
RAJC
PRACTICE
WITH
SCIENCE.

Photo. by The Stereoscopic Co. Limited, London. *Frontispiece.*

THE AUTHOR.

FARMING INDUSTRIES

OF

CAPE COLONY.

BY

ROBERT WALLACE, F.L.S., F.C.S., F.R.S. EDIN., &c.,

Professor of Agriculture and Rural Economy in the University of Edinburgh;

Author of

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PERSONAL STATEMENT AND INTRODUCTION.

THE distance covered during my South African visit completed the **one hundred and fifty thousand miles** of foreign travel by land and sea which I have undertaken during the last nine years in the interests of agricultural research. During that period I have studied on the spot the agricultural resources of India, Australia and New Zealand, Canada, the United States of America, Greece, Italy, Egypt, and South Africa, and I have published accounts of the results of my investigations. On this occasion my visit was undertaken at the **invitation of the Government of Cape Colony**. Soon after the appearance of my Australian work in 1891, I was approached on the subject by the late Sir Charles Mills, then Agent-General for the Colony in London, and I have since learned that this was done probably at the suggestion of the Hon. J. X. Merriman; but my existing engagements made it impossible to comply with the suggestion till the spring of last year, when, on the completion of the five months' course of lectures in this University in the end of March, six months were left free for the work in hand. The ground it was necessary to cover was so extensive that the four months spent in the country were barely sufficient to do it without more than the usual amount of **discomfort and personal fatigue,** and the undertaking proved more trying from the physical standpoint than even the journey of thirteen thousand miles which I made by rail in India in the hot weather of 1887. The railway was used where it was possible to do so, but a reference to Maps 1 and 2 will show that long distances,

amounting to over two thousand miles, had to be covered by **Cape cart**—a vehicle constructed like a dog-cart, but with a pole in place of shafts, and drawn by two horses as shown in Plate 4, or four horses as in Plate 9. The **roads** were often very rough, being merely tracks on the veld, but no accident occurred sufficient to mar the enjoyment of an almost daily recurrence of sunshine and clear **winter weather**, or the interest attaching to new experiences which continued to unfold themselves. The sky being clear, the days were generally warm; but the evenings, which in that latitude and time of year are long, were chilly, and the nights quite cold.

I had every reason to be thoroughly satisfied with the **treatment I received** at the hands of the Department of Agriculture, as well as from members of the Government Opposition. Everything which could add to my personal comfort was provided. While I was left absolutely free to conduct my investigations according to my own plan, I was supplied with suggestions relative to the best routes to follow, and introductions to leading farmers, as well as with an officer of the Department as guide and companion, when this was considered necessary, which was during the greater part of my sojourn within the borders of Cape Colony. I was particularly fortunate in **my travelling companions**. At first I was accompanied by **Mr Eustace Pillans**, a horticultural expert, whose knowledge of the work of his Department was of special value to me in the western fruit- and wine-growing areas. My companion for the greater part of the way, including the important stock-rearing districts, was **Dr Hutcheon**, the Colonial Veterinary Surgeon, a Scotsman from the neighbourhood of Peterhead, in common with whom I had many kindred associations and national recollections. The Doctor's early boyhood had been spent with an uncle who belonged to the strictest of Calvinistic doctrinaires of the time—now nearly half a century ago—and he had been schooled in a thorough knowledge of the Shorter Catechism, the Psalms of David, and in the historical and other mysteries of the books of the Old and New Testaments. Being possessed of a retentive memory and a decided taste for literature, and

having been an omnivorous reader, he was able, during our long and what might otherwise have been tedious drives, to wile away the hours not devoted to agricultural discussion by literary effusions of a most interesting and varied character. He would tell a humorous story, sing a Scottish ditty, or quote at length from the Bible, Huxley, or Herbert Spencer (two of his favourite authors), with equal aptness and fluency. Among the Boer population his knowledge of Bible history was a valuable supplement to a courteous demeanour in gaining the respect and esteem of those with whom he came personally in contact. It is told of him, soon after his arrival in the Colony, that he met at a place which shall be nameless a body of Boer farmers, with the object of discussing certain questions relating to diseases in live stock. The farmers, full of confidence in their own superior knowledge, derived from personal experience in the Colony, compared with which nothing else could be of any account, were not inclined to look with favour or respect upon the new arrival. The chief spokesman had a long list of what were thought to be unanswerable or difficult queries carefully written out, and each, as he put it, was "clinched with Scripture." The answers were, however, so much to the point, and each Scripture quotation capped with another so appropriately, that long before the end of the list had been reached the Doctor had the meeting enthusiastically on his side, and the unfriendly efforts of the ringleaders entirely collapsed. Another important secret of the success and popularity of the Colonial Veterinary Surgeon was his early training on the old Scottish plan, which was eminently practical. There is no operation of the farm, from the smallest and most insignificant to the most important, that he has not practised to proficiency with his own hands; and, moreover, in the performance of his official duties, in which he comes much in contact with individuals, he can well claim the distinction of genius, as defined, if I remember aright, by one of our greatest economic philosophers, as "possessing the faculty of taking infinite pains."

During the tour of investigation, in conformity with my usual custom, copious notes were daily taken in duplicate, and one copy mailed home each week to form a guarantee of

the safety of the information collected, in the event of loss of luggage, or any mishap occurring to my note-books.

While visiting farms, and meeting and talking privately with as many farmers as possible, I make it a rule to reserve the public expression of any definite opinions on agricultural matters until I have completed my investigations, and **to avoid public meetings**, on account of such being a waste of valuable time, and infinitely more liable to develop heated controversial discussions which convince no one, than to contribute to one's stock of information relative to a new country. I trust that the executive committees of agricultural societies and associations, whose invitations I consequently felt in duty bound to refuse, will understand and appreciate the necessity for my doing so.

On my return to Cape Town, it still remained to be decided what form my **statement to Government**, including **recommendations for improvement** in the various branches of the subject, should take, and after full deliberation it was agreed that a report in the form of a blue-book would be unattractive, and would probably not be as widely read as a fully illustrated and more popularly written production, and that consequently a volume on the lines of my Indian and Australian works would be preferable, if completed in time to be considered by the Cape Parliament during the current session. As in the case of my investigations, I was left free to express my views on the position of the farming industries, on the agricultural education of the Colony, and on the constitution of the Agricultural Department of Government, and it is my hope that it will not be thought that I have taken any undue advantage of the confidence placed in me by criticising too severely in those few instances in which I felt it to be my duty to strongly express disapprobation of existing conditions.

The **arrangements for publication** were entrusted to Mr Spencer Todd, C.M.G., the acting Agent-General in London, and myself, and I take this first public opportunity of thanking Mr Todd for the personal trouble he took in supplying information, and in furthering in every way the progress of the work.

The **publishers**, Messrs P. S. King & Son, working equally in the direction of facilitating progress and minimising the labour and anxiety of the author, accepted the printing tender of the **Darien Press**, Edinburgh, a firm with whom I have had long and agreeable business relations, and who, if possible, have on this occasion excelled their previous performances in the excellence and the expedition of the execution of their share of the work.

The **blocks** for the printing of the **full-page plates** were the artistic work of Messrs M. & T. Scott, photo-process engravers and zincographers, Edinburgh, and mark a wonderful advance in the development of the appliances for half-tone printing within recent years. The frontispiece and the portrait of Dr Hutcheon were supplied by the same firm, and done by the Scott process, an improvement on the gelatine or collotype process. Many of the **text illustrations** were drawn by Mr J. T. Murray, artist, Edinburgh.

My thanks are also due to my friend, Mr J. G. Bartholomew, who took much personal interest in the compilation of an original and instructive **series of maps**,* with, as a basis, the new and complete map of South Africa drawn in the office of the Surveyor-General in Cape Town, and now being reproduced by Mr E. Stanford with the object of publication. Proofs of three of the four sheets which will form the large new map were supplied by Mr Stanford, but the fourth sheet not being ready as was expected in March, the maps had to be completed from a photograph of the missing part, which entailed additional labour and expense, and delayed the publication of the book for six weeks. This time was, however, not altogether lost, as it enabled me to maintain a standard in the last chapters similar to that originally adopted in the earlier parts of the work. The **writing was begun** in the last week of October, and the final chapter **was completed** on 15th May, within twelve months of the date on which I left Cape Town on the long tour of inspection of the Colony.

I have followed the plan adopted by me on previous

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* The Geological Map is after E. J. Dunn's map published in 1887, and the Rainfall Charts were taken from those of Gamble issued in 1886.

occasions, and given a **brief outline** of the *route* taken, leaving to **separate chapters** the discussion in detail of the leading subjects of interest.

I did not confine my researches or remarks merely to what I saw and learned from farmers and others on the spot, but I **utilised** to the fullest extent the large **mass of reports and blue-book literature** with which I was provided by Mr Charles Currey, the Permanent Secretary of the Department of Agriculture; and, in addition to others which are mentioned in the text, I also **freely employed** for purposes of reference, comparison, and illustration, the following **standard works**:—

1. The voluminous Reports of the Department of Agriculture, Washington, U.S.A.
2. The local Reports issued by Colleges, Schools, and States in America, especially those of California dealing with fruit culture, salt soils, and irrigation.
3. The Agricultural Gazette of New South Wales.
4. The Agricultural Journal of Cape Colony.
5. The South African Agriculturist's Almanac.
6. The Argus Annual.
7. The Official Handbook of the Cape and South Africa.
8. Essays, Lectures, and Reports of the South African Exhibition, 1885.
9. Manual of Injurious Insects, &c., by E. A. Ormerod.
10. Veterinary Medicine, by Wm. Williams.
11. Veterinary Surgery, by Wm. Williams.
12. Plant Diseases, by Marshal Ward.
13. Useful Native Plants of Australia, by Maiden.
14. Select Extra-tropical Plants, by Von Mueller.
15. The Cambridge Natural History, Insect Vol., by Sharp.
16. The Works on African Hunting, by F. C. Selous.
17. Theal's Histories of South Africa.

I have endeavoured to **give my authority** where a reference or quotation is made, not only with the purpose of acknowledgment, but also as a guide to the reader where he may find the subject discussed. I have been specially indebted to the **American Government publications** for valuable

subjects used as text illustrations, and I trust that the appreciation of the value of such work as the Agricultural Department at Washington has done for a number of years, will be still further acknowledged in a realistic and ideal way by the Cape Government adopting the most perfect form of acknowledgment, viz., by imitation of the American methods of pictorial illustration in connection with the production of the future *Agricultural Journal* of Cape Colony.

Owing in a measure to what seemed to be lack of sufficient care on the part of the Eastman Company, in developing the film negatives supplied by the Company, and which I had unwittingly rather over-exposed in the South African climate, the numbers of **photographic subjects** of my own taking, available for full-page illustrations, were fewer on this occasion than on any of my former tours. The names of those to whom I have been most indebted for making good the deficiencies are Mr Wm. Roe, Graaff Reinet; Mr Percy Ashenden, M.I.C.E., Cape Town; Dr Hugo, Worcester; and Messrs Wilson & Co., Aberdeen, N.B., and Pocock, Cape Town.

In addition to copious illustration by plates and figures, I have tried to maintain what I have previously endeavoured to establish as **characteristic features of my writings**—viz., brevity of expression, and the compilation of a vast number of detailed facts, which are meant to be of value to those interested in putting in practice the operations described. In following this course, I have studiously avoided superficial generalisation, which is a thing of air, and usually incapable of being utilised in the construction of a satisfactory working plan of anything. I have also persisted in the unusual course of calling every one merely by his name without the meaningless prefix Mr, and I did so without intending to display undue familiarity, or to be in any sense discourteous. On the contrary, I raise the individuals whose names I take the liberty of mentioning from the ordinary rank and file of the numberless misters, and place them on the same platform as long-standing and prominent authorities in science, literature, art, and philosophy. No one would think of doing honour to Newton, to Raphael, to Burns, or to Carlyle, by calling one or all of them Mr! I have, in short, adopted the course

of saving printers' ink and the status of my friends in one breath by the disuse of the most flimsy of all courtesy tinselling.

It would be impossible, as well as inexpedient, to mention in detail the numerous friends to whom I was indebted for personal **attention and hospitality**, but I trust they will accept this public acknowledgment—a supplement to my previous individual thanks—as an indication that the courtesies offered have not been forgotten, nor are likely to be so.

I have, when occasion offered, acknowledged the sources from which much of the information has been collected and assistance received, but a pleasing duty yet remains for me to perform, viz., to mention specially my esteemed friends, **Professor MacOwan** and **Dr Hutcheon**. I do not exaggerate when I say that but for their help, rendered during the period of my visit to the Colony and throughout the past six months, it would have been quite impossible for me to complete the work in the time, or to make it the book of reference which I trust it will become.

I have frequently been asked the **questions**—Is Cape Colony a great agricultural country? and is there a hopeful future for the farming industries of South Africa? But these are not queries that can be answered by a categorical "yes" or "no." I have employed over 500 pages of letterpress to state the position as it stood in 1895, and those who do me the honour of reading these pages will see that with qualifications I repeatedly say "**yes**" and as frequently say "**no**" to both queries. I would further add that much in the **future prospects** of the agriculture of the Colony depends upon outside influences which have nothing to do with the energy or skill of the farmer, and the stock-rearing capacity or the grain-producing power of the soil. I feel convinced after years of careful study of the question, that there is little hope for the agriculture of the future in Cape Colony, or in any part of the world, so long as the **standard of currency** remains in the unsatisfactory condition in which it is found to-day. That agriculture will be carried on, and that stock will continue to be reared after a fashion, goes without saying, whether the world be prosperous or not; but the question which the currency

matter will determine is, whether agriculture is to assume its rightful position as the oldest and most honourable among the arts, and be practised and supported, as in the Roman Empire of old, by the best in the land, or be left, as by the Greek philosophers and soldiers, to serfs and slaves. Are the agriculturists of the future to occupy that independent and honourable position among their fellow-workers in other spheres which they have done in times past, or are they to be the hewers of wood and drawers of water to the rest of the community? These are the points which the course taken by the nations in the great problem of the world's currency will settle for the farmer, however skilled or unskilled he may be in his practices.

My visit to South Africa was associated with a number of **pleasing experiences and incidents** of a personal character apart from interests of a purely agricultural nature. From the scientific point of view, perhaps the most gratifying experience was found in the conclusive confirmatory evidence which I have been able to lead, of the universal nature of the phenomenon pointed out in my Indian work relative to the **skins of cattle** and other animals whose habits lead them to exposure to the influences of tropical sun, being **black or dark in colour**, although the hair is very frequently white. Writing to me on this subject in 1888, the late **Professor Huxley** said: "The fact you mention is of very great interest, as showing a hitherto unsuspected relation between colour and climate."

One of the conspicuous **advantages of foreign travel**, especially if a journey be taken in an official capacity, is the opportunity afforded of meeting, and in so doing taking the measure of, such prominent **historical and distinguished personalities** as Mr Cecil Rhodes, Mr F. C. Selous, President Kruger, Sir Edgar Vincent, Sir Henry de Villiers, Sir David Tennant, and Sir James Sivewright. In addition to these, but not individually, may be mentioned the numerous **millionaire magnates** who have, through a happy combination of ability and good luck, been the architects of handsome fortunes derived from the diamond mines of Kimberley, the gold-bearing reefs of Johannesburg, or from the once too well-lined and

open-mouthed pockets of an unsophisticated, over-confident and over-confiding British public and French peasantry. The study of such a heterogeneous multitude is one of infinite variety, but its interest becomes none the less in consequence.

Congenial spirits and **social pleasures** often unexpectedly present themselves to the traveller when in a mood for their enjoyment, and like an oasis in the desert, are hailed

MINE HOST OF YELLOW WOOD. *Photo. by the Author.*

with great satisfaction. One of the most pleasing incidents by-the-way which hold a foremost place in the author's recollection was the night spent at Yellow Wood, under the roof of Mr H. R. Hazelton, the hospitable landlord, retired sailor, and poet. His good fellowship, his fund of anecdotes, his familiarity with standard literature, his collection of poetic gems, and his own by no means ordinary poetical effusions,

formed a complete bill of fare for a night of intellectual revelry. "Mine host" will excuse the reproduction, probably somewhat imperfectly from memory, of his charming **Address to a Mosquito**,* which on account of truthfulness of description and beauty of poetic expression cannot fail to be appreciated :—

"Away, away, thou wily, buzzing pest,
  Torturing my musings with thy hated hum,
Chasing an angel's voice when it would rest,
  Thou imp! obtruding, spoiling flowers that come.
Surely some fiend hath cast thee from his den
  To tease, perplex, and worry us at leisure;
And with a Judas kiss steal blood from men,
  Leaving his venom as you take your pleasure.
Away, foul foe, soft beauty's rude destroyer,
  Hence to some tainted form and revel there,
And not on beauty's cheek, thou vile annoyer;
  If fiend thyself, thou hast no business there."

ROBERT WALLACE.

THE UNIVERSITY, EDINBURGH,
May 1896.

* Mosquitoes, following the railways, have spread from the coast districts, and increased much in numbers in the Colony within recent years.

HISTORICAL PREFACE

BY HARRY STRATFORD CALDECOTT.

JOHANNESBURG, *March* 1896.

DEAR PROFESSOR WALLACE,

I shall endeavour to relate the story of South African history in broad outline in the shape of a familiar letter rather than in the more ponderous form of a set treatise. I had commenced something in the latter form, when my work was interrupted by the exciting political and other events of the past ten or twelve weeks. I was also becoming afraid that the more ambitious project would have become too bulky for your purpose, and the time in which you required it was too limited to do justice to the whole story in detail.

The authorities I chiefly rely on are Theal's "Histories of South Africa," Wilmot's "Expansion of South Africa," Basil Worsfold's "South Africa," Caldecott's "English Colonisation," Scott Keltie's "Partition of Africa," and Lucas's "Historical Geography of the British Colonies"; and if I sometimes use their *ipsissima verba* without special acknowledgment, it is only to save needless elaboration of footnotes.

HISTORICAL SUMMARY.

For this I am mainly indebted to Mr Worsfold.

B.C. 1700. Land of Punt (S.E. Africa) conquered by the Egyptians.

B.C. 1000. Solomon's Expedition to the land of Ophir (S.E. Africa).

B.C. 600. Voyage of Phœnician seamen (from Red Sea) round Africa.

A.D. 35. Sabaen King Kharabit is in possession of the E. coast of Africa.

Portuguese Period.

1486. Discovery of the Cape (Cabo Tormentoso) by Bartholomew Diaz.
1497. Vasco da Gama sails to India by the Cape.
1505. Alvarez de Cahal occupies Sofala (East Coast).
1580. Sir Francis Drake passes the Cape on his (return) voyage round the world.

Dutch Period.

1602. Netherlands East India Company Chartered.
1648. Wreck of the "Haarlem" in Table Bay.
1652. Arrival of expedition under Van Riebeck.

Government by the Dutch East India Company.

1657. Nine of the Company's servants settled as "free burghers" at Rondebosch.
1679. Simon van der Stell appointed Commander.
1688-89. Huguenot emigration.
1709. The use of French in official communications forbidden.
1714. Returns show Cape Town has 300 houses, and that the whole population of settlement = free burghers, 647 men, 341 women, 900 children, employing 93 men-servants, and owning 1,178 male, 240 female slaves.
1779. The Franco-Dutch settlers send representatives to Holland praying for reforms.
1783. Birth of Tshaka.
1786. Fish River declared the limit of the Colony, and magistracy established at Graaff Reinet.
1795. British Force (under Admiral Elphinstone and General Craig) take possession of the Cape.
1803. Restoration of the Cape to the Dutch after the Treaty of Amiens.
1806. Surrender of the Cape by General Janssens to Sir David Baird.

Period of British Rule.

1806. Population of Colony = 73,663, of whom 26,720 were of European descent; exports £60,000, imports £100,000.
1807. **Earl of Caledon** appointed Governor: postal communication, circuit courts, regulations for Hottentots.

1812. **Sir John Cradock**: "loan-leases" converted into perpetual quit-rent properties—public schools established in country districts. First Kaffir War (1811-12): Kaffirs driven back to original Dutch frontier (the Fish River). Foundation of Grahamstown.

1814. **Lord Charles Somerset**.

1815. The Cape formally ceded to Britain by Holland. (The agreement passed the Cape and other possessions [notably Ceylon] to the British Government in return for Java and a sum of money.)

1817-19. Second Kaffir War: Defence of Grahamstown by Wiltshire—boundary advanced to Chumie and Keiskamma Rivers—missionaries sent to Gaika tribe.

1820. Albany settlement: arrival of 5,000 British emigrants at Algoa Bay. Foundation of Port Elizabeth.

1824. Natal first colonised by party of British settlers.

1826. **General Bourke**: ordinance declaring free coloured men equal in law with the whites.

Report of Royal Commission: establishment of Executive Council, Supreme Court, Resident Magistrates (in place of Landdrosts), Schools, &c. (conversion of Dutch into British Colony). English ordered to be used as official language.

