has occupied a considerable amount of time, and advantage has been taken of the outbreak to carry on a little research.

The first of the publications based on the work carried out by Dr. Cowdry, Dr. Ham, and members of the staff of the Laboratory, has been published.

The tick survey is progressing, and other published results relate to Rift Valley fever, rabies, fowl-pox, parasitic worms, and arachnida.

*Outline of Research Work, 1932-33, Veterinary
Research Laboratory, Kabete.*

Rinderpest.—The vaccine plus virus method of immunization; its application in the field, with particular reference to the control of disease in certain native reserves. Long-term immunity tests of animals treated by this method and by closely related methods. Investigation of the mechanism of immunity.

Foot-and-mouth Disease.—The typing of viruses responsible for outbreaks of the disease in Kenya.

The Snotziekte Group of Diseases in Cattle.—Investigations have shown that there is a disease closely related to, if not identical with, snotziekte, which occurs in various parts of the Colony, and which in the past has not infrequently been mistaken for rinderpest. This disease occurs quite independently of contact with wildebeeste, which are usually regarded as the reservoir of the virus of snotziekte. Both conditions are under investigation.

Horse-sickness.—The histopathology of the lesions. The susceptibility of donkeys. A study is being undertaken of the behaviour of virus inoculated into the central nervous system of mice, after the technique of Nieschultz and Alexander, with a view to determining whether a virus fixed in mice may prove of value in the immunization of horses.

Blue Tongue.—The histopathology of the lesions. Mosquito transmission.

Fowl-pox.—Comparison of virus from different hosts with particular reference to immunizing properties on domestic fowls.

Contagious Pustular Dermatitis.—Investigations concerning the identity of the disease that attacks very young lambs, and that found in older sheep.

Contagious Bovine Pleuro-pneumonia.—An attempt is being made to standardize a serological diagnostic test, and to ascertain how soon after infection a positive reaction is given. Etiological conceptions are being thoroughly overhauled.

Anthrax.—Studies on immunity in connexion with the preparation of suitable vaccines.

Respiratory Diseases of Sheep.—Considerable progress has been made in the etiological study of this group of diseases. The investigations are being continued.

Rabies.

An extensive outbreak of rabies caused general public uneasiness in both settled areas and native reserves. The Kisumu-Londiani, Molo, Kericho and Sotik settled areas and the Lumbwa, South and Central Kavirondo Native Reserves and contiguous areas were implicated in the outbreak.

The outbreak is believed to have originated in the South Kavirondo Native Reserve, and escapes of rabid animals therefrom spread the infection to the contiguous areas.

The disease has been confirmed both histologically and biologically as affecting dogs and jackals. As the result of bites of rabid animals, several natives have died from the disease, and Europeans and natives have received anti-rabies treatment. Cattle also contracted rabies in that way, and on destruction the disease was confirmed.

The outbreak assumed such alarming proportions that authority was given to embark upon a campaign for the destruction of all uncontrolled canines and small carnivora in the infected areas, and rigorous legislation was introduced for that purpose.

An intensive campaign was thus organized for the destruction of rabies carriers by the laying of poison baits. This campaign is proceeding with satisfactory results.

Great assistance has been given by the Native Administration, Police Officers, Assistant Game Wardens, Europeans, Indian farmers, and by the natives themselves, with the result that the number of rabies carriers has been greatly reduced.

The rabies outbreak has not spread beyond the limits of the areas originally infected.

The numbers of cases of rabies confirmed up to the 31st December are as follows:—

Dogs	...	...	...	...	...	12
Jackals	...	...	...	...	...	9
Bovines	...	...	...	...	...	1

A considerable number must be added to this total, as many suspicious animals were destroyed in such a manner as to render the carcass useless for examination.

The medical authorities report that several natives and Europeans have been treated for rabies throughout the year.

(a) (i) SETTLED AREAS.

SUMMARY OF OUTBREAKS OF DISEASE IN SETTLED AREAS DURING THE PAST SIX YEARS

DISEASE	1927	1928	1929	1930	1931	1932
Rinderpest	73	83	66	34	29	61
East Coast Fever	31	37	32	33	33	76
Pleuro-pneumonia	20	8	4	3	1	1
Blackquarter	22	18	13	93	104	54
Trypanosomiasis	11	6	9	12	10	8
Foot and Mouth Disease	22	7	7	44	20	21
Horse Sickness	8	18	11	20	19	11
Ulcerative Lymphangitis	42	27	23	8	3	9
Epizootic Lymphangitis	7	7	3	3	..	6
Contagious Bovine Abortion	1	9	5	8	29	16
Swine Fever	2	7	..	3	4	1
Anthrax	27	43	20	23	25	25

RINDERPEST SERVICE.

During the year the rinderpest service assisted in district double inoculations in Nairobi, Rumuruti, Uasin Gishu and Trans Nzoia and Lumbwa districts.

QUARANTINES.

The following particulars are furnished in respect of quarantines imposed and revoked during the year, in Settled Areas and Native Reserves, showing comparison with 1931 :—

Disease	Imposed		Revoked		Remaining	
	1931	1932	1931	1932	1931	1932
East Coast Fever :—						
Northern "Clean" area	36	46	25	25	63	74
Molo "Clean" area ..	6	12	5	13	14	13
Limuru "Clean" area ..	1	..	2	..	2	2
Rinderpest	32	73	33	70	15	18
Trypanosomiasis	12	6	12	8	16	14
Rabies	3	3	1	..	3	6
Pleuro-pneumonia	5	2	5	2	12	12

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE NAIROBI DISTRICT DURING THE YEAR AND THE THREE PREVIOUS YEARS

DISEASE	1929	1930	1931	1932
Rinderpest	45	13	3	13
East Coast Fever .. .. .	..	9	1	3
Bovine Pleuro-pneumonia	1	..	..	..
Anthrax	8	4	3	3
Epizootic Lymphangitis	1	3	..	6
Ulcerative Lymphangitis	9	1	..	4
Horse Sickness	2	5	1	2
Swine Fever .. .. .	..	..	1	..
Blackquarter .. .. .	..	..	6	3
Trypanosomiasis .. .. .	..	4	5	4
Foot and Mouth Disease .. .. .	..	..	1	7
Equine Piroplasmosis .. .. .	..	1	..	..
Hæmorrhagic Septicæmia .. .. .	..	..	..	1

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN
THE NANYUKI DISTRICT DURING THE YEAR AND THE
THREE PREVIOUS YEARS

DISEASE	1929	1930	1931	1932
Rinderpest	4	10	6	..
East Coast Fever	17	10	12	16
Pleuro-pneumonia	2	1	2	..
Foot and Mouth Disease .. .. .	..	36	5	..
Contagious Abortion .. .. .	..	..	6	..
Trypanosomiasis	1	1	..	2
Heartwater .. .. .	..	..	1	..
Nairobi Sheep Disease .. .. .	..	..	1	..
Blackquarter	3	..	19	1
Horse Sickness	4	8	1	6
Anthrax .. .. .	..	..	..	1

The Nanyuki veterinary district includes the Laikipia administrative district.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN
THE NAKURU DISTRICT DURING THE YEAR AND THE
THREE PREVIOUS YEARS

DISEASE	1929	1930	1931	1932
Rinderpest	3	..	1	3
Pleuro-pneumonia .. .. .	..	..	..	..
East Coast Fever	9	2	12	13
Trypanosomiasis .. .. .	..	..	..	1
Blackquarter	1	6	17	2
Anthrax	5	1	15	8
Foot and Mouth Disease	4	..	6	4
Horse Sickness .. .. .	..	2	1	1
Ulcerative Lymphangitis .. .. .	..	..	1	5
Contagious Abortion	3	..	41	8
Avian Tuberculosis .. .. .	..	..	1	..
Kikuyu Fowl Disease .. .. .	..	..	4	2
Swine Fever .. .. .	..	..	3	1
Redwater .. .. .	..	..	18	9
Anaplasmosis	7	..	25	10
Paratyphoid .. .. .	..	..	2	1
Three Day Sickness .. .. .	..	..	..	3

Uasin Gishu and Trans Nzoia Districts including Kitale.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN
THE ABOVE DISTRICTS DURING THE YEAR AND THE
THREE PREVIOUS YEARS

DISEASE	1929	1930	1931	1932
Rinderpest	1	1	11	24
East Coast Fever .. .. .	..	..	1-	26
Anthrax	4	9	7	9
Blackquarter	9	64	59	42
Anaplasmosis .. .. .	..	..	5	2
Piroplasmosis .. .. .	..	..	2	3
Trypanosomiasis	6	1	..	1
Ulcerative Lymphangitis	7	1	6	..
Foot and Mouth Disease	1	5	10	7
Horse Sickness .. .. .	..	..	6	1
Kikuyu Fowl Disease .. .. .	..	..	27	11
Contagious Abortion .. .. .	..	..	1	..
Pleuro pneumonia .. .. .	..	..	..	1

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE
IN THE LUMBWA DISTRICT DURING THE YEAR AND
THE THREE PREVIOUS YEARS

DISEASES	1929	1930	1931	1932
Sheep and Goat Pox	1	..	..	..
Rinderpest	2	7	5	18
East Coast Fever	6	4	3	8
Trypanosomiasis .. .. .	..	3	3	..
Pleuro-pneumonia .. .. .	..	1	..	..
Contagious Abortion .. .. .	..	2	2	..
Ulcerative Lymphangitis	5	3	..	..
Blackquarter .. .. .	..	6	4	..
Heartwater	1	1	..	..
Horse Sickness .. .. .	..	4	50	..
Anthrax	1	..	..	2
Foot and Mouth Disease .. .. .	..	..	..	2

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE
IN MACHAKOS DISTRICT DURING THE YEAR AND
THE THREE PREVIOUS YEARS

DISEASES	1929	1930	1931	1932
Rinderpest	5	8
Pleuro-pneumonia	1	..	..
Anthrax	1	1
Blackquarter	4	3	1
Horse Sickness	1	..

Mombasa District.

The figures showing the importations during the year of pure-bred breeding and other stock are also shown under the subdivision of animal husbandry.

Stock arriving in Mombasa were as follows:—

(a) From Overseas : 4 horses, 35 cattle, 43 dogs, 39 sheep, 3 camels, 8 poultry, 3 pigs, 8 rabbits, 1 cat, 113 mice and 4 guinea-pigs.

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Cattle	450	479	548	786	766
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During the year, the following brands were issued or otherwise dealt with:—

“S” brands supplied	22
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PERMIT SYSTEM.

During the year the following changes took place in the personnel of honorary issuers of permits:—

Remaining 31st December, 1931 ..	137
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New appointments	9
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The opportunity is taken to record appreciation of the valuable assistance rendered by these gentlemen, not alone to the Department, but also to the stock trade in general.

RETURNS FROM THE GOVERNMENT DIPPING STATIONS FOR THE LAST FOUR YEARS

STATION	EQUINES					CATTLE					SHEEP AND GOATS				
	1928	1929	1930	1931	1932	1928	1929	1930	1931	1932	1928	1929	1930	1931	1932
Nakuru ..	36	..	1	41	230	6,974	13,404	1,993	1,826	6,750	15,442	26,997	24,518	29,570	33,817
Gilgil ..	2	1	..	20	..	9,048	9,765	4,049	6,107	3,922	1,245	..	760
Isiolo ..	121	98	112	134	29	921	80,085	55,515	70,295	69,851	68,160
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During the year 456 dipping fluid samples were analysed by the Senior Agricultural Chemist, free of charge and as a public service. An additional 34 samples were analysed on payment.

VETERINARY QUARANTINE STATION, NAIROBI.

Admissions.

Fifty-four imported bovines passed through the quarantine station during the year; all were imported from Great Britain with the exception of three from South Africa. Of these, nineteen remained over from late admissions in 1931, therefore thirty-five were actually admitted during 1932, of which eight still remained in quarantine at the close of the year.

Two dogs were admitted during the year, and one was still undergoing the prescribed six months' quarantine at the end of the year, the other having been released during the year. The two dogs, two cats (one domestic and one genet), and one Bengal tiger, which remained from 1931, were all released on completing their six months' quarantine.

List of Bovines imported during the year, showing breed and sex.

	<i>Bulls Cows or Heifers</i>	
Friesian	1 ..	2
Ayrshire	8 ..	..
Shorthorn	8 ..	..
Red Poll	1 ..	..
Jersey	3 ..	..
Guernsey	8 ..	4
	<hr/>	<hr/>
	29	6
	<hr/>	<hr/>
	<i>Total 35</i>	

Mortality.

One Ayrshire bull died suddenly in the quarantine station from acute "quarantine" disease.

Six bovines failed to pass the tuberculin test; four were destroyed during the year and two at the beginning of the current year, the post-mortem examination confirming the presence of tuberculosis in all six. They consisted of three Guernsey bulls, one Guernsey cow, one Ayrshire bull, and one Jersey bull. Four arrived in one shipment early in October and the remaining two in a later shipment in December.

Averages.

The average period of detention in the quarantine station of twenty bulls actually immunized for redwater and anaplasmosis is tabulated, and follows, together with the incubation period and duration of these protozoan diseases. Only eight out of the twenty shown in the table required an intravenous injection of trypanblue to overcome redwater.

Twenty-two cattle, which included all the cows and heifers, were detained the prescribed thirty days for the tuberculin test, of which four reacted to the tuberculin test and were destroyed.

TABLE SHOWING AVERAGE INCUBATIVE PERIOD AND DURATION TO REDWATER, ETC. ON TWENTY CATTLE.

Quarantine No. of Bovine	No. of days elapsing between inoculation and presence of <i>Anaplasma centrale</i>	Duration of reaction to <i>Anaplasma centrale</i>	Number of days elapsing between inoculation and presence of Redwater	Duration of Redwater	Whether Trypanblue given	No. of days elapsing between inoculation and presence of <i>A. marginale</i>	Duration of reaction to <i>A. marginale</i>	No. of days detained in Quarantine	Remarks
166	31	14	15	3	Trypanblue	33	23	179	Imported from S. Africa
167	34	21	21*	1	No	27	30	179	
168	34	14	19*	3	No	43	17	177	
173	32	35	12*	4	No	32	29	180	
174	32	35	12*	4	No	32	16	180	
175	45	18	18	2	Trypanblue	32	16	166	
176	26	23	20	3	No	33	22	199	
177	40	15	14†	1	No	33	16	199	
181	40	27	18	5	No	36	23	146	
182	37	28	22	1	No	34	25	144	
183	41	17	20	3	No	35	13	144	
184	43	22	30‡	1	No	32	21	153	
185	35	21	14	2	No	32	15	154	
186	35	37	15	2	Trypanblue	26	36	168	
187	34	25	11*	3	Trypanblue	33	19	168	
188	33	22	29‡	1	Trypanblue	33	16	168	
189	50	4	22	4	Trypanblue	33	15	164	
194	45	34	17	2	No	42	9	157	
196	41	18	8	4	Trypanblue	29	18	208	
197	36	23	10	4	Trypanblue	34	13	208	
Averages on 20 Bovines	37.45	22.90	17.35	2.65	40%	33.20	19.85	172.40	

* Failed to first inoculation and was re-inoculated for Redwater.

† Failed to first and second inoculations and was inoculated a third time for Redwater.

‡ Probably reacted previously, but parasites not detected until breakdown to Redwater, prior to *Anaplasma Marginale* reactions.

Revenue Collected.

The sum of Sh. 9,358/15 was collected in respect of quarantine fees and inoculation of sera and vaccines to cattle in the quarantine station, of which Sh. 8,872/25 was for quarantine fees, and Sh. 465/90 for charges for inoculations with sera and vaccines.

RESEARCH.

At the Research Laboratory further experiments have been carried out in connexion with the immunization of cattle by the combined vaccine and virus method, and large-scale tests of the safety of the method have been made in the field. The results in so far as the safety and convenience of this technique are concerned have been highly satisfactory. Long-term immunity tests of animals immunized by a closely related method, viz. inactivated vaccine plus attenuated vaccine, in 1927-28, will shortly be made. The technique in question possesses many advantages over the old serum-simultaneous inoculation, and will no doubt prove of the greatest value in the control of this disease.

Foot-and-mouth disease viruses collected in Kenya and Southern Rhodesia have been typed, and the methods of immunization against this disease reviewed, but there is small prospect of devising any practicable method of immunizing cattle.

Investigations into the vecting or intermediary hosts of the viruses of Rift Valley fever and Nairobi sheep disease have been continued, and progress has been made.

A feature of particular interest has been the diagnosis of hæmorrhagic septicæmia in bovines and the preparation of a vaccine.

Rabies diagnosis has occupied a considerable amount of time, and advantage has been taken of the outbreak to carry on a little research.

The first of the publications based on the work carried out by Dr. Cowdry, Dr. Ham, and members of the staff of the Laboratory, has been published.

The tick survey is progressing, and other published results relate to Rift Valley fever, rabies, fowl-pox, parasitic worms, and arachnida.

*Outline of Research Work, 1932-33, Veterinary
Research Laboratory, Kabete.*

Rinderpest.—The vaccine plus virus method of immunization; its application in the field, with particular reference to the control of disease in certain native reserves. Long-term immunity tests of animals treated by this method and by closely related methods. Investigation of the mechanism of immunity.

Foot-and-mouth Disease.—The typing of viruses responsible for outbreaks of the disease in Kenya.

The Snotziekte Group of Diseases in Cattle.—Investigations have shown that there is a disease closely related to, if not identical with, snotziekte, which occurs in various parts of the Colony, and which in the past has not infrequently been mistaken for rinderpest. This disease occurs quite independently of contact with wildebeeste, which are usually regarded as the reservoir of the virus of snotziekte. Both conditions are under investigation.

Horse-sickness.—The histopathology of the lesions. The susceptibility of donkeys. A study is being undertaken of the behaviour of virus inoculated into the central nervous system of mice, after the technique of Nieschultz and Alexander, with a view to determining whether a virus fixed in mice may prove of value in the immunization of horses.

Blue Tongue.—The histopathology of the lesions. Mosquito transmission.

Fowl-pox.—Comparison of virus from different hosts with particular reference to immunizing properties on domestic fowls.

Contagious Pustular Dermatitis.—Investigations concerning the identity of the disease that attacks very young lambs, and that found in older sheep.

Contagious Bovine Pleuro-pneumonia.—An attempt is being made to standardize a serological diagnostic test, and to ascertain how soon after infection a positive reaction is given. Etiological conceptions are being thoroughly overhauled.

Anthrax.—Studies on immunity in connexion with the preparation of suitable vaccines.

Respiratory Diseases of Sheep.—Considerable progress has been made in the etiological study of this group of diseases. The investigations are being continued.

Hæmorrhagic Septicæmia of Cattle.—Immunological studies are being undertaken whenever opportunity offers.

Contagious Bovine Abortion.—Diagnostic methods are being subjected to review. The possibility that separate strains of the organism may exist is under investigation. Field trials of practical control methods are being made under close supervision.

Paratyphoid of Calves.—The causal organism is being compared with numerous stock *Salmonella* cultures, with a view to accurate typing of the Kenya strain. The detection of adult carrier animals by means of the agglutination test is proving of value.

Fowl Typhoid.—Immunological studies are being continued.

Sterility in Cattle.—Experimental investigation of an apparently contagious form of sterility, which may be associated with a contagious vaginitis.

East Coast Fever.—Comparative studies of *Theileria* obtained from other countries. Investigation of immunity. Attempts to evolve a therapeutic treatment. Transmission by ticks other than *R. appendiculatus*.

Trypanosomiasis.—Attempts to establish serological diagnostic methods for the important African species on a practical basis.

Ticks.—The distribution of tick species and its relation to the incidence of tick-borne diseases in Kenya. Description of new species collected in the Colony. Investigation of the life-cycles of different species.

Myiasis.—A study of several species of blow-flies with reference to their development and their mode of infesting domestic live stock.

Tsetse-flies.—Survey of the tsetse-flies of the Colony. Observations are being made on fly-infested areas. Experimental trapping is being carried out, and a systematic investigation of methods of control has been arranged with the collaboration of the Kenya Medical Department and the Department of Tsetse-fly Control of Tanganyika Territory, extending over a period of years.

Helminths.—A survey of the helminths of domestic and wild ruminants is in progress. New species have been described, and the relationship of infestations of game to infestations of domestic animals is being investigated.

Research in the Field by J. Anderson, B.Sc., M.R.C.V.S., at Sangalo African Veterinary Training Centre, North Kavirondo.

Excretion of the Alpha Hormone in the Urine of the Pregnant Cow.—Investigations carried out during the year have shown that the alpha hormone (oestrin) is present in the urine of the native cow during pregnancy in comparatively small amounts. Very small amounts are excreted during the first 100 days of pregnancy, that is, less than 30 m.u. per litre of urine. Thereafter it increases gradually, and reaches a maximum towards the end of pregnancy of 830 m.u. per litre. There is, however, considerable individual variation in the amount excreted at any particular stage of pregnancy and from time to time in the one animal.

The Presence of Anterior Pituitary Hormones in the Blood and Urine of Pregnant Cows.—The rho II factor of the anterior pituitary does not occur in the urine of pregnant cows. As yet insufficient work has been done to state definitely that it is absent or is present in very small amount in the blood.

The Seasonal Incidence of Matings in Native Cattle.—Data which have been collected from certain stock farms show that heifers tend to mate more frequently during the dry season of the year. This fact is borne out by native evidence from North Kavirondo; here a calving season is recognized which corresponds to a mating season in January.

Through the kindness of the Director of the B.E.A. Meteorological Services, information relating to rainfall and temperature has been obtained for several districts. It has thus been possible to obtain a correlation between sexual function and climatic conditions.

It is suggested that the seasonal incidence of matings in cattle is due to environmental factors which stimulate the anterior pituitary to elaborate the rho I factor, which, indirectly, through the medium of the ovary, is responsible for the state of oestrus. Present knowledge does not permit us to do more than refer to these environmental factors generally in terms of light and food.

It would be premature at this stage to point a practical application. Nevertheless, it should be borne in mind that an increase in sexual and reproductive functions at one time of the year implies a lesser capacity for these functions at others. Cows kept under wholly natural conditions in this country may therefore experience a form of temporary sterility.

The Effect of Adrenalin upon Milk Yield in the Goat.—Experiments are in progress which show that adrenalin is effective in causing a reduction in the yield of milk. This is probably brought about through the action of adrenalin upon the blood pressure and blood flow to the mammary gland.

It is known that emotional states, change of temperature, etc., are responsible for variations in milk yield. The secretion of adrenalin is normally increased under similar conditions. It is therefore reasonable to postulate that certain variations in milk yield may be due to increased outpourings of adrenalin.

GHEE PRODUCTION.

Greater efforts have been made in certain native pastoral reserves to instruct and demonstrate better methods of producing ghee, in order that the native may obtain a high class clean product for market.

Difficulties have been encountered, which are mostly due to the fluctuating market price of ghee, and, through propaganda at native *barazas*, it was necessary to impress upon the milk vendors the need for accepting a lower price per gallon.

It can be recorded that the production of ghee has increased immensely, particularly in the Nyanza Province, and there would appear to be plenty of scope for further greater production, provided the facilities are available.

Hitherto, the general marketing, etc., has been undertaken by the departmental officer concerned, and with the object of relieving officers of this task and giving greater incentive to commercial marketing, Government have appointed an agent for the sale of ghee.

If all the ghee made under departmental supervision is sold through an agent, it is felt that an early acceptance of standardized grades of ghee will prove effective and help in any attempt to promote an overseas trade.

A large number of dairies owned by Africans in certain reserves have been closed down on account of debt to the suppliers of milk, owing to the fall in the price of ghee and lack of knowledge and experience of business methods.

It is hoped in future to make more effort in certain reserves, where there are concentrations of cattle, with the object

of establishing permanent milk sales at economical prices, in order that the ghee production may increase and the native may gain advantage by the receipt of ready cash.

The quality of ghee produced in native reserves (particularly Nyanza) has improved, and considerable quantities were exported to neighbouring territories.

Every year large consignments of poor quality ghee are imported from Mwanza, and for this reason the price of local produce is consequently decreased.

Activities in Native Reserves.

Coast.—794 tins were exported through Mariakani trading centre to Mombasa and sold at an average market price of Sh. 19 per tin, and also 13,158 gallons of milk were sold at 60 cents per gallon. Twenty-eight tins of ghee were made at the Local Native Council dairies at Gathani, Halslem, and Bamba, and sold in Mombasa at from Sh. 26 to Sh. 30 per tin.

Kisumu ghee is sold in Mombasa at Sh. 23 per tin, and has affected the price of locally made ghee, which must be sold at Sh. 36 per tin to repay the high price of 30 cents per gallon paid to the native producers.

Lumbwa.—An attempt has been made to start a dairy, but without success.

Northern Frontier.—During the period of plentiful grass, 1,035 lb. of ghee were made at the Isiolo Animals Husbandry Centre. Ghee was also made from goat milk to test its value.

Central Kavirondo.—The Local Native Council dairy at Kisiani was controlled by the district veterinary staff. 11,361 gallons of milk were received at a cost of Sh.2,364/73. Ninety-nine tins of ghee were sold at an average of Sh. 22/68 per tin, and the revenue obtained was Sh. 2,256/25, while fourteen tins on hand at the end of the year were sold for Sh. 291.

The price of ghee fluctuated from Sh. 25 per tin in January to Sh. 19/50 in October, and rose to Sh. 24 in November, and fell again by the end of the year to Sh. 21.

The cream from the Kisiani Dairy is transported to the Maseno Training Centre, and made into ghee by the pupils in training.

Kisiani Dairy serves a very small area, in which milk production is not of primary importance, yet the figures appended show that some fifty or sixty people have received the sum of Sh. 11,996 in four years, or an average of approximately Sh. 3,000 annually. The figures are :—

Year	Amount of milk received Gallons	Daily Supply Gallons	Price per gallon Cents	Sh. cts.
1932	11,361.2	31	23	2,364 73
1931	8,561.0	23	32	2,733 57
1930	10,561.5	29	32	3,379 68
1929	8,025	24	40	3,521 00

These figures indicate the extent of production of animal products that could be attained if a group of supervised dairies was organized and run on the lines of Kisiani Dairy.

The output of ghee from the 67 field dairies in the Central Kavirondo Reserve during the year totalled 162,820 lb., bringing to the native stockowners as much as Sh. 90,734, or about 55 cents per pound.

In addition, there is a considerable output of ghee made by Indian traders, who purchase milk from the natives.

In the Kano Location, fluctuating ghee prices, different prices paid to and asked for by milk suppliers, lack of capital by owners of separators, and lack of supplies to support separators, have rendered the making and supply of ghee difficult, but whereas the number of separators working at the beginning of the year was only two, the number increased to fifteen during the year.

The production of ghee from East and West Kano and Nyakatch Locations has increased from 2,604 lb. in 1931 to 7,472 lb. in 1932.

Masai.—The attitude of the Masai towards the making of ghee is one of extreme apathy, as they have little demand for money. Their requirements of cash are met by the sale of animals, a less laborious method than conveying milk to a departmental field dairy every day.

Other difficulties exist in the promotion of the production of ghee from Masai sources, such as (a) the field dairies must necessarily be widely separated, and in consequence the overhead charges such as transport and running expenses are high in proportion to the output; and (b) the shortness of the season during which surplus milk is available.

Traders in the district have been encouraged to manufacture ghee on their own account with equipment hired from the Local Native Council.

The total output of ghee was negligible in quantity, as the locust invasion brought progress in this direction to a standstill.

In the Ngong district of the Masai Reserve a field dairy and ghee kitchen were erected in the Sigheri area, which were kept operating during the long rains, but had to close down owing to lack of grazing and shortage of milk.

Ngong Training Centre.—32,050 lb. of milk from the native herds produced 1,563½ lb. of ghee, or 20.5 lb. of milk to make one pound of ghee, and the surplus milk from the grade herd made 874½ lb. of ghee. The ghee was sold at Sh. 31 per tin of 40 lb., as compared with Sh. 30 per tin from the native herd.

Machakos Training Centre.—28,800 lb. of milk from the native cattle produced 2,878 lb. ghee and 1,925 lb. of butter, from which was made 1,326 lb. of ghee, or 21¾ lb. of milk to make a pound of ghee, which sold at approximately Sh. 24 per tin.

Nandi Training Centre.—31,000 lb. of milk made 2,129 lb. of butter, which made 1,600 lb. of ghee, or one pound of ghee to every 19½ lb. of milk. 14 lb. of milk equals 1 lb. of butter.

North Kavirondo.—At the beginning of the year, five ghee stations were in operation, and five other stations commenced work during the year; two further stations were erected during December, making a total of twelve ghee stations in North Kavirondo.

While funds are provided for the erection of these stations by the Local Native Council, the actual erection of the stations, management, production of good quality ghee, and sale of all ghee, is under the control of the Veterinary Department.

It is the custom to cook the ghee (a) at the station of origin, (b) to re-cook it again at Sangalo Training Centre. This ensures a product of uniform quality. Loss in re-cooking was negligible.