1833. Abolition Act.

1834. **Sir Benjamin D'Urban**: Slave Emancipation carried out.

1834-35. Third Kaffir War: invasion of Colony by Kaffirs—boundary advanced to Kei River: Lord Glenelg's despatch ordering evacuation of new territory—disaffection of "Boer" population.

1835-36. Exodus of the "emigrant farmers" into Natal, Orange Free State, and Transvaal.

1837. Defeat of Moselekutse by Hendrik Potgieter.

1838. Massacre of Retief's party by Dingaan.

Pretorius (Andries) is Commandant-General of Boers—defeat of Dingaan (Dec. 10).

1843. British Government established in Natal, and Natal annexed to Cape Colony.

1846-48. Fourth Kaffir War (War of the Axe): War with the Gaikas terminated by Sir Harry Smith.

1847. **Sir Henry Pottinger** first Governor and High Commissioner.

1848. **Sir Harry Smith**: declaration of British Sovereignty up to the Vaal River and the Drakensberg Mountains.

1849. Convict agitation in Cape Colony.

1851-53. Fifth Kaffir War: Moresh, Basuto chief, submits.

1852. Sand River Convention. Boers beyond the Vaal are absolved from their allegiance, and Pretorius is pardoned.

1853 54. Boers of Orange River sovereignty revolt. Imperial Government decide upon a policy of non-interference—withdraw troops—acknowledge the Orange Free State by the Convention of Bloemfontein.

1853. Representative Government (elective Council and Assembly) granted to Cape Colony.

1854. **Sir George Grey**. New Kaffir Policy. Transvaal acknowledged as a free and independent State.

1856. Natal formed into a separate Colony.

1857. Settlement of Anglo-German legion (2,000) on the Buffalo River (East London founded).

1858. Agricultural German immigration (2,000).

1862. **Sir Philip Wodehouse**: policy of retrenchment insisted upon by the Imperial Government.

1863. First line of Railway opened—public works policy initiated.

1865. British Kafraria incorporated into the Colony.

1869. **Sir Henry Barkly**: authorised to bring in Responsible Government. Discovery of diamonds.

1871. Proclamation of British authority over the diamond fields.

1872. New Constitution (Responsible Government) received Royal Assent: Sir John Molteno first Premier.

1873. Colony divided into legislative districts.

1874. Mr Froude's mission in favour of confederation scheme of Lord Carnarvon.

1877. **Sir Bartle Frere**: authorised to carry out confederation of South African States as Governor of the Cape Colony and High Commissioner in South Africa (April). Annexation of the Transvaal (April 12).

1877-78. Subjugation of Kreli and Sandele.

1879. The Zulu War.

Lord Wolseley, High Commissioner for South-East Africa (June). Administrator of Transvaal.

1880. June 29. Federation Proposals defeated in Cape Parliament.

Aug. 1. Recall of Sir Bartle Frere. **Sir Hercules Robinson** succeeds. Boers revolt under Triumvirate—Kruger, Joubert, and Pretorius (Dec. 16).

1881. Convention of Pretoria (independence of South African Republic [Transvaal] recognised. Suzerain rights of British Government maintained).

1883. Imperial Government takes over Basutoland.

1884. Convention of London (modification of Convention of Pretoria): Bechuanaland Protectorate (Feb. 27).

1885. Sir Charles Warren's Expedition. Extension of Protectorate and formation of Crown Colony.

1886. Discovery of Gold at Witwatersrand (Johannesburg).

1887. Zululand taken over by Imperial Government.

1888. Treaty with Lobengula and mineral concessions obtained in Mashonaland.

1889. **Sir Henry Loch** succeeds Sir Hercules Robinson.
Customs Union Convention (first step towards federation of South Africa).
Charter granted to British South Africa Company.

1890. Cecil Rhodes, Prime Minister. Pioneer Expedition to Salisbury.

1891. Anglo-Portuguese Convention.

1893. Matabele War, and Responsible Government granted to Natal.

1894. Matabele Settlement. Dr Jameson, Administrator.
Glen Grey Act.
British South Africa Company undertakes administration of country north of Zambesi (Nov. 4).
Swazi Convention (Dec. 10).

1895. **Sir Hercules Robinson** reappointed. Annexation of Pondoland.

1896. Invasion of Transvaal by Dr Jameson with a body of 480 volunteers, for the purpose of assisting the **Uitlanders** (chiefly British subjects) to obtain redress of grievances.
Outbreak of Rinderpest among cattle, sheep, and goats in Bechuanaland, Matabeleland, and the Transvaal. Matabele Rebellion.

This brings the history of South Africa down to date. It is a story of constant worry and war—expansion and progress. Mr Lucas is quite right in saying that the colonisation of South Africa has been no easy task, owing to conflicting interests. The work has been complicated by the presence of Dutch settlers, with long-established claims, and a vast native population, not decaying in numbers but holding their own

with the white man. Consequently the progress of the British power has here been more faltering than in other parts of the world. Caldecott states that the problems before our South African Colonies are: (1) (*a*) To arrive at a thoroughly workable understanding with our **Dutch** fellow-colonists, and (*b*) with such Dutchmen as are still **independent neighbours**; and (2) to do the best for the **native races**, especially by training them to take their place at our side in the formation of a mixed community.

In solving the former of these the British and the Dutch have managed to live on, but in a hand-to-mouth fashion, and the Boer War of 1879 showed how far they were from real and effective harmony after dwelling together for eighty years. The inclusion in our Empire of a large territory to which dissatisfied Dutchmen had moved across the Vaal River proved to be premature; we had to fight, and the Boers had the best of it; and then we decided not to bring our strength to bear, but to give way. The Boers occupy accordingly two very extensive regions, one quite independent, under the name of the **Orange Free State**; the other, the relinquished Transvaal, or **South African Republic**, internally independent, but under our control so far as relations with other States are concerned. The writer I am quoting continues: "But although the actual settlement of this part of the problem is still to be worked out, we can have no doubt what the result will be when we look at the problem in a really comprehensive way. The incorporation of these countries in a federated South Africa is only a question of time. The Boers, though in the majority in South Africa at present, are not increasing so fast as the British colonists, and no stream of emigration of anything like the volume of the stream from the British Isles can be directed from Holland. Already indeed the British element is becoming unmanageable by the Boer Governments, and such men as go out there are of a temper not to be trifled with whenever they take their affairs heartily into their own hands. Another Imperial war is not likely; it would be exceedingly unpopular at home, even for the support of fellow-countrymen, and if it came to an actual conflict our colonists would be all the better for depending on them-

selves. . . . At present the extensive areas of the Transvaal and the Orange Free State are occupied chiefly for pasture, but their rich mineral resources will soon be tapped. A network of railways is being laid down, which will develop a community of interest that must go far to make concord among all Europeans in South Africa both easy and indispensable. Mr Worsfold admits that the national difficulty exists, and the native question exists; but neither of these are insoluble problems. There is no inherent divergency between the Dutch and British character sufficient to prevent the amalgamation of the two peoples. The Dutch in South Africa have won the admiration of authorities as distinguished as the late Mr Froude and Mr Selous. . . . At the beginning of the century, when Britain assumed the administration of the Europeans in South Africa, these people had been cut off for more than a hundred years from European influence—that is to say, from civilisation. From that time onwards the quarrel of the Boers has been against the Government as such, and not against individual Britons. As a British colonist, having lived all my life in South Africa, I can personally confirm this opinion and statement of fact. Mr Rhodes has, according to Mr Worsfold, from the commencement of his career grasped the fact that what divides the Europeans in the Cape Colony, and in South Africa generally, is not nationality but education; and additional merit belongs to his public services, because the appeal for support to carry out his measures has been addressed to all enlightened men, irrespective of nationality."

At the present moment, however, when the future destinies of South Africa are in the melting-pot, I am not inclined to pursue the question raised by these writers and the solutions suggested by them, which in every case is federation under the suzerainty of the British flag. The solution will work itself out by the mutual recognition of the common interests, necessities, aspirations, hopes, and fears of the entire European population of South Africa. We only ask not to be made the cockpit of European dissensions.

You must understand that one of the most formidable problems that confronts these European populations is what is commonly called the "native question." Not to intrude my

individual opinions upon this question, I quote again from the latest and most thoughtful writer on South African affairs, who puts the matter in this way:—

"The question which lay at the root of the original separation of the Europeans in South Africa was the question of slavery. The same cause threatened to rend apart the United States of America, but there its operation was prevented, and the national unity was maintained at the cost of a civil war. The question has disappeared in this acute form, for, apart from the Conventions, no European community could venture to maintain an institution which has been condemned by the moral sense of the whole civilised world. But the question of the treatment of the natives, in the form of the admission or not of the coloured people to political and civil rights, still constitutes the main cause which tends to maintain the separation of the Dutch and British. In the Republics the coloured people are entirely excluded from political, and partially excluded from civil, rights. In the British Colonies the principle of political equality, irrespective of colour, is established. Nor is the significance of this difference affected by the fact that both in Natal and the Cape Colony limitations have been introduced to prevent the abuse of such privileges, for these limitations are the result of practical experience, and as such they commend themselves to all reasonable persons."

Thus the position stands—full charged with dangers and difficulties, and not to be solved by impetuosity, violence, or haste; on the other hand, not to be shirked, evaded, nor trifled with.

I do not feel that I can, at this time, add much of value to the discussion of the matters awaiting solution in South Africa. I have indicated the sources of information easily available to the student of South African affairs. I leave the Fates to unravel or cut the Gordian knot in which they are entangled.

Believe me,

Dear Professor WALLACE,

Yours faithfully,

HARRY S. CALDECOTT.

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(NORTHERN SECTION)
GENERAL MAP OF
SOUTH AFRICA
SHOWING
OROGRAPHICAL FEATURES
AND
AUTHOR'S ROUTE
Scale 1 2500000 or 39 4 English Miles to 1 Inch
Author's Route shown thus
BRITISH BECHUANALAND
VRYBURG
KURUMAN
TAUNG
BARKLY
GORDONIA
GRIQUALAND WEST
KIMBERLEY
HERBERT
JACOBSDAL
FAURESMITH
HOPETOWN
PRIESKA
PHILIPSTOWN
BRITSTOWN
BOSHOF
KENHART
NAMAQUA LAND
Great Namaqua Land
Little Namaqua Land
Bushman Land
ATLANTIC OCEAN
LICHTENBURG
PRETORIA
JOHANNESBURG
Mafeking
Lichtenburg
Rustenburg
Kimberley
Upington
Vryburg
Kuruman
Taungs
Hopetown
Prieskaa
Philipstown
Britstown
Port Nolloth
Springbok
Okiep
Kakamas
Keimoes
Kenhart
Reitfontein
Van Wyks Vlei
Brandvlei
Calvinia
Hondeklip Bay
Walvisch Bay
Riet Fontein
Mier
Gemsbok Fontein
Twee Rivieren
Molopo R.
Orange R.
Vaal R.
Hartes R.
Kuruman R.
Longitude East 24 of Greenwich

21st June
JOHANNESBURG
Rand Goldfields
HEIDELBERG
Heidelberg
POTCHEFSTROOM
Potchefstroom
Ventersdorp
LICHTENBURG
Vereeniging
Klerksdorp
Parijs
Vredefort
Reitzburg
High Veld
STANDERTON
Standerton
3rd July
Bethel
Ermelo
ERMELO
Amsterdam
Heilbron Road Sta.
HEILBRON
Heilbron
Villiersdorp
Frankfort
VREDE
Vrede
WAKKERSTROOM
Wakkerstroom
PIET RETIEF
Piet Retief
Derby
Paul Pieters Dorp
KROONSTAD
Kroonstad
Lindley
HOOPSTAD
Hoopstad
Ventersburg Road
Ventersburg
BETHLEHEM
Bethlehem
HARRISMITH
Harrismith
Volksrust
Charlestown
Majuba Hill
Laings Nek
UTRECHT
Utrecht
Newcastle
NEWCASTLE
VRYHEID
Vryheid
Dundee
Glencoe Junc.
O R A N G E   F R E E   S T A T E
Senekal
Winburg Road Sta.
WINBURG
Winburg
Brandfort
FICKSBURG
Ficksburg
KLIP RIVER
Ladysmith
Colenso
UMSINGA
NOUTU
NKANDHLA
ESHOWE
BLOEMFONTEIN
Bloemfontein
20th June
Thabanchu
MOROKA
Ladybrand
LADYBRAND
LERIBE
Maseru
Weenen
WEENEN
Estcourt
UMVOTI
Greytown
B A S U T O   L A N D
BEREA
THABA BOSIGO
Maluti or Double Mts.
Maluti Mts.
Drakens Berg
Quathlamba
Giants Castle
Champagne Castle
Mont aux Sources
Dewetsdorp
Reddersburg
Edenburg
Bethanie
Wepener
WEPENER
Mafeteng
N A T A L
LIONS RIVER
PIETERMARITZBURG
4th July
UMGENI
INANDA
LOWER TUGELA
Stanger
Verulam
Durban
6th July
DURBAN
Port Natal
INDIAN OCEAN
POLELA
Bulwer
Richmond
UPPER UMKOMANZI
IXOPO
Ixopo
ALEXANDRA
Scottsburg
UMZIMKULU
Umzimkulu
MATATIELA
Matatiela
Mt CURRIE
GRIQUALAND EAST
CALEDON RIVER
Smithfield
ROUXVILLE
Rouxville
Zastron
KORNET SPRUIT
QUTHING
Bethulie
BETHULIE
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Jagersfontein
Trompsburg
Orange R.
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REFFRENCE TO CONTOURS OF ALTITUDE
above 8000 feet
6000 to 8000 feet
4000 6000
3000 4000
2000 3000
1000 2000
under 1000 feet
SEA LEVEL
ATLANTIC OCEAN
CAPE COLONY
CARNARVON
FRASERBURG
CALVINIA
VAN RHYNS DORP
VICTORIA WEST
RICHMOND
HANOVER
MURRAYSBURG
GRAAFF REINET
CLANWILLIAM
SUTHERLAND
BEAUFORT WEST
ABERDEEN
PIQUETBERG
CERES
PRINCE ALBERT
JANSENVILLE
WILLOWMORE
MALMESBURY
WORCESTER
OUDTSHOORN
LADISMITH
UNIONDALE
CAPETOWN
ROBERTSON
GEORGE
KNYSNA
HUMANSDORP
SWELLENDAM
RIVERSDALE
CALEDON
BREDASDORP
TABLE BAY
CAPE TOWN
Cape of Good Hope
C. Agulhas
Longitude East 24 of Greenwich


[SOUTHERN SECTION]
GENERAL MAP OF
SOUTH AFRICA
SHOWING
OROGRAPHICAL FEATURES
AND
AUTHOR'S ROUTE
Scale 1 · 2,500,000 or 39·4 English Miles to 1 Inch
0 10 20 40 60 80 100
Author's Route shown thus
INDIAN OCEAN
GRIQUALAND
PONDOLAND
BRITISH KAFFRARIA
COLESBERG
HANOVER
RICHMOND
MIDDELBURG
STEYNSBURG
ALIWAL NORTH
HERSCHEL
FLETCHER
BIZANA
UMSIKABA
EAST
WEST
TABANKULU
MOUNT FRERE
MOUNT AYLIFF
ALFRED
KOKSTAD
MAXEBE
WODEHOUSE
ELLIOT
TSOLO
TIBODE
UMTATA
ENGCOBO
NGCELENI
MGANDULI
ELIOTDALE
WILLOWVALE
KENTANI
KOMGA
BUTTERWORTH
CATHCART
QUEENSTOWN
TARKA
GLEN GREY
STMARKS
CRADOCK
MURRAYSBURG
GRAAFF REINET
ABERDEEN
SOMERSET EAST
JANSENVILLE
WILLOWMORE
UITENHAGE
UMONDALE
HUMANSDORF
KNYSNA
ALBANY
BEADFORT
KING WILLIAMS TOWN
EAST LONDON
ALEXANDRIA
Port Elizabeth
Algoa Bay
Port St Johns
Port Grosvenor
Port Alfred
Bathurst
Grahamstown
Cape Town
Longitude East 24 of Greenwich

Photo. by Wilson, Aberdeen, N.B. PLATE I.—CAPE TOWN AND TABLE MOUNTAIN. *Face page* 1.

FARMING INDUSTRIES OF CAPE COLONY.

CHAPTER I.

OBSERVATIONS ON THE ROUTE IN THE WESTERN PROVINCE.

Cape Town and its Vicinity—Somerset West—The Cape Flats—Stellenbosch District—Boer Houses—Government Trout Hatchery at Jonkershoek—South African Streams—Nooitgedacht Nursery—Rustenburg and Schoongezigty—Proposed Experimental Stations—Paarl and Wellington Districts—Afrikander Custom—Position of Small Holdings—Caledon and Bredasdorp Districts—Sir Lowry's Pass—Wild Birds—Antelope—Swellendam, Robertson, and Worcester Districts—Montague—Hex River Pass—The Karoo—Matjesfontein—Cape Pheasants and Partridges—Aspect of the Karoo—The Nieuwe Veld—Beaufort West—De Aar and Britstown—Bushman Drawings—Caterpillars and Locusts—Kimberley District—Newlands Farm—Snakes—Secretary Bird and other Birds—The Meer-Kat—Oudtshoorn District—Zwaarte Berg Pass—Cango Caves—Irrigation—Railway Communication—Russian Jews—Koeberg and Malmesbury Districts—Manures.

Vicinity of Cape Town.

The author landed at Cape Town on 2nd May 1895, and left it on his return voyage on 11th September. The intervening period of over four months was devoted to a study of the agricultural resources of South Africa in general, but of Cape Colony in particular. As a map of the route taken, showing dates of arrival at the most important places, is attached, it will be unnecessary in referring to the various districts to mention in detail the places visited.

The first few days were spent in Cape Town, in making the acquaintance of members of Parliament (which was in

session at the time), and officials and others interested in agriculture. The first visits to districts near at hand were undertaken from Cape Town as a centre before the extended tour through the Colony was begun. That to Koeberg occurred at the end of the investigation.

Cape Town, with a population of about 50,000,* is only interesting from the agricultural point of view as an important market centre for the sale of farm produce. From it, however, one has not far to travel before reaching, in the famous Constantia wine district, much that is interesting and instructive to an agriculturist.

The **Botanic Garden** † has been well described as "one of the prettiest promenades in South Africa." It is more a **pleasure-resort** than a Botanic Garden properly so called, the site not having been judiciously chosen for the latter purpose. It has been in existence for about sixty-five years, and until it was taken over in January 1892 by the Municipal Authorities of Cape Town from the Board of Government Commissioners who controlled it there had been an incessant struggle, which absorbed the time and distracted the attention of those in charge from scientific botanical work, to make the enterprise a commercial success. The Government now contributes annually a sum of £500 towards its maintenance.

Although Cape Town in itself is somewhat bleak and wanting in arboricultural decorations, being swept by the terrible South-Easters, the elongated **suburban district** lying in the direction of Constantia, and beginning with the village of Mowbray, may be said to have developed, under the sheltering influences of Table Mountain, a grand avenue of trees and other vegetation so luxuriant, so varied, and at times so brilliant, that it would readily pass as semi-tropical.

Constantia, in which is situated the Government wine

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* The **population** of Cape Town, its suburban residential villages, and rural district, numbered in 1891, the year of the last census, 97,074—consisting of 48,381 whites, 1,332 aboriginal natives, and 47,361 others.

† The garden was well laid out by M'Gibbon, a Scottish gardener, who occupied the unenviable position of gardener for over thirty years. He was succeeded by Professor MacOwan, now the Government Botanist, and curator of the extensive and valuable Government Herbarium, who was for the last ten years of the old régime curator of the garden.

Photo. by Wilson, Aberdeen, N.B.

PLATE 2.—BOTANIC GARDENS, CAPE TOWN.

Face page 2.

PLATE 3.—TYPICAL DUTCH RESIDENCE OF THE BETTER CLASS. *Face page 3.*
A Flank of Table Mountain in the background.

farm described at page 138, is favoured by good fortune above most vine-growing areas in the Colony, as it has not yet suffered from the devastations of the phylloxera in the vineyards. The merits of the disintegrated granite **soil** of the locality for the production of wines of superior quality have been known for generations, and recent experiments have demonstrated that most of the common fruits, and table grapes for export, can also be grown to perfection.

Market gardening naturally finds an important place in the productive industries of the place, owing to the isolated position of Cape Town, and the limited amount of garden land within easy reach of the city.

At Rosebank, on the way back to town, is situated the **show ground** of the Western Province Agricultural Society, which was laid out in 1893 at a cost of five or six thousand pounds. The annual show to be held in this attractive and well-appointed centre ought to prove one of the best possible means for undermining the stolid indifference of a large section of the farming population to progressive agriculture.

A visit to Sir James Sivewright's estate of **Lourensford**, Somerset West, proved not only interesting but highly instructive in the matter of demonstrating what excellent results in orchard culture and landscape gardening money can produce under South African conditions.

On the way by train to Somerset West the barren wilderness of the **Cape Flats** is crossed, a worthless stretch of Rhenoster-bush country belonging geologically to the Flats Sandstones in the Tertiary formation, much of which being covered with drift sand, is liable, when cleared for cultivation, to blow into **sand dunes**, which shift their position, and form a menace to cultivation or to any property of value that may lie in their immediate neighbourhood. Here the soil is defective, and the **rainfall** abundant. So perverse is Nature at times in the distribution of her gifts, that up country, where the soil is of much better quality, the rainfall is deficient. A few stray specimens of **ostriches** are to be seen on these flats, but there is too much rain in winter, and the soil is too poor for them to thrive well.

Guinea fowl of a darker shade and more uniform colour than those generally seen in Great Britain are found in this

part of the country as well as in the Eastern Province, and are increasing in numbers since locusts became more numerous. They prefer those parts where the soil is good, and, being fond of acorns, are partial to the shelter of oak-trees, which grow very rapidly in that region of the Colony which is favoured by the fall of winter rains.*

Stellenbosch District.

Stellenbosch has been one of the chief wine-growing districts, and recently, since the phylloxera made its appearance, it is beginning to acquire a reputation for fruit. In addition to being a great **educational centre** for the Western

Photo. by Dr Hugo.
Lourensford, the Property of Sir James Sivewright, K.C.M.G., Somerset West.

Province (having the agricultural school, described in a later chapter, attached to the Victoria College, and a theological seminary as well), Stellenbosch is one of the most picturesque

* The **crowned guinea fowl**, *Numida coronata*, Gray, is widely distributed in Southern and Central Africa. It possesses no white feathers in the wings like the domesticated birds in Europe, and the general colour of its plumage is black thickly spotted all over with white. Guinea fowls feed much on berries and roots. They form good eating. A full-grown cock will weigh over 3 lbs. They roost on the branches of trees—by preference those overhanging water for the sake of safety from the wild cats. They are tame for wild birds, and are easily domesticated.

of South African Boer towns. The old Dutch style of **architecture**, uninjured by modern innovations, was at one time supreme. The ordinary colonial house consisted of one story and a garret, and was built of stone and lime. The walls, which were frequently whitewashed, carried a steep roof thickly and uniformly thatched with reeds or rushes, and the gable ends rose well above the thatch. To make a useful general purpose store, and to render the floor of the loft fire-proof, so that the thatch might burn and the dwelling below

A Peep at the Drive to Lourensford. *Photo. by Dr Hugo.*
An *Agave* or American Aloe is seen in the foreground to the right.

remain intact, a covering of brick and clay was laid over the lining of reeds forming the under surface of the floor. So strong and well seasoned were the beams used by the early inhabitants, that many are still to be seen in different parts of the country in a good state of preservation after the lapse of 250 years.

The **roofs** of many Boer houses in the drier regions of the Colony are flat and almost level. They are covered

with clay and a layer of "brak" earth* spread on the top on account of its well-known property of keeping the rain from penetrating. The edges are raised a few inches above the general level to act as shields from the wind, which would be liable to displace unprotected loose soil; and spouts are introduced at intervals to allow the rain-water to escape.

Many **fires** have occurred in Stellenbosch, and some were said to have been **incendiary fires**, lit by certain coloured people of a vicious type to increase the amount of labour in the place. This has led to the disappearance of many of the old Dutch thatch roofs, and to the substitution, on the plea of greater safety, of probably the least artistic of all possible coverings, corrugated galvanised iron. Even this degradation could not completely neutralise the natural beauty of Stellenbosch, with its broad and regularly laid out streets lined with boulevards of oak-trees, and watered by a network of irrigation channels.

The Government **trout hatchery** at Jonkershoek is situated on the Eerste River (the first river from the mountains emptying into False Bay), from which the water supply of Stellenbosch is taken. Complaint was made that the water was polluted by the fish. If this has been so in the past, there is no necessity for any such pollution in future. Fish exist in large numbers in rivers from which good and pure water supplies are taken in this country, and act more as scavengers of streams than otherwise. Fish kept under control need not pollute a running stream any more than those living under natural conditions. The stagnant water from a pool requiring to be cleaned could be run over a piece of land like irrigation water, and thereby filtered and made sweet and pure. If the area were large enough, none need find its way back into the stream, but remain until removed by evaporation.

In view of the existence of many beautiful pebbly but troutless streams flowing to the sea along the southern coast, a visit to the hatchery ought to be a source of genuine interest to all who claim to possess a share of the sporting proclivities which are associated with the name of Izaac Walton.

* Earth charged with excess of soda and other salts, brought up in solution to the surface by capillary action and left there, as the water escapes by means of evaporation.

PLATE 4.—TYPICAL BOER FARMHOUSE,
Thatched and Whitewashed—the "Stoep" or elevation in front where people lounge in the evenings.

Face page 6.

J. L. Scott, the **overseer** in charge, was trained in an excellent school, viz., the Solway Fishery in the South of Scotland; and the hatchery appliances, so far as completed, are of the most recent and most approved pattern. Glass grilles are used (in place of those made of zinc) to hold the eggs, like trays, so that when the proper time comes the young fish fall through or get carried over the sides. The **ova** take about eighty days to hatch; but after forty days, when the eyes develop, the ova may be moved and washed. The **water** used must be scrupulously clean, and to secure this it is passed through a flannel filter with four screens, in addition to a settling tank outside. Three concrete **tanks**, four feet each way, fed by water from a large settling tank, are kept for "full" fish. A number of year-old fish, some of them ½ lb. in weight, were seen feeding greedily on chopped liver and lungs and clotted blood. In another pool, two- and three-year-old fish, of 4 lbs. and 5 lbs. weight, were kept apart. During the season it was expected that 200,000 fish would be hatched, and a possible 600,000 may be reached when the hatchery is completed. **Spawning** occurred in July and August, some fish only a year old producing eggs. In Scotland the spawning season extends from the 14th of October till about Christmas. The best variety was the red-fleshed **Loch Leven trout**, but the common yellow Scottish burn-trout were also well represented.

South African streams, which do not dry up periodically, are not absolutely without **fish**, as they swarm with the fry of the "springer," a freshwater mullet. Up on the Karoo, where water is at times to be found passing along underground channels,—fissures or "aars" in the rock,—**blind fish** have repeatedly been found. This may be regarded not only as an indication of extensive water channels under the surface, but also that they have been in existence for a very long period of time.

One of the most interesting object-lessons in this district was to be seen on **Nooitgedacht**—a large mixed wine and corn farm with about thirty acres of **nursery** garden—five miles to the north of Stellenbosch. The nursery had been established by the Pioneer Fruit Company in anticipation of the demand for fruit-trees resulting from the destruc-

tion of the vines in the district by the phylloxera. The **soil** of the district being deficient in lime, is more suitable for the growth of fruit-trees or of American vines than of European vines. Apart from a large collection of fruit-trees which had been introduced from Europe and California, the most interesting feature was the wonderful influence of **thorough cultivation** on the soil. Land which had been broken in from a condition as hard and as unsuitable for plant growth as a turnpike road, was kept by frequent cultivation in a beautiful state of tilth, and made to grow plants in splendid condition without the application of irrigation water.

As models of public-spirited private enterprise, two contiguous farms — **Rustenburg**, belonging to Sir Jacob Barry, and **Schoongezigty**, the property of the Hon. J. X. Merriman—must be mentioned. In the management there was a happy combination of new and progressive ideas toned down by a wealth of colonial experience. **Butter and fresh cream** of excellent quality and in perfect condition were put up and sent to the Cape Town market. To illustrate, among other things, how very difficult it is to drag people out of old grooves to which they have been for some time accustomed, although Cape Town stood much in need of large supplies of similar produce if it were only to be had, so unapproachable were the consumers that for the time being the possible limits of the little industry were soon felt. **Fruit-tree planting** was going on apace, and the minor wants of the country in products like **sweet violets** and **tomatoes** were being attended to—as many as seven tons of first quality fruit being marketed from one acre.

Before Stellenbosch was left, **G. du Toit's farm**, which it was once proposed Government should buy for an **experimental station**, was visited. It was found in a very bad state from weeds and neglected cultivation, and the opinion was readily formed that it is not suitable for an experimental farm even if it were expedient for Government to acquire one. The land lies very level and low, and forms a typical place for the development of rust in wheat. £4,000 was said to be the price asked for about 150 acres, and £2 000 more would be required to put the holding in repair. In addition to this, an annual expenditure of over £1,000 to meet the deficit in

the accounts of an experimental station under Government management would no doubt prove to be a minimum estimate.

Frank Myburgh's farm, of **Elsenburgh**, near Mulder's Vlei Station,—1000 acres in extent,—was also examined, on account of a proposal that the Government should become the purchaser. It was interesting from the point of view that the imagination filling up the blanks could paint a place of much rough country grandeur and prosperity in the old slave days. The mansion and numerous ornamental buildings about were built by slaves as long ago as 1761, and a vine which was planted at the time still covers the courtyard and bears grapes. One hundred slaves were at one time retained and supported on the place. Now fifteen "Cape boys"—the name applied to the "off colour" labourer irrespective of age—are all the men employed regularly. Why the Government should purchase a farm at all, or why it is usually proposed that it should invest in a property which would involve the expenditure of a large sum of money to put it in repair, and a large sum of money annually to keep it up, are questions which to understand would involve much patient study and research.

Paarl and Wellington Districts.

Paarl, stretching for seven miles along the foot of a mountain, and beautified for a considerable distance with a central avenue of well-grown fir-trees, is one of the most attractive and most uncommon of Western Province towns. It is the centre of a decaying wine industry and a developing fruit trade. The Government have here a nursery for phylloxera-proof American vine stock, described in Chapter VIII.

The **Wellington district** next visited, and now specially noted for apricots, is by nature well adapted to fruit growing.

A delightful **Afrikander custom** (for those whose digestions are robust enough to endure the treatment) was here first experienced, viz., the offer to a visitor, during the forenoon, of a cup of tea, with a liberal supply, placed in his saucer, of some beautifully preserved home-made *confyt*, manufactured by the females of the establishment from orange, lemon, shaddock, or almost any kind of fruit. The jam

and preserve factories are now attempting to produce it, but they can hardly emulate the skill displayed by the Boer housewives, whose recipes have been handed down in their families for many generations.

The wild **olive** grows freely on the rising ground not capable of cultivation, and **oranges** grew in great profusion on the richer soils until a large number of the trees were destroyed by the dorthesia. Some very fine alluvial soils and some very poor decaying granites are to be found.

While excellent orchard practice may be seen, some of the poorest and most neglected of **small holdings**, with six or eight acres of vines and a few fruit-trees, are too much in evidence. Most farms are **mortgaged**, but exorbitant rates of interest are not charged. Private individuals getting good security are satisfied with six per cent., while banks generally exact seven or eight per cent. Mortgages were much increased about ten years ago, when the price of wine fell very low. The staying power of the small Afrikander farmer in such a district as this is quite astonishing. While many continue long on the verge of insolvency, few become bankrupt. Their **food** is simple and inexpensive, consisting largely of coarse bread and treacle (made by boiling grape juice till it is reduced to one-third of its original volume) supplemented by pickled fish, which is very cheap.

Caledon and Bredasdorp Districts.

The **extended tour** in the interior of the Colony was **begun** on 21st May, and the first short stage was by rail to Somerset West, and thereafter by Cape cart through the Sir Lowry's Pass into the Caledon district, and thence to Napier and Bredasdorp through the Ruggens and the districts of Swellendam, Robertson, and Worcester.

The grandeur of **the pass** is in marked contrast, in the matter of interest, to the extreme poverty of the scanty covering of **soil** on the sandstone hills surrounding it, and the sparse and uninteresting vegetation which there maintains a miserable existence. As the lower level is reached on the other side, the Lower Devonian (Table Mountain) sandstone gives place to a shaly or clay rock, belonging to the Lower Silurian or so-called **Malmesbury beds**, and the **soil** improves,

although it could not be classed as of good quality. A reference to the **geological map** will show that the journey for a considerable distance was made through country belonging to this formation.

Aspinall, the landlord at **Houwhoek**, had, with marked success, during three years used as **manure** on this soil considerable quantities of Thomas's phosphate **slag** powder. The price in England of the last consignment of 50 tons had been £2. 10s., but the gross cost when delivered on the farm mounted up to £4. 10s. per ton. **Guano**, which had formerly been used, was quite discarded for the slag.

Caledon is a large wheat-growing area, but its development is retarded by defective means of transport. **A railway** was being agitated for, and is certainly needed if the district is to be cultivated at all. It may be an extensive, but it never can be a truly great grain-growing district. The soil is not rich enough, and it is not there in sufficient quantity (often being less than one foot in depth to the hard dense clay), to enable this claim to be fairly made on its behalf. Good **arable land** in the district is **worth** about 25s. per morgen (rather over two acres), but no one will sell for less than about £3 per morgen, unless he happens to come to grief financially. The **yield** of **wheat** is about twelve to fifteen fold under favourable circumstances, but the crops suffer severely from **rust**. The practice, fully described under rotations of crops, is to crop the land with grain for a few years, and when exhausted to let it lie out for four or five years to rest. This is probably the best system of management to adopt under existing circumstances. The soil is not one to which either lucerne or turnips would take kindly. The great misfortune about it is that while it lies out resting it grows little but Rhenosterbush, and is practically worthless for feeding the sheep and Boer goats which graze in considerable numbers on the adjoining extensive areas of half "sweet" and half "sour" veld* which have never been broken by the plough.

The country is slightly **undulating**, bleak, and **treeless**, although both oaks and pines would no doubt pay for planting if there were prospects of means being provided for getting

* The terms "sweet" and "sour" veld are explained at page 81.

the produce when ready to market. A few belts of plantation would be a boon as shelter for stock where shelter is much required at times. Government has been with advantage offering encouragement for planting on similar terms to those offered in the United States of America.

Wild birds are naturally more plentiful in this grain-growing district than if it were devoted entirely to stock. Turtle-doves are numerous, also bush-doves (which strongly resemble wood-pigeons in everything but colour), and plovers, which the Boers call "keeweets"—a name probably given, like the Scottish "peeweet," in imitation of the well-known call of the green plover. Among the **small birds**, larks, sparrows, and the little green South African canary are conspicuous. The Bredasdorp district is further noted for a local variety of the Blesbok **antelope**, called the "Bontebok," of which the chief distinction is that the white about the tail extends above it in the case of the latter variety. A very fine specimen, shot at the time by **F. C. Selous** on the property of Piet Van der Byl, weighed 200 lbs. Rhebok exist in numbers to afford good sport in the season.

Swellendam, Robertson, and Worcester Districts.

The country traversed from **Swellendam to Worcester** was of quite a different nature from that of the districts last described, a fact probably due to some extent to an admixture in the soil of *débris* from certain richer beds of the Devonian or Table Mountain sandstone rocks which rise along the course indicated, and form a **range of mountains**, the foot-hills of which may be described as a rich rolling country capable of growing fruit or any ordinary farm crop. Much soil is red in colour, and abundance of water might be caught on the mountains for **irrigation** purposes, but the locality is not one which absolutely requires irrigation water every year, and in conformity with the preponderating influence of the hopeful side of human nature, little preparation is made against an evil day, the time of whose coming is uncertain, and natural possibilities have not been taken advantage of. The southern slopes of the mountains are green and fertile, but on the north side they are rugged and barren.

A few **ostriches** are kept, but it is not a great ostrich

J. Meiring.

PLATE 5.—MOUNTAIN SCENERY, WORCESTER.
Characteristic low bush veld in the foreground.

Face page 12.

country. Numerous **herons** are to be seen, and also a small bustard, the **knorhaan** (scolding-cock),* *Eupodotis afra*, Lay., which is numerously represented and widely distributed through the Colony, and is regarded as one of the South African game birds, though not of the first rank. The "**hammerkop**," or hammer-head, or tufted umbre, *Scopus umbretta*, is another bird of a dull brown colour seen in this and in other districts, which builds an immense nest, in which, like a magpie, it stores lost articles which it picks up. It is a typical African bird, and the sole representative of its family, generally frequenting places where water is found in search of frogs and small fish, of which it is fond. It is harmless, and, though somewhat solitary in its habits, rather tame and domestic for a large wild bird.

Montague is a picturesque village, hemmed in on all sides by mountains, so that it can only be approached by a narrow water-worn gorge or pass five miles long, and rugged and grand in appearance. As the chief industry of the place is the production of **brandy**, its prosperity has not been so great recently as it was a few years ago.

Worcester stands near the northern extremity of a considerable plain on which little cultivation is practised. A portion of the surface is covered by gravel, which appears to have been washed down from the mountains during flood times, but the great drawback to the extension of cultivation is the system of **commonage** under which the village cattle graze and occupy the land which might have been utilised in vastly increasing the importance of Worcester as an agricultural centre. It is in the power of the local authority to let certain areas for cultivation, but such a tenure is necessarily uncertain, and difficulties arise owing to the power to let resting in the hands of those who are personally interested in maintaining the advantages of having the pasture for the village cattle near at hand.

On the way by rail from Worcester to Matjesfontein, the next halting-place, an interesting geological feature, the **Hex River Pass**, was traversed, and by this a steep and rugged way was found through the first range of mountains to the

* The common name is derived from his cry, which "is like a shrill-voiced woman's nagging heard afar, so that the words are not intelligible."

elevated plateau of the Karoo, 3,000 feet above sea-level. The lower valley is decidedly rich from the agricultural point of view, and there the Cape Orchard Company have established a large **fruit farm**, on which 150,000 orchard trees of the best varieties for producing fruit for the London market have been planted, and are beginning to come into bearing.

The Karoo.

J. Douglas Logan's place at **Matjesfontein** is like an oasis in the desert. The rainfall there is so scanty that nothing but Karoo bushes would grow without artificial watering. **Water** is got for railway requirements and for

Photo. by Dr Hugo.

Glen Heatlie, Residence of the Hon. T. T. Heatlie, near Worcester.

irrigation from springs not far distant on the Karoo. **Fruit** and **forest trees** of many varieties have been growing for three or four years, and now, in combination with the tasteful floral cultivation of the place, make the desert actually blossom like the rose. But the conditions do not impress one with the idea of permanency unless under a system of constant renewal. The soil is very shallow, and the Boer method of irrigation (subsequently described) being adopted, the concomitant evils of brak soil and canker at the roots of the trees begin to show themselves. The death of a number of **fir-trees** was locally thought to be caused by the roots

PLATE 6.—VIEW AT J. D. LOGAN'S PLACE AT MATJESFONTEIN. *Face page* 14.

touching the hard rock underlying the shallow soil, and the cankered condition of the lower bark of some of the fruit trees to the presence of lime in the soil.

The existence of a water-dam (filled by a windmill pump) accounted for the appearance of coveys of **Cape Pheasants**, which only live near water. These are dark grey birds with red legs, in shape more like small guinea-fowl than the British game bird.* The common **Cape Partridge** resembles the English bird, but it is smaller in size. It may be found anywhere near to or far from water.†

The **aspect of the country** on the way by rail to Beaufort West, through the "Gouph" or hollow of the Karoo, is at the season referred to desert-like and uninteresting in the extreme, with hardly a tree to be seen, and only a scanty covering of dwarfish and closely-eaten Karoo bushes to represent vegetation. A platelayer's cottage every five miles, and gangs of five men (one per mile of railway), each with a ganger, are about the only indications that the surrounding wilds are not entirely removed from the pale of civilisation. The **soil** is very shallow, except in the hollows or along the

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* No true **pheasant** and no true **partridge** is found in Africa. The **guinea-fowl** is the South African bird most nearly related to the pheasant. Several species of **francolins** belonging to the same family, *Phasianidæ*, are known as pheasants. The two most commonly so-called are (1) the noisy **Cape francolin**, *F. capensis*, Steph., easily recognised among the various species by its large size; and (2) *F. nudicollis*, Bodd., the **red-necked francolin**, a bird partial to forest districts like George and Knysna, where it replaces capensis, which it resembles in all its habits. The pheasant of the Matabele-land colonist is **Swainson's bare-throated francolin**, *Pternistes swainsoni*, Smith, a powerful and coarse-looking bird of an umber-brown colour finely dotted with black. Another francolin, called the **red-wing**, *F. levaillanti*, Valenç., is very generally distributed throughout Cape Colony, the Orange Free State, the Transvaal, and Natal. All these birds prefer to **escape** by fleetness of foot rather than by flight. They **feed largely** on the roots of grasses and other plants, including small bulbs, which they scrape up, but they also eat seeds, berries, and insects.

† The **grey-winged francolin**, *Francolinus africanus*, Steph., is the so-called **Cape partridge**, a bird which is very widely distributed in Cape Colony and the more northern regions of South Africa. It is a "high-ground bird," but not confined to mountain regions. It possesses a hooked bill, which is useful in digging up bulbs and insects on which it feeds.

banks of the rivers (at this season only dry channels), having been washed away by the heavy thunder rains of summer. **Brak** or salt may be seen in hollow places, where it naturally rises readily—the result of the combined action of capillarity in the soil and free evaporation from its surface.