The summary of production for all stations is as follows :
Milk, 442,046 lb. ; cream, 50,928 lb. ; butter, 25,643 lb. ; ghee, 18,515 lb. Amount of cream produced and sold as such, 8,207 lb.

The export of ghee shows a steady increase in quantity during the last six years :—

YEAR	CWT	VALUE
1927	116	726
1928	121	1,004
1929	534	4,476
1930	793	4,927
1931	992	3,810
1932	1,689	6,684

The fall in value during the year is shown from the considerably lower value of the increased output.

The price obtained locally for ghee has fallen from an average of Sh. 24 in 1931 to Sh. 19 in 1932, and local sales dropped proportionately.

HIDE EXPERIMENTATION.

As a result of the provision of the sum of £500 from the Native Trust Fund the experiments proposed by the late Veterinary Adviser to the Secretary of State into the causes of "blister" in hides were undertaken by the Department during the year.

The cost of the experiment will be reimbursed from the proceeds of the sale of hides.

As improvement in the preparation of East African hides is a matter of great importance, the opportunity of arranging for the experiment to inquire into the cause of one of the principal defects was accepted by the Government of this Colony. The information arising out of the investigations will be useful to other Colonial Governments.

Two consignments of hides experimentally prepared have been forwarded to the Imperial Institute and the British Tanners, Ltd., in order that a report may be made on each bale, and the consignments valued and sold by arrangement.

Two series of experiments were undertaken on freshly flayed hides of native cattle, one to be completed during the dry season, and the other in the wet season.

1,000 hides of average weight were used, 500 to each experiment.

Arrangements were made for the purchase of the hides from the Nairobi Abattoir, and the experiments were carried out on an adjoining area of ground, which it was necessary to fence in order to avoid damage or destruction of hides by vermin and game.

Meteorological readings were taken three times daily during the progress of the experiments, and a definite system of marking and reading was instituted. These records were forwarded with each consignment.

The scheme of experiment embraced interrelated series, covering both wet and dry seasons of the year; the period elapsing between flaying and stretching to dry; presence or absence of fat and meat; drying under variously modified "shade" conditions of simple application; and drying in accord with existing native practice, so as to adduce evidence of the influence of the ground upon which the hide may be stretched.

The main object of the experiments is to acquire precise information of the factors believed to influence the formation of "blister" in hides, and in order that Government may have better knowledge so as to instruct the large number of individual producers.

No report has yet been received on the consignment of hides.

Activities in the Native Reserves.

Coast.—There is a decided drop in the export of hides, but a slight increase in quantity of skins.

Hide *bandas* have been established at trade centres in the Kwale district, and practical demonstrations of better preparation were given throughout the Province.

Lumbwa.—This district for the first time is exporting shade-dried hides. A hide-drying *banda* was erected at Kericho, and three natives have been trained in hide preparation work. 576 shade-dried hides were sold for demonstration purposes, and realized high prices, varying from Sh. 12 to Sh. 18 per *frasila*.

Masai.—Wherever possible, hides from slaughtered animals were cleaned and shade-dried before returning them to the natives.

While evincing apparent interest and anxious that their hides should be cleaned for them, not one Masai, even when given all the necessary facilities, could be persuaded to clean

a hide for himself. Here again, as in the case of ghee, progress is dependent on the economic factor, and with a work-shy Masai, until the need of money becomes a pressing one, he will obtain it by the most simple and effortless method.

An attempt was made to start shade drying of hides in the Ol Lorian, but as sun-dried hides realize the same price, the Masai could not be induced to bring in the hides.

Machakos.—Hide *bandas* were erected in Machakos near the slaughter-house, and the opportunity taken to demonstrate the value of better preparation. The prepared hides sold at Sh. 11/50 per frasila, as compared with Sh. 3 for ordinary sun-dried hides. Arrangements are in hand to build more shade *bandas* in the reserve.

Nandi.—An earnest attempt was made to persuade the Nandi natives to make use of the hide *bandas* erected last year, and a trained Nandi native, well experienced in flaying and hide preparation was provided for the purpose of demonstrating, but the attempt was received in an apathetic manner.

It is doubtful if the better preparation of hides in Nandi will make any definite progress, partly because the Nandi native makes domestic use of hides, but chiefly on account of the absence of organized markets where cattle are slaughtered, consequently the volume of output does not warrant the establishment of an experienced grader and dryer within the reserve, and without competitive marketing facilities the itinerant trader buys at a figure far below the ruling price.

Central Kavirondo.—A special effort was made in the Central Kavirondo Native Reserve to encourage the natives by propaganda and demonstration, with the object of assisting the production of shade-dried hides of good quality.

Although great improvement in the quality and quantity of shade-dried hides can be recorded by the increase in the number of frasilas offered for sale, there is yet much patience required to bring the quality into a higher grade by means of better flaying and preparation.

There are sixty hide *bandas* operating in this reserve, which are in charge of private owners who purchase the raw hides from natives, and afterwards dress, clean, shade-dry, and market them.

Unfortunately, the grass roofs of the hide *bandas* readily become dilapidated, and rain soaks through, to the detriment of the hides.

The generous offer of the Local Native Council of Sh. 8,000 was accepted for the erection, during 1933, of 18 *bandas* of a permanent type, consisting of a corrugated iron roof, with cedar-wood post supports, and enclosed with wire-netting. These *bandas* will be built in the chief marketing centres.

An approximate estimated production and value of shade and sun-dried hides in the Central Kavirondo Reserve is:—

Shade-dried Hides.

15,737 frasilas at Sh. 12/50 each ... Sh. 196,712/50

Sun-dried hides.

3,808 frasilas at Sh. 7 each ... Sh. 26,656/00

Total, 19,545 frasilas, valued at ... Sh. 223,368/50

It should be noted that a considerable sum of money, which can be considered a profit, has been returned to the natives of this reserve as the result of the better preparation of hides.

The natives realize now the financial advantage to be gained by selling a better quality hide, and it is hoped that the great efforts may be continued to increase a better production and maintain the increased value.

North Kavirondo.—The hide industry in North Kavirondo has many difficulties to contend with, which prevent its rapid development. An immense amount of propaganda is required to stimulate the natives to shade-dry hides. To do full justice to this aspect of the problem a much bigger native staff is required than is available at present.

Hides produced in North Kavirondo during 1932:—

Sun-dried	...	...	...	...	9,511 frasilas
Shade-dried	...	...	...	...	1,342 frasilas

The majority of hides produced at present fall into one of the lower grades of the sun-dried type.

The following is the number of hide *bandas* in North Kavirondo: North Maragoli, 3; North Teriki, 4; Maram, 6; Wanga, 1; Malikisi, 1; Buhayo, 1; Kimilili, 1; South Maragoli, 3; Bunyore, 2; Waholo, 1; Mumias, 2; Kakalelwa, 1; Bungoma, 1; a total of 27.

Northern Frontier.—A commencement was made in this Province, and a tribal retainer from the Garissa district was trained at the Isiolo Training Centre in the better methods of preparation of hides. Although this instructor met with difficulties, in that the natives will not pay any attention to his teaching, the enthusiasm of the District Officer has been the cause of a definite advantage in assisting in the sales of shade-dried hides.

The quantity and value of exports of hides and skins from the Colony for the last five years are shown below :—

YEAR	Hides	Value	Skins	Value
	Cwt.	£	No.	£
1932	53,506	87,067	524,329	16,167
1931	34,848	63,354	942,285	36,870
1930	46,066	115,112	1,709,155	66,131
1929	64,369	263,804	1,502,203	74,052
1928	54,735	239,860	1,702,858	82,581

ENTOMOLOGY.

Ticks and Tick-borne Diseases.—The problems relating to ticks and tick-borne diseases throughout the Colony have been dealt with by the Veterinary Entomologist (Dr. E. A. Lewis, M.Sc., Ph.D.). His activities in the field have been concentrated more particularly on the peculiarities of tick distribution in the Masai Reserve. For many years, it was believed that, with the exception of the area adjoining the Ngong Hills and the Trans-Mara country, the reserve was free from East Coast fever and its chief vector, *Rhipicephalus appendiculatus*.

A searching inquiry into the past and into the present conditions has revealed the fact that wider areas than those suspected have been rendered "dirty". The extensions seem to have been from known East Coast fever centres, or along the boundaries of the Kikuyu and Ukamba Reserves. Belts of country along the eastern wall of the Rift Valley, and near the Kedong River, on both sides of the Mara River, and adjoining the Sotik district, have become endemic to East Coast fever.

According to the degree of intensity of tick distribution there is evidence of tendency to spread. A comprehensive and detailed account of the ticks and tick-borne diseases in the Masai Reserve will be published later.

Tsetse-flies.—During the year the Veterinary Entomologist was instructed to include in his duties the study of tsetse-flies and their distribution throughout parts of the Colony.

Considerable progress has been made and much detailed information gained. The result of a careful survey of the tsetse-flies in the Masai Reserve will be published shortly. The position concerning this pest in the coastal area has been the subject of preliminary investigation, and it is a pleasure to acknowledge the valuable advice and guidance which has been received from Mr. C. F. M. Swynnerton, Director of Tsetse-fly Control in Tanganyika Territory.

It is hoped that this line of research will be strenuously pursued in the future, and not allowed to lapse. It has been, and is, our hope to continue this work, and thus contribute Kenya's share to the veterinary aspect of the subject.

PASTURE INVESTIGATION.

During the year under consideration, work on pasture investigation has continued in collaboration with the Officer in charge, Grassland Investigation. The main problems which have to be taken into account are (1) the improvement of management over vast areas of natural pasture chiefly in the native reserves, and (2) the provision of comparatively small areas of cultivated pasture. This latter problem at present concerns only more advanced stock farming under European settlement, but in the future it will apply in some measure also to the more thickly populated native areas, which are, of necessity, the higher rainfall parts of the reserves.

Improvement under (1) is dependent on (a) the limitation of stock to the carrying capacity of the areas concerned, and (a) the possibility of introducing improved methods of grazing management.

There appears no alternative to drastically enforced legislation for the purpose of bringing about stock reduction, and even if this can be applied, the problem is further complicated by conflicting interests with the flooding of the stock markets which would ensue.

The development of improved grazing management amongst stockowning tribes depends upon the existence of a more advanced state in land tenure than communal ownership and upon an adequate distribution of permanent water supplies. The former must be encouraged if progress is to be made, and already considerable improvement can be reported with regard to distribution of water supplies in a number of native areas. It is essential that every effort should be exerted to remove obstacles for the improvement of pastures in the native reserves.

The development of cultivated pastures in areas of European settlement is dependent on the possibility of cultivating superior herbage species in the areas where types suited to the conditions of more intensive grazing do not already exist. It is necessary first to isolate the valuable species from the indigenous flora, and at the same time to experiment with introduced herbage plants, although few of the latter have so far given promise of fulfilling the requirements.

Another important line of investigation is that on fodder crops. Such crops are essential to stock farming in most parts of Kenya, and efforts are being made to determine those best suited to areas which experience different climatic conditions.

During the year, work has been continued at the animal husbandry centres on experiments designed to give information on the effects of different intensities of grazing and on grass-burning on different types of natural pasture, and efforts have also been made to establish observational plots of promising species and fodder crops, with the object of determining the behaviour of the various plants under different climatic and soil conditions. The whole of this work has, unfortunately, been greatly retarded by frequent locust attacks.

The feeding of dairy stock is very important, and each year it is noted that more serious consideration is given to this phase of development, as much useful knowledge has been gained by practical experience.

In the established pastures of this Colony we have a good natural food which in a normal season of rain possesses qualities of palatability and nutritiousness.

The cheapness and quality of this food has made the different conditions of production a possibility through the careful management of pastures by an intensive system of paddocking and the conserving of grasses by a rotational system of grazing.

The annual rainfall was variable throughout the Colony, although sufficient for an ample growth of pasture; unfortunately, the depredations of locusts on the new growth of grass caused great hardship and made the rainfall effects almost negligible.

Experimental Farm, Naivasha (Rowett Institute).

As the result of these invasions, the experimental work undertaken at the Experimental Farm, Naivasha, has suffered

in respect of grassland improvement. However, the following observations have been made regarding feeding experiments for milk production :—

1. *Feeding for Milk Production.*—(i) The addition of maize ensilage at the rate of 30 lb. per day to the concentrates ration increased the individual yield by one-third of a gallon daily during the drought period, January-March, 1932.

(ii) The addition of green forage, kale and lucerne, fed at the rate of 20 lb. per cow daily, to the concentrates ration increased the individual yield by approximately one-half gallon daily over the period July-December, 1932.

(iii) Green lucerne alone, fed in quantity, up to 55 lb. daily, to cows on very restricted grazing, maintained a full milk yield over a six weeks period, comparable to yield obtained when pasture is succulent.

2. *Calf Rearing.*—Extension of the period of hand-feeding from six to nine months resulted in increased live weight of 40 lb. per head at nine months' old, at an additional cost per calf of Sh. 9 per head.

The rearing of calves in pairs on foster mothers was found to be quite successful; this method producing better growth rates at a lower cost per head than was experienced in hand rearing.

3. *Sheep Feeding.*—The supplementary feeding of (a) a mineral mixture, (b) a mineral plus concentrates mixture, to weaned lambs resulted in a small but definite increase in live weight, which, however, scarcely justified the outlay, having regard to the market value of sheep products at the present time.

4. *Presumed Iron Deficiency.*—An observational test to throw light on the nature of unthriftiness in cattle grazed on an area of laval origin in the Naivasha district was carried out. Throughout the period of twelve months no signs of malnutrition were noted, nor were any beneficial effects apparent as the result of feeding iron-rich salt mixtures.

Grassland Improvement.—No significant results were obtained from the work attempted under this heading, the growth of herbage throughout the year being, on account of continued locust depredations, negligible in quantity and of short duration.

Statements on milk production costs and the marketing of the wool clip in 1932 are included in the separate report of the Officer in charge, Experimental Farm, Naivasha.

OVERSTOCKING : NATIVE RESERVES.

The native pastoral areas and reserves comprise approximately 100,000,000 acres of this Colony. They are grazed by approximately twelve million head of stock, and considerable herds of game. Large portions of the reserves are not available for use, as will be explained.

By allowing the pastoral native reserves to remain overstocked and by failing to make the necessary changes, is only putting off the evil day, as the reserves are rapidly deteriorating into desert conditions.

A fair indication of what exists in the pastoral areas may be taken from the conditions existing in the Machakos Native Reserve.

The rainfall averages about forty inches a year. Such a rainfall, under conditions of a dry easterly wind, a steady hot sun, and a porous quartz soil, is insufficient to ensure adequate and permanent grazing for a large stock population. In some areas, although there may be a sufficient amount of grazing, there is no water to be obtained, or the area is infested with tsetse-fly, etc. In others, there is an adequate amount of grazing for a short while after the rains, but not enough to last for an appreciable time. An increasing amount of land is being placed under cultivation, while big areas are allowed to remain fallow.

Bearing in mind that the arrest of the process of deterioration and destruction of the land is the essential point of issue, the various factors mentioned, taken together, mean that the reserves have a very low carrying capacity, which must decrease each year under the present conditions.

The success of any reconditioning measures for the amelioration of the present situation is dependent on a reduction of stock; and any means taken without consideration of this fact will be simply adding fuel to the fire.

The problem of the reduction of native stock is one that is becoming increasingly urgent in its demand for solution, because of the complications and the difficulties of interference with the stock prejudices of the natives, to whom cattle have a very special meaning. Nothing can be more pleasant to the minds of the African pastoral peoples than the provision of a large and ever increasing mob of stock. This should not be permitted to continue if the development of the native reserves is to be undertaken and the stock industry to be placed in an economic position.

NATIVE STOCK.

The question of surplus native stock has again been considered, and in spite of the recommendations laid down by several commissions this puzzling problem remains unsolved. No form of destocking would be reasonably successful or justify any necessary measures until a market is made available, and by a market is meant some form of economic disposal. Meat and by-product factories have been considered, but mostly in relation to schemes from the financial point of view and on the basis of an assumed market value for native cattle. It may be that these are not the best avenues to approach this important question; in the absence of markets, it is impossible to assess a market value, and it is only on a basis of actual worth that a value could primarily be assessed. This is an important point and has a definite bearing on any general disposal scheme.

An increased production of dairy products is the main feature of the improvement in the dairy industry, and the organization of departmental services in native reserves has been the practical means of stimulating an enlarged output of native ghee and an increase in value of hides produced by an approved system.

DEVELOPMENT OF THE ANIMAL INDUSTRY IN THE
NATIVE RESERVES.

The present position in the pastoral areas of the native reserves from a disease point of view is very unsatisfactory, and because of the presence of disease the policy of Government can only be one of severe quarantine restriction.

Movement of stock is permitted, however, through certain exits or quarantine stations, where the stock are inspected and dealt with in accordance with the type of stock or disease prevalent, and liberated for general or restricted movement under escort.

In certain native reserves where a continued active campaign has been accomplished over a period, progress can be reported in disease control by the absence of certain specific diseases, with the result that free movement of stock has been permitted from these areas on authorized permits.

The restriction on movement of stock has prevented a general spread of contagious disease, and in consequence the incidence of certain diseases was less. Unrestricted movement of stock during the War period left the whole Colony afterwards very heavily infected, and it is doubtful if certain

pastoral areas will ever recover until some sustained campaign of control is undertaken, such as that agreed to by the Board of Agriculture in respect of the control of rinderpest and pleuropneumonia in the Masai Reserve over a period of five years.

Other colonies have been able to develop animal husbandry in native reserves, but only when the disease control had been accomplished successfully.

A definite programme of work for the purpose of organizing and carrying into effect a system of stock conservation in native reserves has been drafted, but owing to various complications and difficulties which have arisen, the general scheme for the development of the natural resources of the pastoral tribes is still under consideration.

The objects of the general scheme are (1) to prevent and control the spread of animal disease, (2) the improvement of native stock by better methods of animal husbandry, (3) to organize and promote means by which the native may be trained to carry these principles into effect.

PUBLICATIONS.

Bulletins and other articles emanating from the Division of Animal Industry, except the Veterinary Research Laboratory, Kabete, which are shown in the report of the Chief Veterinary Research Officer, were as follows:—

Bulletins.

- “The Poultry Industry: Egg Marketing,” by V. Liver-
sage, B.Sc., M.S., N.D.A., Agricultural Economist,
and W. D. D. Jardine, B.Sc., N.D.A., N.D.D.
(Hons.), Live Stock Officer (Bulletin No. 2 of 1932).
- “A Study of the Ticks in Kenya Colony: The Influence
of Natural Conditions and other Factors on their Dis-
tribution and the Incidence of Tick-borne Diseases:
Part II, A Report on an Investigation into the Tick
Problem of the Rift Valley (continued), the Uasin
Gishu and the Trans Nzoia District, Kenya Colony,”
by E. A. Lewis, M.Sc., Ph.D., Entomologist (Bul-
letin No. 6 of 1932).
- “Silos, Ensilage and Silage,” by T. Y. Watson, B.Sc.
(Agric.), Dip. Agr. (An. Husb.) Cantab., Acting Live
Stock Officer (Bulletin No. 26 of 1932).

"Report on the Economic Results of the Commercial Side of the Farm during 1931," by V. Liversage, B.Sc., M.S., N.D.A., Agricultural Economist, and H. Gunn, M.A., B.Sc., B.Sc. (Agric.), Manager, Government Stock Farm, Naivasha (Bulletin No. 27 of 1932).

Leaflets and Press Articles.

- "The Management of Stock Bulls."
- "A Note on Wool Production."
- "Beans as a Feed for Live Stock."
- "Supplementary Foodstuffs for Cattle."
- "Pumpkins for Stock Feed."

(a) (ii) NATIVE RESERVES.

AFRICAN VETERINARY TRAINING CENTRES.

It has long been the view of this Department that the best method of approaching the native pastoral tribes, with the object of (a) disease control, and (b) the improvement and development of the pastoral industry, is through educational demonstration and propaganda in their various reserves. For this purpose, the idea was conceived of gradually establishing what may virtually be regarded as model dairy farms, directly in contact with the tribes at the most suitable centres available and staffed and equipped to give demonstration and instruction in disease control, veterinary sanitation, and the elementary principles of animal husbandry. A system of resident pupilage has been adopted, the course extending over a period of two years.

Herds of native cattle, representative in type of the areas concerned, have been provided at each centre, in order that the pupils may work with types familiar to them and compare their traditional customs with up-to-date methods.

At the same time a searching investigation is being carried out into the full productive capacity of the various types of native cattle, with the object of selective breeding and herd improvement.

Data obtained in this way clearly indicate that native cattle are capable of vast improvement in every productive direction, a matter of real importance regarding tribal prosperity and overstocking in native reserves.

Disease control, however, is the primary essential in relation to pastoral development. All stockowners desire and demand this service: the native is not an exception.

The native-owned stock population of this Colony has been estimated at approximately 12,000,000 head, and if a general organized system of veterinary service is to be applied, it becomes increasingly obvious that the natives themselves must accept a far greater share of responsibility, for which they must be trained and suitably prepared. Such training and preparation constitutes the most important part of the curriculum at these centres.

It will thus be seen that the whole scheme of veterinary training centres is based on a long-range policy, designed toward the gradual and progressive development from every point of view of the native pastoral industry, and in full sympathy with native capacity to understand and assimilate.

The establishment of centres remains the same as in 1931, since no new development in that direction has been possible owing to financial stringency, and for the same reason further development of certain of these centres has been retarded.

African Veterinary Training Centres are located and discussed as follows:—

Ngong: Masai Province.

Maseno: Nyanza Province.

Sangalo: Nyanza Province (partly developed).

Baraton: Nzoia Province (partly developed).

Isiolo: Northern Frontier Province.

Machakos: Ukamba Province (partly developed).

Mariakani: Coast Province (partly developed).

Ngong African Veterinary Training Centre (Masai Reserve).

Staff: 1 Veterinary Officer, Ngong District; 1 Stock Inspector. Native pupils: 35.

School.—As stated in the 1931 Annual Report, it was decided to reserve the school for Masai pupils only, although a few pupils of other tribes have been accepted by permission.

The school syllabus provides for both literary and technical training, the former being necessary as it has not been possible to obtain sufficient Masai pupils with a reasonably general knowledge of education. In order to give more attention to

individual pupils, the class has been divided into two sections, one section being engaged in literary work whilst the other was on practical, and vice versa.

Teaching of the purely school subjects was carried out by the native teacher, who performed his duties in a very conscientious manner. Progress was such that it was possible to enter sixteen pupils for the Elementary "B" examination, with six successful results.

The school gardens were planted up during the rains with potatoes, peas and maize. Excellent crops were harvested, except in the case of maize, which was damaged by locusts. From five bags of seed potatoes (Kerr's Pink), sixty-six bags were harvested.

To each pupil was allotted a plot of ground, for the cultivation and cleaning of which he was held responsible throughout the year. By this system it was possible to create healthy competition, as prizes were given at intervals for the best garden.

Some doubts were entertained as to whether the Masai natives would react favourably to cultivating *shambas*. At first, they put up a show of resistance, but after a certain amount of persuasion they were initiated into the mysteries of using ploughs, *jembes* and *pangas*. They were greatly impressed by the fact that it was possible to grow crops—namely potatoes and peas—which were not destroyed by locusts. This was all the more appreciated as potatoes and peas augmented their food rations throughout the year.

Hides.—In order to provide for practical instruction in the preparation of hides, an arrangement was made with the various butchers using Ngong slaughter-house that all green hides should be sent to that centre. By this arrangement, two or more hides were available daily for instructional purposes. Demonstrations were given in the following :—

1. Proper method of cleaning and dressing hides.
2. Stretching.
3. Shade-drying.
4. Tying into bundles for transport.

Thereafter the preparation of the hides was entirely carried out by pupils under supervision. Several specimens of leather were obtained for demonstration purposes, with the object of showing various conditions which made a hide valueless, e.g., (a) branding, (b) dry rot, (c) damage by insects to raw hide.

Inoculation.—All pupils have been taught to use a hypodermic syringe, and to take aseptic precautions before inoculating an animal.

When practicable, pupils have accompanied the Veterinary Officer when working in the reserve.

Health.—The school was free from outbreaks of epidemics during the year. On addition to the school, all pupils had to be treated for intestinal parasites.

Learning Capacity.—So far as can be estimated from the work done up to date, Masai youths have average capacity for learning. In fact, when the extreme conservatism of their elders is realized, it is rather surprising to find that these young boys are so amenable to teaching. Up to the present, the majority of the pupils show most interest in things pertaining to animal husbandry, although a few have wider interests.

Buildings.—During the year the following buildings were erected:—

1. A milking shed to accommodate twenty-five cows. This was built of rough forest timber and thatched with grass. The floor is of beaten murrum.
2. A wood and iron shed with beaten murrum floor. This shed provides accommodation for cooking the pupils' food.
3. Wash-house for pupils.

The entire labour lines have been repaired during the year.

The stone building previously used as the office has been taken over as the school, while the vacant wood and iron bungalow has been converted into an office.

In addition to the foregoing, a great amount of time had to be spent in re-thatching the existing buildings.

Rainfall.—The total rainfall for the year was 30.98 inches. This shows a decrease of 4.49 inches on 1931 and a decrease of 13.22 inches on 1930.

Dipping.—As no cases of tick-borne diseases occurred during the latter half of 1931, it was decided to dip at longer intervals; accordingly, dipping has been carried out every seven days.

No cases of tick-borne disease have been recorded during the year.

Ghee.—The following figures show the amounts of ghee made during the year from the native herd, together with the relative amounts of milk :—

Total milk : 32,050 lb. Total ghee : 1,563½ lb. From the above totals, it will be found that 20.5 lb. of milk are necessary to make one pound of ghee.

There has been a marked fall in the output from August onwards. This is due to the grazing having been eaten out by locusts.

The quantity of ghee made from surplus herd milk was 874½ lb.

Ghee was sold at an average of Sh. 31 per tin of 40 lb., which shows a decrease on the prices realized in previous years, but when compared with the price obtained for ghee made in the reserve, namely, Sh. 20 per tin of 40 lb., must be considered satisfactory.

Game.—Fencing was extensively damaged by game, the most troublesome of which were kongoni and zebra. In addition to these, there were incursions of buffalo, giraffe, and lions. During the month of September, three lions raided a mob of cattle and donkeys, killing a cow and a bullock, and wounding a donkey which subsequently died. Two of the lions were shot, a third escaping; but there were no further raids. Hyenas, working in large packs, raided the weaner herd of cattle on various occasions, and killed some ten head all told.

Cultivation.—Lucerne : This crop has yielded several excellent cuttings during the year. Maize : An area had been cleared and ploughed for planting during the March rains. The crop came up very well, but in June was completely destroyed by locusts. Hay : Nine stacks of excellent hay were secured during the year.

Grazing.—Except during the months of May and June, there has been a shortage of grazing throughout the year. In the early months of the year this was due to heavy overstocking which had taken place in 1931. Grazing improved after the long rains, but was practically eaten out by locusts—adults and hoppers—in June and July.

Fortunately, with the reserve of hay and lucerne, it was possible to feed stock, and thereby avert heavy losses from

starvation. The effects of the shortage of grazing were more evident in the grade herd, despite the fact that they were being fed larger amounts of hay and lucerne.

Stock.—Number on hand on 31st December, 1932:—

Total native cattle	...	...	...	126
Total grade cattle	...	...	...	137
Total work oxen	...	...	...	41
Total sheep	...	...	...	118

Disease.

Contagious Abortion.—No cases occurred in 1932. In view of the tremendous losses from this disease in the previous two years, all cows and heifers on the farm have been tested at two months' intervals, but no animal gave a positive reaction.

Blackquarter.—One case occurred during the year, but all animals were vaccinated, and there have been no further cases.

East Coast Fever.—There were no cases during the year.

Scour amongst Native Calves.—All calves were inoculated with colon bacillosis vaccine at birth, and every effort was made to disinfect the calf sheds. In spite of these precautions scouring persisted, and the infected calves were dosed with sodium tellurite. Here again, treatment met with failure. A sick calf was taken to Kabete Laboratory, where the possibility of the disease being a bacillary infection was ruled out. There is, however, a peculiar type of growth to be found on the mucous membranes of the stomachs, investigation into which is at present being carried on at the Laboratory. The only treatment which appears to have a slight beneficial effect on these cases is dosing with an alkali. Changing of the sheds, however, solved the trouble.

Sheep.—A small flock of Masai and Samburu ewes, with a Masai ram, are run at the station. The number on hand on 31st December, 1931, was seventy-eight, whilst at the end of this year the number is one hundred and eighteen. In addition to these, nineteen head have been transferred to the Veterinary Laboratory, Kabete, during the year, and five others died. The annual increase has therefore been sixty-four head, that is, 82.05 per cent, which indicates that Ngong is a good "sheep" district.

Calf Rearing.—The calves are taken away from the dams at birth, and are completely hand-fed on whole milk for a period of two months, after which a gradual change-over is made to separated milk, the fat which is then absent being replaced by the fat contained in concentrates. Funds available for purchasing concentrates being so limited, it has been necessary to reduce the amount of concentrates fed and to replace them with lucerne hay. In spite of this, the calves have done well.