In some places **lime** has come up to the surface by the same agencies through the shattered rock, much of the latter being basaltic and columnar in structure. The **surface** is not by any means level or plain-like, being generally uneven and rugged, rough, and stony in places.

The **Nieuwe Veld** is a higher plateau running west from near Beaufort West to Fraserburg, and north nearly to Victoria West. The southern and eastern edges of this table-land, as seen from the railway, resemble flat-topped hills. The species of bushes which grow on the Karoo veld are nearly all aromatic, and the best of them specially suited as food for sheep, while on the Nieuwe Veld aromatic bushes are mostly absent, and cattle and horses do better.

Beaufort West is situated in a grazing district, but an interesting experiment in cultivation under a system of **irrigation** from a large dam* adds an additional interest to the place. A number of **small holders** of morgen (two-acre) lots do very well, growing a succession of farm crops and vegetables.

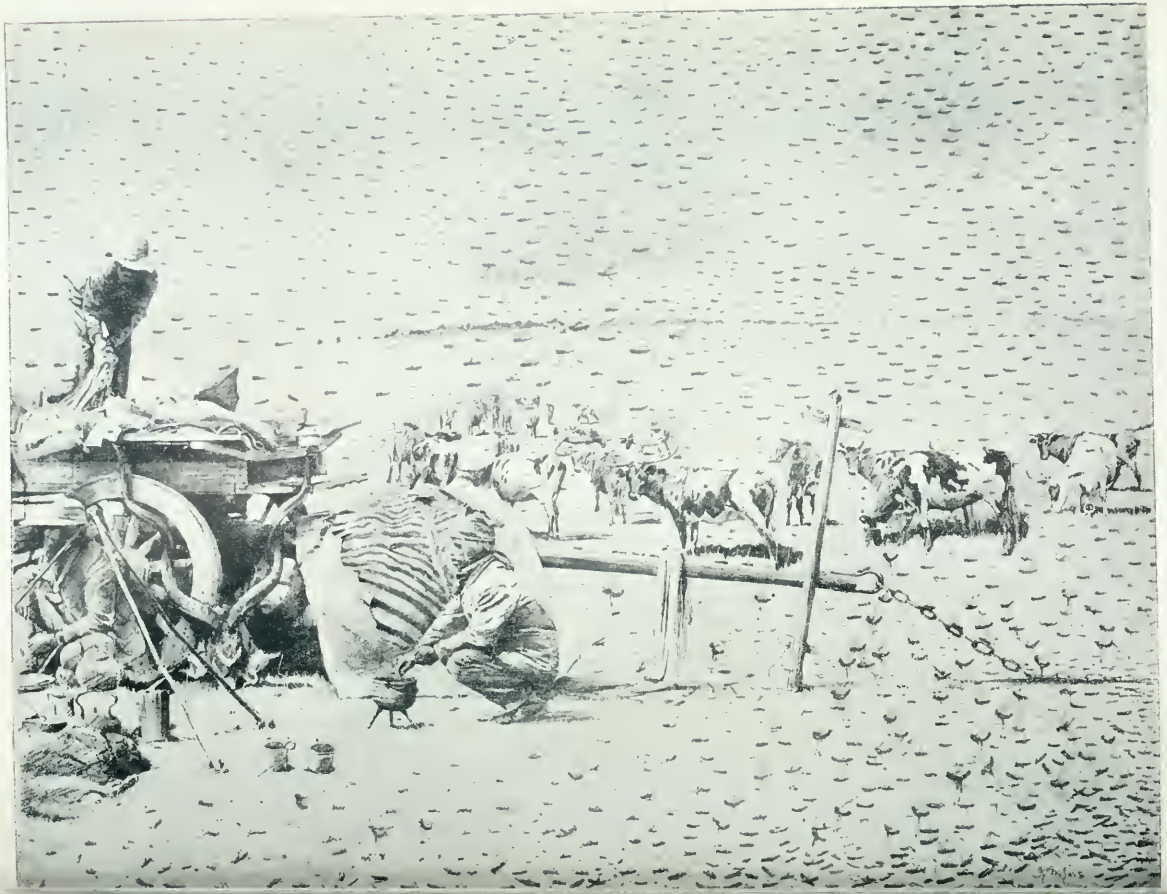
Oaks do not thrive in the district owing to the presence of brak in the soil, but Robinias and pear-trees do well, the main street in Beaufort West (extending to a mile in length) being lined on each side by a row of pears. A stretch of rich **alluvial plain**, nearly twenty miles in length, lies to the north-east of Beaufort West in the direction of Nels Poort, where the surface rises and becomes more rugged and like the western part of the plateau of the Great Karoo traversed, but the **soil**, as one goes north, although still shallow in many places, has not been so much washed away. In some parts it is deep and of good quality, and there is no lack of lime.

The country to the west of **De Aar** (the junction on the Kimberley Railway line for the Eastern Province and the Transvaal) is genuine sweet Karoo, forming excellent pasture for sheep, goats, and ostriches. The two most important

* Described in the chapter on irrigation.

PLATE 7.—SCHILDERSPAN, JACKSON'S FARM, ON THE KAROO NEAR BRITSTOWN.

Face page 16.



places visited were the property of the Smartt Syndicate near **Britstown**, and Jackson's farm, **Schilderspan**, a good day's journey farther in the direction of Prieska. Most of the limited work of crop growing now practised is done under **irrigation**; but, as will be explained later, both dry-land cultivation and irrigation might be considerably extended. The **soil** is not too heavy for irrigation purposes, being light, and even liable to blow in places; but as **brak** already appears in some parts, the amount of water will require to be skilfully regulated. At Tygerpoort, the site of an important irrigation scheme, a very fine assortment of **Bushman drawings** may be seen,—the figures having been chipped out, by probably a hard piece of stone, on the smooth and polished surfaces of the basaltic boulders covering the sides of the Bushman's Kopje. One easily recognised the outlines of a bushman, baboon, horse, lion, tiger, elephant, rhinoceros, hippopotamus, buffalo, eland, koodoo, wildebeest, porcupine, and snake. The fact that a horse with a bushy tail is among the figures brings the date of these rude works of art down till after the importation of horses by the early settlers. It is interesting to notice that no attempt to portray a **bird** has been made, although water-fowl are plentiful in the vleis and other wild birds elsewhere in the district. (See Appendix A.)

Some parts of the veld had a few months before been eaten quite bare by vast numbers of black **caterpillars** (rispers), ½ inch to 1½ inch in length, the larvæ of a drab or cream-coloured **moth**. The only personal experience of a swarm of destructive **locusts** was made while driving from Britstown to De Aar. The swarm was not massed in close order, and the locusts flew about in numbers sufficient to remind one of a fall of broad flakes of snow.

Kimberley District.

The **geological formation** being the same all the way from Matjesfontein to Kimberley—viz., the Lower Karoo or Ecca beds—accounts in a great measure for the similarity of the **soil**, as seen on the course taken through the central parts of the Karoo country.

Round Kimberley, and for miles in a north-eastern direction, much of the **soil** is **brick-red** in appearance, a warmer

and brighter colour than the dull brown of the Karoo soils; nevertheless, the colour is far from being appreciated, when, during the frequent dust-storms from which both Kimberley and Johannesburg periodically suffer, everything becomes covered with red gritty powder.

The red soil is rich in quality, and is characterised by an abundant growth of grass (the Karoo bush having disappeared), the "**Kameel-doorn**," *Acacia giraffæ*, the largest of the Cape acacias, and a **poisonous bulb**, *Ornithoglossum glaucum*, Sal., which is known by the local name of "Slang-kop." * Lying to the north of Kimberley is a great **alluvial plain**, which, like many similar plains in the Colony, once formed the bed of an ancient lake. In this instance, when the water escaped it must have discharged into the Orange River.

The De Beers **Horse-breeding Farm**, and something of the grazing qualities of the district near Kimberley, 4,000 feet above sea-level, are described in Chapter XV.

The Orchard of 45 acres of fruit-trees, also belonging to the same Company, is another feature of interest. All the common fruits do well, with the exception of custard-apples, loquats, and oranges. There the trees are pruned in the most approved fashion, and irrigated according to a scientific principle.

Perhaps the largest private property examined in the Colony was George Paton's farm of **Newlands**, situated fifty miles north-west of Kimberley, and extending to about 50,000 acres of well-selected grazing veld. This part of the country is much better adapted for cattle than for sheep, and some 4,000 of the former and only 400 of the latter were kept. **The dairy**, fitted with modern British appliances, including refrigerating plant worked by the ammonia process, was a recent successful development. About 100 lbs. of butter were made daily, salted (½ oz. to the pound of butter), and sold in Kimberley at 2s. 6d. per lb. Until the refrigerating plant was secured, the great difficulties to contend with in manufacturing the dairy produce were the high temperature of the well-water supply, which registered 72° F., and the great heat of summer.

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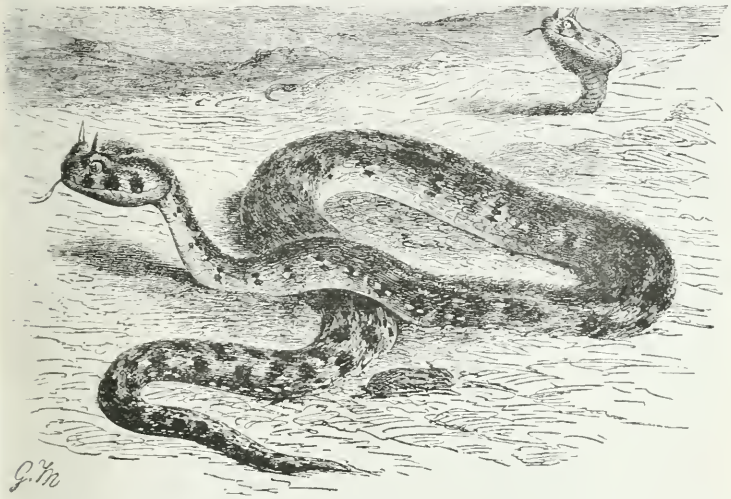
* See page 96.

PLATE 9.—ENTRANCE TO ZWAARTE BERG PASS GOING FROM THE NORTH.

Face page 18.

The height above sea-level is 3,400 feet, and the average rainfall for ten years amounted to 19.55 inches, which mostly fell during the summer months—November to April inclusive. Strong **winds** blow in the latter part of September and in October, bringing up the summer rains from the sea. Crops grow very well under **irrigation**, but only limited areas can be satisfactorily cultivated, owing to the small amount of irrigation water.

Lime is abundant in the soil, and, contrary to the general belief, though this is the case **snakes** are numerous—the deadly puff-adder, and the *Cerastes* or "Hornsman" snake, by the



CERASTES OR HORNED VIPERS IN THE SAND. $\frac{2}{3}$ths Nat. Size.
From the Royal Natural History.

bite of which Cleopatra committed suicide. The horn-like appendages* of this snake come out immediately over the eye, like the horns of the little "shangaan" or Livingstone antelope.

Of birds that had not been previously observed, the **secretary bird**, which was recently reported in a sporting British newspaper as extinct, was decidedly the most conspicuous. It

* These are curiously modified and enormously enlarged scales, which are shed in the process of desquamation.

is still present in considerable numbers in the Colony, and widely distributed, being seen near to Port Elizabeth, and also to the north of Kimberley. It is rarely molested, being looked upon by people generally as a friend. It lives on snakes, lizards, insects, and in fact on any living and moving thing which it can find as it stalks majestically over the veld on legs which in length resemble those of the modern game-fowl. (See Plate 42.)

The **horse-shoe plover**, named from a marking on its neck, is a small bird which practises the interesting custom of repeatedly jumping upon pats of hard cow-dung to disturb the beetles sheltering underneath. These it very quickly devours as they try to make good their escape. Like the plover, the **sand-grouse** or Namaqualand partridge is numerous in the veld. This is said to belong to the same species as the birds which came from Persia to England a few years ago. The **meer-kat**, *Suricata tetradactyla*, of the Colony is wonderfully like the prairie-dog of the Western States of America. They are about the same size, they both take shelter in holes on the open level ground, and sit up on their buttocks by way of elevating themselves to command a longer range of view, but the meer-kat has a long bushy tail, which is wanting in the prairie-dog.

Oudtshoorn District.

After completing the tour of the Eastern Province, the author made an interesting and instructive detour from the main line of railway at Prince Albert Road Station, with the object of seeing the **Oudtshoorn district**, and of returning to Cape Town by way of Mossel Bay. The first part of the journey to Prince Albert lay through the plateau of the Great Karoo, which does not differ in general appearance from the Karoo country already described.

The range of mountains which separates the Karoo from the bush country, lying at a lower level to the south, was crossed by way of the **Zwaarte Berg Pass**, which displays some of the grandest illustrations of stratified rock contortions to be seen in any part of the world.

The mountains close by also contain another marvellously

PLATE 10.—TRANSPORT OX-WAGGONS APPROACHING THE ZWAARTE BERG PASS.

Face page 20.

Photo. by Percy Ashenden, A.M.I.C.E. PLATE 11.—MODERN DUTCH FARMHOUSE NEAR OUDTSHOORN. *Face page* 21.
The elevated Platform or "Stoep" on which people rest seen in front.

interesting feature, from the geological point of view, in the world-famed **Cango Caves**, which no visitor to Cape Colony should fail to see.

The site of the great **irrigation scheme** which Government is asked to carry out was examined, and is described in a succeeding chapter on irrigation.

Little wonder that extended irrigation should be looked upon by the people of Oudtshoorn as an additional blessing which the Government might be induced to confer upon them, as the prosperity of the community is largely due to the success of the association of lucerne growing and ostrich farming, which has been made possible by irrigation. Tobacco is one of the minor products grown in the district; but this and the ostrich and lucerne farming are discussed at length in future chapters.

The two desiderata which this prosperous district requires are (1) **railway** communication to convey produce to market; and (2) some effective means of exposing and combating the usurious practices of feather pedlars, frequently German, Polish, or Russian **Jews** of a low type, who swarm about the country as feather buyers. Their method of working is to bewilder the ignorant and imperfectly educated farmers by offering them ready cash, of which they often stand much in need. They buy the feathers on the ostriches months before they are ready to pull, and advance a part or the whole of the price, for which they accept a bill bearing interest at 5 per cent., but not 5 per cent. per annum, as the ignorant people believe, but 5 per cent. (or 1s. per pound) per month—60 per cent. per annum! They not only secure the exorbitant interest, but have security for the money advanced in the feathers they purchase. Another trick they play on isolated people living in a country place is to send relays of buyers, and offer, one after the other, sums much below the market value of the feathers—probably immediately after a sudden rise in the market has taken place. After three or four buyers have offered probably 30 per cent. less than the real value, one man is instructed to offer 5 per cent. more than the highest of the previous offerers, and he thus secures the purchase at 25 per cent. below its market value, and the rogues divide the plunder among them.

Koeberg and Malmesbury Districts.

A short visit was made to the **Koeberg district**, an important grain-growing area lying thirty miles to the north of Cape Town. **The soil**, like that of the grain-growing district of Caledon, is on the Silurian beds, but here there have been granitic intrusions in the geological strata, which probably account to some extent for the soil being very different in character from that of Caledon. The Koeberg soil is shallow, a foot being considered a good depth, and very stiff and heavy to work. In the **Tygerberg district** it is more open, and the crops come earlier to harvest, although sown at the same time as the crops in Koeberg. All the surface except stony places is fit to plough, but the depth to which the plough goes is usually not more than four or five inches. It is found more satisfactory to plough in the seed in the hard soil than to trust to covering it with a harrow. The reddish soil forming the tops of the low rounded hills is of better quality than the brown soil of the hollows. The soil cannot be said to be exhausted, although the growing power is now not so good as it used to be thirty years ago. At one time it grew six or seven grain crops in succession; now only two can be satisfactorily grown without a rest. Land now lies out two or three years. Better results would be got if it were left five years, but the farms are so small that the land cannot be left vacant so long. In this district, under existing conditions, no farm should be less than 1,000 acres in extent. There is no possibility of irrigation, and a good rotation of crops is impracticable, as grass disappears in summer. **Guano** has been found to lead to the exhaustion of the soil; but farmers, although they do apply manure to certain crops, are not skilled in the selection of the most suitable manures, and fall into the dangerous and expensive practice of buying mixed corn manure, for which they pay £8 per ton. Owing to high winds, difficulty is experienced in getting concentrated manures uniformly spread over the ground.

The **Malmesbury grain producing district** lying to the north of Koeberg is very much like it, but not quite so good. The farms are larger, the land lies out for four years, and greater numbers of sheep and cattle are kept.

CHAPTER II.

OBSERVATIONS ON THE ROUTE IN THE FREE STATE, TRANSVAAL, NATAL, AND THE EASTERN PROVINCE OF CAPE COLONY.

Journey made North of Cape Colony—Surface Appearances of the Orange Free State—Surface Appearances of the South African Republic—Trees near Johannesburg—Basuto Land—Irene Model Farm—A Whirlwind—Farm Crops—Value of Land—Coach Journey, Johannesburg to Standerton—Appearance of the Country—Natal—East London—German Settlers—The Queen's Park—Port Elizabeth—Kragga Kama—Uitenhage—Grahamstown—Albany and Bathurst—Market-Gardening and Fruit-Growing—Poultry—Cook-house—Somerset East—Bedford—Dairying—Winter Food for Cows—Fort Beaufort, Stockenstrom, and Victoria East—Tobacco—Lovedale Mission Station—Cradock—Middelburg and Steynsburg—Irrigation—Albert and Wodehouse—Halse Brothers' Farm, Carnarvon—Tennyson Settlement—High Grass Veld—Burghersdorp—Spreos—Parson Crows—Aliwal North and Barkley East—Five Days' Drive into New England—Queenstown—Winter Food—Cathcart, Stutterheim, and King William's Town—Forest Station—Kei Road—German Settlers and their Difficulties—Government Aid Necessary.

BEFORE beginning his tour of investigation in the Eastern Province, the author made a **run** through the Orange Free State and the Transvaal as far as **Johannesburg** and **Pretoria**, and returned by way of **Natal**, taking steamer at Durban for Port Elizabeth, and calling at East London in passing.

After crossing the Orange River and entering **the Free State**, the character of the surface rapidly changes from a Karoo-bush to a grass country, although both are at first on the same geological formation; and so far as appearance goes there is little difference all the way through the South African Republic to Johannesburg.

The **grass** consists largely of the valuable rooi-grass which was observed to predominate in the grass-veld near Kimberley. At first the formation is rugged and full of

kopjes, but it soon opens into **extensive plains**, on which large numbers of cattle, sheep, and horses are found grazing. One of the finest of these is seen by day from the mail train, extending almost from Bloemfontein, the capital of the Orange Free State, to Winburg Road.

The farms are well **fenced** with wire, on the "Coerimony"* principle, supported by wooden or sometimes stone posts placed thirty feet apart, and bound by five double ties between each pair of posts. The plains are dotted with numerous **ant-hills**.

The **soil** is of a light alluvial nature, deeper than in the Colony, and it works into sandy heavy roads under the wheels of the ox-waggons. Near Johannesburg it becomes still deeper, and is of a bright red colour. It is very sandy, and rises with strong winds into disagreeable dust-storms. Crops grow without irrigation, but the soil is poor, and has little staying power unless manure be applied.

Trees grow in a marvellous way, but this is not to be wondered at, as their roots can readily penetrate to a good depth, and they require so very little from the soil as compared with a succession of crops. Millions of the Australian "blue-gum" or "fever-tree," *Eucalyptus globulus*, Labill., have been planted within a few miles of Johannesburg, in the belief that wood would be required in large quantities for the mines. These have grown very rapidly, but the deep levels, consisting of very hard rock, are said not to require nearly so much wood as the first mines that were worked. The belief is consequently gaining ground that before many years there will be an over-supply of wood of the inferior kind produced by the blue-gum. Specimens which had been grown along the edges of the plantations, so that they benefited by abundance of air and light, were found one foot in diameter at the base while not more than four years planted. Although no other species of Eucalyptus grows nearly so rapidly as the blue-gum, some—notably *E. amygdalina* and *E. rostrata* (the red-gum)—produce wood of superior quality, and grow remarkably well.

Basuto-land was not seen, but the evidence was overwhelming that this rugged and mountainous country, inhabited

* Named after the farm near Inverness, Scotland, where this form of fence was first erected in Britain.

Photo. by Wilson, Aberdeen, N.B.

PLATE 12.—VIEW OF JOHANNESBURG FROM THE NORTH.

Face page 24.

by one of the most civilised, energetic, industrious, and independent of the native peoples, is possessed of probably the richest soil and the most suitable climate for crop-growing of any part in Southern Africa.