After careful consideration of the results previously recorded at this station, the following system of calf-feeding has been adopted and proved successful :—

NATIVE CALVES

<i>First week</i> ..	.. 1st day ..	colostrum, 1 lb.
	2nd day ..	colostrum, 1 lb. morning and evening.
	3rd day ..	colostrum, 1½ lb. morning and evening.
	4th, 5th, 6th, 7th days as on	3rd day.
<i>Second week</i> ..	Whole milk	2 lb. morning and evening.
<i>Third to eighth week</i>	Whole milk	2½ lb. morning and evening.

At the age of two months, a gradual change-over is made to separated milk. When this change is completed, small quantities of lucerne hay and concentrates are given until the maximum amount is reached.

From records kept it can be stated that up to the time of weaning, the cost of rearing a well-grown calf does not exceed Sh. 28.

GRADE CALVES

<i>First week</i> ..	.. 1st day ..	colostrum, 1 lb.
	2nd day ..	colostrum, 1 lb. morning and evening.
	3rd day ..	whole milk, 2 lb. morning and evening.
	Fourth to seventh days as on	third day.
<i>Second and third wk.</i>	Whole milk ..	3 lb. morning and evening.
<i>Fourth week</i> ..	Whole milk ..	4 lb. morning and evening.
<i>Fifth and sixth week</i>	Whole milk ..	4 lb. morning and evening.
	Separated milk ..	1 lb. morning and evening.
<i>Seventh week</i> ..	Whole milk ..	3 lb. morning and evening.
	Separated milk ..	2 lb. morning and evening.
<i>Eighth week</i> ..	Whole milk ..	2 lb. morning and evening.
	Separated milk ..	4 lb. morning and evening.
<i>Ninth week</i> ..	Whole milk ..	1 lb. morning and evening.
	Separated milk ..	5 lb. morning and evening.
<i>Tenth week</i> ..	Separated milk ..	9 lb. morning and evening.

Lucerne hay is included in the ration in lieu of concentrates.

This ration is continued until the calf is weaned.

GRAIN IN WEIGHT OF CALVES

	Average weight at birth	Average weight at six months	Average daily gain
<i>Machakos</i> ; Native	34 lb.	177 lb.	.79 lb.
<i>Boran</i> : Native ..	40 lb.	223 lb.	1.02 lb.
<i>Grade</i>	46 lb.	237 lb.	1.07 lb.

Three Boran calves from selected dams are being reared for stud bulls, and have been fed on a higher ration.

PARTICULARS OF CALF WEIGHTS AND MILK YIELDS OF SELECTED DAMS

No.	Date of Birth	Weight at birth lb.	Weight 31-12-32 lb.	Milk yield of dam				% butter fat
				Lactation 1st	2nd	(gallons) 3rd	4th	
81	16-4-31	34	653	143	349	342	..	5.3
24	25-1-32	44	400	None	338	214	330	5.6
70	15-5-31	32	520	257	265	235	..	5.3
97	2-2-32	42	384	149	201	246	..	5.6

Native Herd.—This herd comprises three types of cattle—Machakos, Boran and Masai. The object of the experimental work being carried out on these cattle is to obtain reliable statistics of each type as regards :—

- (a) Quality of milk.
- (b) Length of lactation period.
- (c) Whether milk or beef type.
- (d) Calving frequency.

Butter-fat Content of Milk.—From tests carried out in October and November, it was found that there was a general decrease of one per cent in the butter-fat content of the milk. This is thought to be due to the cattle being on practically a starvation diet.

Grade Herd.—This herd provides facilities for instruction of pupils in animal husbandry.

Visitors.—During the year the station was visited by many persons who were interested in the work which is being carried out. The visitors included many European farmers, Government officials, and native stockowners.

All assistance was given and every endeavour was made to supply information desired.

Maseno African Veterinary Training Centre (Central Kavirondo Native Reserve).

Staff.—I Veterinary Officer; I Stock Instructor.

Cattle.—Table I shows the number of stock on the farm at the end of each of the last four years :—

	1929	1930	1931	1932
Breeding stock ..	5	44	116	101
Young stock.. ..	..	6	20	43
Oxen	14	28	67	61

Forty-four animals calved normally during the year; 27 were heifers, 15 second calves, and 2 third calves.

About forty heifers purchased have not yet produced their first calves.

The total area available for grazing at Maseno was not more than 300 acres, and the average number of adult stock carried during the year was from 145 to 150, or, roughly, a beast to two acres. The stock were in excellent condition, despite the fact that the grazing was destroyed by locusts on eight occasions between June and December.

It was noticed that weed plants of various kinds formed an appreciable proportion of the bovine diet, especially so after a visitation of locusts, and even after most of the grass had been destroyed by locusts the cattle did not lose condition, neither did the milk supply suffer to any noticeable extent.

Contagious Abortion.—The whole herd was tested for contagious abortion on three occasions. At the first test, one animal gave a positive reaction; at the second, four; and at the third test there were no reactors in the clean herd.

Milk Yields.—The total amount of milk production was 2,744.31 gallons; the average production per cow per day was 5.03 gallons. A comparison with the 1931 figures is shown below :—

	Milk produced for year	Cow days	Average per cow per day
	lb.		
1931	11,561.0	2,605	4.43
1932	27,443.1	5,457	5.03

Table II shows details of lactation periods completed during 1932, for five animals :—

TABLE II.

Cow No.	Yield of Milk	Days in Milk
	Gallons	
32	251.00	244
11	205.30	348
23	191.45	299
17	160.22	318
111	154.23	271

Table III shows details of cows in milk at 31st December, 1932, for five cows :—

TABLE III.

No. of Cow	Yield to 31-12-32	Days in Milk	Daily Yield at 31-12-32	Highest Yield in a day
	Gallons		lb.	lb.
7	81.38	200	2.94	6.06
74	142.15	194	5.86	10.60
121	84.84	114	5.09	10.20
23	57.39	167	2.4	5.5
17	107.41	123	7.6	9.8

Table IV shows particulars of milk yield of cows which have completed, or which are in their second period of lactation, for five cows :—

TABLE IV.

No. of Cow	1st Lactation Yield	2nd Lactation Yield	3rd Lactation Days in milk	2nd Lactation Days in milk	Remarks
	Gallons	Gallons			
32	205.40	251.0	336	244	Calved again.
28	..	191.45	..	299	Calved again.
16	97.89	114.34	302	296	
23	30.95	130.60	262	332	
11	205.30	88.07	348	62	Still milking.

Butter-fat contents varied from 4.4 per cent to 9 per cent, and averaged 6.5 per cent over 61 tests. It is hoped that regular monthly tests will be made in 1933.

Calves.—Of the 1932 crop of calves, twenty-six are being reared. The average weight of forty-four calves at birth was 34.7 lb., an increase of 3.1 lb. over last year.

Bull calves were, on the average, 7.1 lb. heavier than heifer calves, as shown below :—

	<i>Average birth weight</i>
Heifer calves (26)	31.8 lb.
Bull calves (18)	38.7 lb.
First calves (27)	33.3 lb.
Second calves (15)	36.6 lb.
Third calves (2)	38.0 lb.

Table V shows the difference in birth-weight of first and second calves. In almost every case there is an increase.

TABLE V.

No. of Dam	First calf	Second calf
	lb.	lb.
7	32	37
11	27	30
13	32	36
17	25	32
18	35	38

All calves were weighed at birth, and then weekly for the first two months, and monthly until they reached six months of age.

Table VI shows the increase in weight from birth to six months of five calves :—

TABLE VI.

No. of Cow	Sex	Birth weight	Weight at 26 weeks	Total gain	Average daily gain
		lb.	lb.	lb.	lb.
74	M.	47	213	166	.91
72	F.	43	176	133	.73
92	F.	38	168	130	.71
71	F.	20	149	129	.71
36	F.	35	161	126	.69

The calves received whole milk twice daily for the first two months, at two months a gradual change-over was made to separated milk and concentrates, and at six months the separated milk was stopped; from six months to ten months a small concentrate ration was given, and at ten months the calves were allowed to run out night and day.

Stock Disease.—All the young stock were immunized against rinderpest, blackquarter and anthrax, and there were no deaths from these diseases during the year. Dipping is carried out every five days, and there were no deaths from tick-borne diseases.

A diarrhoea infection gained access to the calf pens in October. About 60 per cent of the calves became infected. No mortality occurred, but as a result of the disease two calves became stunted, and were subsequently destroyed.

The calves were transferred to a new calf shed, and the floor of the infected shed was dug up and relaid.

Pasture.—The grazing during the year was sufficient to maintain the stock in fair condition.

A considerable area of rough grazing was made available by the sisal clearing operations; this grazing consists chiefly of rough *olenge* grass and weeds, with a very small proportion of finer grasses. *Olenge* grass is not relished by cattle, but provides feed when better grazing is not available.

The cattle are herded on the roughage each morning until midday, and are allowed access to the improved area in the afternoon and during the night.

A total area of approximately 90 acres has been planted up with grass, and most of this is now available for grazing.

Twelve acres were planted with Kikuyu grass in September and October. Unfortunately, the Kikuyu grass was eaten to the roots on three occasions by locusts, but despite this the ground should be well covered shortly after the next rains.

On the other area, a mixture of Naivasha star grass and Kikuyu grass was planted; the former covered the ground more rapidly than the latter, but the Kikuyu grass was handicapped to a greater extent by locusts, as they evinced a decided preference for it, eating back to the roots on every occasion. Kikuyu grass is greatly relished by cattle, much more so than any other grass on the farm.

Weeding of pasture absorbed a considerable amount of the farm labour during the year, especially in the wet months; the mower was used to keep down weeds when possible.

Maseno is very fortunate in its rainfall, in so far as the rain is well distributed over the whole year. During 1932, the longest spell of dry weather in which less than .3 inches of rain fell in any one day was three weeks.

Crops.—Buckwheat : The usual small patch of buckwheat was planted and the grain used as poultry food.

Maize : Nine acres of maize were planted in February, but owing to repeated locust invasions and poor germination only about forty bags of maize were obtained. Six acres were planted at the beginning of the short rains, and despite locusts a fair crop should be harvested.

Edible Canna : A hundred edible canna roots were planted out with the long rains, and it is hoped to plant out an acre or two in 1933. Apart from its use as a cattle food, edible canna is a very useful green food for poultry.

Roots : A small area of swedes and mangels was sown ; about two tons of roots were lifted and used as poultry food. An attempt was made to get the cattle to eat them, but without success.

Building and Fencing.—Very little building construction was carried out during the year. Unfortunately, a calf shed and weaner shed were struck by lightning and completely destroyed in the early part of the year. The two buildings had just been completed and were unoccupied.

A new calf shed having a cement floor was built, and is now in use.

Three portable poultry houses were erected, each to house forty birds.

A concrete block two-roomed cottage was built to accommodate the head native scout.

A boiler-house and ghee kitchen were constructed in January, and a hot-water boiler installed. Unfortunately, the supply of clean water is dependent upon rain-water tanks ; when they are empty, all the water necessary for the dairy has to be carried from the river, which is some distance away.

Money was not available for the purchase of fencing materials, and all the available material was utilized in making four calf paddocks, one of 1 acre, two of 3 acres each, and one of 7 acres.

Sisal and Bush Clearing.—As in previous years, much labour was expended on the stumping of sisal, and it is a pleasure to record that, with the exception of about two acres, the whole of the farm has now been cleared.

The sisal stumps have been piled in rows until such time as they can be carted off, and the grazing, such as it is, between the rows can be utilized.

As most of the sisal was taken up by the roots, very little trouble is being experienced by suckers shooting up.

Pupils.—At the beginning of the year three Nandi pupils were transferred to Baraton, and three Bantu Kavirondo to Sangalo.

Fourteen new pupils were admitted, bringing the total up to nineteen. Four pupils completed their two-year course of instruction in September and one in December, leaving fourteen on the strength at 31st December.

A pupil teacher was engaged at the beginning of the year.

All the work in connexion with the cattle and poultry was done by the pupils under a working instructor in each department.

Ten pupils sat for the Elementary "B" examination in December, the results of which have not yet been received.

Examinations on the subjects dealt with in the vocational training and demonstrations were held in July and December. Eight pupils were above the average, and six pupils below the average.

Discipline during the year has been good. The five pupils who completed the course of instruction have been given employment in the department.

It is hoped that funds will be available in 1933 to enable the number of pupils to be increased to twenty-five.

The curriculum for 1933 will include such subjects as anatomy, physiology of digestion, milk secretion, etc., improvement of pastures, poultry husbandry, grading and marketing of animal and poultry produce, benefits of grading, costs, and sheep management.

Rainfall.—The rainfall for 1932 was 59.78 inches, which is less than in 1931.

The driest months were January, June and July. Rain fell on 172 days. Days on which over 0.1 inch was recorded equalled 152. Highest fall in twenty-four hours, 1.67, on 27th February. Longest period without rain was 15 days.

*Sangalo Veterinary Training Centre (North
Karirondo Native Reserve).*

Staff.—1 Veterinary Officer; 1 Stock Inspector.

Cattle.—There were 62 head of breeding stock on the farm at the end of the year.

The herd can readily be divided into two lots: (1) those that are sufficiently mature for breeding and which have borne one or more calves, and (2) those which are not yet ready for breeding. The latter class consists of a relatively large number of animals. These animals have been on the farm for over a year, and although ample opportunity has been given for service many have not yet been mated.

Examples of Milk Yield.

No. of Cow	Length of Lactation	Yield
	days	lb.
22	304	2,020.6
19	183	1,033
27	318	1,043
20	271	772

Number of completed lactations .. 22

Number of uncompleted lactations .. 8

Total .. 30

Number of weeks taken to attain highest daily yield.—The interval between the date of calving and the attainment of the highest daily yield is very variable. The data are too few to be of much significance, but they serve as an indication of this aspect of milk yield in native cattle:—

No. of Animal	No. of weeks taken to attain highest daily yield
22	9
19	8
27	2
20	7

This table should be compared with the previous one.

Comparison between First and Second Lactations :—

Cow	1st Lactation		2nd Lactation	
	Length	Yield	Length	Yield
	days	lb.	days	lb.
1	273	1,244	94 (unfinished)	369
3	155	465	18	4
12	16	10	6 (unfinished)	3
19	183	1,083	16	70
21	21	22	86 (unfinished)	164

Calves.—Number of calves born during 1932, 21. Average birth weights: 1931, 34 lb.; 1932, 36.3 lb.

Calf Rearing.—Calves are not dipped and are subject to intercurrent infections. While East Coast fever is responsible for a considerable mortality, it also causes a very appreciable variation in and retardation of the normal rate of growth. Calf weights at Sangalo cannot therefore be taken as indicative of the normal progress of native calves.

During the year, fencing was erected enclosing three 40-acre paddocks, three 5-acre paddocks, and four calf paddocks of one acre each.

150 acres of bush were cleared.

A dairy school and ghee kitchen were built on the farm.

A few roots of canna were planted in March. This yielded sufficient roots to plant a quarter of an acre in October. The young stock took readily to the green leaves.

A large number of trees were planted around the boundaries and paddocks.

Baraton African Veterinary Training Centre.
(Nandi Native Reserve.)

Staff.—1 Veterinary Officer (part time); 1 Stock Instructor.

Construction and Development.—It is possible to report steady progress in this direction.

1. A calf shed, 80ft. x 15ft., was constructed to accommodate 32 calves in pens.

2. A cow byre, 70ft. x 14ft., to accommodate 17 cows.
3. Milk-weighing shed, 12ft. x 14ft., in cedar, with thatched roof and colas floor.
4. Boys' kitchen in concrete blocks; cement floor; corrugated iron roof.
5. Two native lavatories, concrete base, cedar frames, and corrugated iron.
6. Extension to water supply, and erection of two triple-connexion watering troughs to serve six paddocks in all.
7. A twelve-acre field of virgin land was broken and cross ploughed.
8. Seven experimental grass plots were established.
9. 500 eucalyptus trees were planted out in the form of shade boxes in the paddocks, each shade box being enclosed in a small fenced-in area. 250 trees were planted out in the form of hedges and for ornamental purposes.
10. A further $1\frac{1}{2}$ miles of fencing was put down in the extension of the paddocking system.
11. A dividing road was constructed through the farm.
12. A complete poultry plant was transferred from Kap-sabet. Six portable houses were erected on concrete plinths and suitable fenced-in runs provided.
13. All breeding stock were ear-tattooed, and herd registers commenced.
14. Much time and labour were spent on grazing improvement. The paddocks have been completely cleaned of scrub and bracken.

Pasture Improvement.—A rotational grazing system has worked with remarkable success. The fertility of the grazing lands has been maintained. There is a noted improvement in the pasture.

It is unfortunate that the uneven and broken nature of the ground, caused chiefly by "Masai" pits, precludes the use of a mowing machine.

By heavy stocking of the paddocks, Baraton will gradually be brought up to maximum carrying capacity. A portion of the grazing was set aside as a reserve in case of locust infestation, and has not been utilized.

Two paddocks were burnt off in the nature of an experiment, and it would seem that a little judicious occasional veld-burning, having due regard for the time of the year, is good practice.

The climatic cycle is one of the determining factors in relation to palatability and carrying capacity. December, January, and February are the dry months which seriously affect milk yield and demand careful herd management as regards stock distribution, even with the paddocking system.

The rainfall is well and evenly distributed, and grazing favourable to milk production is plentiful.

60.38 inches fell during the year, a decrease of approximately 17 inches on last year's total.

Live Stock.—The cows numbered 58 during the year. Towards the end of the year, six heifers, bred on the farm, were transferred to the dairy herd; one cow died, which left at the end of the year a total of 63 head.

At the close of the year there numbered 13 weaner heifers, 14 weaner bulls and 17 calves in the process of rearing. In all, 50 head of stock have been reared on the farm.

There are two stud bulls and 31 work oxen.

Milk Production.—Total yield, 45,475 lb.; milk sold to staff, 636 lb.; milk to calves, 8,608 lb.; milk separated, 30,199 lb.; equivalent in butter, 2,129 lb.; average number of cows in milk, 140; average per cow, 2,250.6 lb.

Summary.—14.1 lbs. equal to 1 lb. of butter.

2,129 lb. butter equals 1,600 lb. ghee.

Herd average butter-fat percentage, 5.90 per cent.

One cow averaged 6.20 lb. milk per day per year.

One cow averaged 187.5 lb. milk per month per year.

One cow averaged 2,250 lb. milk per year.

Assuming a native cow to have an average lactation period of 250 days, the herd average works out at 1,678 lb. milk per lactation of 250 days.

As regards butter-fat percentage, observations and tests show that towards the end of the lactation, butter-fat percentage is considerably higher than at the height of the flow of milk.

Cow No. 46.—Tested 5.0 per cent in the first month, and as high as 8.4 per cent in the ninth month of lactation. Increased flow, decreased butter-fat; decreased flow, increased butter-fat.

Generally speaking, second lactation results have been encouraging, although in a few cases there has been a marked falling off in production of milk.

Example:

	1st lactation	2nd lactation
No. 1 ..	1,947 lb.	1,481 lb.
No. 6 ..	1,224 lb.	1,023 lb.
No. 7 ..	2,371 lb.	2,131 lb.

The falling off in second lactation can generally be attributed to definite causes:—

Changing over of milkers in cases of sickness or local leave.

Cow going off in condition and feed.

Lactation is largely influenced by abundance of palatable grazing, and time of calving consequently influences lactation.

Rainfall for the year below the average.

Less liberal concentrates feeding than has hitherto been the case.

Contagious Abortion.—The last contagious abortion test taken showed two positives.

Sterility.—Sterility is causing a certain amount of anxiety. Four cows have gone sterile after the first calf, and two cows after the second calf.

Calves.—A total of 46 calves were born during the year; 25 heifer calves and 21 bull calves. Of this number, 15 bull calves were slaughtered at birth. Four unthrifty calves were slaughtered on account of milk shortage. Two calves died from gastro-enteritis. 24 calves were weaned and are in the process of being weaned.

Average birth weight of all calves, 40.7 lb., with a range of from 26 to 51 lb.

Average birth weight of calves from—

1st lactation cows : 39.5 lb., 26-51 range.

2nd lactation cows : 41.8 lb., 36-49 range.

3rd lactation cows : 42.7 lb., 35-50 range.

Average increase in weight amounted to 0.76 lb. per day over a period of the first 148 days.

At 148 days, the calves averaged 152.7 lb. in weight; one calf weighed 172 lb. at 143 days old; another calf weighed 183 lb. at 156 days old. Weights were recorded at weekly intervals.

An economical ration was given, which differs very little from the Ngong ration. The skim milk supply is increased and graduated six weeks after birth; at two months the calf is receiving maximum skim milk ration. The ration is supplemented by concentrates feeding of maize and bran.

It was found successful to ration calves individually rather than collectively.

Dipping of young stock was carried out at weekly intervals.

Poultry.—Fowls belonging to the Local Native Council were transferred to Baraton in March. The scheme had formerly been in charge of a native, and on transfer the breeding stock were found to have deteriorated to a considerable extent.

A group of pullets and two cockerels of the Rhode Island variety were introduced from a local breeder, and the whole scheme of breeding was changed.

Some fifty chickens have been reared, and several sittings of eggs distributed.

The scheme is maintained by funds supplied by a contribution from the Local Native Council.

Water.—The installation for the supply of water has worked with remarkable satisfaction.

Running costs for the year amount to Sh. 216/96, which averages Sh. 4/16 per week.

General.—A pleasing feature has been the enormous increase in revenue derived from sales of farm produce, which rose from Sh. 424/80 in 1931 to Sh. 1,650/30 in the year under review.

It is expected that the revenue from this source alone will increase considerably over the next few years.

Isiolo African Veterinary Training Centre.
(Northern Frontier Province.)

Staff.—1 Veterinary Officer; 1 Stock Inspector.

This centre continued to make favourable progress throughout the year.

Breeding Herd.—The experimental herd of cattle now consists of 124 head, including cows, calves and bulls, as follows: Cows and heifers, 76; calves, 47; bulls, 1. The total number of calves born during the year was 64, representing an increase of 84 per cent. Seventeen calves died from various causes, or were destroyed.

The following weights of calves (second calf cows) are recorded:—

Highest birth weight	(Female)	..	51 lb.
Lowest " "	(Female)	..	31 lb.
Highest " "	(Male)	..	53 lb.
Lowest " "	(Male)	..	25 lb.
Highest Weaning Weight (six months)	(Male)	..	220 lb.
" " "	(Female)	..	193 lb.
Lowest " "	(Male)	..	145 lb.
" " "	(Female)	..	123 lb.

Twelve calves weighed over 170 lb. each at six months weaning. This year's calf drop are the progeny of milk-recorded cows. The highest weaning weight last year (first calf heifers) was 156 lb. There is thus a notable increase of weight at weaning age between first and second calves from the same cows.

No mortality occurred amongst the adult stock, with the exception of one bull.

Milk Yield.—The milk yield of the herd during the year was very encouraging, having regard to the scarcity of grazing.

Examples of milk yield of cows (second lactation) are shown as follows:—

No. 11	No. 31	No. 51	No. 60	No. 43
2,162 lb.	2,299 lb.	2,321 lb.	2,477 lb.	2,240 lb.

Cow (second lactation) No. 48 averaged 121 lb. per day over a period of 189 days.

Cow (second lactation) No. 60 gave 18 lb. one day—the highest daily yield recorded.

Butter-fat content averaged 5.4 per cent.

Ghee Production.—Approximately 1,035 lb. of ghee were produced at the centre during the year.

During the months of August, September, October, and part of November, no ghee was produced, as all the milk available was required for calf feeding.

The production of ghee from goats' milk is under test; promising results are indicated.

Pupils.—During the year, 35 pupils were admitted, as compared with 14 last year. At the end of the year under review, 17 pupils were under instruction.

The course of instruction is very attractive to the tribesmen, and as a result many applications are received for entrance, and many entrants are later found entirely unsuitable. It is only by careful selection of pupils that the full benefits of the service may be obtained.

Pupils have been received from the following districts: Samburu, Marsabit, Wajir, Moyale, Mandera, and Garissa, and extra-provincial pupils by arrangement from Embu and Meru.

Laisamis Sheep Breeding Flock.—This flock was originally placed at Laisamis, in the Marsabit district, but early in the year a movement to Isiolo was necessary, owing to severe drought conditions at Laisamis and neighbourhood. These conditions remained throughout the year, and it was not possible to return the flock to that area. Mating took place in December and January; the ewes lambed down in May. A definite increase in birth weights is recorded as compared with last year, and a very much decreased mortality. A pupil trained at Isiolo is in charge of the flock.

The original station flocks of Samburu and Gabbra sheep, maintained for instructional purposes, are making fair progress.

Buildings.—During the year a new dairy utensils shed, a new schoolroom, and new quarters for pupils were erected. These buildings were erected by station hands.

An area of approximately three acres of land was ploughed by the pupils, and planted with various kinds of fodder plants.

The rainfall for the year was 20.85 inches. December was the month of heaviest rainfall, with April and November closely following.

*Machakos African Veterinary Training Centre.**(Machakos Native Reserve.)**Staff.*—1 Veterinary Officer; 1 Stock Inspector.*Development.*—A maize crib was built to take the maize and mbazi beans which are grown as food for the stock.

A dipping tank was erected by the Public Works Department, as a result of which it is hoped to eliminate the several tick-borne diseases prevalent in the station.

About ten acres have been put under cultivation, and the following crops planted: Maize, 5 acres; Mbazi beans, 4 acres; and patches of kale, sunflower, and napier grass.

The crops of maize and mbazi beans obtained last season have been very useful, especially for the poultry.

The two paddocks of 32 acres each were used alternately for hay, and excellent crops were obtained in each case. This provision of hay proved invaluable when the grazing was so severely damaged by locusts. The hay was carted out into the grazing areas and helped to keep up the milk supply.

A large number of trees were planted around and within the poultry runs, with the intention of providing shelter from the sun.

A hot-water system was installed in order that the dairy utensils might be properly cleansed. It has acted very satisfactorily.

The five experimental grazing plots arranged last year were used during part of this year.

A heavy infestation of hoppers occurred in the station in the month of June, but was dealt with by poison bait. As a result of this invasion, serious damage was done to the grazing.

Cattle.—There are now 3 bulls, 24 work oxen, 76 adult cows, and 19 calves in the station.

In March, one cow aborted, and was found to be infected with contagious abortion. Arrangements were then made and all cows have been tested three times. Sixteen were returned as positive, and were at once sent over to the quarantine area, and thence disposed of for slaughter.

Dairy Products Produced at the Station.

Milk	...	...	...	...	28,800 lb.
Cream	...	...	...	...	2,878 lb.
Butter	...	...	...	...	1,925 lb.
Ghee	...	...	...	...	1,326 lb.

Thirty-one tins of ghee were sold, and realized Sh. 742/98; six tins are on hand.

Figures for Milk.—Twenty-one cows which calved in 1931 and completed their lactations in 1932 gave results as follows :

Averages number of days milking	...	...	191
Average yield of milk (lb.)	...	...	865

The highest yield was 1,727 lb. over a period of 235 days by a second lactation cow ; the lowest yield was 9 lb. in 9 days by a first lactation cow.

Forty-four cows calved during the year 1932, and completed their lactations. The results were as follows :—

Average number of days milking	...	...	89
Average yield of milk (lb.)	...	...	498

The highest yield was 1,927 lb. over 251 days by a second lactation cow ; the lowest yield was 1½ lb. in six days by a second lactation cow.

Of all the above cows, the average for first lactations was 594 lb. over 123 days, and 608 lb. over 120 days for second lactations.

The poor returns from milking are due to several factors, chief of which are :—

1. The cows, with very few exceptions, are of a poor type.
2. Several of the best cows were cast for contagious abortion.
3. The destruction of the grazing by locusts in July, August and September.
4. Absence of dipping facilities.

Nineteen cows which calved during the year are continuing their lactations into 1933.

No food is given to the cows except grass and, when necessary, hay.

Mariakani African Veterinary Training Centre.
(Coast Province.)

Staff.—1 Veterinary Inspector (part time): 1 Veterinary Assistant.

This centre has made some progress. A small foundation herd of cattle has been secured, but progress must be slow, owing to the necessity for expenditure reduction.

A shade-drying *banda* has been erected, and demonstrations in shade-drying of hides frequently given.

A large number of permits for stock movements to Mombasa and elsewhere were issued.

MASAI PROVINCE.

The report for this Province is shown under three district headings as follows :—

Ngong.—Staff : 1 Veterinary Officer ; 1 Stock Instructor.

Narok.—Staff : 1 Veterinary Officer.

Kajiado.—Staff : 1 Veterinary Officer ; 2 Stock Inspectors.

There is one African Veterinary Training Centre in the Province, at Ngong.

The main diseases to contend with in the Province are : (1) Contagious Bovine Pleuro-pneumonia, (2) Rinderpest, (3) East Coast Fever.

Ngong District.