The **Irene Estate**, ten miles south of Pretoria, has for a number of years been as a model farm one of the show places in South Africa. It has at the same time been a white elephant to its owner, the late A. H. Nelmapius, who bought it for £45,000 from the original owners, a large and influential family of extensive landowners and cattle farmers named Erasmus. The outlays on improvements raised the **capital invested** in the property to £120,000, and it was reported to have been recently sold by the trustees of the late owner for £32,500. It was originally believed that the land would become valuable as building sites for the residential places of wealthy Johannesburg citizens, but anticipations in this direction were not realised, and financial disaster was the consequence. The **area** is about 17,000 acres, but only 600 to 800 acres of alluvial land near the river are under the plough. With the exception of the cultivable land, which does not much exceed 1,000 acres, the quality is only second-rate. As a **grazing farm**, it is incapable of supporting its ordinary stock of cattle during winter, with the exception of the dairy of seventy Friesland cows which receive artificial feeding. It is favourably situated for the Johannesburg and Pretoria markets, as much as 4s. per lb. being paid all the year round by at least some customers who are supplied with butter. It was not as a grazing farm that Irene was known to the public, but as an extensive **flower**, vegetable, and **fruit garden**, and for the perfection of its amenities, 20,000 fruit-trees and 100,000 forest-trees having been planted. Although this part of the concern was an unqualified success as regards practical results, the expenses of production and management were great. As the high prices of the Rand markets are not likely to continue permanently, it will take very careful and economical management, extending to the stock-rearing as well as to the horticultural part of the business, to prevent the estate continuing as a white elephant even with the enormous reduction of the amount against capital account.

The results obtained in connection with this **model farm**

have been more fully stated than the importance of the subject requires, were it not for the necessity of providing an object-lesson to those in Cape Colony who are desirous that Government should embark on a model-farm enterprise at the expense of the State.

A few facts relating to a **whirlwind** which occurred in the neighbourhood of Pretoria in 1893 will give some idea of the intensity of some of the climatic difficulties, fortunately not often occurring, which are met with in South Africa. The great fury of the storm came from the west, and was confined to a narrow belt of a few yards in width. In its course it struck Rietvlei, the residence of S. P. Erasmus. It carried away the corrugated iron roof of the house, and some of the ribbons into which it was torn were dropped five miles away. A number of cattle were dashed together against the walls of a kraal and killed. A Kaffir boy who was in attendance had a marvellous escape, being lifted from his feet and carried several yards, but dropped into the boughs of a tree, which broke his fall. Stones, an inch in diameter, were swept up from the surface of the ground, and dashed against the west and south walls of the house with such force that indentations half an inch deep remain as a memento of the occasion.

The **mealie** or **maize crop,** the staple food of the black population, is the one which grows best in the Johannesburg and Pretoria district. Kaffir corn, *Sorghum vulgare*, Pers., does very well on the alluvial soil following the banks of rivers. The **common grain crops** cannot be safely grown during summer on account of rust and hail. On the high veld not more than one crop in five might be secured, if we except oats, which do not suffer quite so badly as barley and wheat.

Land suitable for cultivation near Pretoria **is worth** about £2 per morgen, and grazing land 10s. per morgen, down to 5s. in the heavy bush country lying to the north, to which the cattle are driven from the grass veld for shelter and better food during the winter season—May to September.

The journey of ninety miles, which occupied fourteen hours,* **from Johannesburg to Standerton**, was done by the

* The ticket for one passenger cost £3. 10s., and £1 extra was charged for luggage over a very moderate amount.

mail coach, drawn by ten hardy active little horses, in good working condition. The start was comfortably made at 4 A.M., when the air was perfectly still; but a little before, and for a time after daybreak, a keen piercing wind (a common feature of the South African climate), combined with dense clouds of road dust, seriously interfered with the enjoyment of the early part of the journey. Towards the end of 1895, the railway from Natal having been completed, the **coach** was discontinued, and simple facts now recorded regarding the manner of coach travelling will in a little while acquire an historical interest. The horses, which were yoked in pairs, and changed by relays every ten or twelve miles of the way, were driven at a pace of about eight miles an hour. A Kaffir held the reins, and handled them with ease and dexterity, and a white man, with whom the chief responsibility rested, used the long-thonged bamboo-handled whip, and worked the brake with a powerful foot lever.

The **country traversed** for a good part of the way is hilly, and covered with grass—the familiar rooi-grass predominating. The greater part of the surface consists of a reddish-brown **soil**. In the hollows, which after rains become charged with moisture during summer, the soil is black, owing to the accumulation of humus from the vegetation, which is there more rank.

Homesteads are dotted here and there at wide distances apart, but there is little cultivation, and few cattle are to be seen at this season, owing to their being away in the milder climate of the bush-veld. The wasteful practice of burning off the withered grass during winter is here in fashion.

After passing Standerton, wide grazing **plains** are crossed, but the nature of the country becomes more **hilly** as the **Natal boundary** is approached. The hills are volcanic, and covered by rounded boulders, which in decaying give off a red sandy **soil** of poor quality. With the increasing humidity of the atmosphere near the coast, an increased area of black soil is found. All the way numerous **ant-hills**, two to three feet in height, stand up like so many gigantic warts on the surface of the veld.

There is little of agricultural interest in the surroundings of **Pietermaritzburg**, the seat of the Natal Government.

The country is rugged and picturesque, and the climate mild, the elevation being 2,000 feet below Johannesburg. The **soil** is red and deep, but poor and very hard, partially owing to the presence of too much iron in its composition. Both **pine-trees** and blue-gums which grow so well near the coast, in Cape Colony, become unhealthy after they arrive at a certain age.

Going east towards Durban, the **mountain scenery**, as the railway zigzags and winds on its way from the high plateau to the sea-level, is very fine. The foot-hills are extensively utilised as **market-garden** ground, and among a great variety of products grown, the pine-apple appears conspicuously.

The aspect of **Durban** and its immediate surroundings is decidedly tropical or semi-tropical, and the growth of vegetation is as beautiful as it is luxuriant.

The great **sugar-cane** plantations, which form an important feature in the agriculture of Natal, lie along the coast country to the south, but time for their investigation was not available.

District of East London.

East London only acquired municipal rights in 1880, but the settlement of the district took place immediately after the Crimean War, when the German legion was disbanded. An **allotment**, varying in size from one acre within the town limits to four-acre and twenty-acre farms situated outside along the coast and up to King William's Town, was given to each **German soldier**. Although they proved to be excellent settlers, hard working and industrious, the size of their holdings was much too small to give scope to their energies, and they have remained poor. With rare exceptions, the few who survive and their descendants might now be classed as "poor whites" but for their industry. The country adjoining the area of small settlements is now occupied by an independent and progressive class of **English sheep-farmers**.

Pending the opening of a contemplated railway from the mouth of St John's River, East London claims the position of being the only important rival to Port Elizabeth as a **seaport** in the Eastern Province engaged in the landing of goods for the inland trade. In its favour it is claimed that

the gradients on the railway leading from it are more easy of ascent than some of those on the Port Elizabeth line, consequently transport up-country should be less costly; yet, nevertheless, it, like many parts in the Colony, connected as well as disconnected with the railway system, possesses a **railway grievance**. The railway charges are so high, that during dry seasons ox-waggons can successfully compete with the railway for a hundred miles or more inland. This is surely a waste of energy, and must be due to some mistake in governmental policy!

Although East London, like Port Elizabeth, suffers from a sand-bar at the entrance to the harbour, over which navigation is dangerous or impossible for hours or days during stormy weather, she can justly claim a beautiful river-mouth, suitable alike for shipping purposes or pleasure seeking.

The **Queen's Park**, within the precincts of the town, is a uniquely interesting spot for a lover of botany, as well as a healthful and pleasurable resort for loiterers of all descriptions. Under the fostering care of W. H. Wormald, the Town Clerk, who was the author's guide, the park has become not only a beautiful garden, but a rich herbarium of South African and other plants, some of which are seen under the influences of cultivation, and others forming a tangled jungle in conformity with Nature's own inimitable arrangement. Only a very few of the most **conspicuous plants** or those most interesting for the moment can be mentioned. The *Poinsettia* or Indian Landmark was there, with its row of bright red leaves surrounding its comparatively insignificant flower; also *Tecoma venusta*, a creeper frequently met with in the Colony, with orange-coloured bugle-shaped flowers hanging in bunches; and *Strelitzia*, called "wild mealie" by the natives, with an inflorescence resembling the head of a crown crane, all the petals being of a beautiful orange colour with the exception of a purple one, which also differs by projecting like a pointed tongue. A curiosity was present in the shrubby "**Papaw-tree**," the fruit of which hangs in clusters. A leg of mutton rolled up in its leaves becomes exceptionally tender, and it is said that a stallion tied close to it becomes sexually impotent. The flower on the male tree is beautifully scented, and resembles a waxy primrose. The female flower

is much larger. The **avocado pear** was interesting, the foliage being not unlike that of the orange-tree, although the leaf is longer. Beside it grew the **custard-apple,** with large mulberry-like apples, and also the large variety of **pine-apple** cultivated in Ceylon.

District near Port Elizabeth.

In the neighbourhood of **Port Elizabeth** the **soil is poor**, being on the Cape Flats Sandstone and Upper Devonian beds. A drive of thirteen miles west to **Kragga Kamma**, the property of J. B. Christian, was made through one of the most barren districts seen in the Colony. The character of the country improved near the end of the journey, and near the coast the surface is covered to a considerable extent with a large dense **bush**. In the case of this better-quality soil, where cultivation is possible, three grain crops are taken in succession, and then the land is allowed to fall out for three years to rest. Although no pasture seeds are sown, a thick **sward of grass** and weedy plants soon covers the ground. One of the chief farm products is **oat hay**, cut while the crop is still slightly green, and sent to the Port Elizabeth market. A common price is 3s. 9d. per 100 lbs., but in times of scarcity, such as was experienced throughout the prolonged drought of 1894-95, the price runs up to 9s. The open bush affords excellent grazing for cattle, and **bush-buck** are numerous in the district.

Uitenhage is a picturesque but sleepy village, with an abundant water supply, distributed by open channels along the capacious tree-lined streets. It is an important centre for **wool-washing**—an operation to be described later. Smith Brothers' **nursery garden** for fruit-trees forms another local industry, which is on the increase.

Districts of Albany and Bathurst.

Grahamstown, the site of the recently established **Bacteriological Institute**, was, until about thirty years ago, an important military station, and the demands for supplies for the troops and transport riders going up-country stimulated agricultural production in the neighbourhood. Albany is

Photo. by Wilson, Aberdeen, N.B.

PLATE 13.—THE MORNING MARKET, PORT ELIZABETH.

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PLATE 14.—COLONIAL GOVERNMENT BACTERIOLOGICAL INSTITUTE, GRAHAMSTOWN (EXTERIOR VIEW).

Face page 31.

essentially a rolling grazing country, of sour veld towards the south and sweet veld to the north, but the alluvial soil in the valleys is capable of producing crops without irrigation.

The trials to which the farming population in the district of Bathurst have been from time to time subjected are subsequently referred to. The agricultural produce of the level alluvial land in the Kowie Valley is sent to Grahamstown market. Kraal manure is not there thought to be of much value when applied to grain crops. It encourages bulk of straw without grain, and produces coarse, inferior fodder. Most probably the manure is deficient in phosphates, like the soil on which it is produced.

Bathurst is a straggling village, laid out, like Grahamstown, on the American plan, with wide parallel streets, crossed by others at right angles. It skirts the base of a rounded hill in a well-bushed veld, providing good pasture for cattle. There is abundance of lime in the soil, and consequently in good seasons numerous excellent leguminous plants grow wild. Nevertheless horses always look unthrifty. Bathurst was settled in 1820 by about seven hundred British emigrants, who mostly received small farms of from 100 acres to 250 acres, a few only being given 500 acres. The tendency now is for the farms to increase in size, and the population to become less numerous. No manure is used, and the arable land has been so long cultivated that wheat goes off with a white blight when it ought to begin to fill. The chief industry of the village is market-gardening, including fruit-growing. All of the seventy families who live there are more or less interested in it, although only three growers, who possess the right to a sufficient supply of irrigation water from a large spring in the village, can grow cabbages or cauliflowers. The others grow mealies, potatoes, and the smaller vegetables. Vines do badly after the second year of bearing. The value of garden land is on the increase. An offer of £500 had been refused by one energetic resident for a fifty-acre lot which six years before cost £120. Part of the increase, it must be admitted, was due to the improvements made by clearing off bush and planting fruit-trees. The red scale on the orange-trees seems to be the chief bugbear of the place. The produce is sold at Grahamstown daily market, and at the weekly

market at Port Alfred,—cauliflowers fetching often 6d. each; cabbages, 2s. 6d. to 3s. per dozen; and oranges, 2s. 6d. per 100.

Many of the **inhabitants** are progressive and industrious, and anxious to be taught the most approved methods and practices of their occupation; but some of the old residents want energy and application, and are too much inclined to drift on in the old lines—a state of matters which is not at all suitable to the district in question.

Poultry keeping is well advanced. Good specimens of the best British breeds have been introduced here, as at other centres in the Colony, during recent years. All the villagers own a few **cows**, which pasture on common land, but the numbers have decreased since the extension of red-water to this part of the country.

Of the **farmers** in the surrounding country, the most successful are those who stuck to farming, and did not divide their attention by going in for "transport-riding." *

The **road from Bathurst** to Grahamstown by way of the Kowie Valley lies through a rolling country, which, until the appearance of heart-water among sheep, was a typical sheep country of half sweet and half sour veld. Now sheep cannot live. Many snug, well-cultivated farms, with the land well fenced with wire, are passed on the way. Where bush exists, there is something of a **semi-tropical appearance**, given by the occurrence of a large euphorbia (milkbush), and by the presence, in addition to an abundance of mimosa, *Acacia horrida*, of a considerable variety of evergreen trees loaded with creepers. The evidences of successful bamboo, pine-apple, and plantain cultivation, which is not yet widespread, although it is on the increase, confirm the impression.

A considerable extent of soil of a dark colour being in the hollows between the rounded elevations of red-brown soil is admirably suited for **fruit-growing**, but before the great possibilities in this direction which the district possesses can be taken full advantage of, there must be better means provided for marketing the produce, and also an increase of white population in the Colony to consume it. The latter might be

* The occupation of driving ox-waggons up-country with stores, &c.

brought about by turning towards South Africa the stream of emigration now being diverted from America.

The **country** to the north-west of Albany, in the **direction of Riebeck**, is healthy and good for sheep, the boundary line between the area affected with heart-water and the sheep area passing north of Grahamstown. The land seen in travelling from Grahamstown to Alicedale rises to a good elevation, and is rolling and grassy, very few bushes occurring, with the exception of rhenoster bush, which increases in quantity as Alicedale is approached. But for the prevalence of heart-water, it would be an excellent sheep-run.

To the north-east, in the direction of **Heatherton Towers**, the general level of the surface of the country descends, and the veld becomes much more bushy. The district is excellent for **ostriches**, and both cattle and sheep thrive well. The **prickly pear,** *Opuntia*, has firmly established itself, but it is not there regarded entirely as a weed, as its leaves are chopped in large quantities, and successfully used as food for ostriches and dairy cows during periods of drought and general scarcity.

District of Somerset East.

Cookhouse, the nearest railway station for Bedford and Somerset East, is also close to the side of the proposed **Slagtersnek irrigation scheme**, referred to in a succeeding chapter on irrigation.

The town of **Somerset East** stands to the west of Cookhouse, two hours by post cart, at the foot of a steep slope flanking an elevated plateau of **sweet-grass veld**, on which horses and cattle do well. The town is the site of the Gill College, and of the **Agricultural School** for the Eastern Province to be mentioned later.

A few facts relating to the **farm of Glenavon**, four miles north of the town, will illustrate some of the chief features of the district. The area of the holding is about 10,000 acres, but only 200 acres are cultivated, and the annual rent is £500. Five years ago, John Cumming, the present occupier, began with 200 cattle, a flock of 1,300 sheep, which has decreased to 350, and 400 Angora goats, which have multiplied until they now number 1,100,—circumstances which indicate the unsuit-

ability and suitability of existing conditions for different classes of stock.

The **arable soil** is shallow as a rule, and there is a good proportion of heavy clay formed by the disintegration of shale or clay-rock.

Mangel wurzel is grown and dibbled out in the field from a seed-bed sown in November.

Some farmers in the district let land to Kaffirs on the half-share principle, who cultivate badly and plough very shallow, being afraid to break their old and rotten implements. They also steal about one-third of such a crop as mealies, which they can carry away at night in small quantities and consume, and the rent is in consequence reduced to one-third of the produce.

Bedford District.

Driving from **Cookhouse** in the direction of Bedford, the open **grass-veld**, growing rooi-grass chiefly, and being at a higher elevation than the mixed grass and bush veld left behind, is soon reached. Both varieties here form sound and healthy pasture for stock. The knowledge as to whether veld is sound or otherwise, is necessarily a matter of experience, as there is nothing in the appearance which meets the eye of an observer to indicate to which class it belongs.

The vicinity of Bedford has recently come prominently before the public as an important **dairying centre**, numerous creameries having been erected, and an important trade in fresh butter established with distant populous centres.

A beginning has been made in the growth of **green winter food** for cows, so that the condition, which becomes very low in spring, and also a certain flow of milk, may be maintained all the year round. It is to be hoped that the growth of food for the winter supply of other farm animals may gradually extend not only in this but in other districts. Under the existing system, much of the land of the Colony is too heavily stocked, yet it does not maintain nearly so many animals as it might do if systematic means were instituted for the supply of winter food. **Silage** has been successfully made of green mealies (maize); and mangels, turnips, pumpkins, and lucerne have been grown by the aid of irrigation in the rich holm-land of the Cowie Valley.

PLATE 15.—ROSS'S FARM, BEDFORD, Located in a Dairying District.

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The **rainfall** is about 28 inches, which is sufficient to enable the Kaffirs to grow mealies and Kaffir corn on the hill-sides forming the valley, on land from which the trees have been intentionally and wastefully burnt off.

Mimosa (*Acacia horrida*) trees are pretty numerous even in the open veld of this part of the country, but they are prevented from growing, as they tend to do, into an impenetrable thicket by a small brown **scale insect**, *Ceroplastes*, which pays periodical visits, and in three or four years, when an attack occurs, the trees are killed wholesale. The last attack began in 1889, and continued for four years. The rotten wood is cleared off by grass fires, although burning the veld is not, as a rule, there regularly practised. Young trees soon spring from the numerous seeds that are annually shed on the veld. A moderate number of trees is most useful, supplying excellent food for sheep in the form of green leaves and of seed pods which drop after ripening.

The district is well **fenced**, and sheep and cattle are run in separate camps; but when a sheep camp becomes too rough, cattle are turned in to eat off the long grass. Sheep at times suffer from autumn fever, which is described in a future chapter on diseases of sheep.

Districts of Fort Beaufort, Stockenstrom, and Victoria East.

Sweet veld prevails in this area of country, which is well adapted for sheep. Stockenstrom has, in addition to a good reputation for sheep and wool production, some claim to notice on account of **tobacco culture**. The Government tobacco farm, which was given up in 1895, was located in this district, the main reason for discontinuing it being that the farmers in the neighbourhood thought that the Government tobacco expert made a mistake in his selection of a farm, and to emphasise this belief they boycotted it, and would not go to see and benefit by the object-lessons which it was intended to provide.

Canker at the roots of the orange-trees appeared in 1883, and few are now left in the district.

The **Mission Station** of **Lovedale**, under the control of Dr Stewart, lies to the east of the area now under consideration, and a few miles from the village of Alice. The **instruc-**

tion given is divided into three departments — religious, educational, and industrial; and nearly 800 natives, of whom 500 are boarders, take advantage of the facilities offered,—a wonderful development since the year of its foundation, 1841, when eleven natives and nine Europeans made up the number in attendance.

At first, instruction was given free to natives, but in 1871 an annual charge of £4 for the board and education of each pupil was introduced. The fee has subsequently been raised to £8, the lowest payment for elementary instruction and simple food; but £12 and £20 are paid by some who receive higher instruction, and participate in greater luxury at the table. The food consists chiefly of mealies and milk. The fees paid by natives on their own account amount to over £2,000 per annum, and the Colonial Government educational grant comes to another £2,000, to which sums require to be added the funds contributed by the Foreign Missions Committee of the Free Church of Scotland, and private donations, which bring up the average income to about £10,000 per year.

The great inducement to go to school in the native's mind is the desire to acquire the magic power of being able to write a letter, and full-grown men come to the institution from the diamond mines of Kimberley, and the gold mines of Johannesburg, and deposit their savings, amounting probably to £20, £30, or £50, to guarantee their position and power to pay while they remain.

Much of the work done is also eminently practical. A large farm is associated with the institution to assist in providing food for the numerous members of the household, and also to supply means for hand labour in the open air. In addition to farm and garden work, carpentering, waggon-making, blacksmithing, printing, and bookbinding are taught; and if, after a period of probation in one of these branches of work, it is seen that a pupil is not likely to succeed in becoming proficient, he is not permitted to continue at it.

Cradock District.