Contagious Bovine Pleuro-pneumonia.—This disease is prevalent in most parts of the district, and there appears to be little hope of eradicating it unless a compulsory isolation policy is adopted. It has been suggested that pleuro quarantine camps should be established in the area. Such camps would require separate water supplies, and this would deprive the Masai of some of their meagre sources of supply. Endeavour has been made to persuade the Masai to slaughter all infected stock, but while readily agreeing that it is the only method of clearing up the disease, they do not practice what they preach.

An endeavour has also been made to eradicate the disease from the stock in Ngong Township by means of slaughter of infected cattle and vaccination of those in contact ; thus it has been possible to control the disease amongst the Kikuyu Forest squatters.

Number of cattle vaccinated : 452.

Rinderpest.—A practice was made throughout the year to clear up this disease by means of temporary immunity conferred by vaccination, quarantining all stock in the infected area until the outbreak had died out. The vaccine was prepared in the field, two per cent of the cattle to be treated being handed over for its preparation. All outbreaks were controlled by this method, with the exception of one which occurred in Ngong Township, where the virus and serum method was used.

Number of cattle vaccinated	2,916
Number of cattle double inoculated :—	
Adults	349
Calves	71

East Coast Fever.—This disease is extending throughout the reserve. It is said to have been first experienced by the Masai around Ngong about 1910. From that time it has gradually spread into the reserve, until now there is a heavy infection as far as the Ol Lorien River in the Kajiado direction, and a patchy infection is present as far as the Kedong River in the Narok direction. The spread of East Coast fever has driven the Masai from what is probably the best grazing area in their reserve, namely, the Ngong Hills.

Foot-and-mouth Disease.—This disease spreads through all stock in the reserve annually, but it does not appear to cause any severe mortality unless concurrent with a drought.

Three Days Sickness.—Only one outbreak was recorded during the year. It occurred in the Ol Lorien district, and proved to be very mild.

Blackquarter.—Several outbreaks have occurred during the year, but no vaccinations were carried out, owing to the fact that the Masai quickly vacated the infected *bomas*.

Grazing.—Throughout the year there was an acute shortage of grazing, due to comparative failure of the long and short rains and to heavy locust infestations. During the months of October and November, a heavy mortality due to starvation occurred amongst stock in all parts of the district.

Water.—Both bore-holes in the Sigheri area and the various other natural sources of water gave good supplies throughout the year. The dam in the Kedong Valley dried up, but this occasioned no great hardship, as the people had previously left the district owing to the grazing having given out.

Slaughter Stock.—Throughout the year there was a good demand for Masai bullocks by the Nairobi butchers. In the month of October, a further outlet for slaughter cattle was provided when cattle were allowed to move under escort to Kiambu. The percentage of cattle condemned for measles has risen during the year. During the month of June, many carcasses were condemned as traces of arsenic were found in them. The source of arsenic was presumed to be the poison bait used in the locust campaign.

All cattle were inspected before being allowed to pass out of the reserve, and a small number were rejected on account of disease, chiefly East Coast fever.

Number of cattle passed to Nairobi	...	11,168
Number of cattle passed to Kiambu	...	358

Kikuyu Stock in Masai Reserve.—That piece of land adjacent to the Kikuyu Reserve and extending to the Narok road is rented from the Masai by the Kikuyu for grazing purposes. In the district around Ngong Township, there are now many cattle belonging to Kikuyu forest squatters, who trade freely with the Masai and surreptitiously move cattle to and from the Kikuyu Reserve. In one instance, at least, this movement has been responsible for an outbreak of rinderpest.

Narok District.

Rinderpest.—A number of outbreaks have been found, but unfortunately only when too late to vaccinate. In cases where vaccination was useless, quarantine measures have been adopted with some small measure of success. Usually, however, the disease when discovered had run through the greater number of the susceptible cattle, and quarantine measures were of little use.

Two outbreaks were dealt with by means of vaccination—one at Ol Pusimoru and the other at Rotian. The *boma* at Pusimoru was vaccinated, and although exposed to infection, remained clear for some months, until the young stock contracted the disease. By this time, however, the neighbouring *manyattas* had moved.

In the outbreak at Rotian, which started in the Chief Masikondi's *manyatta*, four *manyattas* were vaccinated, with good results in three of them. The fourth *manyatta*, which had animals sick and in the incubative stage of the disease, continued to have deaths for some weeks after vaccination.

Pleuro-pneumonia.—The quest for a pleuro-pneumonia quarantine area containing grazing, water and salt has been part of the work during the year. The position as regards pleuro-pneumonia in the Narok area is serious. A survey of the *bomas* on the Mau revealed the fact that some 75 per cent were infected. Gordai, Deitei, Mosero, Lemebe and Barabatabuk have all revealed the presence of the disease.

The Deitei was considered to be, if not absolutely suitable, as near suitable as could be hoped as a pleuro-pneumonia quarantine. Salt was not present, but water was more or less permanent. The area has been observed to cause a deficiency disease, which fact, when discovered, caused abandonment as a quarantine. Other areas have been surveyed with the object of finding a suitable area, but none have been found to fulfil all requirements. The Narrosura area appears to be quite free of the disease, and efforts are being made to keep it so.

East Coast Fever.—This disease appears to be on the increase. Certain areas, such as the Mara River area, are definitely highly infected, and as such are avoided by the Masai. Latterly, however, the Mara country has been used owing to drought and shortage of grazing, and many deaths have occurred from East Coast fever.

Other areas, such as the Trans Mara, have East Coast fever, but are used by the Masai. Their herds are small, and they lose a good percentage of their young stock each year. Mosero, on the other hand, is a comparatively new focus of infection, and from there it has spread as far afield as Ndulele and Syabei. This spread has been due to seasonal movements of cattle. It is also known in the vicinity of Barabutabuk, and to a lesser degree towards Basdumat.

The Ol Tigana (East Coast fever) of sheep reported by the Masai is, perhaps, in some cases "fly" and in others liver disease.

Redwater.—This would appear to be confined to an area on the north-eastern slopes of the Mau; no cases have been seen or reported elsewhere. Losses are not great.

Anthrax.—An outbreak occurred during the latter part of 1931, and early part of 1932, in the Trans Mara country.

Trypanosomiasis.—From reports received from the Masai and from observation, it was considered that "fly" was spreading. This conclusion was borne out when Dr. Lewis, Entomologist, paid a visit to Narok in December, 1932. The belt along the Kilimafeza road now reaches to within some four miles of Barabutabuk, and, with only a small gap, stretches to the Mara River. This country is used at certain times for sheep only. Positive cases of "fly" have been obtained from sheep in this area. In Trans Mara, too, the disease is spreading; the fly spreading up the tributaries from the central River Gori belt. Positive smears have been taken from mules, donkeys, cattle and sheep. Certain areas on the edge of the "fly" belts are used in the dry season, but are unusable during the rains owing to the seasonal spread of the tsetse.

Kajiado District.

Rinderpest.—The campaign which was instituted in June, 1931, was continued, one dose of field-prepared vaccine being used to confer a temporary immunity on those susceptible stock exposed to infection.

Three hundred and ninety-one head were slaughtered for the production of approximately 676,000 c.c. of vaccine, which allowed for an average dose of 35 c.c. per head.

A total of 19,322 head of susceptible stock were vaccinated in 27 outbreaks, while in five other outbreaks, quarantine alone was imposed. The distribution of outbreaks was as follows: Loitokitok district, 2; Kaputei area, 15; Matapato area, 9; Purko area, 1; Dalal Egotok area, 5.

General Conclusions.—It may be assumed that there is no appreciable variation in the quality of the vaccine, which is prepared from the pooled spleens of reacting animals.

The vaccine does not confer a solid immunity for at least ten days after inoculation, and rinderpest may be deliberately introduced or naturally contracted during that period. A mild reaction usually occurs in those vaccinated stock which develop rinderpest.

It is probable that a mild reaction without clinical symptoms other than a rise in temperature may occur in vaccinated stock exposed to infection. This, while doubtless enhancing the immunity, means that apparently normal stock may be reacting and be infective while reacting.

The degree of immunity has diminished three months after vaccination, and seven or eight months after vaccination stock may be considered to be wholly susceptible.

Given the absolute co-operation of the stockowner, rinderpest can be controlled by the methods adopted. In the Loitokitok district, with roughly 80,000 head of cattle, only three outbreaks have occurred since May, 1931, and in no case did infection extend beyond the original focus. The total mortality from rinderpest during this period has been less than fifty head.

The success of a campaign such as the one being operated in this district depends on adequate control of movement rather than on the actual vaccinations. Vaccine alone is unable to control the spread of rinderpest unless control of movement can be enforced.

The course of outbreaks is often prolonged by the introduction of susceptible and unvaccinated stock into infected areas—a movement not always deliberate, as it may happen that the rains and grazing in infected areas are better than elsewhere. The Masai prefer rinderpest to lack of grazing.

Deliberate infection of vaccinated stock, as soon as possible after vaccination, is common. Those owners whose stock develop rinderpest after vaccination are usually loudest in their praises of the vaccine, while on two occasions there have been complaints because vaccinated stock failed to develop the disease.

This practice is understandable, in that it is in the interests of the individual stockowner that his animals should develop an immunity more permanent than that conferred by one dose of vaccine, and this he achieves by provoking a reaction to rinderpest which is controlled by the vaccine previously inoculated. In fact, the Masai themselves have adopted a vaccine-virus method of immunization.

Contagious Bovine Pleuro-pneumonia.—Infection is centred in the Dalal Egotok section, among the Purko at Besil, and among the Matapato at Soysien. The Loitokitok area is free. All herds, known to have been infected during the last five years, have been marked down, with a view to the immediate segregation of all actively infected animals as soon as the disease appears. In this way, infection can be appreciably reduced, as though the chronic lungers is almost invariably the primary source of the infection, if every animal known to be actively infected is immediately isolated, it is unlikely that the remaining susceptible stock in the herd will all be infected from the one or two unknown lungers. Animals undergoing a natural attack of the disease must be more highly infective than the partially recovered lunger.

Attempts to induce owners to slaughter the lungers, which only they themselves know, have not met with success, as this would often involve the sacrifice of female stock.

Suitable areas for the segregation of infected stock have been set aside and demarcated at Lenarau and at Besil, but progress during the year has been hindered by lack of staff, while drought and the depredations of locusts made it impossible to make use of the quarantine areas.

Serum Conglutination Test.—Over one hundred blood samples from animals said to have been infected during the last five years were submitted to the Laboratory for testing by the method elaborated by the late Chief Veterinary Research Officer. Except for the identification of susceptible and non-infected animals, the test does not appear suitable for general use; as it would prove impracticable to isolate in

quarantine all animals which react as positive to the test, since it was found that in nearly every case recovered animals (of which only a small percentage would be infective eighteen months after infection) reacted as positive to the test.

East Coast Fever.—This disease is confined in the Kajiado district to a small area near Kiu, and to the slopes of Shombole and the Southern Uaso Nyiro south of Lake Magadi. Mortality in both of these areas has been heavy, and the disease is said to have assumed an unusually virulent form, with a tendency to spread in the latter area.

Owing to scarcity of grazing, cattle from the Loitokitok district were allowed to cross the Rombo River and move to Zawani in September. East Coast fever caused heavy mortality, and in order to prevent infection becoming established on the slopes of Kilimanjaro, all cattle returning to the Loitokitok area from the grazing concession were kept on the plains for a month before being allowed access to the mountain.

Blackquarter.—There is little doubt that blackquarter is responsible for a mortality almost as great as rinderpest, while in some parts of the district it is said to kill more stock than rinderpest and pleuro-pneumonia together. The remedy lies in the vaccination of the susceptible stock, but the payment of a mere thirty cents per dose limits the demand to an occasional request for two or three doses. It is hoped that it will be possible to issue two or three hundred doses paid for out of Local Native Council funds, and that this free vaccination will serve to convince individual owners of the undoubted merits of the vaccine.

Foot-and-mouth Disease.—This is common during the rainy season, but is seldom responsible for more than a temporary loss in condition. The Masai look on the disease as of small significance.

Stock Exports.—From Loitokitok, 701 head entered Tanganyika after supervised auctions, while a further 62 head passed out under permit.

Sheep and goats numbering 1,813 passed out through Ngong.

Stock Census.—A detailed stock census over the whole of the Kajiado district was taken by veterinary scouts during October, November and December. The total for the district

amounts to 293,966 head, distributed among the different sections as follows: Loitokitok, 82,521; Matapato, 72,746; Kaputei, 64,012; Lodogalani, 29,693; Dala Egotok, 17,929; Purko, 14,171; Il Damat, 4,558; Kekonyuke, 3,143; Sigirari, Ngidongi, and unclassified members of other sections, 7,183.

UKAMBA PROVINCE.

Staff.—1 Veterinary Officer (part time); 1 Stock Inspector.

There is one African Veterinary Training Centre in the Province, at Machakos.

Machakos Reserve.

With moneys provided by the Machakos Local Native Council, a beginning has been made with the instruction of pupils in the preparation of hides and ghee. There are at present one instructor and four pupils doing hide preparation work, one pupil being from the Kitui Reserve, to which he will be posted as an instructor.

Four pupils are being taught the preparation of butter and ghee.

Two hide sheds have been erected near the slaughter-house in Machakos, and can accommodate about sixty hides at a time.

All the hides belonging to the butchers in the township are dressed there, and a tendency is being shown by local natives to bring hides in for dressing.

Arrangements are in hand to build several other sheds in the Machakos Reserve, and to apply the provisions of the Hide Drying Rules. There is every prospect of success in this direction.

So far, about 100 hides prepared at the Machakos sheds have been sold at an average price of Sh. 11/50 a frasila, as compared with Sh. 3/9 for ordinary sun-dried ones.

As regards ghee, the position is not so simple, but it is hoped to arrange one or two centres during 1933.

The essential difficulty, especially in the initial stages, will be one of adequate supervision.

Disease.—The incidence of rinderpest was a source of worry, especially during the earlier part of the year, when the heavy movement of stock into the reserve kept up a series of fresh outbreaks. It is to be regretted that most of this movement was illicit, and is almost impossible to stop.

Soil Erosion.—An area of land, much denuded of vegetation, has been chosen as a demonstration plot for reconditioning. Trenches, etc., have been dug and grass and other plants put down, but a considerable time must elapse before any beneficial result can be seen; and in this connexion it would appear that but little can be done until the underlying question of stock reduction is in operation.

The Agricultural Officer in charge of pasture improvement visited the reserve, and has expressed complete agreement with the general means required for a solution of this question.

Poultry.—A small number of poultry has been disposed of to the Machakos Local Native Council, and during 1933 this will be considerably augmented, as provision is being made for poultry to be kept at all the native schools in the reserve.

Kitui Reserve.

It was found possible to remove the quarantine restrictions for rinderpest.

Goat Scab.—A sheep dip has been put into use in one part of the Kitui Reserve, as a preliminary in the campaign against scab, which is prevalent here, and so far the results have been satisfactory.

COAST PROVINCE.

Staff.—1 Indian Veterinary Inspector in charge of veterinary services for the Province; 1 Indian Veterinary Assistant, Mombasa, for Port veterinary duty; 1 Indian Veterinary Assistant, Lamu; 1 Indian Veterinary Assistant, Mariakani.

There is one African Veterinary Training Centre in the course of development.

Stock Disease.—The control of trypanosomiasis is one of the most important problems concerning the pastoral industry of the Coast Province. A complete survey of the distribution of tsetse-fly is proceeding, and it is expected will be completed at an early date. The survey also includes a stock census. Rinderpest or pleuro-pneumonia have not been observed in the Province during the year, but mortality has been caused by East Coast fever.

Animal Husbandry.—The veterinary staff is endeavouring to promote industrial progress in every possible way, and particularly by visits to districts and villages, instructing,

demonstrating and investigating outbreaks of disease. Visits of this nature were commenced in Kwale and Kilifi districts, particularly with the following objects in view :—

1. Castration of all young bulls unsuitable for breeding.
2. Investigation of outbreaks of East Coast fever, trypanosomiasis, and tsetse-fly areas.
3. The establishment of shade-drying hide *bandas*, and demonstrations in handling and shade-drying of hides.
4. Lectures on the life-history of tsetse-fly, and precautionary measures to be taken for stock protection.
5. Elementary lectures on animal husbandry.

NORTHERN FRONTIER PROVINCE.

Staff.—One Veterinary Officer; one Stock Inspector. The services of three other Stock Inspectors for varying periods were available during the year, for special duty.

There is one African Veterinary Training Centre in the Province, at Isiolo.

Stock Disease.—The quarantine for contagious bovine pleuro-pneumonia still remains on the entire Province.

The districts of Marsabit and Samburu are extensively infected with this disease, and a high mortality, particularly in young stock, is reported.

Rinderpest still remains at Garissa, and during the year an effort was made to suppress the outbreak by the use of an inactivated vaccine prepared in the field. Eleven thousand vaccinations were carried out, but complete success in suppression was not attained, owing to unauthorized movement of stock. It has, however, been possible to reopen the cattle trade to Lamu, subject to detention and observation at Garissa.

The quarantine for pleuro-pneumonia in the Wajir district was revoked.

A veterinary survey and stock census of Marsabit Mountain was carried out during the year. The stock census of that area at the time is as follows: Cattle, 11,054; sheep, 592; goats, 8; donkeys, 295; mules, 2; camels, 25. A stock census of Samburu is now proceeding as a preliminary to vaccination for pleuro-pneumonia.

Trypanosomiasis continues to render practically useless large areas of otherwise valuable grazing, particularly on the few large rivers in the Province.

Entomology.—The following is a list of flies other than tsetse collected during the year, mostly at Isiolo: *Muscida* sp., *Hippobosca capensis*, *Pangoni magnetii*, *Pangoni elongata*, *Megachile felina*, *Bembex mobii*, *Stilbum cijanurum*, *Auchmeroruyia lutella*, *Sarcophaga* spp., *Trombidicum gigas*, *Cordylobia anthropophaga*, *Engasta loncatus*, *Scorcidæ*, *Eumenes leu-casius*, *Megachile gratioza*, *Sphegia* sp.

Pasture Grasses.—A good deal of attention has been devoted to a survey of the fodder grasses of the Province, and the following species have been identified, some of which through the courtesy of Professor Linton, Royal (Dick) Veterinary College, Edinburgh:—

Specimens of grasses identified in the Northern Frontier Province.—Isiolo District: *Pennisetum masaicum*, *Pennisetum ciliare*, *Pennisetum* spp. various, *Digitaria milaniana*, *Sporobolus indicus*, *Sporobolus* spp. various, *Chloris myriostachya*, *Echinochloa naplocuda*, *Eragrostis* sp. (unidentified), *Cyperus rotundus*, *Commelina* sp. (probably *C. purpurea*), *Panicum maximum*, *Mariscus* sp., *Dactyloctenium aegyptium*, *Setaria* sp., *Tragus racemosus*, *Digitaria horizontalis*, *Aristida adoensis*. Samburu District: *Cynodon plectostachyum*, *Themida triandra*, other unidentified spp. Bura District: *Cyperus rotundus*, *Cynodon plectostachyum*, *Pennisetum sporobolus*, *Cyperus myriostachya*, *Digitaria milaniana*, *Pennisetum ciliare*, *Eragrostis* spp., *Sporobolus* sp. (probably new), *Dactyloctenium aegyptium*, *Chloris myriostachya*, *Entropogon monostachyos*, *Chloris tenella*, *Cenchrus ciliaris*.

In addition, many other species have been collected, and are being identified.

Experimental cultivation of *Digitaria ciantha* (woolly finger grass) is being carried out at Isiolo with good results. The grass planted in a "dry" area, compared with that planted near the river, has shown better growth than the latter, and successfully withstood a drought from April until October.

Agropyron cristatum (Canadian wheat grass) is also under trial.

Experimental feeding of *Tribulus terrestris* to sheep under controlled conditions did not produce any toxic symptoms over a period of ten days.

Poisonous Camel Bush.—A specimen of this bush reported by local tribesmen to be poisonous to camels was identified as belonging to *Capparis* sp. and known locally as "Gora" or "Gumbor."

A dairy and hide drying *banda* have been erected at Garissa by the District Commissioner, under whose supervision they are operated. A dairy has also been established at Kipseng in the Isiolo district, by a tribesman. It is not yet known whether this enterprise will meet with success.

The production of ghee beyond very moderate limits is not encouraged in the Northern Frontier Province, and its export is not likely to become a material industry. There is, however, a surplus of milk during and after periods of generous rainfall, and it is at such periods the manufacture of ghee for export is encouraged.

The hide and skin trade has received a severe setback owing to depressed prices, and it is unlikely to recover until market values have sufficiently appreciated to show a margin of profit, allowing for difficult and expensive transport.

The sheep trade still continues, in a comparatively undisturbed way, export taking place through Isiolo and Lamu.

The numbers of sheep and goats exported through Isiolo and Lamu during the year are as follows, as compared with 1931 :—

		<i>Isiolo</i>	<i>Lamu</i>
1932	...	68,160	6,104
1931	...	69,851	8,124

but the export of cattle through Lamu is considerably decreased, principally due to the protracted outbreaks of rinderpest at Garissa :

			<i>Isiolo</i>
1932	...	...	343
1931	...	...	1,289

NZOIA PROVINCE.

Staff.—One Veterinary Officer, Eldoret (part time); one Stock Inspector, Baraton, Nandi. The services of two other Stock Inspectors were available for temporary duty.

There is one African Veterinary Training Centre in the province at Baraton.

Nandi Reserve.

Rinderpest.—This disease persisted in the reserve throughout the year.

Totals of stock immunized against rinderpest :—

11,781 adults
1,608 calves
169 virulent blood tests
<hr style="width: 10%; margin: 0 auto;"/>
13,558

The above totals constitute a record in Nandi for some considerable years, and when due consideration is taken of the depressed conditions prevailing, and further, that Baraton was closed as an inoculation centre for three months on account of the prevalence of pleuro-pneumonia, it will be readily realized that rinderpest immunization has taken on a firm hold and is greatly welcomed and appreciated by the Nandi tribesmen.

The pleasing feature of the Baraton double-inoculations is the exceedingly small cost to Government. The biggest charge against the inoculations is the cost of virus producers which amounted to Sh. 1,170.

Inoculations are carried out just outside the Veterinary Training Centre, thus saving mileage charges which would otherwise be entailed travelling from one centre to another.

The inoculators employed serve the dual purpose of assisting at rinderpest immunization and in the general routine of the Training Centre.

A 5 per cent mortality is given as a conservative estimate. It is difficult to determine the exact percentage mortality attributable to rinderpest reactions alone, there are so many factors influencing mortality.

Contagious Bovine Pleuro-pneumonia.—Two outbreaks of this disease were reported during the year, both of which proved positive on investigation.

The first outbreak occurred in South Nandi, and it was hoped that it would be possible to avoid unnecessary hardship on the tribesmen of Northern Nandi by the imposition of quarantine measures in the north. Unfortunately the second outbreak occurred in the Northern Nandi and the whole reserve was thrown into strict quarantine. The two outbreaks were suppressed by rigid isolation, slaughter of the obviously infected, and vaccination of infected and surrounding mobs of cattle. A Stock Inspector was made available for the pleuro-pneumonia vaccination campaign which is at present in progress.

Some 35,000 head of cattle have been given protective vaccination.

Foot and Mouth Disease.—This disease was prevalent in the early part of the year. It only appeared in a mild form and appeared to die out when the regular rains were well advanced.

Blackquarter and Anthrax.—Sporadic outbreaks of these diseases were reported as having occurred from time to time, but nothing appeared of a widespread nature.

Elgyo and Marakwet Reserves.

The only work done for the natives in these areas was the inoculation of some 900 head of stock against rinderpest. Facilities were made available at Cheborowa, without result.

Suk Reserve.

During the year this reserve was opened for export of slaughter stock following on urgent representations by the District Administration. Unfortunately, however, tuberculosis was found later causing temporary stoppage, but movement was again resumed after a Stock Inspector had been stationed at Keringet.

NYANZA PROVINCE.

Staff.—Central and South Kavirondo: One Veterinary Officer (Maseno), one Stock Instructor (Maseno), one Stock Instructor (hide preparation), one Stock Inspector, Kibigori Quarantine Station. North Kavirondo: one Veterinary Officer (Sangalo), one Stock Inspector (Sangalo). Lumbwa: one Veterinary Officer. Kericho: one Stock Inspector (part time).

There are two African Veterinary Training Centres in this Province: (1) Maseno, (2) Sangalo. These centres are discussed under their respective headings.

Additional staff was made available for the rabies campaign.

Central and South Kavirondo Reserves.

The main activities of the staff in the Central and South Kavirondo Reserves were concentrated upon the following during the year:—

- (1) Control and Eradication of Stock and Poultry Diseases.
- (2) Improvement of Cattle and Poultry.
- (3) Improvement of Hides and Skins.

- (4) Improvement of Quality and Quantity of Dairy and Poultry Products.
- (5) Establishment of subsidiary Veterinary Centres.
- (6) Facilitating the movement of Stock to and from the Reserves.
- (7) Census of Stock in the Central Kavirondo Reserve.

(1) *Control and Eradication of Stock and Poultry Diseases.—Rinderpest.*—No epidemic of this disease took place in the Central Kavirondo Reserve, but numerous sporadic outbreaks were controlled by the serum simultaneous method. Rinderpest double-inoculations completed from the Maseno Station totalled 13,125. Rinderpest double-inoculations completed at the Kibigori Station totalled 3,030.

There has been a decrease in the number of double-inoculations against rinderpest for 1932, as compared with that of 1931. This can be accounted for by the low incidence of the disease during the year, the lack of ready cash due to the damage of cash crops by locusts, and to the inability of the natives to obtain work in the settled areas.

In the South Kavirondo Reserve control of rinderpest was not contemplated, because the Stock Inspector was entirely employed on the rabies campaign. In this reserve rinderpest is rife, and large numbers of stock succumb daily with great loss to owners.

Contagious Bovine Pleuro-pneumonia.—No positive or suspicious case of pleuro-pneumonia was discovered during the year in the Central Kavirondo Reserve, and it is considered that its incidence is negligible.

In South Kavirondo, inquiries were made in all locations visited during the rabies campaign, and with the exception of the Kamukago and Sakwa Locations no reliable information was elicited from the natives that pleuro-pneumonia existed.

It has been the policy of the staff to examine the lungs of animals slaughtered for food at all markets, and up to the moment no case has been observed.

An outbreak of pleuro-pneumonia occurred in the Nandi Reserve, a short distance from the Kibigori Quarantine Station. The Stock Inspector, Kibigori, took charge of this outbreak and by slaughter and vaccination the disease was eradicated. 3,548 animals were presented for vaccination during this outbreak.

East Coast Fever.—This disease is endemic throughout the South and Central Kavirondo Reserves; the mortality amongst calves is estimated to be 60 to 80 per cent.

The natives of Central and South Kavirondo when visiting the Maseno Training Centre are invariably surprised at the good condition and growth of the calves reared at the centre, where five day dipping is practised, and advantage is taken of such opportunity to explain the reasons why the centre calves are infinitely superior to those in the reserve and also the advantages of dipping to eliminate other tick-borne diseases besides East Coast fever.

At the Kibigori Quarantine Station 208 head of bullocks from European farms were tested for East Coast fever and branded L.F.

Central Kavirondo.—Trypanosomiasis.—The Samia and North Ugenya Locations have been known to be severely infected with this disease for a number of years, but unfortunately no organized attempt to help with its control and eradication could be attempted owing to stress of other work.

Large tracts of these locations have been denuded of stock, and it is imperative that the tsetse breeding places be destroyed in the near future, if stock are to be returned to these areas. It is proposed to extend clearing of bush annually till such time as all the breeding places are destroyed in the reserve.

On the completion of this clearing of bush, large areas will be reclaimed which to-day are devoid of stock.

A trypanosomiasis quarantine was chosen in the North Ugenya Location by the Veterinary Officer and Headmen, where bovines could be brought and inoculated with 4 per cent tartar emetic solution. The natives took advantage of this quarantine and over 200 head of cattle were given a course of this treatment with excellent results.

A few outbreaks in the Kibos area were treated with tartar emetic solution.

South Kavirondo.—Since a veterinary survey has not been carried out, it is impossible to gauge the distribution of trypanosomiasis in this reserve. It has, however, been diagnosed in the Kanyidoto and Gwasi Locations. In these two locations, large areas are infected, and the native population has been depleted, since natives will not settle where stock cannot be husbanded.

Anthrax and Blackquarter.—Notwithstanding the fact that no positive cases came under observation during the year, it is considered that numbers of stock succumb to these diseases annually.

One thousand doses each of anthrax and blackquarter vaccines were inoculated into animals in an area in the vicinity of Chief Nikodemo's *boma*, in the Kisumu Location. It was thought if all the stock in one small area were vaccinated against these two diseases, the stockowners therein might be in a better position to realize that vaccination was efficacious, because losses amongst stock from these diseases would be evident in the contiguous unvaccinated areas.

Foot and Mouth Disease.—Only one outbreak was reported, and this appeared in the Kibigori Quarantine Station during the months of February, March and April. It caused some annoyance since no stock could be exported till the outbreak subsided. No mortality resulted amongst stock in the quarantine.