The railway going north from Cookhouse, passing along the boundary line between the districts of Bedford and Somer-

set East, runs at first through a rugged and **broken country**, badly infested with **prickly pears**. The **soil**, which is not deep, is light and red in colour, growing quantities of "**tulp**" or poison bulb, with a light-blue flower, among the scrubby bushes, and also a plant called "**stink-blaar**," *Stramonium*, which poisons chick-ostriches. Neither are eaten by goats, nor as a rule by sheep or cattle that are reared in a district in which they appear. The district of Cradock is hilly and stony, and both in appearance and in reality a typical place for **Angora goat** farming.

Excellent holm-lands lie along the banks of the Great Fish River, which flows almost due south through the district, but where irrigation is not practised with care brak soil is liable to occur. At **Halesowen**, Hilton Barber's place, about a mile from Cradock, some of this alluvial soil was seen undergoing the process of levelling in preparation for the irrigation of a lucerne crop. Irrigation is necessary owing to the rainfall being light, only about 15 inches, and coming mostly during summer. The good quality of the land was to be gauged not only by the excellence of the products of cultivation, but by the gigantic size of a number of pear-trees; and there is little doubt but that it has also had a material influence upon the size of bone of the **thoroughbred stud** of horses, which has developed into one of the best in the Colony.

Middelburg and Steynsburg Districts.

The districts of Middelburg and Steynsburg, lying to the north of Cradock, and at a **higher elevation**, are quite different from it in appearance and character. In going north by rail towards Tafelberg station, the stony country is soon left behind, and a regular **Karoo veld** entered. The **plains** are at first not extensive, but broken by rising ground. In the districts under review, there are large tracts of **land** which would suit excellently **for cultivation**, and which possess unique facilities for the supply of irrigation water, but at present the holdings are too large for any one to personally supervise the work associated with crop cultivation. Charles Southey's farm of **Culmstock**, in the Middelburg district, for example, extends to 14,000 acres. The soil does not become so hard

under the influence of irrigation as do the alluvial soils on the Great Fish River banks, but in certain low-lying areas **brak** is liable to appear, the result either of the soakage of water from brak springs which exist in the district, or from capillary action in, and evaporation of water from the soil itself. There is little doubt but that the surface has, upon the whole, become considerably drier since it has been stocked with sheep, owing to the formation of "sluits" and even rivers by the washing of escaping rain-water.

The Steynsburg Government scheme of irrigation is probably the most promising of all the large irrigation schemes in the Colony, not only on account of the natural facilities for storing water, but also for the extensive area of good land to which it is possible to apply it.

Albert and Wodehouse Districts.

The Albert and Wodehouse districts contain an extensive and **elevated area** of grassy veld which runs up to the Stormberg range. On the highest parts it is sour veld, while at lower elevations it is half-sweet and half-sour. The **hills** as a rule are water-worn and bare of soil, with volcanic rocks protruding in places. A portion of the soil has lodged in the hollows, and this has subsequently been cut in many places by deep sluits, and is again beginning to wash away.

The largest cropping farm seen in the Colony was found in **Carnarvon Farm**, worked by the **Halse Brothers**, near Sterkstrom. The total area is 11,500 morgen, and nearly 3,000 morgen (roughly 6,000 acres) are under the plough. The **bicycle** is found to be of the greatest service to the management in covering the long distances between the different centres of work on a farm of this size. The average **rainfall** is about 22 inches, but irrigation water is necessary for most crops, and storage in dams has been provided to the capacity of 1,500,000 gallons. As many as 300 acres of **potatoes** have been grown in one season; but they are not irrigated, as the additional supply of moisture is believed to aggravate the "ring disease" from which the crop suffers. **Mealies** can also be grown without irrigation, but most of the other crops require artificial watering. It was on this farm that the **Tennyson**

Settlement was placed; but the excitement of making money in a short space of time at the Rand, and the want of experience in manual work, have proved too much for the majority of those who formed the settlement, and it has broken up.

The **high grass veld** of which the Stormberg forms the centre, is healthy for stock, chiefly sheep; but at this elevation salt is not present in sufficient quantity to form an antidote for **parasitic attacks**, and wire-worm and liver-fluke are troublesome. The country lies bleak and bare, and there is a great want of natural **shelter** for stock, which leads to the loss of condition during winter and spring, the time when animals can least afford to suffer in this way.

In the vicinity of **Burghersdorp**, which does not lie at such a high elevation as the land last referred to, there is good arable land, and a considerable amount of cultivation, in addition to the grazing of sheep and cattle.

A few miles to the north a Welsh settler named **Davis**, who had only been about four years in his farm, is, as the result of steady application to work, rapidly growing into a position of independence on a holding of 3,000 morgen, which he leases for £130 of yearly rent, £7 of taxes having also to be paid. The **stock**, which was steadily increasing in numbers, consisted of 1,100 sheep, and 70 head of cattle, including 40 milch cows. **Cheese** is manufactured and readily sold at 1s. per lb. The **soil** is pretty heavy, but with good cultivation and the skilled application of irrigation water, it grows good **crops**. Barley does very well, and English winter oats, introduced from Natal, do not seriously suffer from the severity of the climate, although they are slightly injured by winter frosts. It is the general practice to irrigate the common grain crops, but both mealies and wheat grow in the district on land which it is found impossible to irrigate.

One evening was spent at **Ellesmere**, the well-known place of E. Hughes, who farms a large tract of sheep land of superior quality. The veld is not annually burnt, but only now and then when it becomes too rough. Here a sheep per morgen is light **stocking**, whereas on some parts of the Karoo three morgen are required to keep one sheep.

Provision for the reception of irrigation water, to be used in cultivation, was found in a **large dam** (with a bank 300

yards long, 100 feet wide at the base, and 34 feet high at the centre), which had cost about £800.

The district is capable of great development both in the direction of cultivation and of keeping stock, but before the best results can be obtained the large farms must be split up, so that a greater amount of personal supervision may be given by the farmers to the work going on.

An interesting natural phenomenon was observed in the form of a **warm spring**, which issued at a temperature of 100° F. from a 6-inch bore-hole 70 feet deep, made by one of the Government water drills. Water at this temperature, and free from an excess of soluble salts, is a boon for irrigation purposes, and may also be used with advantage in dipping sheep, and even for household needs.

The **spreo**, *Spreo bicolor*, Gm., is one of the most widely distributed and numerously represented of the wild birds of the Colony. It is a little larger and more massive than a starling, to which it is allied, and it occurs in a number of distinct plumages—the most common colours above being bronzy, with a distinct gloss of green under certain lights, and purple and white below. It is at times the friend, and under other circumstances the enemy, of the farmer. It is most destructive of fruit, and also of grain crops, when its natural food is scarce; but it greedily devours locusts, ticks, and other injurious insects, to make amends for its shortcomings at other times. An interesting feature in the life-history of the bird was observed at Ellesmere. Thousands of them collected at sunset in a clump of tall white poplar trees, coming from the veld in all directions in flights of one hundred or more, and keeping up an incessant chirruping until all had arrived and darkness set in.

The **parson crow**, *Corvus scapulatus*, Dand., is another bird which occupies a position somewhat similar to that of the spreo with regard to the farmer, and corresponds to the common rook in this country. It is widely distributed in South Africa, but it is not seen in crowds of such large numbers as the rook. It takes its familiar name from the fact that it has a white breast and white ring round its neck, while the rest of the body is black, or nearly so, like a parson's coat.

Districts of Aliwal North and Barkly East.

Although the country generally is devoted in the main to **stock farming**—the breeding and rearing of sheep, cattle, and horses—**cultivation** is possible on a considerable area, and crops are grown pretty extensively by a number of progressive farmers. **Dairying** has also been introduced in a modern form at Braam Spruit. J. Bekker has a model and ideal dairy, fitted with recent and approved appliances. The roof of the building is amply shaded by trees, and the well has a temperature which rarely rises, even during the heat of summer, much above the normal winter reading of 58° F. The butter is sent to Johannesburg, and the price realised is 2s. per lb.

An extensive system of cultivation is practised at **Fairview** by A. J. Orsmond, who four years ago bought the place, extending to 500 morgen, for £1,000. Locusts have been exceedingly destructive in this district during each of the last four years. In fact, if their ravages are to continue, it will be impossible to carry on cultivation at a profit. The growing of fodder (oaten and wheaten hay) is the chief object at present, but the district is favourably situated for the production of grain. Soft wheat, which is in greater demand than hard wheat with colonial millers, grows well without being attacked by **rust**, and leguminous crops as well as root crops and pumpkins thrive admirably. The potato also thrives, and it is even thought to be a fertilising crop,—a circumstance which is probably due to the thorough cultivation which the crop requires, rather than to any inherent quality in the potato. The **soil** is of such a nature that irrigation makes it very hard if it be allowed to dry, and even a heavy thunder-shower will harden the surface two inches down. On soil of a lighter description nothing is heard of the potato contributing to its fertility.

By way of giving a second illustration of the value of land, it may be mentioned that a **stock farm** on the way to Karnemelk Spruit, area 1,700 morgen, and capable of carrying under the present system of management 2,000 sheep and 100 cattle, was recently bought for £1,500. There is a capacious dam on the place, which would contain enough irrigation water to grow roots sufficient, under a more enlightened system of

management to almost double the stock-supporting capacity of the property.

The **winters** are very dry, cold at night and clear. A great advantage to the coast land in the east of the Colony, which does not extend so far inland as Aliwal North, is the heat derived from the tropical Mozambique current which laves the shore, so that frost seldom occurs. **Rains** then come with the south-east trade winds in November and March, but the higher elevations up-country are mostly dependent upon thunder rains.

The **high price** of agricultural **implements** is a serious drawback to a struggling cultivator, who does not possess much capital to invest in appliances. Self-binding reaping machines still cost £55 each in this district, although they can now be bought in Great Britain for a little more than half this price.

A **five days' drive** by cart was taken from Aliwal North through Lady Grey into the Barkly East or **New England district**, an elevated track of grass-veld on which sheep, cattle, and horses do well in summer, but, as is the case in Aliwal North and in many other parts of the Colony, become very poor during the barren months of spring, when the grass shows up withered and brown. The predominating rooi-grass gives it the appearance of withered bent of a reddish colour. It is a rugged, hilly country, with flats cut deeply by narrow valleys, and an abundance of rich black soil on the flats and in the hollows that, under cultivation, works down into the condition of a garden mould. The farms are mostly **ring-fenced**, but want subdividing. Where this is done, and sheep are allowed to run at large, they thrive much better than when herded in flocks. It is in this district that so much success has already been achieved in the **growing of turnips** to supplement the natural winter food of sheep.

It would seem, from the introduction of **Lincoln sheep**, that, excellent though it be, more is expected of the supplementary turnip crop than it can possibly accomplish. Reginald Orpen had, early in 1895, imported 70 well-bred Lincoln rams, which, landed at Cape Town, cost about £20 each, with the intention of putting them to 5,000 merino ewes, and continuing to breed from the half-bred ewes with

pure-bred Lincoln rams. This subject need not be followed here, as it is fully dealt with in a succeeding chapter on sheep and sheep-farming.

A serious drawback to the extension of cultivation with the object of grain production in this high region is the danger of its being frosted at midsummer.

The two great wants of the district are common to many parts of the Colony, viz., more farming capital at the disposal of the occupiers, and a railway to convey the produce to market. Neither desideratum need long be denied to the district if farmers will only follow the excellent example which has been set them by Orpen, of Avoca, and Wallace, of Holbrook, in growing turnips for winter and spring food. The higher parts of the New England district being more humid than the interior plains of the country where ant-hills are numerous, these disappear. The work of soil manufacture which the ant undertakes is, however, in this and the humid coast districts, taken up by earth-worms, which in moist soil in favourable situations assume an enormous size—some being over three feet long, and about an inch in diameter.

Queenstown District.

Queenstown is one of the most prosperous and progressive of the districts visited. The farming community is mostly of British extraction, and the practices adopted are largely English in origin. The area cultivated is extensive, and the stock of cattle kept is superior, including many well-bred animals, belonging to the Holstein and the shorthorn breeds. A few superior polled Angus cattle were also observed. Crosses between the Ayrshire cow and Friesland bull are held in high estimation as dairy cattle.

The cutting of sluits or open channels in the veld by the action of water, the process described as occurring further up-country, is being carried out in favourable localities in this district, where only a few years ago no drainage of the kind existed. It is necessary to burn the withered grass on the veld, as it is to some extent "sour," to improve the quality of the "koper-draad" or copper-wire grass, *Andropogon*, which, when burnt, shoots up a month earlier than other grasses in spring Burning also prevents the tufts of copper grass

spreading too widely, and killing out good grasses which are valuable later in the season.

Green **winter food** for sheep and cattle is mainly provided by the growth, under irrigation, of barley and wheat as green forage. Thousand-headed kale has been tried, and it does best when planted out in January. Turnips are liable to suffer seriously from the attack of the turnip flea-beetle or **turnip-fly**, *Phyllotreta nemorum*, when the young plant first appears in April. The Aberdeenshire remedy of steeping the seed in the oil of turpentine for a few hours before sowing might be tried in the initial stages, until the area of cultivation extends sufficiently to warrant the use of one of Strawson's spraying machines, by which a few gallons of paraffin could be distributed per acre over the crop of young plants while yet they possess only the first pair of leaves or cotyledons. Either remedy would, as a rule, probably save the crop.

The **bean** crop does not give a heavy yield, but it is an excellent forerunner of grain crops. A **wild vetch**, a variety of the common vetch, has become a very troublesome weed in cultivation; but it is not an altogether unmixed disadvantage, as it, like the bean, is most active in the fixation of the free nitrogen of the air for the benefit of succeeding crops.

Although one generally hears more of the losses sustained by the farmer as the result of a prolonged **drought**, it is admitted in this district, as well as in other parts which are at times liable to suffer from heavy falls of rain, that the losses sustained, both in crop-growing and in stock-farming, are greater with **excessive wet** than with too much sunshine.

Districts of Cathcart, Stutterheim, and King William's Town.

On the way by rail from **Queenstown to Kei Road**, a good **grass country** is soon entered, dotted with mimosa trees and bushes. During the seasons 1891, '92, '93, a large grey-striped **caterpillar** attacked the mimosa in the area located between Tylden and Cathcart, and large numbers of all classes of farm stock, and even Kaffir women **aborted**, it was believed, in consequence, although the results of some experiments, conducted by the Department of Agriculture,

did not confirm the popular belief. The **mildness of the climate**, as compared with the areas traversed up-country, was indicated by the appearance of the early leaves on the mimosa-trees.

The **district of Cathcart** rises to a good height, and is bare and bleak, and not unlike the Stormberg country, there being no trees, and a distinct want of shelter. The Bontebok flats lie to the west, and Gaika-land to the east. The whole area was at one time thickly stocked with springbuck and other **game**, the grass being short and suitable for antelopes or sheep, although mostly grown on sour veld. The land is sound and healthy for stock, but for liver-fluke and other worm parasites, which, owing to the heavy falls of rain during summer, are more prevalent here than in drier districts. The **ant-heaps**, in presence of the extra supply of moisture, are less numerous than where the rainfall is less.

The farms are **fenced**, and sheep are not herded in mobs, but permitted to spread naturally to feed, as is the custom on the hilly ranges in Great Britain. During the lambing season the lambing ewes and the young lambs are brought near the homestead at night, as a precaution against the depredations of jackals. Similar practices had been previously noticed near Bedford. Double lambs are not numerous on the veld. This is a matter which is dependent to a large extent upon the supply of food, and the annual lowering of condition in winter and spring militates against the occurrence of large numbers.

To the south of Toise River Station is the Fort Cunynghame Government **Forest Station**, where a large number of trees, mostly pines, have been planted for experimental purposes. Close to Kabousie Station is **Waterford**, the estate of the late **J. J. Irvine**, who is reported to have spent £150,000 upon it in improvements. Although the sum may be somewhat exaggerated, it was in any case sufficiently large to be an object-lesson worth considering by those who advocate the establishment of Government model farms. As a lower level is reached, **ant-hills** become more numerous.

In the **neighbourhood of Kei Road**, turnips do not grow so well as in New England, on account of the irregularity in the rainfall, and the numbers of insect enemies.

The turnip fly and the red ant are both destructive. Mangels sown broadcast do well at times, but in 1894 some crops were cleared off by caterpillars, thought to be those of the white cabbage butterfly.

Roots are too uncertain in this district to be solely depended upon for winter food, as there are frequent droughts, and irrigation is not practised, but with silage in addition, as a second line of defence, the safety of the live stock at all times could be ensured.

The dimensions of the **earth-worms** on the flat and in moist land are quite phenomenal.

An effort is being made by some to improve the quality of the flocks. A lot of **Tasmanian sheep** (six ewes and one ram) was examined, which cost on landing nearly £200. These animals cross very well with the Cape merino, but a general movement in this direction cannot proceed far until better provision is made for sheep during the barren spring months and dry seasons.

The cultivation of wheat is checked through the injury done by **rust** and by **frost**, and all branches of cultivation have during the past four years suffered from the ravages of **locusts**.

Attempts at **thorough cultivation** on the English plan have not always proved successful. John Landrey,* of **Mowbray Park**, gave a good illustration of the occasional superiority of certain native customs over European innovations. A crop of mealies in a field which had been three times ploughed during summer was devoured by grubs, while a Kaffir's crop close by in which the soil had been only scratched escaped. The parent insect seems to have found the well-worked fallow the more attractive place to lay her eggs. In the growth of mealies, English farmers have something to learn in another direction from their Kaffir neighbours. In places where an English farmer will only harvest one crop out of three, grown under a system of dry-land cultivation, the Kaffirs will secure five crops out of six. The explanation seems to be that the Kaffir is always hoeing the

* To whom the author was much indebted during his visit to this district.

surface while the crop is growing, and keeping the soil in a loose state, and consequently in a condition to conserve the soil moisture.

Mowbray Park, extending to 2,500 acres, cost £2,500 eleven years ago, but with the fencing and other extensive improvements which have been made, it must have more than doubled in value during that time.

The great majority of the population are **English farmers** of a progressive type, but the district contains many of the **German legion** already alluded to as settling in the vicinity of East London. Though industrious and hard-working, their condition of poverty, verging on starvation, is similar to that already described. The average size of a holding is about 25 to 30 acres of arable land, and that not of the best quality, with right to pasture a number of stock on the village commonage. Each village possesses a board of management, which regulates the number of animals to be kept by each occupier. At the **village of Wiesbaden** which the author visited, the number of cattle is fixed at forty, or of sheep eighty. But most of the people are so poor they have very few beasts, and are thus unable to take advantage of their grazing rights. Fate has been against them. Their small holdings, at all times too small, have gradually become poorer, like themselves, although they carefully preserve manure, and even buy it from Kaffirs for sixpence or a shilling for one of their small waggon-loads, and carry it from the native quarters on to their land.

The usual **rotation** adopted by the settlers is—(1) Mealies; (2) Wheat; (3) Potatoes (manured); (4) Barley (seeded) or side oats, *Avena orientalis*, which does not require rich soil, and may be grown for forage (oat-hay). After barley, the land must be manured in preparation for any crop, with the exception of mealies. The return got from wheat is about eight-fold, and the seed sown is one bushel per acre. When sown late in spring, the grass grows almost as quickly as the crop, and it is more liable to **rust**. The Kaalkop wheat has been in years past the best rust-resisting variety, but its power in this direction is becoming less and less.

The **potato**, which at one time formed an important stand-by, has gone down both in quality and yield. The German

blue variety, imported from Brandenburg, dwindled till it grew itself out a few years ago, and other varieties which have been too long cultivated in the district are following in the same direction. Land that without being manured would at one time have produced sixty bags of very fine potatoes per acre, is now unable, even when manured, to grow more than forty bags of tubers of inferior quality. Potatoes and forage crops may be planted twice annually. At one time one potato-crop would follow another on the same land, but that exhausting system is not now possible. This may to some extent be due to the exhaustion of potash. The east of the Colony has no store of granite to yield felspathic potass elements as the west has. The German settlers are so poor that their case is on a par with the small Irish farmer, and calls for the suspension of some of the ordinary rules of political economy, and the **interposition of Government**, with the object of helping them because they are unable to help themselves.

New varieties of seed of all descriptions are wanted, and some method could surely be devised by which a Government given to paternal acts might bring the means of procuring seed within the reach of the poorest and most helpless class without pauperising them.

The most important matter, and one to which the Government might well devote itself without delay, is the **extension of** the size of the **holdings**. If something is not done to enable this industrious community to reap the benefit of the labour they are able and willing to undertake, the time will soon arrive when something probably more costly and less worthy may have to be undertaken for them as paupers or "poor whites."