Contagious Bovine Abortion.—Throughout the Central and South Kavirondo Reserves this disease causes considerable economic loss to stockowners, in that at least 25 per cent of the female stock abort, causing a diminution of the calf population, loss of condition and milk supply of the infected cows.

The Maseno Centre herd was tested periodically and from results obtained the situation regarding this disease is satisfactory.

Demodectic Mange.—This year very few lesions of infection were observed in the skins shade-dried in the hide *bandas*. In comparison to the situation last year, the disease has abated considerably, with consequent gain to the stockowners, in that the hides when presented for sale realized a higher price than they would if ruined by the results of the disease.

Other Diseases, e.g., Streptothricosis, Distomiasis, etc., are prevalent in the reserves. The latter condition, from observation, is very serious in some locations and 50 per cent of the animals slaughtered for food show liver infestation.

South Kavirondo.—Rabies.—This reserve was declared by Proclamation No. 117 of 27th November, 1931, to be a "Rabies infected area."

During the earlier part of the year investigations were carried out to ascertain the incidence of rabies in the reserve, and when it was found to be prevalent in a number of locations, a campaign was organized and commenced, to destroy rabies carriers by poison-baiting. Ownerless and stray dogs were destroyed in this manner in the following locations: Karachonyo, Kabondo, North Mugirongo, Kamagambo, Mumbo, Gem, Kanyada, Kochia, Kitutu, Wanjari, Kanamkago, Sakwa, and South Mugirongo.

The figures below show the number of poisoned baits distributed, and the results attained in the above-mentioned locations:—

No. of baits used	Carnivora destroyed				Other Carnivora
	Dogs	Hyænas	Jackals	Cats	
24,703	9,215	121	214	50	293

The procedure adopted during the poisoning campaign was to issue poisoned baits to native personnel, who proceeded throughout the locations destroying all ownerless and stray dogs which were seen and distributing baits in places likely to be the habitat of wild carnivora. When satisfied the dog population had been greatly reduced, numerous baits were issued to the Chiefs and Headmen with instructions to lay the baits throughout their locations.

The figures of the number of carnivora destroyed, shown above, were compiled from actual numbers of carcasses observed, and it is surmised that at least twice or three times as many were destroyed in the long grass or thick bush.

From four locations in this reserve brains of suspected rabid dogs were obtained which, when examined at the Veterinary Laboratory, Kabete, proved positive to rabies.

Kabondo: 2 cases; 26th September, 1932.

Wanjari: 1 case; 22nd November, 1932.

Mumbo: 2 cases; 25th and 27th November, 1932.

Kanamkago: 1 case; 5th December, 1932.

In addition, two bovines were bitten by rabid dogs in the Kabondo Location. The cattle died some time after being attacked, their brains were forwarded to the Kabete Laboratory, and proved positive to rabies after microscopical examination.

It is of interest to record that natives of the Kisii Locations have a much smaller dog population than the Luo, and feed and take care of their dogs in a manner superior to that of the Luo.

Central Kavirondo.—This reserve was declared by Proclamation No. 37 of 25th May, 1932, to be an infected area for rabies.

On the 3rd May, 1932, information was received from the District Commissioner, Kisumu, that a child had been bitten in the Kisumu Location by a suspected rabid dog. The child subsequently died in the Kisumu Hospital. The brain of the child was forwarded to Nairobi for diagnosis and proved positive.

Steps were immediately taken to round up all dogs in the suspected area, and have them destroyed.

The following figures indicate the numbers of poisoned baits distributed and animals destroyed in the reserve during the year:—

Poisoned baits	Carnivora destroyed	
	Dogs	Hyænas
1,517	911	5

No positive case of canine rabies was diagnosed in this reserve.

(2) *Improvement of Cattle and Poultry.*—During the year at the Maseno Veterinary Training Centre the rudimentary principles of Animal and Poultry Husbandry were explained and demonstrated to the native pupils.

Whenever an opportunity occurred such as at *barazas*, etc. efforts were made to explain to the native inhabitants the advantages accruing from the proper methods of animal and poultry husbandry.

Attention was paid to the castration of scrub bulls in the North Ugenya Location. Frequent demonstrations of castration by the Burdizzo method were given in this location and one trained native scout travelled all over the location castrating these useless bulls, when offered by the owners. Some hundreds of scrub bulls were castrated in this manner and the inhabitants were more than satisfied with the efficacy of the method in comparison with the cruel and primitive method of crushing the testes to pulp by means of stones or rungs. It is hoped during 1933 to extend this work into the surrounding locations.

Approximately 600 pure bred Rhode Island Red and Australorp hens and cocks were issued to the locations and paid for by the Central Kavirondo Local Native Council from the £240 voted by this Council last year.

During the 1932 Local Native Council estimate meeting, the elders voted Sh. 3,000 for the purchase of pure bred poultry during 1933.

(3) *Improvement of Hides and Skins.*—A special Hides and Skins Officer was detailed to the Central Kavirondo Reserve during the year, for the furtherance of the policy of encouraging the natives by propaganda and demonstrations to produce only shade-dried hides of a No. 1 quality.

It is satisfactory to state that a great improvement has been recorded in the quality and quantity of shade-dried hides exported.

The procedure adopted in achieving this result was to erect additional hide *bandas* where warranted and by constant supervision, keep the old ones in a reasonable state of repair.

At *barazas* throughout the locations the people were asked to bring all their green hides to the *bandas*, for preparation in a suitable manner, so that the top price might be realized.

All the hide *bandas*, numbering over 60, in the reserves were originally built by the natives themselves with little help from this Department.

The grass *bandas* are worked by native traders who purchase the green hides from the tribes and bring them to the *bandas* where they are dressed, cleaned and dried. The traders are private individuals and are not in the employment of Government. In the larger *bandas* as many as six men are constantly employed.

The chief drawback to the preparation of shade-dried hides of No. 1 quality is that the *banda* roofs, made of grass, eventually become delapidated and rain soaks through the roofs causing the hides to deteriorate. This will be overcome during 1933, since the Local Native Council Central Kavirondo voted Sh. 8,000 for the erection of 18 *bandas* of a permanent type, consisting of corrugated iron roofs, cedar posts and wire netting sides.

When these buildings are completed, a further advancement will be made in the percentage of firsts exported to Mombasa, causing a greater cash return to the natives, than that obtained during the year, because large numbers of hides were destroyed due to leaking *bandas*.

The new buildings will be erected in the chief markets as near the main roads as practicable, so that inspection will be facilitated thus assuring and maintaining a uniform quality of hides.

Tours of instruction were constantly made to all the *bandas* and practical instruction given where possible in :—

- (a) Flaying and trimming.
- (b) Better washing and cleaning.
- (c) Better stretching.

The chief faults noticed were bad flaying, insufficient washing, causing stained hides, too much meat and fat left on, in order to obtain a heavier hide.

The following table shows the situation and number of hide *bandas* in the Central Kavirondo Reserve :—

<i>Location</i>	<i>No. of Bandas</i>	<i>Location</i>	<i>No. of Bandas</i>
Samia	3	N. Ugenya	3
S. Ugenya	2	Alego	5
N. Gem	3	S. Gem	2
Kadimu	1	Sakwa	3
Asembo	1	Seme	1
Kisumu	3	S. Teriki	2
Kajulu	1	E. Kano	3
W. Kano	1	Nyakatch	3
Maseno	1	Kisumu Town	1

Total .. 39

(4) *Improvement of Quality and Quantity of Dairy and Poultry Products.*—One Stock Instructor and native staff concentrated upon this work during the greater part of last year, travelling throughout the milk producing locations instructing the native ghee producers in the best methods to obtain a high class product, and rectifying any mistakes to be seen during these inspections.

Where the milk supply warranted the establishment of new dairies, efforts were made through the Chiefs and Headmen to help to attain this result.

Unfortunately the price of ghee per 36 lb. was only Sh. 19 to Sh. 22 and this poor price was accountable for the low production during the year, since this price hardly enables the producer to make a reasonable living.

Through propaganda at *barazas*, etc., it was impressed upon milk vendors that they must accept a lower price per gallon for their milk in order to enable the ghee producer to carry on.

Attention was paid to the buildings used for ghee production and wherever indicated the owner was persuaded to erect a suitable building, that is, cement floor, Kavirondo matting ceiling and sides made with netting wire.

The following table shows the number of dairies to each location, estimated annual output and value:—

<i>Number and situation of Dairies</i>	<i>Estimation of output</i>	<i>Estimation of value</i>	
	lb.	Sh.	cts.
Seme .. 27	42,220	23,733	00
Sakwa .. 21	36,430	20,267	00
Asembo .. 19	44,400	24,667	00
Uyoma .. 10	26,860	14,933	00
S. Gem .. 2	4,800	2,667	00
Kadimu .. 1	1,920	1,067	00
Kisumu .. 1	2,880	1,600	00
E. Kano .. 4	3,240	1,800	00
85	162,820	90,734	00

The output of ghee from separators owned by Indians in Central Kavirondo, who purchase the milk from natives in their vicinity, has not been taken into consideration. The Indian output has not as yet been investigated, but is of considerable importance.

The quality of the ghee exported from the Central Kavirondo Reserve has decidedly improved during the last few years, and considerable quantities are exported to the surrounding territories, e.g. Uganda and Tanganyika.

Poultry Products.—By the distribution throughout the locations of pure-bred poultry, an improvement of the indigenous breed will eventually become apparent. It is well known that the indigenous breeds of poultry are of very poor conformation and of poor egg-laying capacity.

A beginning was made during the year in forming a local egg-circle at the Maseno Centre. Eggs were brought in by the natives of the surrounding districts, tested and exported to Nairobi, etc., for consumption; 18,000 eggs were tested and sold in this manner.

A native is in charge of this attempt to persuade his people to bring in fresh clean eggs for export, by offering them a higher price per egg than the local traders.

It is intended in the future to organize a number of these egg-buying centres throughout the reserve for export.

(5) *Establishment of Subsidiary Veterinary Training Centres.*—Two subsidiary veterinary training or social centres were established during the year by moneys granted by the Local Native Council of Central Kavirondo.

The members of the Local Native Council decided the centres should be erected in conjunction with two of the most important markets in the reserve, namely Kaluo and Nyando, in the Alego and East Kano locations respectively.

Each centre comprises the following :—

- Veterinary instructor's house, kitchen and latrine.
- Dairy and ghee kitchen.
- Hide *banda*.
- Butcher's shop.
- Cattle crush.

The main objects of the training centres are to improve the quality and increase the quantity of animal products in their vicinity, as well as to initiate the supervision of the chief markets, so that in future all native produce offered for sale therein may be of uniform quality.

The buildings are of a permanent nature, and will last at least ten years with minor repairs annually.

At each centre one trained veterinary scout was installed, whose duty it is to carry out the dairy work, supervise the hide, butcher and market activities, and assist in disease control work in that locality.

Natives in the neighbourhood of these centres may take a course of instruction in dairy, hide or butcher work, and help will be given in any such enterprise they may undertake in the surrounding districts.

(6) *Stock Movements.*—Stock for breeding-up purposes were permitted movement out of the Central and South Kavirondo Reserves during the year via the Kibigori Quarantine Station.

Very little advantage was taken of this concession, and only a few hundred head were exported.

Slaughter oxen exported to Uganda via Kisumu during the year numbered 2,950.

The estimated value of these 2,950 bullocks exported to Uganda is Sh. 177,000.

Permits for the movement of 15,679 sheep and goats were issued to proceed from the Central Kavirondo Reserve.

(7) *Census of Stock in the Central Kavirondo Reserve.*—The following figures are a conservative estimate of the stock for ten locations: Total cattle, 149,198; oxen, 12,773; bulls, 18,315; cows, 57,874; heifers, 18,370; young heifers, 20,444; young bulls, 21,422; sheep, 66,629; goats, 112,032; poultry, 223,125. Total female stock, 96,688; total bulls, 39,737; total oxen, 12,773.

North Kavirondo Reserve.

Stock Disease.

Rinderpest.—In the earlier part of the year, North Kavirondo was comparatively free from rinderpest. In March, an outbreak occurred in the Kabras locality, and from there the disease spread westwards. The rapid spread raised the suspicion of the coincident existence of foot-and-mouth disease. The presence of foot-and-mouth disease was subsequently confirmed in virus makers. It was impossible to obtain virus makers free from this condition for a considerable period, and as a result no inoculations were carried out during April and for the greater part of May. Inoculations were recommenced at the end of May.

Contact was established with the Veterinary Officer, Tororo, Uganda. This co-operation makes for greater efficiency in disease control along the Kenya-Uganda border. One or two small outbreaks occurred near the border during the year. The cattle in the affected districts were few in number, and the disease was fairly localized. Movement of stock across the border is not permitted.

All the stock at the Sangalo Training Centre are vaccinated against rinderpest.

Foot-and-mouth Disease.—In April, there was a comparatively rapid spread of disease through the reserve, attended by considerable mortality in cattle. The suspicion that this might be due, partly at least, to foot-and-mouth disease, was subsequently confirmed by the occurrence of this condition in virus makers. Typical foot-and-mouth lesions were noted.

The high mortality in native cattle at this period would seem to have been due, not to either rinderpest or foot-and-mouth disease alone, but to a combination of the two. It is therefore impossible to offer any opinion as to the virulency of this particular outbreak of foot-and-mouth disease.

Rabies.—In view of the proximity of North Kavirondo to affected districts, a close watch for rabies was kept throughout the year.

Arrangements were made with the District Commissioner, Kakamega, with a view to any suspected cases being reported immediately to the Veterinary Officer. In two instances the existence of rabies was rumoured, but neither could be substantiated.

Sterility.—When the census was taken in the Malikisi (see later), information was sought as to the fertility in cattle. It was found that a relatively large number of *bomas* contained cows whose sexual and reproductive functions were abnormal.

These cows can be divided roughly into (a) those which do not mate, (b) those which mate but do not conceive, (c) those which abort. The economic loss from sterility in this country must be considerable.

Improvements of Markets.—A scheme based on that of Central Kavirondo was submitted to the Local Native Council, but no funds were obtained for this purpose owing to the financial situation.

There are several large markets in the southern locations; in the northern locations, markets are few in number and small. Some four or five animals are slaughtered every week in the larger markets. It is in such places that any scheme for improvement can most readily be effected.

The development of markets will be encouraged in those places where they do not at present exist or are very small. This will present many advantages, e.g. the slaughter of animals in recognized places under hygienic conditions; ultimately the aim should be to institute some form of meat inspection under veterinary supervision; sale of meat under hygienic conditions; erection of ghee stations, where the cattle population permits; sale of stock can be encouraged, thereby making purchase of stock easier for Europeans and others; and in general the marketing of native products can be stimulated.

It is proposed therefore, as far as circumstances permit, to develop markets by the erection of hide *bandas*, ghee stations and butchers' shops.

Native Staff.—It is highly desirable that a veterinary scout should be stationed permanently in each location. His duties would be (a) notification of outbreaks of disease, sudden deaths, etc.; (b) supervision of ghee stations; (c) supervision of hide *bandas*; (d) inspection of markets; and (e) inspection of meat.

Movement of Stock out of Reserve.—The figures for 1932 are :—

Purchased by Europeans	...	...	866
Under traders' licences	...	...	538
Squatters' stock	...	...	527
			1,931

Census.—A census was taken in the Malikisi location during the months of April and May, when no inoculations were carried out on account of foot-and-mouth disease. Information obtained in this way is not strictly accurate, but it does provide an approximate estimate of the number of live stock.

Cattle.—The total number of cattle in this location is 31,920, divided as follows :—

Cows	...	...	...	10,026
Heifers	...	...	...	8,602
Bulls	...	...	...	3,574
Oxen	...	...	...	3,270
Calves	...	...	...	6,448
				Total ... 31,920

The female stock, omitting mention of calves, outnumber the male stock. Two reasons can be advanced for this : (a) the slaughter of male stock for food, and (b) sale of oxen.

Over 6,000 calves were born during 1931, comprising 3,731 heifer calves and 2,717 bull calves. These figures provide a further explanation of the discrepancy between the numbers of male and female stock. It appears that there may be a selective mortality, pre- or post-natal, affecting bull calves more than heifer calves.

These 6,000 calves cannot be taken as representing the increase of stock for that year. They are merely the births. In the absence of figures for mortality and slaughter, the actual increase in stock cannot be given. It is probably not very high. A conservative estimate would place the annual increase in the neighbourhood of 3 per cent.

Sheep.—There are very few sheep in the location. The numbers are :—

Ewes	...	...	...	...	£03
Rams	...	...	...	...	386
Lambs	...	...	...	...	274
					1,463

Goats.—Goats are more numerous than sheep :—

Males	...	...	...	...	1,852
Females	...	...	...	...	2,035
Kids	...	...	...	...	1,177
					5,064

Dogs and Cats.—The number of dogs is estimated at 500. Cats are kept, following the Baganda custom.

Fowls total 16,000.

INOCULATIONS AND VACCINATIONS FOR 1932.

NORTH KAVIRONDO.

	<i>Rinderpest</i>				<i>Colon Bacillosis</i>	<i>Para-Typhoid</i>	<i>Black-Quarter</i>	Revenue
	Double Inoculations		Mortality	Vaccinat's.				
	Adults	Calves						
Native	15,011	1,642	3%	119	24	24	118	Revenue collected : Sh. 39,169/50. Revenue outstand'g. : Nil.
Farm	..	..	..	..	..	..	..
Trade	..	..	..	..	..	..	..
<i>Totals</i>	15,011	1,642	..	119	24	24	118	Sh. 39,169/50.

Total Number Double Inoculations : 16,653.

Comparison with Previous Years :

Double Inoculations..	1928	1929	1930	1931	1932
	16,513	7,808	14,903	3,657	16,653

LUMBWA RESERVE.

Rinderpest.—Double inoculations were carried out at four centres in the district, i.e. Kericho, Kipterre, Litein, and Sotik Post, and the natives in the South Lumbwa Reserve have much appreciated the facilities made available for the immunization of their stock.

Tested virus makers were used from Kabete, and practically no mortality was reported.

Rabies.—Early in August, 1932, the first outbreak of rabies occurred on a European-owned farm adjoining Kericho Township. Owing to the serious nature of the disease, all stray dogs were destroyed, and an extensive poisoning campaign instituted. From the time of the first outbreak, until the end of the year, the necessity of coping with this menace had prior claim even to the exclusion of rinderpest double inoculations in the district.

53,000 poison baits were distributed under the supervision of the district staff, and this method of dealing with all stray dogs and small carnivora has proved highly successful.

Up to the end of the year, six positive cases of rabies were proved to occur in this district, three of these in dogs and the remaining three in jackals. (These figures do not include the Sotik settled area.)

168 dogs were shot in Kericho and adjoining tea estates by the staff.

GENERAL.

Throughout all the native pastoral reserves, the year under review has been a difficult one for the native stockowner, who cannot be expected to understand the adverse influence of the general economic depression on his marketable stock and stock products. For some years past, the development of the native pastoral industry has been a particular endeavour of this Department, and it is an unfortunate circumstance that the depression should occur just as the results of this endeavour were gradually becoming apparent, and before the native pastoral industry could be built up on solid and secure foundations.

H. H. BRASSEY-EDWARDS,
Deputy Director (Animal Industry)
and Chief Veterinary Officer.

REPORT OF THE CHIEF VETERINARY RESEARCH OFFICER

STAFF.

Mr. J. Walker, Chief Veterinary Research Officer, left the Colony on the 26th June, 1932, on vacation leave pending his retirement, which took effect from the 7th October, 1932. Mr. Walker was appointed Veterinary Pathologist in June, 1918, and remained in control of veterinary research until the date of his departure in 1932. During his 14 years' service in Kenya he carried out much valuable investigational work into the diseases of stock, and was responsible for the initiation and development of control measures which have since proved of signal importance to the Department in its efforts to control and eradicate disease, with reference more particularly to the major contagious diseases of cattle in this territory. Mention might be made of his efforts to establish the serum-simultaneous method of inoculation against rinderpest on a sound basis. As a result of his researches he was able to lay down a rational programme for the carrying out of such inoculations, which secured a great measure of uniformity and efficiency to this difficult process. In the prevention of losses during this inoculation from transmitted and intercurrent diseases his work was equally productive of results, and he was able to establish as a routine a technique for the production of virus for field use which obviated the danger of transmission of protozoan-parasites. He was responsible for improvements in the technique of production of pleuro-pneumonia culture virus, and it was largely due to his efforts that the culture vaccine was so widely adopted, both in the settled areas and in the native reserves, with results that are reflected in the position of the Colony to-day. His work on East Coast fever demonstrated the almost insuperable difficulties that attend attempts to immunize cattle against this disease, but on the other hand he was able to show quite clearly the efficacy of control by dipping and hand-dressing. More recently he devoted much time to the production of a satisfactory vaccine for horse-sickness and to the investigation of the so-called East African swine fever.

The value of Mr. Walker's work has always been appreciated in the Colony, both by his colleagues in the department and by the stock-owning community in general. Prior to proceeding on leave Mr. Walker acted in the capacity of Deputy Director (Animal Industry) and Chief Veterinary Officer during the absence on leave of Major H. H. Brassey-Edwards from 5th March to the 26th June.

From the date of Mr. Walker's departure until the return from leave of Major Brassey-Edwards on 20th October, the duties of Deputy Director (Animal Industry) and Chief Veterinary Research Officer were taken over by the present Chief Veterinary Research Officer, whose substantive appointment as Chief Veterinary Research Officer was gazetted from the 7th October, 1932.

Mr. Fotheringham was gazetted Veterinary Research Officer with effect from the 1st January, 1932.

Mr. W. B. C. Danks returned from leave on 5th September, 1932. Mr. Danks was fortunate in securing in 1931 a Rockefeller Foundation Fellowship in Medical Science, which enabled him during an extended leave to visit many of the more important research institutes in the United States and Canada. He was able to make a more protracted stay at St. Louis, where he worked in the laboratories of the University of Washington under the direction of Dr. E. V. Cowdry; collaborating with him in the continuation of the researches on East Coast fever which were begun at Kabete in 1930.

It is with pleasure that I acknowledge the satisfactory manner in which all members of the staff have carried out their duties during the year.

CORRESPONDENCE.

3,963 inward and 2,536 outward letters and telegrams were dealt with during the year, a total of 6,499. This is exclusive of communications received and despatched in connexion with slides and specimens submitted to the laboratory for diagnosis. 6,138 slides and specimens were received and reported upon. A classification of these reports is given later under the heading "Technical Routine".

LABORATORY FARM.

Twenty-six acres of green maize, sown in November, 1932, were cut and made into ensilage, producing about 80 tons. The crop was small since it had to be cut before it was mature, to save it from destruction by locusts. During the long rains a mixed crop of maize and sunflower was planted which produced about 300 tons of ensilage. All ensilage produced during the year was fed to the stock between August and November to supplement the grazing which had been completely destroyed by locusts.

During the short rains 15 acres of Napier grass cuttings were planted, of which a very high percentage has struck. This crop promises well, and should prove of great value as

green food and for conversion into ensilage. Additional crops planted during the short rains included 10 acres of maize and sunflower, and a small trial plot of edible canna.

Five small plantations of shade trees were established in the various pastures where shade for the cattle is at present lacking.

A portion of the farm labour was employed continuously throughout the year in cutting out the recurrent growth of bush in all pastures.

A small area has been set aside and marked out in experimental plots, under the direction of the Soil Chemist and the Agricultural Officer in Charge of Grassland Improvement. The experiments, which are now in progress, have been designed to demonstrate in the one case the effects upon the flora of the pastures of grazing of varying degrees of intensity, and in the other the effect of different manurial treatments. It is hoped that the information gained in these experiments will assist us in the regeneration of the laboratory pastures after overstocking and locust invasions.

Forty-one calves were born in the special breeding herd maintained at the lower farm for the rearing of cattle under tick-free conditions.

BUILDINGS AND PLANT.

Buildings.—The general maintenance, improvement and repair of all laboratory buildings and staff quarters was carried out by the laboratory workshops staff. The main items in this connexion were :—

- (1) Alterations and improvements to the post-mortem room.
- (2) Alterations to the rinderpest-serum production wing, and the conversion of a portion of this wing into a general media preparation room.
- (3) Erection of a wattle and daub shed with double fenced boma for accommodation of cattle on pleuro-pneumonia experiments.
- (4) Erection of kennels with strong wire fences for the isolation of dogs under observation in connexion with rabies.
- (5) Erection of guinea-pig houses and runs.
- (6) Conversion of certain rooms into a foot-and-mouth-disease laboratory.

Plant and Apparatus.—The steam, gas, electrical and water systems gave satisfactory service throughout the year.

The only new item of apparatus installed was an electric air compressor in the rinderpest serum wing.

General.—Several tsetse-fly traps for experimental use in the field were made in the laboratory workshops. Other work included the repair and maintenance of transport vehicles and farm implements, the manufacture of serum and other packing cases, and of various appliances for laboratory use.

FINANCE.

Expenditure.—The amount sanctioned was £25,014 but owing chiefly to the suspension of anti-rinderpest serum manufacture, consequent to large stocks being on hand, considerable savings were effected, and the amount actually expended was £22,669.

Revenue.—Revenue accruing directly to the laboratory from the sale of laboratory products totalled £3,256. Of this amount only £246 was in respect of sales to other Governments.

This is exclusive of revenue derived from rinderpest inoculations by the field staff, such revenue being shown under "Veterinary Inoculation Fees." The value of anti-rinderpest serum issued to the field staff, at the scheduled rate of Sh. 2 per 50 c.c., was £27,592.

The sale of surplus live stock and hides realized £716, and £12 was derived from the sale of various stores.

LIVE STOCK.

The following table shows the number of live stock, other than small animals and poultry, on the books of the laboratory during the year, including animals sent by or purchased from stock owners for experimental purposes or for the preparation of laboratory products:—

SPECIES	On hand 1-1-1931	Increase	Decrease	On hand 31-12-31
Horses	21	15	18	18
Mules	16	5	..	21
Cattle	835	682	796	731
Sheep	137	257	210	194
Goats	9	9	9	9
Pigs	17	54	64	7
Eland .. .. .	..	5	5	..
Buffalo	1	..	..	1

In addition to the numbers shown in the table 371 cattle were purchased at outstations by members of the field staff for rinderpest virus production. These animals were taken on charge by the officers concerned, but the cost of purchase, a total of £525, was met from laboratory votes.

TECHNICAL ROUTINE.

The appended table shows the number of slides, specimens, etc., registered during the year, together with a list of the species of animals concerned :—

Cattle	..	..	..	5,355
Horses	..	..	..	114
Mules	..	..	..	55
Donkeys	..	..	..	28
Sheep	..	..	..	108
Goat	..	..	..	21
Pigs	..	..	..	41
Dogs	..	..	..	146
Jackals	..	..	..	14
Fowls	..	..	..	170
Turkeys	..	..	..	11
Ducks	..	..	..	9
Camels	..	..	..	3
Cats	..	..	..	2
Various	..	..	..	61
			TOTAL	6,138

LABORATORY PRODUCTS.

Anti-Rinderpest Serum.—The total quantity prepared amounted to 113,925 dose units, each of 50 c.c. Large stocks of serum, totalling 161,580 x 50 c.c. units were on hand at the beginning of the year. The existence of this large reserve allowed the suspension of production early in April, when the financial position, together with added cost of replacing with expensive artificial foods the grazing that had been destroyed

by locusts, necessitated the immediate abandonment of serum manufacture. As the reserve stock became depleted manufacture was resumed on a smaller scale in October. Consumption by the field staff during the year was high, 275,915 x 50 c.c. units, and this unusually high figure is reflected in the increased revenue collected as double-inoculation fees. At the close of the year less than 15,000 units remained on hand, quite an inadequate reserve.

The quantity of serum produced during the year was a little less than the amount upon which the original estimates of expenditure were based, viz., 120,000 units, but it must be remembered that savings on the vote for production of sera and vaccines were surrendered to the value of £450 or roughly 9 per cent of this vote.

The only sale to foreign countries was a shipment of 2,000 dose units to Shanghai for the Culty Dairy Co., Ltd.

Rinderpest Vaccine.—The issues of rinderpest vaccine during the year show a slight increase over those of 1931. Reference is made elsewhere to the satisfactory result of tests carried out in Shanghai with vaccine shipped in cold storage, and to the placing of an order for bi-monthly shipments to this port.

Anthrax Vaccine.—The preparation of a single spore vaccine has been continued, and issues during the year have been almost double those of 1931.

Blackquarter Vaccine.—There has been a slight fall in the demand for this vaccine.

Horse Sickness Vaccine.—The demand for this vaccine is irregular, and in the current year has been less than in 1931.

Paratyphoid Vaccines.—The demand for both types of vaccine continues to rise.

Sodium Tellurite.—A solution of sodium tellurite is prepared for the treatment of white scour in calves. The efficacy of the treatment is undoubted, and since last year when the compound was first gazetted as a scheduled laboratory product the issues have almost doubled.

PREPARATION AND ISSUES OF LABORATORY PRODUCTS FOR THE YEAR ENDING 31st DECEMBER, 1932

PRODUCTS	Balance on hand 31-12-1931	Prepared by Laboratory during the year	Returned to the Laboratory	Used in the Laboratory	Total Local Issues during the year	Issues to other countries	Written off as too old for Issue	Balance on hand 31-12-1932
Anthrax Vaccine (single spore) ..	Nil	17,452	195	Nil	17,452	Nil	Nil	Nil doses
Blackquarter Vaccine	"	49,117	Nil	905	48,212	"	"	" "
Bluetongue Vaccine	51,670	Nil	"	Nil	1,165	"	"	50,505 "
Colon Bacillosis Vaccine	893	3,070	31	"	3,084	"	"	910 "
Contagious Abortion Vaccine	Nil	1,038	Nil	"	1,038	"	"	Nil "
Fowl-pox Vaccine	"	9,568	"	10	9,458	100	"	" "
Fowl Typhoid (K.F.D.) Vaccine	"	34,432	"	4	34,428	1,070	"	" "
Horse-Sickness Vaccine	"	132	"	Nil	132	Nil	"	" courses
Experimental Vaccine for Suppurative Pleuro-pneumonia of Sheep and Goats	"	2,750	"	"	2,750	"	"	" doses
Pleuro-pneumonia Vaccine	"	80,195	"	"	79,545	650	"	" "
Paratyphoid Vaccine	"	2,917	"	"	2,917	Nil	"	" "
Paratyphoid Feed Vaccine	"	2,440	"	"	2,440	"	"	" "
Redwater and Anaplasmosis Vaccine	"	187	"	6	181	"	"	" "
Rinderpest Vaccine	"	30,148	"	75	29,593	480	"	" courses
Serum, Anti-rinderpest	161,580	113,925	20,475	20	276,840	2,000	200	14,920 doses
Sheep-pox Vaccine	Nil	5,000	Nil	Nil	5,000	Nil	Nil	Nil "
Sodium Tellurite	"	12,082	"	"	12,082	"	"	" "
Trypanblue, Bovine	478	Nil	16	10	243	"	"	236 "
Trypanblue, Canine	90	72	Nil	1	121	"	"	40 "
Tartar Emetic	Nil	600	"	Nil	600	"	"	Nil "
Wireworm Remedy Powder	291,000	492,200	1,000	"	608,500	10,500	"	165,200 "

Anti-rinderpest Serum Field Staff .. 275,915 doses.
 Stockowners.. 925 "
 Shanghai .. 2,000 "
 Total Issues, 1932 278,840 "

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A G R

RESEARCH.

Rinderpest.—Field investigations into the practicability of immunization by the vaccine plus virus method of inoculation have been continued. In particular one large herd containing some 1,200 previously unprotected animals was treated by this method. The preliminary dose of vaccine was either 10 c.c. or 15 c.c. and the virus employed was the supernatant fluid from a centrifuged spleen extract, the dose being equivalent in certain cases to 0.4 grammes of spleen tissue and in others to 0.3 grammes. There was an interval of twelve days between the inoculation of vaccine and that of virus. The incidence of reactions to the virus inoculation was roughly in agreement with that recorded in animals previously treated by this method (*vide* Department Annual Report, 1930, p. 110), and apart from thermal reactions no clinical symptoms were observed in any of the animals except nine which contracted rinderpest in severe form. Since none of the remaining 1,190 animals showed even the mildest clinical manifestations of rinderpest, it is thought these nine animals, of which eight were in one herd, must accidentally have escaped the vaccination.

Experience in this inoculation was borne out by the results of two subsequent inoculations on other farms, and the method is now being made available for general use in certain areas of the Colony. The 1,200 cattle referred to above have been distinctively branded and random samples drawn from this herd will be subjected to immunity tests at regular intervals until immunity is found to be waning. These tests should furnish a reliable index of the durability of the immunity provoked by the treatment, and should warn us before danger arises of the need to reimmunize cattle protected by this method.

Developments in the policy of the Department in relation to the control of rinderpest in certain of the pastoral reserves make it imperative that the vaccine plus virus method should be made available for routine use at the earliest possible moment. The policy of suppressing outbreaks of rinderpest, in such enzootic areas as the Masai Reserve, by means of a single injection of locally-prepared inactivated vaccine has achieved its first object of protecting those parts of Tanganyika Territory which march with the Kenya Masai Reserve from repeated invasions of rinderpest from the Kenya side. It has further enabled the staff to clean up certain administrative districts and to maintain these areas free from infection for

periods long enough to permit a considerable export of saleable cattle to markets in Tanganyika Territory or in the Kenya coastal areas. On the other hand the very efficiency and rapidity with which natural outbreaks of the disease are being suppressed must inevitably result in a rapidly progressive increase in the proportion of susceptibles among the adult native cattle population in these areas. Young cattle are being efficiently protected against the normal incidence of rinderpest during the period of their lives when they are least susceptible. The situation is fraught with danger in the near future, and until Government is in a position to offer a service which will guarantee that these susceptible areas are not exposed to risk of infection some means must be sought to continue the suppression of outbreaks without sacrificing the valuable herd immunity of the Masai cattle.

The vaccine plus virus method offers a solution of the difficulty. The immediate safety of the method is established beyond doubt, at all events with the laboratory prepared vaccine. A proportion of the animals treated will undoubtedly derive from the proposed vaccine virus inoculation a permanent active immunity comparable to that provoked by double-inoculation or by a natural attack of the disease; these are the animals that react either thermally or in completely inapparent form to the virus inoculation. There is, however, some doubt about the remainder of the animals. It is known that when the virus inoculated is in the form of virulent blood a certain percentage of vaccinated animals will completely resist infection with the virus and will again become susceptible when the temporary protection afforded by vaccination has weakened. It is apparently otherwise when the virus is inoculated in the form of a cell-free spleen extract. The "attenuated" vaccine used in vaccine experiments carried out as long ago as 1927 can for all practical purposes be considered as a spleen extract virus, and it has been shown that an injection of such a virus can prolong the period of immunity afforded by a single dose of vaccine up to at least thirty-three months even though reactions from the virus inoculation are inapparent in 97-98 per cent of the animals. The recent field experiments have been designed to show whether all these non-reacting animals acquire the more permanent immunity when relatively small doses of extracted virus are used in place of the larger dose of attenuated vaccine (15 c.c.) which was employed in the 1927 experiment.

It is interesting to record that during the year an experimental shipment of inactivated vaccine was made to Shanghai. The journey occupied roughly two months, during which time the vaccine was held in cold storage. On arrival animals were inoculated with three doses each of 10 c.c. at weekly intervals and were afterwards submitted to a test with virulent blood. I am informed that the results of the test were completely satisfactory, and the firm in question proposes to rely entirely upon the vaccine for protection against rinderpest in the future. Since April regular bi-monthly consignments have been shipped to this firm.

Foot-and-Mouth Disease.—Foot-and-mouth disease broke out in February amongst the cattle of the dairy herd maintained at the laboratory. Advantage was taken of the enforced period of quarantine to make a brief investigation of the virus concerned in this and in other outbreaks. European type strains, "A", "O" and "C", were obtained through the kindness of Dr. Andrews of the Veterinary Research Laboratory of the Ministry of Agriculture at Weybridge, Surrey, and this material together with polyvalent hyper-immune serum from the Prussian Station on the Island of Riems was consigned by air-mail to Kenya. Prior to this particular outbreak viruses from outbreaks in the Nanyuki area had been sent home for typing, and Dr. Andrews now reports that the only virus that was viable on arrival proved to belong to type "O", the commonest of the European strains.

The Kabete strain was a little unusual in that at first it showed a considerable overlap with two of the European types. Both "A" and "C" viruses completely protected guinea-pigs against the freshly isolated Kabete virus, conversely an infection with the Kabete virus conferred complete protection against the "A" type and almost complete against the "C" type. During a series of rapid passages in guinea-pigs the power to protect against "C" gradually declined until by the thirtieth passage the Kabete strain cross-immunized completely with "A" and not at all with "C". This virus proved then to be a variant of the "A" type.

Another virus collected in the Nakuru District was found to be identical with the Kabete strain.

Two separate samples of virus, collected from cattle in the Southern Rhodesian outbreak, were forwarded to Kabete for examination. These viruses also appear to differ in some

respects from the ordinary standard types, although in the earlier inoculations of guinea-pigs one of them seemed closely to approach the "O" type. Owing to shortage of susceptible guinea-pigs it has not been possible to complete the typing of the Rhodesian viruses, but it is interesting to observe that there are in Kenya cattle completely immune to the Rhodesian virus, an indication that this type of virus must have been responsible for some of the recent outbreaks of foot-and-mouth disease in this Colony.

The outbreak of the disease at Kabete was benign in character and the mortality among 800 cattle of all ages amounted to three calves only, all of which showed gastroenteritis and degenerative changes in the myocardium. Unsuccessful attempts were made to protect cattle against contact infections with the Kabete virus by large injections of convalescent serum drawn from animals that had passed through marked reactions. Equally the German hyperimmune serum in the prescribed and in much larger doses failed to protect animals completely against contact infection. Simultaneous inoculation of virus and immune or hyperimmune serum delayed the appearance of symptoms, but did not modify the course of the infections to any noticeable extent. The treatment of guinea-pigs with inactivated formalized vaccine proved moderately successful, but the impossibility of providing an adequate supply of virus for the immunization of cattle by this method remains for the present an insuperable obstacle to the practical utilization of the vaccine.

One feature of the outbreak at Kabete, which is in agreement with field experience, is worthy of mention. This is the apparent ease with which the spread of infection may be arrested. Although practically every animal at the laboratory became infected we were able by simple precautionary measures to prevent extension of the outbreak to the cattle at the neighbouring upper and lower farms. Ox transport between the three farms was discontinued and the wheels of the motor lorries used in its place were disinfected before leaving the laboratory grounds. There was no movement of animals from the laboratory to the farms, but the normal movement of animals and foodstuffs in the opposite direction was continued. Instructions were given that boys employed at the laboratory were on no account to trespass on either of the farms, but it

is doubtful if these instructions were rigidly observed. In spite of what in England would have been considered as glaring imperfections in our quarantine measures both farms remained free from foot-and-mouth disease. It is the general opinion of veterinary officers in the field that the spread of foot-and-mouth disease in Kenya is effected almost entirely through the agency of actually infected animals and that fomites, so important in Europe, play a negligible part. In all probability the higher temperatures that obtain in the tropics and the increased exposure to bright sunlight react unfavourably upon the chances of survival of the virus *in vitro*.

Rift Valley Fever.—The investigation of this disease has been continued by Mr. Hudson and myself although progress has been hampered by scarcity of experimental animals. A technique has been evolved for the feeding of the mosquitoes which are suspected to act as vectors of the disease, and it has been possible to demonstrate survival of the virus in certain mosquitoes for periods up to nine days. It is hoped to complete this phase of the investigation in the near future.

An attack of Rift Valley fever provokes a remarkably high-grade immunity in sheep. One recognizes here another analogy with the behaviour of yellow fever virus, to which the Rift Valley virus is so closely related. Unweaned lambs born of immune mothers are stolidly immune to experimental infection even though they may be born more than two years after the recovery of the ewe from the natural or experimental disease. Shortly after weaning such lambs again become susceptible indicating that the immunity is a passive one and is milk-borne. We have in certain instances been able to inoculate simultaneously two lambs from the same immune mother, an older weaned lamb and a younger unweaned lamb from the next succeeding pregnancy. In each case the weaned lamb has proved susceptible and the unweaned one completely resistant. It is evident that this state of affairs, together with the marked age resistance that is acquired by sheep, must be an important factor in determining the periodicity of severe outbreaks in enzootic areas.

A highly potent hyperimmune serum has been prepared in cattle. It is possible by balancing the doses of serum and virus to "double-inoculate" ewes successfully and so to take advantage of this milk-borne passive immunity to protect lambs at the most susceptible period of life. The serum could also be used directly on lambs at birth to protect them during

an outbreak of the disease, and it is probable that as the passive immunity produced by the serum weakened natural infection would occur with the production of mild reactions only.

At the request of various interested workers in other parts of the world, the virus of Rift Valley fever has been supplied to certain institutes engaged in the study of yellow fever. It has been shown by Findlay that the susceptibility of old and new world monkeys to Rift Valley fever closely parallels the susceptibility of the same species to yellow fever. In his monograph on Rift Valley fever Findlay was able to confirm our original findings and further considerably to enlarge the scope of the investigations.

Nairobi Sheep Disease.—Several outbreaks of this disease have been diagnosed during the year. It has usually been necessary for the owner of the infected flock to send an affected sheep to the laboratory, where it has generally been possible to furnish a tentative diagnosis after a post-mortem examination of the sick animal. In every case the interim diagnosis has been confirmed by the inoculation of tissues into susceptible and immune sheep. The efficacy of hand-dressing with oily suspension of tobacco extract has been repeatedly demonstrated in the control of these outbreaks.

Investigations into the possibility of transmission by ticks other than *R. appendiculatus* have been continued. A report will shortly be published.

Horse Sickness.—The histo-pathology of this disease has been studied by Mr. Fotheringham in material obtained from animals infected in the course of vaccine production.

Cytological changes have been observed in certain parenchymatous organs; and although these changes vary in intensity from case to case, they are consistently present in cases so far examined.

Further research along these lines is desirable since the recognition of specific changes may lead to a simplification of laboratory diagnosis. The present method of animal inoculation of suspected material is both costly and slow, and adequate supplies of suitable experimental animals are not always obtainable.

The specificity of the changes under consideration is being investigated further and the results will be reported in a separate communication.

Fowl Paralysis.—This interesting disease was diagnosed for the first time at the laboratory in a bird recently imported from a well-known English breeding flock. The diagnosis was based on macroscopic and histological examination of the tissues. Attempts were made to transfer the disease to susceptible fowls, but without success. It is difficult to see how importation of this disease, now so widely spread among European breeding flocks can be avoided, but it is suggested as a precautionary measure that imported birds should be accompanied by a certificate from the breeder stating that his breeding flock is free from infection.

Fowl-Pox.—The inclusion bodies in this disease were subjected to a histo-chemical study by Mr. Danks during his work in St. Louis.

Rabies.—Rabies was diagnosed from the brain of a dog received from the Sotik area on August 3rd. From then until the end of the year seventy-four brains were examined. The results are summarized in a table. The rapid method of embedding from acetone has been used and the strain employed as a routine has been Goodpasture's. Mann's stain has also worked satisfactorily. It has been possible to report the result of histological examination thirty hours after receipt of the material.

Goodpasture's stain has given uniform results and is free from any risk of overdecolorizing. In no case has there been any difficulty in deciding whether Negri bodies are present or not.

When human beings were known to have been bitten by the dog and where microscopical examination had revealed no Negri bodies rabbits were inoculated with material preserved in 50 per cent glycerine. Also in one case where brain lesions were present (cuffing of the vessels and neuronophagia) inoculations were made. In the last-mentioned case the presence of rabies was proved, but in other cases the results of inoculation of experimental animals have been in agreement with the histological diagnosis.

Five strains have been passaged in rabbits by Mr. Hudson. In four dog strains the incubation period during the early passages in rabbits was rather long, being from fifteen to twenty-eight days. This has been found to agree with the results obtained with local strains during past outbreaks in

Kenya (1912-1916) and with experience in West Africa. The remaining strain from a jackal, now in its sixth passage, has taken 14, 14, 10, 14 and 12 days. It may be mentioned that rabbits are being inoculated as a routine by the temporal route, which is much simpler and gives the same results as the classical method of trephining.

The existence of nervous distemper in the Kiambu and Nairobi area has been responsible for some increase in the number of specimens submitted for diagnosis of rabies. During the examination of brains received with histories suggestive of nervous distemper no bodies have been encountered that could be confused with Negri bodies.

Where sufficient of the brain has been forwarded an attempt has been made by Mr. Hudson to confirm the findings of Thomas and Jackson (1930). These authors have stated that examination of the oculo-motor centre is of greater value in the detection of Negri bodies than examination of the hippocampus. Experience during the present outbreak is not in agreement with their findings. Out of three positive brains received for examination Negri bodies were approximately as frequent in the oculo-motor centre as in the hippocampus in one. In the other two, one from a dog and one from a jackal, although Negri bodies were numerous in the hippocampus none could be found in sections of the oculo-motor centre.

The brains of rabbits inoculated with fresh and passaged street virus have given comparable results. Of sixteen rabbits examined five showed equally numerous Negri bodies in the oculo-motor centre and in the hippocampus, five showed them less frequent in the former location and six showed no Negri bodies in the oculo-motor centre although they were present in the hippocampus. In no natural or experimental cases were bodies present in the oculo-motor centre when absent from the hippocampus.

Negri bodies in the brains of jackals have always been large and numerous. This is in accord with the general experience of workers in India. In the bovine cases the Negri bodies were particularly fine and large.

Negri bodies were studied by Mr. Danks in collaboration with Dr. W. P. Covell, with particular reference to their chemical composition. The modern technique of microincineration was successfully applied to these inclusions.

TABLE SHOWING DIAGNOSES ON SUSPECTED RABIES
BRAINS, 1932

	Animal	Kisii	Kericho, Sorik	Muhoroni Songhor	Fort Ternan, Lumbwa, Kedowa	Mau Summit, Londiani	Njoro, Molo	Eldoret	Naivasha	Ft. Hall, Kisumu, Kabete, Nairobi	Total
Positive ..	Dog ..	5	5	..	2	1	..	..	..	..	13 & 2
	Jackal ..	..	6	1	..	1	..	..	..	..
	Ox ..	2	..	..	..	..	..	..	..	..
Total positive all animals ..	..	..	..	..	..	..	..	..	..	..	23
Negative ..	Dog ..	5	11	3	4	1	2	1	1	5	33 5 3
	Jackal ..	..	2	1	1	..	..	..	..	1	
	Ox ..	..	1	1	1	..	..	..	..	..
Total negative all animals ..	..	..	..	..	..	..	..	..	..	..	41
Too decomposed for diagnosis	Dog ..	4	1	..	..	..	..	..	..	..	5
	Jackal ..	..	..	..	1	..	..	..	..	..	1
Brain badly damaged by shooting in head ..	Dog ..	..	..	..	..	1	..	..	..	..	1
Brain removed too soon after being bitten ..	Dog ..	3	..	..	..	..	..	..	..	..	3
TOTAL ..	..	..	..	..	..	..	..	..	..	..	74

Contagious Bovine Pleuro-Pneumonia.—Efforts have been made to improve the diagnostic test in use at the laboratory and some little progress has been made in this direction.

Attempts to transmit true pleuro-pneumonia to susceptible cattle failed in every instance but one. In this case an animal inoculated intratracheally with an extremely small dose of filtered virulent thoracic lymph developed typical acute pleuro-pneumonia on the 18th day after inoculation, and died on the 29th day. Pathognomonic lung lesions were found, and a pure culture of the organism was obtained from lymph in the thoracic cavity. It is noteworthy that in this instance the material for inoculation was taken at death from an acute and rapidly fatal case of the naturally-contracted disease. In a contact exposure experiment one animal out of eight cohabiting with six chronic cases of the natural disease developed an infection which was detected by the precipitin-agglutinin test. On post-mortem examination he was found to have a sequestrum the size of a golf ball in the right lung, and surrounding

this an area in which the septa were actively infiltrated and the lung tissue proper incompletely hepatized. Histologically the lesion was diagnostic.

Examination of preparations of solid cultures of the organism has fully confirmed the findings of Wroblewski (1931) and Orskov (1927) with regard to the general morphological characteristics of the organism, which are not at all those figured by older observers.

It is proposed to continue an investigation of the etiology of the disease and of diagnostic laboratory tests, and the intention is to make use of a branch laboratory which will be set up in the Masai Reserve. With this object an application for assistance has been made to the Colonial Development Fund. Any grant made by the fund will be devoted to the employment of an additional research worker and to the purchase and equipment of a mobile laboratory to be used in these investigations.

Respiratory Diseases of Sheep.—Until recently work on the respiratory diseases of sheep in Kenya Colony has been confined to the investigation of a specific condition for which the name Laikipia lung disease has passed into general use.

Although this condition has been fully described in publications by Whitworth and Mettam, there is still a great deal of misunderstanding regarding the nature of Laikipia lung disease.

At the request of sheep farmers further researches are now being carried out by Mr. Fotheringham. Preliminary investigation revealed the existence of many distinct forms of pneumonic lesions in sheep, none of which could be put down to Laikipia lung disease.

Examination at the laboratory of a large amount of material drawn from areas in which the so-called Laikipia lung disease is prevalent has shown that the following separate conditions exist and must be taken into account in any attempt to form a clinical diagnosis :—

- (1) Laikipia lung disease.
- (2) Verminous pneumonia.
- (3) Jagziekte (?).
- (4) Chronic catarrhal pneumonia.
- (5) Caseous lymphadenitis of Nocard.
- (6) Septic pneumonia of lambs.
- (7) Necrotic pneumonia.
- (8) Pulmonary echinococcosis.
- (9) Sheep-pox lung lesions.

The results of a preliminary survey of these conditions have been submitted for publication, and will be available in the course of the year.

Hæmorrhagic Septicæmia in Cattle.—Although the occurrence of sporadic cases of this disease has been frequently suspected in the past it has not been possible to obtain a definite diagnosis. In July an outbreak of an extremely fatal disease affecting chiefly young cattle was investigated in the Machakos area. Cattle of all ages were affected, but the majority of the cases occurred in animals under two years of age. In almost every case a subcutaneous and intramuscular swelling was present, commonly in the throat region, on the sternum or on the shoulder. Less frequently swellings occurred on the hind quarter, the extremities or in the perineal region. A few animals died suddenly without any demonstrable tumour. No organisms could with regularity be demonstrated in blood smears taken at or before death, nor in most cases could definite bacilli of the *Pasteurella* group be demonstrated in smears of the inflammatory tissue. Inoculation of white mice with blood or tumour tissue taken from animals *in extremis*, invariably resulted in the death of the mice within forty-eight hours from a bipolar septicæmia. Pure cultures of the organism were also obtained from tumour tissue and blood collected at the laboratory. It was also possible to induce characteristic swellings in susceptible cattle by the inoculation of tumour tissue or pure cultures of the organism into a superficial lymph gland, although the disease set up was less fatal than the naturally occurring disease. The mortality in the outbreak in question amounted to twenty-seven head, spread over a period of ten days. Five days after treatment of the whole herd with a killed vaccine cases ceased to occur, but it is uncertain whether the cessation can be attributed to vaccination or whether it was not due to the operation of natural causes.

A second less extensive outbreak occurred in the Limuru District and here cases continued to be reported during a period of three weeks but ceased after vaccination of the survivors.

The attention of field veterinary officers was drawn to the existence of the disease, to the methods by which a laboratory diagnosis could be made, and to the probability that sporadic cases of the disease might be encountered in various parts of the country. As a result a diagnosis of hæmorrhagic septicæmia was made with material furnished from a farm in the Lunbwa area, on which sporadic cases were reported to occur

to the number of about 50 per annum. Vaccination was applied and no further cases have been observed since the vaccination.

East Coast Fever.—The exposure experiment to which a reference is made in the Annual Report for 1931, p. 297, was completed. The object of the test was to ascertain whether "T" branded cattle, that is cattle known to have been immune at one time to East Coast fever, would lose their immunity after prolonged periods in clean areas or on farms where they were protected from infection by short interval dipping. While the number of animals in the experiment was too small to justify definite conclusions, it may be stated that of eight such animals exposed to heavy infestation by ticks in the East Coast fever camp at the laboratory all survived and none of them contracted clinical East Coast fever. Three of the eight showed some slight febrile period between the 16th and the 35th day, accompanied by more or less enlargement of the superficial lymph glands, but Koch's bodies could never be demonstrated in smears. Susceptible control animals died after 18 to 30 days exposure in the camp.

Tissues from reacting from moribund and from recovered animals were collected by Mr. Walker for transmission to Dr. Cowdry whose second paper, in the preparation of which Mr. Danks has collaborated, is now in press.

Sterility in Cattle.—The observations on this condition have been continued, and during the coming year it is hoped to commence experimental work with a small herd of maiden heifers.

Poisonous Plants.—Mr. Hudson has continued his collection of plants eaten by stock, and has tested several species for poisonous properties.

Entomology.—Dr. Lewis' field work on tick-distribution has been confined during the year to a complete survey of the whole of the Masai Reserve, where in the absence of dipping the normal fauna of tick-life can be studied in its natural state.

Amblyomma variegatum is undoubtedly the predominant species of tick in this large area; *A. gemma* and *Rhipicephalus cvertsi* are also very common and widely distributed; *R. simus* and *R. Kochi* are frequently taken on domestic stock; and *R. pulchellus* may be collected from most animals—species and individuals. The last-named species is so prevalent in some districts that it may be collected in any of its developmental stages practically throughout the year. Instances of infestation

of man and of the production of painful inflammatory lesions by the bites by larvæ and nymphæ of this species are by no means rare. *R. pulchellus* is so numerous on the Athi Plains that it is frequently called the "plains tick"; it is however entirely absent from the extensive plains in the Narok administrative district of the Masai Reserve. *Boophilus decoloratus* is distributed throughout the reserve, but the infestation of stock by this species seems to be heavier in the more hilly and more thickly bushed areas, such as Loitokitok at the foot of Kilimanjaro, Ngong and the Ngong Hills, and in the Melili District at the foot of the Mau. *R. appendiculatus* is unevenly distributed in the Masai country in Kenya. Large areas seem to be entirely free from this species, whereas others are heavily infested.

The material and the data collected during several *safaris* in the Masai Reserve is now being arranged with a view to publishing a detailed and comprehensive report in the near future.

Observations on the development and biology of tick-species have been continued in the laboratory. It has been impossible to give adequate attention to laboratory experiments, owing to the demands upon Dr. Lewis's time by field work.

Myiasis.—Studies on "blow-flies" and myiasis have progressed during the year, and a contribution to the subject will shortly appear in the Bulletin of Entomological Research.

Tsetse-Flies.—Advances made in the study of tsetse-flies and animal trypanosomiasis during the year promise well for the future progress of this line of research in Kenya Colony. At the moment, however, there are indications that two important species, *G. pallidipes* and *G. fusca*, are actually spreading, and considerable areas of rich pasture in native reserves have been rendered valueless, and the native has been driven to find new grazing beyond the range of the flies.

It is anticipated that a paper on tsetse-flies and their distribution in the Masai Reserve will shortly be available for publication.

It is desired to put on record our appreciation of the invaluable advice and assistance given by Mr. C. F. M. Swynerton, Director of Tsetse-fly Control in Tanganyika, who visited Kenya during the year and who is co-operating closely with us in research on tsetse-fly problems of this Colony.

PUBLICATIONS.

The following list of publications for the year includes two papers published in 1931, but not included in the Annual Report for that year:—

- 1931—Daubney, R. and Findlay, G. M. "Une Nouvelle Maladie des Animaux Domestiques, etc." *L'Hygiene Sociale*, pp. 994 and 1331.
- 1931—Findlay, G. M. and Daubney, R. "The Virus of Rift Valley Fever or Enzootic Hepatitis," *Lancet*, Vol. 221, p. 1350.
- 1932—Cowdry, E. V. and Ham, A. W. "Studies on East Coast Fever Part I. The Life-cycle of the Parasite in Ticks," *Parasitology*, Vol. 24, pp. 1-49.
- 1932—Daubney, R. and Hudson, J. R. "Rift Valley Fever," *Lancet*, Vol. 222, pp. 611-612.
- 1932—Daubney, R. and Hudson, J. R. "*Oesophagostomum multifoliatum* n. sp. An Undescribed Nematode from Sheep and Goats," *Parasitology*, Vol. 24, pp. 265-267.
- 1932—Daubney, R. "The Life Cycle of *Moniezia expansa*," *Journal of Parasitology*, Vol. 19, pp. 1-11.
- 1932—Covell, W. P. and Danks, W. B. C. "Studies on the Nature of the Negri Body," *American Journal of Pathology*, Vol. 8, pp. 557-571.
- 1932—Danks, W. B. C. "A Histochemical Study of Microincineration of the Inclusion Body of Fowl-pox." *American Journal of Pathology*, Vol. 8, pp. 711-716.
- 1932—Lewis, E. A. "Some Tick Investigations in Kenya Colony," *Parasitology*, Vol. 24, pp. 175-182.
- 1932—Lewis, E. A. "A Study of the Ticks in Kenya Colony," Part II, *Bulletin No. 6*, Department of Agriculture, Colony and Protectorate of Kenya.

R. DAUBNEY

REPORT OF THE ACTING LIVE STOCK OFFICER

DAIRYING INDUSTRY.

The development of the live stock industry on dairying lines is probably the most hopeful programme of progression on which the Colony can at present embark. The cattle question especially has, during the past few years, been occupying the minds of many who are interested in the future of breeds suitable for this country, and of those who look to their herds for their livelihood; in fact, of all who have capital invested in live stock and of those others who have the interests of the Colony at heart. Undoubtedly, in the past, many owners considered their herds as a liability, but the parting of the ways has now come, and it is realized that all live stock are a definite asset in the economy of the farm, whether on the mixed farm, on the dairy farm, or on the dairy-ranching farm.