In place of every facility being offered to those who are desirous of taking up new land at reasonable rates, the difficulties in the way of any one being able to acquire unoccupied Government land are practically insuperable. There is no complete **survey** which can be referred to, and if a man applies to Government for a small plot of land, he has not only to pay for the land, but also the expenses of a surveyor going from King William's Town to do the work, which probably does not occupy him more than a few minutes. The brief statement of the facts of a case brought to the notice of

the writer will show the unsatisfactory nature of the existing position, and how ripe it is for adjustment on liberal and possible lines. A settler desired to purchase an acre lot, which, on being appraised by a local committee, was found to be worth £1 in fair market value; but it was discovered that the plot had no less than £5. 12s. 6d. of survey and transfer expenses (!) standing against it, and the transaction did not take place. This sum the aspirant to its possession will be bound to pay before the land can be rescued from the state of nature in which it lies. Surely some more equitable and reasonable plan, which would be mutually advantageous to the Government and to would-be purchasers, could be instituted.

KAROO AND ANT HEAPS.

CHAPTER III.

GEOLOGICAL, OROGRAPHICAL, AND LAND SURFACE FEATURES.

Geological Survey Commission—Geological Map of Cape Colony—Contributors to the Geological Knowledge of South Africa—Littoral Zone, Malmesbury Beds, &c.—Table Mountain Sandstones—Rand Gold Mines, Johannesburg—Johnstone on the Deposition of Gold—Bokkeveld (Devonian) Beds—Elephant Rock—Carboniferous Era—Dwyka or Trap Conglomerate—Ecca and Karoo Beds—The Hills—Fresh-water Basin—Diamonds—Stormberg Rocks—Coal—Cave Sandstone—Volcanic Action—Three Chains of Mountains—Cape Colony Watershed—Rivers—Soil Washing and Wearing—Character of Soil—Want of Surface Water—Underground Supply—Report of Inspector of Water Drills—Shallow and Deep Boring—Dolerite Dykes—Artesian Water—Pumping Water by Windmills—Deep Drill for Geological Survey—Warm and Brak Springs—Drift Sands near Port Elizabeth.

ALTHOUGH South Africa has proved to be surpassingly **rich in minerals** of many kinds, it is somewhat anomalous that no systematic geological survey has ever been made of it. So far as Cape Colony is concerned, this defect is about to be amended. After much preliminary discussion and hesitation, the Colonial Government appointed in 1895 a **Geological Survey Commission**, consisting of Dr Muir, Superintendent-General of Education; the Hon. J. X. Merriman; Dr Gill, Her Majesty's Astronomer at the Cape; C. Currey, Permanent Secretary of the Agricultural Department; and Thomas Stewart, C.E., F.G.S. This was done in compliance with the recommendation contained in the report of a **Select Committee** of the House of Assembly, dated 8th July 1895. This Committee also recommended, in view of the fact that since 1876 a sum of £36,905 has been "incurred in connection with geological research," that "as a preliminary step, great service would be rendered by the collection, collation, and publication of all the **existing information** on the geo-


GEOLOGICAL FEATURES
Scale 1 : 5,600,000
English Miles
0 10 20 30 40 50 100 150 200
REFERENCE TO COLOURING.
Areas within which Nitrates are said to occur.
Diorite Syenite &c. INTRUSIVE.
Diabase &c. later than Lydenburg Beds } OLDER VOLCANIC.
Dolerite &c. later than Stormberg Beds } NEWER VOLCANIC.
GRANITE.
GNEISS.
Cape Flats Sandstone TERTIARY.
Umtamvuna Beds CRETACEOUS.
Sunday River Beds & Enon Conglomerate } JURASSIC.
Stormberg Beds { Volcanic Beds, Cave Sandstone, Red Beds, Molteno Beds } CARBONIFEROUS TO TRIASSIC.
Karoo Beds
Ecca Beds, Kimberley Shales (Unconformity)
Dwyka Conglomerate (Unconformity)
Quartzites of the Zuurbergen, Zwarteberges & Witteberges } CARBONIFEROUS.
Bokkeveld Beds U. DEVONIAN.
Table Mountain Sandstone (Unconformity) } L. DEVONIAN.
Malmesbury Beds { Slates & Intrusive Granite of Cape Town Neighbourhood } SILURIAN.
Namaqualand Schists.
CAPE COLONY
ORANGE FREE STATE
NATAL
BASUTO LAND
GRIQUALAND WEST
BECHUANALAND
ZULU LAND
TRANSKEI
INDIAN OCEAN
Great Karoo Plain
Great Bushman Land
Little Bushman Land
Karroo Berg
Roodeberg
Witteberg
Zwarteberg
Swartberg
Langeberg
Cape Town
Port Elizabeth
East London
Durban
Port Nolloth
Kimberley
Bloemfontein
Pretoria
Johannesburg
Mafeking
Vryburg
Kuruman
Upington
Prince Albert
Beaufort West
Aberdeen
Graaff Reinet
Cradock
Grahamstown
Port Alfred
Port St Francis
Cape of Good Hope
Table Mountain
Longitude East 24 from Greenwich
The Edinburgh Geographical Institute

logy of South Africa," but the Survey seems to be the most interesting and important matter in hand.

The Commissioners had a **grant** of £1,500 placed at their disposal, £1,250 to be devoted to the Survey, and £250 to miscellaneous expenses.

The accompanying **geological map** is taken from that compiled by E. J. Dunn, and published in 1887. Although admittedly far from complete, it furnishes a general outline of the geology of South Africa, so far as it has been explored from time to time by geological experts. Frequent reference to the map, and the explanatory key to the classification of the strata represented, make elaborate descriptions of the positions of the different rocks unnecessary.

As the knowledge of facts relating to South African geology is likely soon to expand, the shortest possible reference will now be made to the subject.* The first important worker in the geological field was **A. G. Bain**, a road engineer, who, while superintending the construction of the magnificent mountain passes in the Colony, had a unique opportunity to follow his natural inclination in the line of geological research. **Andrew Wyley**, of the British Geological Survey; **E. J. Dunn**, of the Geological Survey of Victoria; **T. Bain**, the late Geological and Irrigation Surveyor of the Colony; **Dr Atherstone**, of Grahamstown, and a number of others, have contributed their share to the general stock of geological information pertaining to the Colony.

The **littoral zone**, which appears in the south-west of the Colony, belongs to the "ancient sedimentary deposits of the palæozoic or primary formation," and is classed as Silurian.

The lower "**Malmesbury**" and "**Lydenburg**" beds are clay slates, varying from soft mud-stones to fine argillaceous schists and gritty sandstones.

Masses of granite pierce these rocks, and overlie them in a considerable number of places indicated on the map.

Lying unconformably to them, and covering the clay slates and granites, "is a great horizontal deposit, at times 10,000 to

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* Indebtedness is acknowledged to the chapter on geology in the Official Handbook of the Cape and South Africa, and to a paper by D. Draper on "The Rand Conglomerate," reprinted, with discussions thereon, from the *Standard and Diggers' News*, Johannesburg, 11th June 1895.

12,000 feet deep, of unfossiliferous quartzose (**Table Mountain**) sandstone, with, in some places, embedded pebbles or conglomerate." This stretches east and north from the elbow formed in the Cape Town direction, and caps the first or **coast range** of mountains.

It is in the auriferous conglomerates of this formation that the famous **Rand Gold Mines** at Johannesburg are situated, which before the end of 1895 employed 70,000 natives, and produced gold at the rate of £9,000,000 per annum, with a prospect of an increase to £12,000,000 or £14,000,000 within a few years, when the deep-level mines now being sunk (some to a depth of 2,500 feet) come into active production. At one time it was thought that the gold-bearing conglomerate on the Rand or ridge formed the edge of a great basin, and that the beds in the centre of this area, probably 200 miles in diameter, would be found lying horizontally, and comparatively near the surface; but this theory is exploded, and it is believed that the conglomerates yielding gold were forced up from a great depth by the protrusion of granite, which accounts for their dipping to the north and also to the south of the granitic mass lying to the south of Pretoria.

Wherever the Table Mountain conglomerates appear, the oldest yet discovered in Africa, they contain gold, but generally not in "payable" quantities.

The **gold** is not **found** in the pebbles, but in an invisible condition in the matrix of indurated cementing material joining these rounded water-worn masses into a hard and solid rock. It is believed that the gold in solution, probably as the chloride, must have been precipitated in a very fine state of division, as it filtered through the conglomerate during the process of its formation into rock.

The following interesting note by the Hon. J. C. F. Johnson, Adelaide, on the "**Deposition of Gold**," recently appeared in the *Transactions of the Australasian Institute of Mining Engineers*, and the specimens referred to were exhibited at the Imperial Institute, London, in February 1896:—

The question as to how gold was originally deposited in our auriferous lodes is one to which a large amount of attention has been given, both by mineralogists and practical miners, and which has been hotly argued by those who held the igneous theory and those who pronounced for the

aqueous theory. It was held by the former that as gold was not provably existent in nature in any but its metallic form, therefore it had been deposited in its silicious matrix while in a molten state, and many ingenious arguments were adduced in support of this contention. Of late, however, most scientific men, and indeed many purely empirical inquirers (using the word empirical in its strict sense) have come to the conclusion that though the mode in which they were composed was not always identical, all lodes including auriferous formations were primarily derived from mineral impregnated waters which deposited their contents in fissures, caused either by the cooling of the earth's crust or by volcanic agency.

The subject is one which has long had a special attraction for the writer, who has published several articles thereon, wherein it was contended that not only was gold deposited in the lodes from aqueous solution, but that some gold found in the form of nuggets, had not been derived from lodes, but was nascent in its alluvial bed; and for this proof was afforded by the fact that certain nuggets have been unearthed, having the shape of an adjacent pebble or angular fragment of stone indented in them. Moreover, no true nugget of any great size has ever been found in a lode such as the Welcome 2,159 oz., or the Welcome Stranger 2,280 oz.; while it was accidentally discovered some years ago that gold could be induced to deposit itself from its mineral salt to the metallic state on any suitable base, such as iron sulphide. Following out this fact, I have experimented with various salts of gold, and have obtained some very remarkable results. I have found it practicable to produce most natural-looking specimens of auriferous quartz from stone which previously, as proved by assay, contained no gold whatever. Moreover, the gold, which penetrates the stone in a thorough manner, assumes some of the more usual natural forms. It is always more or less mammillary, but at times, owing to causes which I have not yet quite satisfied myself upon, is decidedly dendroidal, as may be seen in one of the specimens which I have submitted to members. Moreover, I find it possible to moderate the colour and to produce a specimen in which the gold shall be as ruddy yellow as in the ferro-oxide gangue of Mt. Morgan, or to tone it to the pale primrose hue of the product of the Croydon mines.

I note that the action of the bath in which the stone is treated has a particularly disintegrating effect on many of the specimens. Some, which before immersion were of a particular flinty texture, become in a few weeks so friable that they could be broken up by the fingers. So far as my experiments have extended they have proved this, that it was not essential that the silica and gold should have been deposited at the one time in auriferous lodes. A non-auriferous silicious solution may have filled a fissure, and after solidifying, some volcanic disturbance may have forced water impregnated with a gold salt through the interstices of the lode formation, when, if the conditions were favourable, the gold would be deposited in metallic forms. I prefer, for reasons which will probably be understood, not to say exactly by what process my results are obtained, but submit specimens for examination :—

1. Piece of previously non-gold-bearing stone. Locality, near Adelaide, now showing gold freely in mammillary and dendroidal form.
2. Stone from New South Wales, showing gold artificially introduced in interstices and on face.
3. Stone from West Australia, very glassy looking, now thoroughly impregnated with gold; the mammillary formation being particularly noticeable.
4. Somewhat laminated quality from Victoria, containing a little antimony sulphide. In this specimen the gold not only shows on the surface, but penetrates each of the laminations as is proved by breaking.
5. Consists of fragments of crystallised carbonate of lime from Tarrawingee, in which the gold is deposited in spots, in appearance like ferrous oxide, until submitted to the magnifying glass.

The whole subject is worthy of much more time than I can possibly give it. The importance lies in this: That having found how the much-desired metal may have been deposited in its matrix, the knowledge should help to suggest how it may be economically extracted therefrom.

SECRETARY'S NOTE.—If the above process were reversed, under what conditions could it be applied for the extraction of gold?

The author would like to add, How are the investing public to be protected against swindlers who introduce gold into specimens which possess no gold naturally, and pretend that they are samples of large deposits?

The **Bokkeveld beds** rest conformably upon the coarse gritty sandstones of the Table Mountain sandstone series. They consist principally of soft micaceous deposits of various colours, abounding in fossil trilobites and other **Devonian** forms of extinct marine mollusca. Numerous Devonian fossils occur in argillaceous shales which rest on the Bokkeveld beds in the **second belt of mountains**.

The next important stratum,* but not separately shown on the map, is chiefly made up of **dolomitic limestone**, consisting of equal quantities of the carbonates of lime and magnesia, small quantities of silica, and also bands of it in the form of "hornstone, being interstratified with the more calcareous rock." The rock weathers into curious irregular shapes, which somewhat resemble the wrinkled hide of an elephant, hence the origin of one of its names, **Elephant Rock**, or in Dutch

* On the authority of D. Draper.

"Oliphant Klip." In the Transvaal, where it occurs pretty extensively, its position in the geological sequence is said to be slightly unconformable to and immediately overlying the upper conglomerate bed known as the "Black Reef."

It is also the rock in which the world-famed **Cango Caves** have been excavated by nature, and in which numerous caverns, underground watercourses, and sink-holes occur.

The conspicuous band marked 6 on the geological map belongs to the **carboniferous era**, and consists of a white coarse sandstone and quartzite.

In superposition to this is the **Dwyka** or **trap conglomerate**, a unique formation which has puzzled geologists. It contains "fragments derived from all the formations earlier than itself known in South Africa, such as granite, gneiss, quartz, jasper, porphyry, amygdaloid, limestone, schist, slate, shale, sandstone, and trap, and of sizes varying from that of a pin's-head to blocks several feet square, the whole being set in an indurated, and in some instances metamorphosed, muddy substance," which Professor Seeley says has probably been formed from the dust of volcanic ash which has settled in water, and set round the rock fragments, binding them together. It is now located at an average altitude of over 3,000 feet above sea-level.

The stratum is marked 7 on the map, and is the **lowest** of the extensive **Karoo beds**, and skirts a basin 800 miles long and 250 broad, occupying the central part of Cape Colony, and extending northwards far beyond its borders. It has been thought by prominent geologists that glacial action had to do with the laying down of this formation.

The Lower Karoo beds are of great thickness, very old, and distinctly unconformable to the Upper Karoo beds. It has consequently been necessary to distinguish them by different names.

The Dwyka conglomerate is "followed by a succession of shales and sandstones of immense thickness," called "**lacustrine**" **beds**, which are noted for the "homogeneity of the deposits and the fossil **reptilian remains** found in them." The Lower Karoo beds are now familiarly known as the **Ecca beds**, and include the Dwyka conglomerates already referred to.

The **Karoo beds**, marked 8 on the geological map, overlying the Ecca formation, occupy a much wider surface area and the two together form a very large proportion of the southern extremity of South Africa.

The **hills** in the **Karoo area** possess a characteristic aspect, being composed of alternate layers of sandstone and shale, which weather unequally, and consequently show on their sides irregular horizontal bedding. All but the smaller peaks are flat-topped, and frequently they are capped with basalt, which has prevented the underlying horizontal strata from being weather-worn, and carried away by the natural process of erosion, which is so exceptionally active in South Africa that vast tracts of country lying between those low flat-capped hills have been denuded of successive layers of soil formed from the decaying rocks. The general surface has in consequence been greatly lowered. It has been remarked that a flat-capped hill and a small peaked hill are frequently found close to each other; but it would seem that this is merely a coincidence or matter of chance. It is also pretty widely believed that the Karoo area was at one time the site of a great saucer-shaped **fresh-water basin**, and owing to the uniformly horizontal position of the Upper Karoo beds, and to the absence of marine fossils in the Karoo beds generally, that South Africa has during long epochs of later geological time **not** been **submerged** in the sea like so many existing dry land areas, besides areas that now form sea bottoms, which were formerly dry land.

It is in the Karoo or Kimberley shales that **diamonds** have been found in such numbers, enclosed within **volcanic** pipes filled with blue clay, which is supposed to have been at one time boiling mud in the mouths of active geysers. G. S. Corstorphine, Professor of Geology of the School of Mines, Cape Town, without expressing any opinion of the popular theory, says, "It is a serpentine tuff, often very hard, and consisting of sharp angular fragments of rock."

The **Stormberg rocks**, about 1,000 feet thick, which lie immediately and conformably on the upper strata of the Karoo beds, occupy a position to the north-east of the extensive Karoo area. This is the only formation in which **coal** has been found in Cape Colony. It consists of "coarse grey

PLATE [illegible] — [illegible] Cattle [illegible] Oak Tree [illegible]
Enclosed by Mountain Walls — The crumbling [illegible] by the [illegible] River [illegible]

quartzose grits passing into a conglomerate, and alternating with thin bands of shales and claystones, with which are intercalated the coal seams." Coal in South Africa has not been grown where it is now found; but the vegetable matter used in its formation has been carried by rivers into great lakes, and deposited in layers even 60 feet in thickness. In the process of deposition it had become mixed with fine sand and mud, which now form part of the solid mass, making the coal inferior in quality, and largely increasing the proportion of ash left after burning as compared with that of British coal. On the top of the coal-bearing strata are sandstones, among which is the "**cave sandstone**," covered with hard volcanic matter, which forms the roofs of great caves made by the weathering of the sandstone.

Volcanic action has been extensive in South Africa at various remote periods of time, but the disturbances and displacement of rocks have been comparatively local, and the position of the great body of the rocks remains unaltered. Locally, however, "vast masses of **dolerite**, in the form of dykes and lateral sheets, pierced through or welled over the stratified rocks in all directions." It is to the appearance of this dolerite capping that the irregularity of the surface is mainly due, its hardness interfering with the uniformity in results of the natural process of weathering, which, had the rocks been all like each other, would have worn away the surface equally, and given it a more horizontal or slightly rounded form. On the Stormberg range, where the mountains run up to over 7,000 feet above sea-level, the flows of dolerite seem to have been on a very extensive scale.

The Colony is intersected by **three** pretty distinct but irregular **chains of mountains**, lying east and west, and marking in a rude way areas occupying different elevations, like the steps of a stair.

The **first** or **coast range**, beginning from the east, includes the Longkloof, the Lange-bergen, the Drakensteen, and the Bokkeveld Mountains.

The **second chain** includes the Kat-berg, Winter-berg, and Zwarte-bergen ranges.

The **third** and highest **chain** is a continuation of the great **Drakensberg range**, which forms the western boundary of

Natal with the Orange Free State and Basutoland. This embraces the Stormbergen, the Snieuwberg, the Nieuwveld, and the Roggeveld Mountains.

The **veld** lying between the first and the second chain of mountains is generally "sweet," and the country excellent for live stock. Where the rainfall is abundant, and even excessive at certain periods, the soil is injuriously washed, and the vegetation becomes "sour," viz., coarse and wiry, as it comes to maturity. This condition prevails near the coast and on the high land of the interior, which rises as a central plateau of irregular form.

The third chain of mountains forms the main **watershed of the Colony**, separating the rivers into two great divisions—those that flow with an easterly or southerly direction into the Indian Ocean, and those that find their way to the Atlantic by a northerly or westerly course.

Many so-called **rivers in the Karoo** and inland parts of the country become dry water-channels during the rainless winter season, their courses being marked by water-worn pebbles, and by the growth of a greater number of mimosa-trees in those districts in which trees grow than are found on the higher and drier land adjoining. So much is this the case that South Africa has been rather sweepingly, and as a whole inaccurately, described as "a country of rivers without water"; the same authority adding, "flowers without smell, and birds without song." After heavy thunder-showers rivers in the arid regions sometimes come down suddenly and with great force, forming a wall of water twenty feet deep, which is a considerable source of danger to any living thing taken unawares in its course. The Karoo rivers flow in a condition which may aptly be described as muddy and brown like pea-soup. The **soil** is loose and easily moved by water, and the surface, growing only straggling bushes, which do not protect it from erosion as a grassy sward would do, becomes water-worn and bare.

One of the most prominent surface features of the country as a whole is the **want of** anything like a satisfactory or uniform **covering of soil**. The heights are washed bare of earth. Only a limited portion of that removed has been deposited in the hollows or on the plains. Even where accumulations of

PLATE 17.—SWIMMING A RIVER IN FLOOD

Face page 58.

Photo. by W. Roe, Graaff Reinet. PLATE 18 — A DEEP SLUIT, *Face page* 59.

soil have taken place when the country lay in a state of nature, a comparatively recent denuding action has been called into activity, in the shape of **watercourses**, originally begun by sheep and other farm animals making little pathways in the veld. These rapidly wear into deep sluits, and even large rivers, down which immense quantities of soil are carried by the escaping rain-water.

A proper **management of grazing veld** now involves, in the case of dry land, the stopping of watercourses as they begin to form; and in a humid district the making of them by opening a furrow, which speedily deepens sufficiently, under the action of the water, to carry off any excess of moisture.