Serious attempts are being made to improve the cattle, and, as a corollary, to improve both pasture and feeding in general. The first steps in applying proved animal husbandry methods are being taken, and the part played by a well-bred animal of correct type in the economical production of dairy products is now realized. Although the necessity for promoting creameries is appreciated, too little attention has been paid to the producer and his methods. In most countries, commercial undertakings follow production, or at least go hand in hand with it; but has this been the case in Kenya? It is to be earnestly hoped that farmers will not allow the country to remain a land of samples. Until recent years the live stock industry (from the animal husbandry point of view) has received the least attention by farmers of all the varied agricultural interests in the country. However, it is now being demonstrated how they can improve their position by the application of methods which have stood the test of experience.

While it must be admitted that the Agricultural Department is doing a great deal for the stock farmers, there remains much to be done by the stock farmer himself in the way of general organization.

Breeding Policy.

During the past year it was gratifying to see that numerous stock farmers became very enthusiastic with regard to the question of cattle improvement. Due primarily to financial reasons, some farmers are still using low grade bulls, and it was advised that as soon as opportunity permits good pedigree bulls or very good high grade bulls should be acquired.

In the grading up along Ayrshire lines, it is advocated that breeders use a Dairy Shorthorn or Red Poll bull on native cattle for the first cross. This produces an animal possessing increased size and stamina and with bigger and better bone and larger "barrel". This should be used subsequently as a foundation stock for the straightforward breeding with Ayrshires.

The breeding of pedigree stock is increasing, especially in relation to the Ayrshire and Friesian breeds. The demand for good Shorthorn bulls during the year has exceeded the supply, which is a natural outcome of the policy advocated above. Naturally, the prosperity of the breeder of pedigree cattle and that of the owner of commercial cattle are contingent one on the other, for in the main their interests are similar.

Feeding.

Of necessity, improved breeding must always be accompanied by improved feeding, and it is of equal importance to demonstrate to farmers how to feed their stock as well as to educate them in breeding methods. It has been one of the chief aims of this Division to induce farmers to breed a better class of animal, and at the same time to point out that such cattle require sufficient food to enable them to take advantage of their inherited good qualities. At this stage of the Colony's development the simplest method of feeding is required. Balanced rations and scientific feeding are being left to the more advanced stockowner to use as he thinks fit.

The growing of supplementary crops, such as marrowstem kale, rape, sugar beet and Napier grass, was strongly urged, not only to provide ample fodder for the more productive animals, but also to even up the problem of feeding throughout the year. The provision of pits of silage and stocks of hay sufficient to tide the cattle through periods of drought and shortage of pasture was also emphasized. In this connexion, it is pleasing to record that there is a definite realization that the production of these crops will assist in solving many of the feeding problems and the maintenance of milk yields during adverse grazing periods. Although there is still considerable room for improvement, many farmers are now planting fodder crops. It is advisable that more attention be given to the growing of lucerne, as not only is this the best of all known green foods, but, in addition, it can withstand moderate droughts and is resistant to attack by locusts.

Calf Rearing.

During the year under review, many farmers commenced the hand-rearing of calves, with the object of obtaining increased and more economical production of butter fat. On the larger and more extensive farms various systems of dairy-ranching are practised, and although the value of hand-rearing of calves cannot be doubted, its use on these "dairy ranches" will not arise until higher grade animals with better milking qualities have been bred; then modified systems can be adopted.

On a few farms the practice of hand-rearing has been discontinued. This was due in the main to lack of direct supervision. It must be remembered that successful hand-rearing of calves necessitates the closest personal attention, as strict cleanliness in every operation, regular feeding, and other similar factors are involved.

Pasture Management.

Increasing interest with regard to the improvement of grazing by fencing and paddocking was observed. Experimental attempts are being made on some farms towards rotational grazing, and it is encouraging to see these initial efforts. Paddocking was commenced in many instances, and the beneficial effects which it had on the grazing were very noticeable. The importance of having at least one or two paddocks near the homestead was continually advocated, and although fencing entails considerable outlay, hopes are entertained that a more extensive use of paddocking will soon become general.

Cream Production.

While some areas—notably the Rift Valley from the Escarpment to Gilgil—experienced extremely adverse conditions of drought and loss of pasture owing to locusts, the Thomson's Falls, Solai, and Sabukia areas had unusually heavy rains, and in consequence grazing in these districts was fairly plentiful. During 1932, the rainfall over most of the Colony was rather erratic, and in consequence grazing was also erratic. In spite of this fact, however, the quantity of cream produced exceeded that of 1931, and Kenya Co-operative Creameries, Ltd., was able to produce an exportable surplus of butter far in excess of that of the previous year. During a period of low prices it is essential to realize that all saleable produce and especially that which is exported must be of first-class quality. The Creameries can do much regarding

the making of finest butter, but the all-important part rests with the primary producer, namely, the producer of butter fat, and more cream of uniform and better quality must be produced if Kenya butter is to make its "mark" on the London market and elsewhere. Improvement in the quality of cream supplied is a matter which every producer of cream must always bear in mind.

The quality of cream produced during the year showed a definite improvement, and in July, 1932, a consignment of butter exported from the Nanyuki Creamery scored 94 points on the London market, and realized prices equal to those of New Zealand finest, the value of which at that time was Sh. 105 per cwt.

Butter Levy Ordinance.

This Ordinance (which was brought into effect on 12th December, 1931) has now been working for more than a year. It has been successful in stabilizing the internal price of butter and has also afforded a slight assistance to the export trade. This amounted to 17 cents per pound on every pound of butter exported.

Tinned Butter.

The manufacture of tinned butter was continued, and advice based on the experience of other countries regarding the tinning of butter has been of assistance in surmounting difficulties.

Slaughter Stock.

The main issue regarding slaughter stock lies in the fact that these animals are increasing at a far greater rate than the local demand for beef. Also the elementary methods in vogue at the present time concerning the production of slaughter stock are causing what might be a small, profitable industry to become a harassing liability. Unfortunately, the majority of bullocks on European farms are by no means suitable for export markets.

On dairy farms, especially those which carry lower grade cattle, and where this does not interfere with the milk flow of the mother of the calf, owners should seriously consider the advisability of slaughtering bull calves at birth. In many instances, the cost of rearing calves for beef does not appear to be taken into consideration. Were this studied in detail, many farmers would find that they could more profitably

separate the milk which they are at present feeding to bull calves, and kill these calves at birth. It should be borne in mind that, if fed properly, a bull calf up to the age of six months should consume at least 60 gallons of whole milk, 200 gallons of separated milk, and 140 lb. of grain ration. Taking the value of whole milk at 25 cents per gallon (cost of production), separated milk at 10 cents per gallon (feeding value), and grain at 5 cents per lb., the cost of feeding alone up to this age amounts to Sh. 42.

Cheese.

Owing to the limited demands of the local market and slowness of development of export trade, cheese-making made but little headway in 1932. It is hoped, however, that if a cheese of uniform and long-keeping quality can be produced, considerable quantities will find a market in India. Lack of desirable curing facilities is still a serious obstacle to the expansion of the cheese trade.

THE PIG INDUSTRY.

The demands of the local market for pigs and pig products remained fairly steady throughout the year. The quality of baconers supplied to the factories showed considerable improvement. Culling of breeding stock resulted in a better standard of pig, which it is hoped will be maintained. Large White boars have been in steady demand, and the use of this breed has done much towards the fixing of a definite type of bacon pig throughout the Colony.

Improvement in methods of feeding pigs for bacon was observed, due in the main to the more widespread use of separated milk, which in turn works back to increased butter-fat production. During the first half of the year it was feared that there might be an acute food shortage, due to damage to cereal crops by locusts. By a judicious use of foodstuffs available this difficulty was overcome. There is still considerable scope for improvement in housing conditions.

THE SHEEP INDUSTRY.

The main sheep areas in the Colony—Rift Valley and Laikipia—suffered prolonged droughts and locust infestations, which made grazing conditions very difficult. In spite of such adverse circumstances, the sheep remained in good condition.

Wool prices continued to remain low, and in most cases were totally unremunerative. A collapse in the fat wether-

trade during the latter half of the year was also experienced. Conditions for the sheep farmer in 1932 were extremely difficult.

It is hoped that when prices become more normal an increase in the number of small flocks will become apparent. It is also hoped that flock owners will develop the pure-bred Merino ram trade, with a view to a more rapid grading up of wool. It has often been stated that in successive generations of country-bred rams the wool becomes too fine and loses its density. Opinions of many sheep breeders in the Colony have been obtained, and there appears to be some difference of opinion as to whether the fleece weights become lighter under good conditions of management. More stress is placed on the deleterious effect on wool length of frequent dipping necessitated by sheep-scab infection, and also to the incidence of internal parasites.

Density of wool is a character which can be inherited, but light weight from fineness and lack of length is more easily effected by conditions of environment and management. Efforts should therefore be directed to ensure more adequate nutrition of the flocks, the eradication of disease, and the exercise of greater care in the selection and use of rams.

THE POULTRY INDUSTRY.

This industry is developing, and supplies of eggs from European farms were in excess of the requirements of internal markets. The Kenya Poultry Club succeeded in initiating a "ships' store" trade at Mombasa, and it is hoped that this will develop into a definite export trade. Poultry-keepers are realizing that the business of poultry farming is as specialized as any other branch of agriculture, and is no longer a mere source of "pocket money" for the farmer's wife. Breeds such as Rhode Island Reds, White Leghorns and Australorps are becoming increasingly popular, and are gradually replacing the nondescript type of hen so commonly found in years past.

SCHEME FOR THE ASSISTED IMPORTATION OF PEDIGREE LIVE STOCK.

It is with regret that the Division has to record the suspension of this Scheme for an indefinite period as from the commencement of 1932. This was necessitated, in the first instance, by lack of financial support from the Empire Marketing Board.

During the year, however, the following importations of pedigree live stock were made :—

<i>Cattle.</i>	<i>Sheep.</i>
29 Males—	39 Rams—
8 Ayrshire,	2 Romney Marsh,
8 Shorthorn,	34 Merinos,
1 Red Poll,	2 Northumberland,
3 Jersey,	1 Corriedale.
8 Guernsey,	
1 Friesian.	<i>Pigs.</i>
6 Females—	2 Large White Boars,
2 Friesian,	1 Large White Gilt.
4 Guernsey.	

COMMITTEES.

East African Stud Book.—This Committee met from time to time during the year, and a system of ear-marking cattle by the tattooing method was drawn up for use in Kenya. A system of milk recording was also under consideration. Information regarding the fertility of horses was collected by the Society's Secretary, Mr. Mervyn Hill, and his findings published in a booklet issued to breeders of horses and those interested in the subject.

During the year the Society sustained a great loss in the death of its editor, Mr. J. H. D. Beales.

The duties of editor of the East African Stud Book are now being carried out by the Secretary of the Royal Horticultural and Agricultural Society.

During the year application for entry in Volume VI of the East African Stud Book were accepted for 223 farm live stock and 40 horses. Particulars of these entries will be published when sufficient additional ones have been received.

Pig Industry Consulting Committee.—This Committee met during the year, when the future of the pork export trade was fully discussed. The proceedings of this meeting were published in the Press.

The Butter Levy Advisory Board met several times during the year and amendments were made to the original Ordinance. A statement of the working of this Ordinance during its first year of operation is mentioned earlier in this report.

Animal Industry Standing Committee.—This Committee of the reconstructed Board of Agriculture met twice during the year. Numerous problems connected with the live stock industry were discussed, of which the immunization of cattle against rinderpest was one of the most important.

ROUTINE WORK.

I arrived in the Colony on the 7th January on first appointment, and was seconded to the Subdivision of Animal Husbandry. During the absence on leave of the Live Stock Officer—April to November—I took over these duties.

Outward letters numbered 535, of which 304 were special advisory letters dealing with inquiries regarding the feeding and breeding of cattle, pigs, sheep, poultry, supply of pig feeds and general animal husbandry.

Interviews.—167 interviews were held in the office, when advice was given on: general cattle management, dairying, sheep, wool, fencing, butter-making, mineral licks, poultry management, construction of farm buildings, incubating eggs, etc.

Farms Visited.—These numbered 156, in the following areas: Nairobi, Machakos, Kiu, Limuru, Naivasha, Kinangop, Gilgil, Nakuru, Solai, Thomson's Falls, Rumuruti, Nyeri, Nanyuki.

Publications.—Articles for Press publication were supplied on the following subjects: "Forage Crops", "Pumpkins", "Wool Production", "Feeding of Beans to Live Stock", "The Care of the Stock Bull". A pamphlet dealing with the making and uses of silage was printed, and pamphlets on a comparison of the bacon and pork types of pig and on pig feeding await publication. The Live Stock Officer published, in collaboration with the Agricultural Economist, a pamphlet on the marketing of eggs and a report on the activities of the Naivasha Creamery.

In conclusion, I should like to take this opportunity of thanking farmers in the various districts visited for giving me every opportunity to examine in detail their farms and for placing every convenience at my disposal. My thanks are also due to them for their very kindly hospitality, which assisted me greatly in carrying out my work. In no less a manner do I appreciate the help, assistance and encouragement which I have received from colleagues during the past year.

T. Y. WATSON.

REPORT OF THE OFFICER IN CHARGE OF WORK AT
GOVERNMENT FARM, NAIVASHA

(In collaboration with the Rowett Research Institute, Aberdeen)

FARM OPERATIONS, 1932.

The Naivasha Stock Farm, which depends for its maintenance on revenue from the sale of animal products, shared in 1932 the effects of general depression experienced on farms throughout the Colony. The year was marked by a fall in prices. Butter fat showed a decline from 95 cents to 70 cents per lb. Slaughter steers, which could be sold at Sh. 100 in January were by the end of the year a drug on the market at half that sum, while a similar condition governed the disposal of slaughter wethers. The return from the sale of wool showed a perceptible increase.

The annual rainfall was below average—17.5 inches only being recorded. Under normal conditions, this amount, though inadequate for the growth of fodder crops, would have ensured ample growth of pasture to meet the requirements of the stock carried by the farm, as the herbage reacts quickly to rain, and exhibits a useful carrying capacity in periods of drought. Unfortunately, on every occasion when new growth made its appearance depredations by locusts followed. Thus the effects of rainfall were rendered practically negligible.

Further, it was not possible to carry out to a satisfactory conclusion the field work in connexion with grassland improvement which was contemplated in the experimental programme. Therefore the results of feeding tests with animals on locust-ridden grazing must be considered in the light of the conditions by which they were governed.

In this report, the progress of the various classes of live stock is dealt with, statements on the experimental work attempted, and financial transactions appended.

Milk Production.

The total number of grade cows carried throughout the year was 119. These are mainly grade Shorthorn and Friesian. Forty per cent of these appear to be of more improved breeding than first cross.

On account of consistently low milk yield, seventeen cows were used as foster mothers. Two calves were allotted to each cow, and neither the dam nor the calves received supplementary feed. Therefore milk for sale was produced by 102 cows.

For reasons already outlined, grazing conditions were most unfavourable for milk production, a stage being experienced in October and November when the pasture was inadequate for maintenance requirements. In consequence, expenditure on supplementary feeding stuffs was high, and, as revenue from milk was derived solely from the sale of butter fat to the Kenya Co-operative Creamery at the average price of 78 cents per pound, the net profit per cow was reduced in proportion.

The total quantity of milk produced during the year was 30,068 gallons, an average yield of 294 gallons per cow, and the cost involved, exclusive of grazing, was 17 cents per gallon. Of this the cost of home grown and purchased supplementary foodstuffs was 8 cents, labour charges 4 cents, and the remaining 5 cents covered depreciation of the herd, maintenance of bulls, and dipping and dairy charges.

The output of butter fat was 9,211.5 lb., or 90 lb. per cow.

Further details of costs of milk production are given in the appendix.

The birth-rate in the herd for the year, excluding stillborn and premature calves, was 75 per cent.

Calves.

With the exception of those suckled in pairs by foster mothers, calves were reared by hand. General improvement in the health of young calves followed the subdivision of calf houses into individual pens. This procedure almost banished early gastric disorders and attacks of bacillary necrosis. It has been found unprofitable to rear steer calves. These are now slaughtered at birth or, when this is possible, are disposed of at an early age for slaughter.

Owing to the deplorable condition of the grazing towards the end of the year, hand feeding of heifer calves was continued until they reached the age of ten months. An account of experimental work in calf-rearing appears later in the report.

Steers.

The rearing of grade steers for ultimate disposal as slaughter stock has proved an unprofitable side line on the farm. In 1932, hand-reared calves were transferred to steers at a capital charge of Sh. 55, which was their estimated cost of maintenance from birth to one year old. The herd of steers incurred an expenditure for the year of Sh. 4.33 per head, exclusive of any charge for the grazing allocated. Thus, at the age of

three to four years, when these animals are marketable, their cost of production will have greatly exceeded their anticipated market value. Hence it appears to be more profitable to slaughter bull calves at birth and concentrate on female stock, the financial return from which should at least cover the outlay incurred.

Sheep.

Climatic conditions in 1932 were favourable to the general well-being of the flock, except during periods of severe locust infestation, when young stock experienced a setback. Owing to locusts, there was a high death-rate among newly weaned lambs.

The wool clip for the year was satisfactory. Breeding ewes averaged 7.5 lb. per head for twelve months' growth, hoggets over twelve months averaged 8.0 lb., and lambs shorn for the first time when nine months' old yielded 4.0 lb.

Further improvement in quality and yield of wool is anticipated from the addition to the flock of four Merino rams, imported from South Africa. These rams were landed at Mombasa at the moderate price of £10 per head. They are well-covered rams of flock standard, and on being shorn of eighteen months' growth of wool gave an average of 28 lb.

The wool clip sold in 1932 was exported in two consignments of approximately equal quality and weight. For purposes of comparison, one lot was sold on the London market and the other on the Continent. The sales accounts of each consignment are summarized in the appendix, and show that the average net return per pound of wool, f.o.r. Naivasha, was 33.3 cents.

Making no charge for grazing, the estimated profit on the flock, in which in December there were 750 sheep over twelve months of age, amounted to £157 for 1932.

Pigs.

As attention was directed to the establishment of foundation stock from which to ensure cross-bred pigs of uniform type with which to carry out feeding tests in the near future, no feeding experiments were undertaken with pigs in 1932. Large White boars were used on Large Black sows to obtain cross-bred litters suitable for bacon production. The Middle White-Large White cross was bred to test its merits for the production of pork. It may be mentioned that the white breeds have suffered considerably from sun scald, and, except in

the morning and evening, appear to require well-shaded surroundings. Surplus breeding stock, consisting of eight Large White boars and two Large White gilts, was sold to pig-breeders during the year.

EXPERIMENTAL WORK.

Supplementary Feeding of Dairy Cows for Milk Production.

Only in abnormal years is the rainfall of the farm more than 20 inches per annum; in 1932, it was extremely low, namely, 17.5 inches. Thus, owing to lack of pasture, the cows in milk must receive supplementary feeding for at least nine months of the year. As concentrates at the rate of 2 lb. daily for each gallon of milk produced have failed to maintain a yield of approximately that given when the herd has access to green grass, certain feeding tests were carried out in 1932 to observe the effect on the individual milk yield of feeding ensilage and green fodder added to the concentrates.

1.—Maize Ensilage in addition to Concentrates.

This test was carried out under drought conditions during a period of eight weeks—January to March, 1932. Two groups of ten cows, of approximately equal milk yield at the commencement, were used for the test.

Feeding:

Group I.—2 lb. of concentrates (simsim cake two parts, wheat bran 1 part) daily for each gallon produced.

Group II.—30 lb. ensilage daily, plus concentrates (less 2 lb. per head) as above, daily.

Results obtained were as follows:—

	GROUP I Concentrates only	GROUP II Concentrates and 30 lb. Ensilage
Average Initial Daily Yield per Cow ..	19.2 lb.	19.0 lb.
Average Daily Yield over 8 Weeks Period ..	14.9 lb.	18.2 lb.
Concentrates Consumed per Head	185 lb.	116 lb.
Cost of Concentrates	Sh. 8/51	Sh. 5/33

Increase per Head in Yield in Group II over Group I=3.3 lb. Daily.

II.—Concentrates plus Green Forage Trial.

A test to observe the influence of green forage on milk production was begun on 15th July, and was in progress at the end of the year. Two groups of seven cows each were tested as follows :—

Both groups received concentrates as in Test I above, while Group 2 were fed 10 lb. kale and 10 lb. green lucerne for the first six weeks, and 20 lb. green lucerne daily for the remaining four months. The ration of Group 1 had to be doubled in October and November, as owing to locust depredations the grazing could barely supply their maintenance requirements.

Average milk yields during the period were as follows :—

Milk Yield.—Pre-period July 1–15; Experimental period, 16th July–31st December. Group 1, concentrates only; Group 2, concentrates plus 20 lb. green forage daily :—

	July 1-15	July 16-31	Aug.	Sept.	Oct.	Nov.	Dec.
Average yield per cow	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Group I	400	411	657	528	365	309	384
Group II	417	443	738	636	558	510	569

Total production per cow during 5½ months (169 days) experimental period: Group 1, 2,654 lb.; Group 2, 3,454 lb. Difference in favour of Group 2: 800 lb., or approximately one half gallon per cow per day.

III.—Lucerne Trial.

A short trial to observe the reaction of milch cows to restricted grazing and a liberal allowance of green lucerne, with no concentrates, was carried out over a six-week period, 1st October to 15th November, when grazing conditions were deplorable.

Twelve cows were run during the forenoon and at night in a two-acre paddock which had little or no herbage available. Each morning they were given an average quantity of 20 lb. of lucerne per head. An additional 35 lb. were also given in the afternoon, making a daily total of 55 lb. per head.

A fairly uniform yield of milk, amounting to an average of 21 lb. per day per cow, was obtained throughout the period. The best yield was an average of 34 lb. daily for the period.

Fluctuations in yield were small. This test serves to indicate the value of feeding easily digestible green forage in quantity with the minimum of dry fibrous herbage.

Calf Rearing.

Prior to the end of 1931, all calves bred on the farm were hand-reared according to the following method of feeding:—

First month: Whole milk, increasing daily to a maximum of 9 lb. at fourteen days' old.

Four to six weeks: Gradual change over from whole to separated milk; 3 lb. concentrates daily; maize meal and wheat bran offered.

Six weeks to six months: Separated milk, average 15 lb. daily; total, 200 gallons. Concentrates, 100 lb. per calf over the period.

Thus each calf received 35–40 gallons whole milk, 200 gallons separated milk, 100 lb. meal mixture (cake 1 part, maize meal 1 part, wheat bran $\frac{1}{2}$ part).

The calves treated as above were thrifty animals when six months old, but subsequent to their rations being reduced towards the end of the feeding period, growth was slow and erratic in the succeeding six months.

Accordingly, ten Shorthorn grade calves received extra feeding until nine months old; five being fed one gallon separated milk and five a meal mixture at the rate of 1 lb. per head daily. Ten calves of equal birth weight, fed for six months only, were under observation as a control group. The following figures on live weight increase were recorded:—

	AVERAGE WEIGHT AT			
	Birth	6 months	9 months	12 months
	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>
GROUP I—				
Six months' period ..	63.0	228	270	329
Nine months' period ..	62.4	243	310	346

Average increase in live weight of Group 2 compared with Group 1—

At 9 months=40 lb. At 12 months=17 lb.

Cost of extra feeding—

Five calves on separated milk=Sh. 9 per head.

Five calves on concentrate mixture=Sh. 4/50 per head.

Daily rate of live weight increase from birth—

Group I—At 9 months=0.76 lb. At 12 months=0.73 lb.

Group II—At 9 months=0.91 lb. At 12 months=0.77 lb.

The total cost of hand-rearing each calf until twelve months old, at which date calves are transferred to steers or heifers, was :—

Group 1.—Sh. 46.

Group 2.—Sh. 55, when fed separated milk for three additional months; Sh. 50/50, when fed concentrate mixture for three additional months.

The above cost of production is excessive for steer calves, which must be grazed from two to three years before being sold as slaughter animals, the price for which is Sh. 60 to Sh. 70 on the hoof in a glutted market.

Alternative Method.

In view of the relatively high cost of production of hand-reared yearling calves, an alternative method of suckling two calves on foster mothers was tried in 1932. Cows which had given consistently low yields of milk over two consecutive lactations were used for the experiment, and on calving each cow was given a recently born calf to rear together with its own. Although grazing conditions were critical at one period of the year, neither the dams nor the suckling calves received any additional feeding.

By the end of the year, four pairs of suckling calves had reached the age of twelve months, and the relative data concerning their progress in growth and cost of production are given to afford a comparison with the corresponding data cited above for hand-reared calves. Calves reared in pairs are charged with the maintenance and depreciation of their foster mothers for one year, and also with all costs incurred for attendance, vaccines and sundries up to the age of twelve months.

SUCKLING CALVES.

	Average Birth Weight	Weight at 6 months	Weight at 9 months	Weight at 12 months
	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>
Four pairs, eight calves..	57.5	245	329	401
Average daily gain ..	..	1.03	1.0	0.97

Cost per head for 12 months=Sh. 32

From the foregoing data it will be observed that in growth rate up to twelve months of age, the advantage is with the suckling calves, and their total cost per head for the period may be estimated at Sh. 20 less than hand-reared calves.

Sheep.

Records of the rate of growth of young stock bred on the farm show the period of least progress is between the time of weaning from their dams, at six months of age, and the age of twelve months. Thereafter their progress would appear to be uniform. A feeding test with lambs weaned in June, 1932, was begun in July. For this, three groups of forty lambs in each were employed. These lambs were grazed together, but penned separately at night, when one group received a salt mixture *ad lib.*, the second group given in addition a mixture of concentrates rich in protein, while the third group received no extra foodstuffs.

The lambs were weighed when supplementary feeding was begun and at monthly intervals thereafter. The average live weight increases were as follows:—

	GROUP I		GROUP II		GROUP III	
	Grazing alone		Cattle salt 50 parts Bone meal 50 parts		Cake 60 parts Bran 20 parts Maize 10 parts Mineral mixture 10 parts	
	Wethers	Ewes	Wethers	Ewes	Wethers	Ewes
	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>
Average initial weight, July	53.6	53.6	53.4	48.8	52.15	51.9
Average weight—						
August	56.7	56.3	55.3	51.5	56.2	55.1
September	54.2	55.5	56.8	53.3	57.5	55.5
October	51.2	51.2	50.3	47.7	53.4	53.7
November	53.4	53.3	54.8	51.1	58.2	56.5
December	57.5	57.7	58.4	54.2	62.26	61.0
Average increase per head	3.9	4.1	5.0	5.4	10.11	9.1
Cost of feed per head per period			50 cents		Sh.	1/42

In October, when grazing conditions were at their worst, all animals received a setback, but by the end of the year, when the pasture had recovered to a certain degree, animals in Group 3 were superior to the other two groups, though the latter showed no indication of stunted development. From the results given above it would appear that the cost of feeding even a small ration of concentrates would scarcely appear to be justified, having regard to the present market value of sheep products.

Improvement of Masai Sheep.

A flock of Masai ewes is kept on the farm. Up to the present these have been crossed with rams of the Masai, Suffolk, half-bred Masai-Suffolk, and Black-headed Persian breeds. The progeny of these matings and figures indicating their rate of growth are discussed below :—

Unimproved Masai.—Lambs were vigorous, and at eighteen months had attained the weight at which it is customary to sell them for slaughter.

Suffolk-Masai half-bred.—This cross showed highest birth weight, exhibiting the body conformation of the sire to a marked degree. The wethers were saleable for mutton at eighteen months.

Quarter Suffolk-Masai cross.—These were lighter at birth than the half bred, and retained something of the Suffolk body outline. They grew coats in which hair and wool were intermingled, and were favoured by natives who purchased ram lambs for breeding.

Persian-Masai cross.—Equal in birth weight to the unimproved Masai, lambs of this cross showed a uniform rate of growth during their first twelve months. The Persian markings of the coat predominated, and the cross-bred is not as narrow in the body as the unimproved type.

AVERAGE LIVE WEIGHTS (LB)

	Average birth weight		Weight at	Ewes	Wethers
	Ewes	Wethers			
	<i>lb.</i>	<i>lb.</i>		<i>lb.</i>	<i>lb.</i>
Masai Lambs	5.8	6.3	18 months ..	84.2	92.1
Quarter-bred Suffolk-Masai	8.0	8.5	18 months ..	104.6	110.0
Ditto	6.6	6.9	8 months ..	58.6	62.4
Half-bred Persian-Masai	5.8	6.3	12 months ..	65.2	69.2
Ditto	5.9	6.5	7 months ..	45.5	48.6

In view of the response of the unimproved Masai sheep to good conditions of grazing, the flock will be improved in future by selection and culling, to obtain a uniform flock of the Masai type, without improvement from any other breed.

Pasture Investigation.

In collaboration with the Officer in charge of Grassland Improvement, certain preparatory field work was carried out with the object of recording data on the following aspects of pasture management :—

- (1) Seasonal yield in nutrients of individual local species of grasses.
- (2) Reaction of pasture to different degrees of intensity of grazing by cattle.
- (3) Reaction of natural grazing to (a) the application of artificial fertilizers, (b) the application of farmyard manure, (c) rejuvenation by cultivation.

Dealing with the progress of (1), four local species, viz., *Cynodon plectostachyum*, *Themeda triandra*, *Pennisetum clandestinum*, and *Chloris gayana*, were planted, and the imported species, *Digitaria eriantha* (Woolly Finger grass) were planted out in replicated plots during the long rains of 1932.

Themeda triandra, which is widely distributed throughout the Colony, failed to become established when transplanted. The imported species also made but little progress. Of the other three local species, *Chloris gayana* (Rhodes grass) showed the most vigorous growth. Owing to lack of rain and continued ravages by locusts, at no time was there sufficient growth to allow of cutting, and therefore estimation of yields could not be carried out.

(2) Paddocks were fenced off for this work, but the condition of the pasture did not suggest that any significant data could be derived by stocking with cattle.

(3) Excepting an apparent vigorous growth following the application of farmyard manure, and rejuvenation of the sward by cultivation with peg-toothed harrows, the plots remained as sparsely covered as the adjoining veld; locusts again being the controlling factor in the situation.

Mineral Deficiency: Feeding Test.

On a certain area adjoining Lake Naivasha, where the soil is of larval origin, the natural pasture is reported to be unsound grazing for live stock. In 1930, when the herbage was rank and abundant, there was a high percentage of unthrifty animals in the herds. In the opinion of their owners, their condition was due to some dietetic deficiency. The appearance of the soil and herbage supported this opinion, this being similar to the area in the Nakuru district where lack of adequate iron salts in the pasture results in the general

debility of grazing animals. Accordingly, to find if a dietetic deficiency did exist and whether it could be corrected by the feeding of certain mineral salts, it was decided to carry out an observational test over a period of twelve months on a farm where malnutrition had caused some mortality in cattle. When the test began in September, 1931, pasture was abundant but dry, with a high fibre content.

Three groups of ten each of two-year old steers not previously grazed on the farm, and three groups of six cows each, with calves at foot, in poor condition, which had been brought on to the farm eighteen months earlier, were run as a separate herd for purposes of observation. Mineral mixtures were offered to two groups, while the third group had no supplementary feeding.

GROUP I	GROUP II	GROUP III
No mineral supplement	Cattle Salt .. 30 parts Bone Meal .. 50 Muriate of Potash 10 Iron Oxide .. 10 <i>Ad lib.</i>	Cattle Salt .. 65 parts Iron Oxide .. 35 <i>Ad lib.</i>

During the first three months the condition of all animals remained stationary, but after the November rains a definite recovery in condition was observed, irrespective of feeding, which did not seem to appeal to the animals which had free access to the mineral licks. A slight falling off was noticeable in several instances during a period of scanty grazing in February, 1932, but this was remedied when new grass appeared in the wake of the April rains. Again no group showed to advantage compared with the others. In February and June, the Acting Live Stock Officer inspected these cattle, pronounced them in thrifty condition, and stated that there was no apparent difference between the respective condition of each group. The steers were weighed after twelve months' grazing on the farm, and the average increase in live weight showed little variation between each of the three groups.

AVERAGE LIVE WEIGHTS OF STEERS

	GROUP I Not Fed	GROUP II Salt Mixture	GROUP III Salt Mixture
September, 1931 Average wt.	<i>lb.</i> 684	<i>lb.</i> 681	<i>lb.</i> 677
September, 1932 Average wt.	824	833	840
Average gain in weight ..	140	152	161

By September, 1932, all three groups were falling off in condition owing to scarcity of pasture, hence the relatively small gain in weight over twelve months. As the average increase in weight of steers of the same age as those used on experiment, but grazed on Government Farm from September, 1931 to September, 1932, was only 175 lb., the rate of increase recorded for the experimental steers may be considered normal on locust-ridden grazing.

There being no symptoms of malnutrition during the period of the experiment, it is presumed that the new grass which appeared after the first locust infestation may have been superior in chemical composition to the parched fibrous herbage on the which the stock had been grazing previously. This opinion was supported to some extent by stockowners on neighbouring farms, who made no mention of a qualitative deficiency in their pastures after the November rains of 1931.

Native Heifers.

A herd of twenty-five native heifers of the type belonging to the Lumbwa district of Kenya was purchased in January, 1932. It was proposed these animals be given conditions of feeding and management equal to those of the grade herd on the Farm, and later employ the data recorded of their performance as milk producers for purposes of comparison on the economic basis.

The heifers calved shortly after arrival, and the highest daily yield recorded was 5 lb. The longest lactation period was five weeks. Two heifers were allowed to suckle their calves, but their yield was not sufficient to keep their offspring alive. The calves were weak at birth, their birth weights averaging 24 lb.

Speaking generally, the heifers showed stunted development. This was particularly so in respect of those which arrived in calf, which it was obvious were culls from native herds. There was a certain degree of growth and development among the younger heifers in the herd, which were mated, and it is probable that those which produced calves will show some improvement in future. Experience indicates that in attempting to utilize native cows as dairy animals, only those which have been secured as the result of rigorous selection should be employed.

APPENDIX

MILK PRODUCTION—SUMMARY OF COSTS

Number of cows in herd	102
Total production, 1932	30,068 gallons
Average yield per cow in herd	294 „
Amount of milk separated for butter-fat.. .. .	27,116 „
Total butter-fat sold	9,211.5 lb.
Total butter-fat sold per cow	90 lb.
	<i>Sh. cts.</i>
Total charges against herd, excluding grazing, foodstuffs, wages, sundries, depreciation of herd, maintenance of bulls, etc.	5,277 54
Cost of production of milk per gallon	17
Total revenue from butter-fat sold from 27,116 gallons of milk separated	7,327 53
Return per gallon of milk separated	27
Net profit per gallon of milk sold as butter-fat	10

N.B.—The above returns do not include the separated milk by-product fed to calves and pigs on the farm. This amounted to 18,393 gallons, which charged to calves and pigs at 10 cents per gallon, raises the return per gallon of milk separated to 33.8 cents. Also no charge is included for grazing consumed by cows.

Marketing of Wool, 1932.

Consignments of nine bales each of wool, of approximately equal quality, were exported to the London and Continental markets in August, 1932.

SUMMARY OF ACCOUNT SALES

I.—CONSIGNMENT SOLD IN LONDON, 9 BALES=3,597 lb. net.

	<i>Sh. cts.</i>		<i>Sh. cts.</i>
To Gross Receipts ..	1,733 75	By Freight to Coast ..	107 03
„ Freight Rebate ..	24 94	„ Shipping Charges at Coast	98 63
		„ Ocean Freight ..	302 42
		„ Consolidate Rate, Brokerage ..	109 25
		„ Commissions, etc. . .	8 25
		„ Balance	1,133 11
	<u>Sh. 1,758 69</u>		<u>Sh. 1,758 69</u>

To Balance brought forward—Net Return .. 1,133 11

Net Return per lb. f.o.r. Naivasha=31.5 cents.

II.—CONSIGNMENT MARKETED IN FRANCE, 9 BALES=3,474 lb.

	<i>Sh. cts.</i>		<i>Sh. cts.</i>
To Gross Receipts ..	2,363 50	By Freight to Coast ..	103 84
„ Freight Rebate ..	27 58	„ Shipping Charges at Coast	114 08
		„ Freight to Antwerp	339 08
		„ Sorting, Washing, etc.	593 66
		„ Exchange, Telegram Charges	18 18
		„ Balance	1,222 24
	<i>Sh.</i> 2,391 08		<i>Sh.</i> 2,391 08

To Balance brought forward—Net Return .. 1,222 24

Net Return per lb. f.o.r. Naivasha=35.1 cents.

Revenue.

Revenue to meet recurrent expenditure for maintenance of the Farm is derived from the sale of produce, namely, butter fat, wool and live stock. A summary of outputs for 1932 and the cash return for each is given below :—

Quantity Sold	<i>lb.</i>		<i>Sh. cts.</i>
Butter-fat	9,211.5	Cash Return	7,327 53
Wool	7,071	Cash Return, net ..	2,355 35

STOCK SALES

BREEDING STOCK		SLAUGHTER STOCK	
	<i>Sh. cts.</i>		<i>Sh. cts.</i>
Cattle—		Cattle—	
1 Bull	700 00	26 Steers	2,460 00
1 Cow	200 00	8 Calves	93 00
Pigs—		Pigs—	
8 Boars	1,255 00	2 Weaners	56 40
2 Gilts	500 00	Native Sheep—	
Native Sheep—		20 Wethers	300 00
2 Rams and 23 Ewes..	495 50	Grade Merino Flock—	
Grade Merino Flock—		95 Wethers and Cul- led Ewes	1,666 00
13 Ram Lambs ..	260 00		
	<i>Sh.</i> 3,410 50		<i>Sh.</i> 4,580 40

TOTAL PROCEEDS FROM ABOVE IN 1932—

	<i>Sh.</i>	<i>cts.</i>
Butter-fat	7,327	53
Wool	2,355	35
Breeding Stock	3,410	50
Slaughter Stock	4,580	40
<i>Sh.</i>	17,673	78

VALUATION OF LIVE STOCK AND EQUIPMENT,
31ST DECEMBER, 1932.

	<i>Sh.</i>	<i>cts.</i>	<i>Sh.</i>	<i>cts.</i>
I.—LIVE STOCK ON HAND—				
Cattle	45,947	00		
Sheep	21,207	00		
Pigs	2,570	00		
Horses	760	00		
			70,484	00
II.—IMPLEMENTS AND EQUIPMENT			5,380	26
III.—SUNDRY STORES			356	55
IV.—FOODSTUFFS ON HAND			504	34
TOTAL VALUATION	<i>Sh.</i>		76,725	15

FARM OPERATING ACCOUNT, 1932

	<i>Sh.</i>	<i>cts.</i>		<i>Sh.</i>	<i>cts.</i>
1st January, 1932—			31st December, 1932—		
To Balance brought forward	8,707	92	By Sundry Payments	14,271	97
„ Cheques Paid in	16,935	19	„ Balance	11,371	14
<i>Sh.</i>	25,643	11	<i>Sh.</i>	25,643	11
1st January, 1933—					
To Balance brought forward	11,371	14			

FIXED DEPOSIT ACCOUNT WITH NATIONAL BANK OF
INDIA, LIMITED

	<i>Sh.</i>	<i>cts.</i>		<i>Sh.</i>	<i>cts.</i>
1st January, 1932—			31st December, 1932—		
To Balance	9,292	00	By Balance	9,665	00
22nd August, 1932—					
To Interest on above	373	00			
<i>Sh.</i>	9,665	00	<i>Sh.</i>	9,665	00
1st January, 1933—					
To Balance on Fixed Deposit	9,665	00			

H. GUNN.

Part IV.—Miscellaneous

LOCUST CAMPAIGN

At the beginning of 1932 an anti-hopper campaign was in progress in the Meru district and along the Kenya and Uganda Railway line from Athi River to Simba. Heavy hatchings had occurred over large areas to the east of a line between Mount Kenya and Mount Kilimanjaro mainly in uninhabited and inaccessible country.

The coffee parchment bait first used in the previous campaign had been improved and was generally found to be highly efficient even when fresh grass was available as food. The exception was on the coast where, for reasons not yet satisfactorily explained, hoppers refused to take bait. It is surmised that this may have been due to the fact that herbage near the sea has a salty flavour and the salt taste of the bait does not therefore prove attractive to hoppers as it does where salt is lacking.

By mid-February a considerable proportion of hoppers had been destroyed where it had been possible to attack them, and the remainder, together with those hatched in the less accessible areas, were on the wing.

During this campaign the Meru, Kitui, Machakos and coastal natives did excellent work.

The resultant swarms starting from these uninhabited areas were not accurately traced, but the general trend of movement was in a southerly and south-westerly direction towards and into Tanganyika. The damage caused to crops was negligible, also to grazing except in the Voi and Eastern Masai districts and in North Kenya.

By about the 10th March a few unimportant swarms remained in the Rift Valley, but with this exception the Colony was practically clear.

Although occasional reports of the presence of the Desert Locust, *Schistocerca gregaria*, were received, no specimens of this variety have been obtained during 1932, and it is believed that this species was entirely absent and that all swarms were of the Tropical Migratory Locust, *Locusta migratorioides*.

Long Rains Breeding.—The south-westerly movement referred to above appears to have been only a large circling motion and in the latter half of March swarms began to return from

the south, first along the shores of Victoria Nyanza and at a later stage up the Rift Valley and further eastwards. These swarms were mature on arrival and in early April laying commenced in the Nyanza, Nzoia and Rift Valley Provinces and shortly after in the Kikuyu, Ukamba and Masai Provinces.

A vigorous anti-hopper campaign was started in all these areas except the Masai Province, where work was confined mainly to the Masai-Ukamba and Masai-Kikuyu borders.

Due in part to less intensive laying than had been assumed and in part of the effect of egg parasites, particularly tachinid flies, hatchings in the Nzoia and Nyanza Provinces were not of such importance as in the previous year and were controlled with comparative ease. In the Rift Valley the heaviest and most prolonged infestation that has occurred in the Colony in recent years was sustained. The infestation was also heavy in Machakos and on the Ukamba-Kikuyu border. Due to the sustained and energetic efforts of farmers and honorary locust officers in the affected areas and the valuable assistance of parties of King's African Rifles working in these areas, a very large measure of control was obtained except in some outlying districts. From such intense and continuous laying escapes were inevitable, but they were on such a scale that the damage caused by them in the latter part of the year was comparatively unimportant and had they not been reinforced from over the north-western border of the Colony it is believed that they would have been entirely wiped out by natural causes of which the most important during the last few months of the year were birds. Even with these reinforcements from outside the Colony, swarms have become so scattered and reduced that no important layings took place during the short rains, and by the end of the year under review only a few scattered bands of hoppers were known to exist, of insufficient importance to warrant anything but local action.

Damage to Crops.—During 1932, with the exception of wheat, the damage sustained by arable crops from locusts was small in comparison with the previous year. As is inevitable when locust swarms are present, certain individuals suffered serious losses, but it is estimated that the damage to grain crops other than wheat did not exceed 10 per cent. This was to a large extent due to rainfall which was of such a nature as to produce plentiful supplies of grass in most areas throughout the year to which the locusts mainly confined their attention. Late planted wheat crops on the Plateau suffered very severely. The case of grazing was otherwise and very serious losses were

sustained over wide areas. Nor is the damage confined to the loss of much needed grazing during the past year, but the progressive deterioration of pastures caused by the locusts having selected the better and finer types of grass for their attacks with the consequent impetus given to the coarser types of lower feeding value is likely to be felt for some years to come.

Organization.—The organization to deal with hoppers followed that developed in 1931. All bait was mixed in and despatched from Nairobi and its distribution by settlers and natives organized by honorary locust officers, district officers, and in heavily infested provinces by locust control officers and locust officers, paid from the funds provided for the campaign. To all those who have assisted with so much good will and energy the thanks are due not only of the Department and of Government, but of the rest of the community who have benefited by their public spirited action. To the officers and men of the King's African Rifles, to the General Manager and staff of the Kenya and Uganda Railways, to officers of the Administrative, Forest and other Departments who have given such valuable help, I would express this Department's thanks. Close co-operation with the Tanganyika organization on the inter-territorial boundary has been maintained.

Methods.—No new methods of dealing with hoppers have been developed during the period under review, but a steady improvement in the quality and consequent effect of the coffee parchment bait has been achieved. This has formed the standard method of dealing with hoppers, supplemented, where conditions were favourable, by the use of power sprayers. Ten of these outfits were purchased in the early part of the year and have proved invaluable where the proximity of water made their use practicable. Although the cost of such machines is considerable it has been shown that this cost is saved in arsenite of soda alone within two months of their being put into commission in comparison with the use of the old type of hand pump. The area that can be dealt with in a given time is also considerably greater than in the case of any other form of apparatus previously tested.

Locust Committee.—Six meetings of this committee were held during the course of the year. The policy and methods to be adopted having been decided during the previous year the necessity for frequent meetings of the committee did not arise. The helpful advice of members is recorded with gratitude.

Purchase of Locusts.—The offer of Government to purchase dried locusts at any administrative centre met with no response. No dried locusts were offered for sale.

Cost.—The cost to Government of the campaigns carried out during 1932 was as follows :—

	January to March, 1932	April to December, 1932	Total for 1932
	£	£	£
Salaries	627	1,203	1,835
Materials (Arsenite, Gunny Bags, etc.) ..	1,639	7,166	8,825
Purchase of Power Sprayers .. ..	..	1,001	1,001
Rail Warrants	1,567	2,376	2,963
Local Transport and Travelling Allowances	840	1,493	2,333
Labour (including rations)	486	1,432	1,918
Telegrams and Trunk Telephone Calls ..	27	53	80
Hopper Destruction on Unoccupied Farms and Crown Lands	221	699	920
Locust Scouting	71	100	171
Transport, (Petrol, Oil, Repairs to Lorries, Tyres, etc.)	1,895	3,653	5,548
Repairs to Tentage and Camp Equipment ..	32	148	180
Sundries	77	583	660
TOTAL	£ 6,502	19,932	26,434

In addition to this expenditure from Government funds the money value of time spent on locust work by farmers and their labour and by natives probably exceeded this figure by three or four times.

The magnitude of the effort made may be realized from the fact that during the long rains campaign no less than 134,181 bags (60 lb.) of bait were distributed and that during the later stages in the Rift Valley alone over 3,500 bags were distributed daily and six power sprayers were in operation.

A total of over 157,000 bags of bait were prepared at Nairobi during the year and 78 tons of arsenite of soda used.

PRINCIPAL CHANGES AND NEW APPOINTMENTS IN TECHNICAL STAFF DURING 1932.

I.—ADMINISTRATION AND GENERAL.

Nil.

II.—DIVISION OF PLANT INDUSTRY.

The following Agricultural Officers arrived on first appointment on the dates shown:—

Mr. T. Y. Watson, B.Sc., Dip. Agric. Sci. (Cantab.), 7-1-32.

Mr. J. E. P. Booth, B.Sc. (Agric.), A.I.C.T.A. (Trinidad),
11-3-32.

Mr. R. E. T. Hobbs, N.D.A. (Reading), 10-3-32.

Mr. P. C. Chambers, B.A., A.I.C.T.A. (Trinidad), 18-11-32.

Mr. R. J. Benstead, N.D.A., and Mr. M. D. Graham were appointed Temporary Agricultural Officers from 21-1-32 and 3-5-32 to 31-12-32 respectively.

Mr. E. Cottingham was transferred from the post of Temporary Agricultural Officer to that of Plant Inspector on 1st May, 1932, *vice* Mr. H. L. Bolton, transferred to Scott Agricultural Laboratories as Insectaries Manager. Mr. Bolton's services were terminated on 31st December, on abolition of his appointment.

Mr. J. W. Phillips, Laboratory Assistant, and Mr. H. R. H. Stone, Plant Inspector, proceeded on leave on 28th December and 1st December respectively, pending termination of their appointments.

III.—DIVISION OF ANIMAL INDUSTRY.

Captain O. Dixon, M.C., M.R.C.V.S., Senior Veterinary Officer, was promoted to Assistant Chief Veterinary Officer on 1st January.

Mr. J. Walker, M.R.C.V.S., Chief Veterinary Research Officer, proceeded on leave on 26th June, pending retirement, which took effect from 7th October.

Mr. R. Daubney, M.Sc., M.R.C.V.S., Assistant Chief Veterinary Research Officer, promoted to Chief Veterinary Research Officer, from 7th October.

Mr. W. M. Fletcher, Temporary Stock Inspector, appointed locally 1st March, and resigned 10th September.

Mr. J. S. Nimmo, Temporary Stock Inspector, appointed locally 15th February.

Mr. A. R. Paxton, Stock Inspector, resigned and proceeded on leave, 18th December.

STAFF LIST

As at 31st December, 1932.

A.—ADMINISTRATIVE AND GENERAL.

Director.—Alex. Holm, C.B.E., F.H.A.S., M.R.A.S.E. (Gold Med.), S.E.A.C. (Dip. Hons.).

Assistant to Director.—D. L. Blunt, M.A.

Agricultural Economist.—V. Liversage, B.Sc. (Lond.), M.S. (Wis.), N.D.A.

Accountant.—H. S. Land.

Office Superintendent.—E. J. Kelly.

Clerks.—R. Abram, J. S. de W. Ainsworth, Miss M. V. Ashe, Mrs. M. A. Carr Hole, A. Clough, P. M. Corfe, Miss H. M. Dewar, J. B. Gould, A. J. Kemp, S. Morrell, J. S. Nelson, Miss A. O. P. O'Meara, R. F. G. Palmer, F. Parker, J. Riddell, A. Wake, Miss J. Webster.

B.—DIVISION OF PLANT INDUSTRY.

Deputy Director.—H. Wolfe, M.Sc. (Agric.).

Senior Coffee Officer.—A. D. le Poer Trench.

Agricultural Officers.—P. Booth, N.D.A., U.D.A., D. C. Edwards, B.Sc. (Agric.), N. Humphrey, A. C. Maher, B.A., Dip. Agric. (Cantab.), A.I.C.T.A. (Trinidad).

Plant Inspectors.—E. Cottingham, H. N. Jones, C. D. Knight, T. L. McClelland.

SUB-DIVISION OF NATIVE AGRICULTURE.

Agricultural Officers.—A. G. Bailey, M.A. (Oxon), J. E. P. Booth, B.Sc. (Agric.), A.I.C.T.A. (Trinidad), P. C. Chambers, B.A., A.I.C.T.A. (Trinidad), G. W. Gaddum, B.Sc. (Agric.), Dip. Agric. (Wye), M. H. Grieve, B.Sc. (Agric.), A. S. Hartley, R. E. T. Hobbs, U.D.A., W. G. Leckie, B.Sc., C. O. Oates, N.D.A., W. O. Sunman, B.Sc. (Agric.), Dip. Agric. (Wye), W. L. Watt, Cert. H.A.S. Forestry, T. Y. Watson, B.Sc., Dip. Agric. Sci. (Cantab.).

SCOTT AGRICULTURAL LABORATORIES.

Senior Entomologist.—T. J. Anderson, M.A., B.Sc. (Hons., Edin.), F.Z.S., F.E.S.

Entomologists.—H. C. James, Ph.D., B.Sc., N.D.A., N.D.D., R. H. Le Pelley, Ph.D., D.I.C., B.Sc. (Hons.), A.R.C.Sc., F.E.S., F. B. Notley, B.Sc. (Hons.), H. Wilkinson, A.R.C.Sc., F.E.S., F.L.S.

Senior Mycologist.—J. McDonald, D.F.C., B.Sc. (Hons.), F.L.S.

Mycologist.—C. A. Thorold, B.Sc.

Senior Agricultural Chemist.—V. A. Beckley, M.C., M.A., A.I.C.

Soil Chemist.—G. H. G. Jones, M.Sc.

Agricultural Officer.—S. Gillett, Dip. Agric., Hons. (Wye).

Laboratory Assistant.—F. McNaughtan, B.Sc.

Junior Laboratory Assistants.—F. W. Evans, E. C. M. Green, R. N. Noble.

Learner Laboratory Assistants.—G. Finch, A. S. M. Gilfillan.

Clerk.—B. A. Pickering.

PLANT BREEDING SERVICES.

Senior Plant Breeder.—G. J. L. Burton, M.C., B.A.

Plant Breeder.—R. J. Lathbury, M.A.

Agricultural Officer.—N. D. Spranger.

Junior Laboratory Assistant.—G. Gamble.

GRADING AND INSPECTION AND COOL STORES SERVICES.

- Chief Grader and Inspector.*—C. L. Silvester, N.D.A., N.D.D.
Grader and Inspector.—F. B. L. Butler, F.L.S.
Assistant Grader and Inspector.—E. L. Bradford.
Superintendent, Maize Conditioning Plant and Cool Stores.—D. F. Sargent.
Mechanic.—A. E. Taylor.
Clerk.—H. S. Cuthbert.

C.—DIVISION OF ANIMAL INDUSTRY.

(a) ADMINISTRATIVE AND EXECUTIVE DIVISIONS.

- Deputy Director (Animal Industry) and Chief Veterinary Officer.*—H. H. Brassey-Edwards, M.R.C.V.S.
Assistant Chief Veterinary Officer.—O. Dixon, M.C., M.R.C.V.S.
Senior Veterinary Officers.—R. C. Wheeler, M.B.E., M.R.C.V.S., J. T. C. Bradshaw, M.R.C.V.S.
Veterinary Officers.—R. Scott-Little, M.R.C.V.S., D.V.S.M., R. L. Creery, M.R.C.V.S., E. J. Mulligan, M.R.C.V.S., W. J. Emerson, M.R.C.V.S., F. R. Hale, M.R.C.V.S., E. Beaumont, M.R.C.V.S., T. B. McClure, M.R.C.V.S., H. Hay-Barclay, M.R.C.V.S., D. F. Macpherson, M.R.C.V.S., W. M. McKay, M.R.C.V.S., F. W. Aston, M.R.C.V.S., D.V.S.M., R. A. Hammond, M.R.C.V.S., J. Anderson, M.R.C.V.S.
Stock Inspectors.—D. Wyartt, W. L. Lewis, G. White, H. E. Evans, L. E. Smith, J. Harris, J. F. Greig, C. B. Jolley, F. H. Poolman, J. Denwett, J. H. Ward, R. H. Cameron, F. J. O'Hara, G. L. Murray, G. D. Cowen, C. G. Norman, G. D. Henderson, G. Alcock, G. W. Low.

(b) DIVISION OF VETERINARY RESEARCH.

- Chief Veterinary Research Officer.*—R. Daubney, M.Sc. (Wash.), M.R.C.V.S.
Assistant Chief Veterinary Research Officer.—Vacant.
Veterinary Research Officers.—J. R. Hudson, B.Sc., M.R.C.V.S., W. B. C. Danks, B.Sc., M.R.C.V.S., W. Fotheringham, M.R.C.V.S.
Laboratory Superintendent.—A. Walker.
Laboratory Assistants.—J. T. Schultz, H. J. Gray, J. R. McQueen, E. J. Hall, W. P. Bruce, F. Lyons, J. Forsyth, S. R. Pelling.
Overseer and Stockman.—G. M. Eames.
Yard Foreman.—A. McDougall.
Clerks.—J. H. Crampton, A. E. Dawes, Miss R. M. Dennis, L. O. Johns, S. G. Sharp.
Librarian.—D. Dewar.
Mechanic.—O. Stenmark.
Storekeeper.—J. Scott.
Assistant Storekeeper.—G. W. Clochley.
Laboratory Students.—W. P. Langridge, E. W. Temple-Boreham.
- (c) ANIMAL HUSBANDRY.
- Live Stock Officer.*—W. D. D. Jardine, B.Sc. (Edin.), N.D.A., N.D.D. (Hons.).
Instructors in Stock.—J. Anderson, C. G. Bishop, H. C. W. Guy, A. Lambie.

KENYA RAINFALL 1932

	Total Rainfall	Average Rainfall	No. of Years	Excess	Deficit
	<i>Inches</i>	<i>Inches</i>		<i>Inches</i>	<i>Inches</i>
COAST PROVINCE—					
Lamu	46.51	35.29	26	11.22	..
Malindi	47.75	39.91	38	7.84	..
Kwale	46.00	37.80	21	8.20	..
Teita-Voi	26.87	21.06	21	5.81	..
UKAMBA PROVINCE—					
Kitui	46.24	40.14	28	6.10	..
Machakos	43.31	36.69	37	6.62	..
KIKUYU PROVINCE—					
Nairobi	39.45	36.89	16	2.56	..
Kiambu	41.22	41.76	24	..	0.54
Fort Hall	56.52	45.78	31	10.74	..
Embu	41.77	41.79	24	..	0.02
Meru	58.24	53.98	19	4.26	..
Nyeri	43.39	37.11	28	6.28	..
NAIVASHA PROVINCE—					
Naivasha	24.13	29.07	28	..	4.94
Laikipia-Rumuruti	26.09	28.43	20	..	2.34
RIFT VALLEY PROVINCE—					
Nakuru	41.60	36.48	23	5.12	..
Ravine	54.07	43.98	29	10.09	..
NZOIA PROVINCE—					
Nandi Kapsabet	56.61	63.39	26	..	6.78
Uasin Gishu-Eldoret	40.77	41.45	21	..	0.68
Traus Nzoia-Kitale	44.80	45.34	11	..	0.54
NYANZA PROVINCE—					
Kisumu	52.79	44.54	29	8.25	..
Kakamega	77.95	78.43	11	..	0.48
Kisii	65.02	51.51	5	13.51	..
Lumbwa	50.01	47.61	27	2.40	..
Kericho	69.52	71.34	27	..	1.82

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