There is great diversity in the **quality of the soil** of Cape Colony, depending on the nature of the rocks from which they have been derived, and on the circumstances under which they have been deposited. The best districts, as may be gathered from what has already been said, are mostly in the form of pockets or small areas. In this matter, the remark that "the country is one of samples" is in the main correct. The most serious deficiency in the composition of the soil is the **lack of** available "bone-earth" or **phosphate of lime.** The defect is shown by the appearance of disease in farm stock, due to the want of proper bone nutrition, and in the ravenous manner in which **animals devour** the **bones** of dead animals that lie about on the surface. This is all the more wonderful, seeing that **lime** is so **abundant** in many of the geological strata represented, although it is absent to quite an exceptional extent in the Lower Silurian or Malmesbury beds, which contain less than a half per cent., and there are quartzites, sandstones, and shales almost destitute of lime.

Much of the lime seen on or near the surface—throughout the vast stretch of the Karoo beds, for example—is in a peculiar amorphous condition, not unlike chalk when it occurs in quantity. It appears as if it had been precipitated or settled from solution, after being brought near to the top in an ascending current of soil-water, which made its escape by evaporation. Ample evidence of this is seen in the lime deposited in the cracks of shattered basaltic rocks visible on the surface in many parts of the country.

One of the prominent defects of Cape Colony is the **want of water** on the surface, or within the reach of plants and animals. As is the case in many arid countries, with heavy periodical rains, the supply exists, but it is naturally conserved by having a covering of the earth's crust over it to protect it from the sun. In other words, an **ample supply** of water for live stock, and for a limited area of garden cultivation by irrigation, exists below the surface, and, fortunately for the Colony, the supply is only a few feet down, rendering deep boring unnecessary. As the supply is entirely dependent upon the rain which soaks into the ground, as it were, for protection, the supply, though it ought to be sufficient, is not unlimited, and ought to be conserved, so that the supply of the future may be ensured. Although water will at first rise by pressure in some places above the mouth of the borehole, the catchment areas are so small that anything like a supply of **artesian water** is meagre, and far from permanent.

The work undertaken by Government of sinking boreholes with **diamond drills** to moderate depths of 43 feet on the average has been attended with most gratifying results. In a very large majority of cases what appears to be practically an inexhaustible supply of water has been found, which is made readily available by pumping. The **Report** of the **Inspector** of Water Drills, presented in 1895, shows that an aggregate of 13,480 feet were sunk during the preceding year, at a cost of £613 for diamonds, or 11d. per foot. The sinking of **deep bores**, which has in Queensland proved so successful, if at the same time costly, is quite unnecessary in Cape Colony, and owing to the character of the strata, it is extremely questionable if water would be found.

Sinking to 1,570 feet in **Queensland** has cost on the average about £4,000 for each bore; but there water is not reached a few feet from the surface, and the areas of unbroken rock strata through which the water percolates from a higher level are immense.

The **water** in Cape Colony is **held** back in the soil **by dolerite** or trap **dykes**, which frequently intersect the strata, and it is inside such an area, at a little distance from one of these dykes, that the experienced borer commences operations. If the **dyke be cut**, which was and is a very common colonial

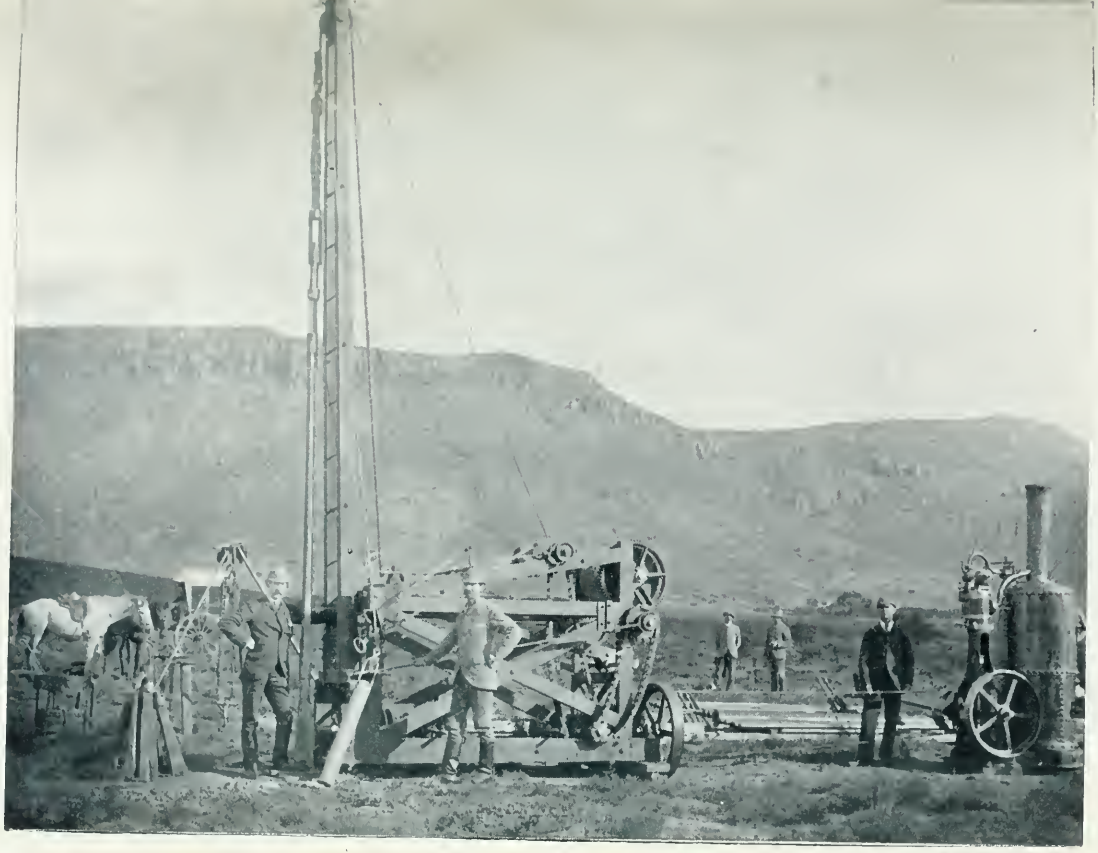


Photo. by Roe, Graaff Reinet. PLATE 19.—STEAM JUMPER DRILL BORING FOR WATER. *Face page* 60.

Photo. by W. Roe. PLATE 20.—WELLWOOD FARM, IN THE MOUNTAINS NORTH-EAST OF GRAAFF REINET. *Face page 61.*

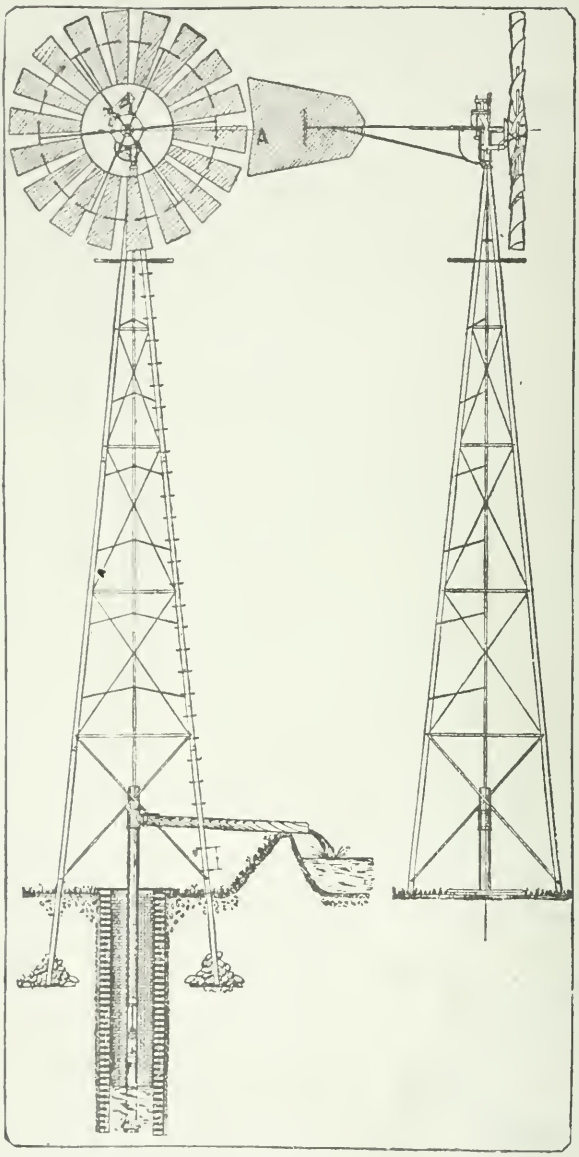
Entirely developed by Surface-water collected in Dams.

practice, to get the water to flow, the height of the water-table retained in the soil will be lowered, and if the natural rain supply is less than the amount permitted to escape, which would readily be the case with a limited catchment area, the supply will shrink, and be more difficult to reach. It is for a similar reason that the flow from an **artesian well**, if of local character, often becomes weaker as time goes on.

Dr Hutcheon, the Colonial Veterinary Surgeon, has strongly advocated the use of **well-water for stock** rather than surface dam water, on account of the latter becoming filthy with the droppings of the animals allowed to walk into and stand in it, and also owing to such places becoming favourable breeding-grounds for internal animal parasites. The great difficulty is the application of the power for pumping, a large number of farmers declaring that "unless water will flow, a well is of no use."

Although **wind power** has been on the whole a failure in South Africa, it must not be taken for granted that ultimate success cannot be achieved by it. There existed difficulties peculiar to the country, in the form of high winds and the unreliable nature of black labour, which under the circumstances were sufficient to account for the result, but neither of these are unsurmountable or permanent difficulties.

High winds exist in California, where air-motors have been successfully used for years, and certain forms of the most recent steel mills are so strong, and require so very little attention, that there are few places where a white man cannot be found free to devote all the time required to keep a motor at work. To raise pure water for stock, for domestic use, and for irrigation purposes on a small scale, from the vast number of wells which now tap the great subterranean water supply of Cape Colony, or will be bored in the immediate future, a cheap and simple power will be required, and this may be found in certain forms of wind-motors. **Annular steel mills**, with the vanes rigidly fastened to an iron framework, are infinitely superior to those combinations of wood and iron, which collapsed somewhat after the fashion of a large umbrella, and were frequently going out of order. They had the extent of the area exposed to the wind regulated by the movement of the individual vanes rather



THE CHICAGO AERMOTOR (16 FEET) PUMPING WATER ON A FIXED STEEL TOWER (50 FEET).
See also Appendix D.

than by the entire wheel turning automatically under the influence of the rudder-vane to face the wind, or to meet it at an angle according to the strength of the air current impinging upon it. The **Chicago "Aermotor,"** illustrated in the accompanying figure, is an excellent typical example of the class of improved mill referred to.

The **Rollason Wind-Motor*** involves an entirely different principle, but one which appears to be admirably suited to South African conditions. A Rollason motor, 12 feet in diameter, has been for some time in use at Gravesend, draining the rifle butts, under the care of the War Department (Royal Engineers), and doing excellent work by driving a 4-inch double-barrel force pump, which lifts the water from a reservoir, and forces it through 300 feet of 2-inch pipe in the process of discharging it into the sea.

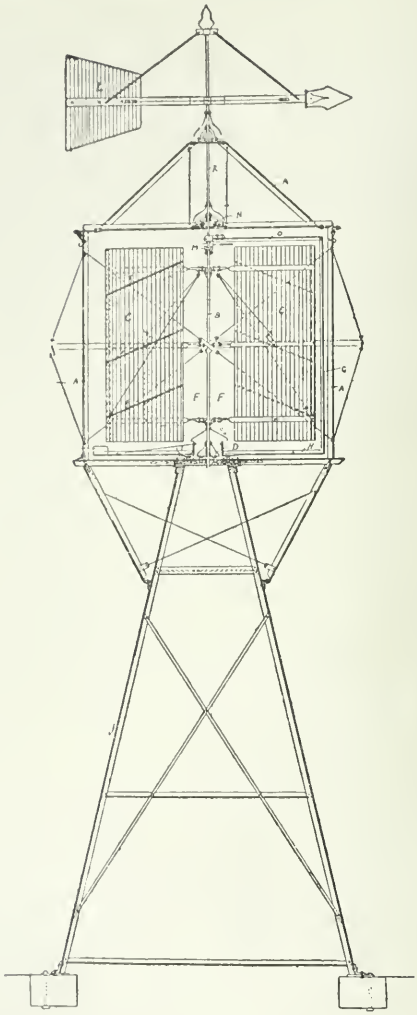
SIZES AND CAPACITIES OF THE MILL.—WIND VELOCITY 11 MILES AN HOUR.

Diameter of Motor.	Size of Pump.	Height of Lift Suction and Delivery.	Approximate Amount Gallons per Hour. 8″ Stroke, 25 Rev.
8 feet × 5 feet high . .	2″ S.	80 feet	125 gallons.
10 ,, ,, . .	3″ S.	100 ,,	280 ,,
12 ,, ,, . .	4″ S.	150 ,,	340 ,,
15 ,, ,, . .	2½″ D.	150 ,,	400 ,,
17 ,, ,, . .	3″ D.	150 ,,	570 ,,
20 ,, ,, . .	4″ D.	150 ,,	1,050 ,,
23 ,, ,, . .	4½″ D.	150 ,,	1,350 ,,
25 ,, ,, . .	5″ D.	150 ,,	1,700 ,,
27 ,, ,, . .	6″ D.	150 ,,	2,450 ,,
30 ,, ,, . .	5″ T.	150 ,,	2,750 ,,
34 ,, ,, . .	6″ T.	150 ,,	3,760 ,,
40 ,, ,, . .	9″ T.	150 ,,	7,800 ,,

S.—Single Action. D.—Double. T.—Treble.

"If the total amount of lift be reduced, then a larger pump can be used, and more water obtained in proportion. For instance, a 10 feet motor, delivering water 50 feet high, would give 560 gallons per hour; if to be forced higher, then a smaller pump is employed. All sizes can be fitted with automatic arrangements for stopping the pumps (when tanks are full), and re-starting them."

* Address of Company, 13 Berners Street, London, W.



SECTIONAL ELEVATION OF A 12-FEET DIAMETER ROLLASON WIND-MOTOR.

The revolving sails of this motor are placed horizontally, and erected on a tower within a skeleton turret (A). From the top to the bottom of the centre of the turret is a vertical steel shaft or axis (B) having five concave sails (C) attached, which revolve on radius rollers (D) immersed in oil. On these sails are fixed a number of inclined ridges or planes (E), which deflect the force exerted by the wind to their peripheries. Between the sails and the shaft is a considerable open space (F) which allows the

PLATE 21.—A ROLLASON WIND MOTOR. *Face page 64.*

It has been suggested that a **diamond drill** for deep levels of 1,000 to 1,500 feet should be **associated with** the Geological **Survey** just beginning, and a bore sunk every hundred miles along a line drawn through the centre of the Colony; the object being to settle the questions relating to minerals and water, as well as to the geological strata underneath, at one and the same time. That a drill to tackle such difficulties as the geological surface-indications cannot explain may ultimately be useful, no one will deny, but the operation is expensive, and should not be resorted to until a complete geological survey of the surface rocks has been made and tabulated, and until it is seen what can be absolutely determined by naked-eye observation.

A curious feature of the Colony is the occurrence at widely distant centres of **warm springs**, sometimes of pure unmedicinal water, and at other times water heavily charged with salts of iron and other soluble salts. On the hillside a little way above Caledon village, a spring registering 120° F. issues from a local formation largely composed of iron, which has been precipitated probably through ages from the water. About ten miles from **Worcester**, across the Breede River, is a large spring and pool of pure water, so hot that dogs which

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wind to actuate three sails out of the five, at the same time. Outside the sails is a screen (G), supported by six radial or cross arms (H), bolted to a centre bearing (I) which is free to rotate independently of the sails. From the top of this screen is a second vertical shaft (K) continued through the apex of the turret, and to this is fixed the vane (L), so that when the direction of the wind changes it moves the screen (G) by the arms (O) into the correct position for the concave sides only of the sails to catch the wind. On the top of the sail shaft is a cup (M) containing oil, within which the shaft (K) rotates. The weight of the vane shaft is carried on the roller bearing (N). The whole weight of the sails and framing supporting the screen is carried on the centre bearing at the bottom of the turret and top of tower, which thus gives to the working part of the motor the desired balance and stability.

There are only four working parts in the motor, three of which move only as the wind changes. The whole of the weight is balanced on the one main working bearing, which rotates on rollers immersed in oil, which may be supplied in sufficient amount to last for several months (thus reducing friction to a minimum), and fitted with covers for protection against dust and rain. The simplicity of construction makes it unlikely to get out of order, and it can be left without attention for lengthened periods. It can work either in a gale or a light breeze.

have unwittingly entered it have become immediately overpowered by the shock to the nervous system, and drowned. Both of these are natural wells that have been in existence for a very long time; but the hot spring, with a temperature of 100° F., already mentioned as occurring near **Burghersdorp**, issued from a 6-inch Government bore-hole, 70 feet deep. The well at **Newlands**, near Kimberley, had a pretty uniform temperature of 72° F.; and that at **Braam Spruit**, near Aliwal North, ranges between 58° F. and 62° F.

A considerable number of **brak** or saline springs occur in different parts of the Colony. The water they discharge is unsuitable for irrigation, although stock often drink it in preference to pure water. A series of these springs occurs in a line from the Fish River to Koonap. The most curious fact relating to them is that they run most strongly during times of drought, and are weakest after heavy thunder rains,—a phenomenon which has not yet been satisfactorily explained.

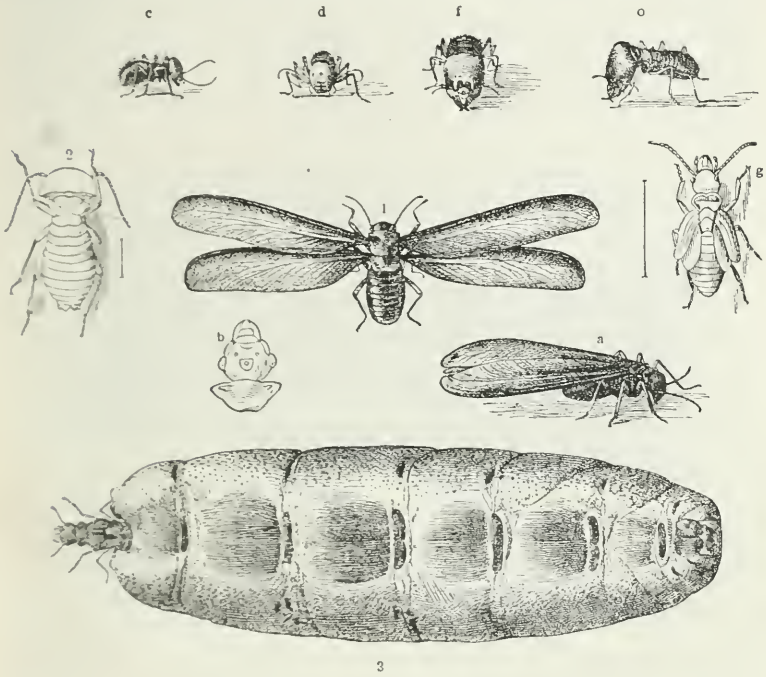
The so-called **white ants**, *Termites*, exist in large numbers throughout nearly the whole of Southern Africa, and exercise a considerable influence upon the land surface features of the continent. Of many species, three or four are well known and easily distinguished by the differences in the form of their

FORM OF ANT-HILL SO COMMONLY SEEN IN CAPE COLONY.

hills. The species which is widely distributed through Cape Colony, Natal, the Free State, and the Transvaal, is *Termes viator*, which constructs rounded shapely **hills or heaps**, like gigantic molehills, about 2 to 3 feet high, which stud the plains like so many cocks in a hay meadow. The hills are

hard exteriorly, and difficult to break down. Inside they are honeycombed with many channels and cells for the accommodation of the numerous colonies of inmates.

Farther north than the area referred to, *T. atrox* and *T. mordax* build cylindrical pillars not quite 3 feet high, furnished with a projecting roof or head shaped like that of a young mushroom. In these parts also *T. bellicosus*, named by



From Brockhaus' Konversations-Lexikon, 1895.

1. *Termes dirus*—Male, from above. (*a.*) Do., side view; (*b.*) Do., head; (*c.*) Worker; (*d.*) Do., front view; (*e.*) Soldier; (*f.*) Do., front view.
2. *Termes bellicosus*—Worker. (*g.*) Nymph. 3. Female of *Termes regina*.

Fabricius *fatalis*, forms hills of gigantic size—many being 10 and 12 feet, and some even 20 feet in height, or as large as a good-sized Kaffir hut. They are more conical and peaked than the ant-heaps of Cape Colony, and furnished with conical turrets on their sides.

Ant-hills are made of earth, cemented together by termite excrement and by secretions from glands existing in the insect

for the purpose. The accompanying figures illustrate a number of the more common forms the insect assumes. The wings are used only to enable the surplus members of the community to swarm off like bees, and are very easily and simply shed after a single flight. The true ant is cased in close-fitting and well-jointed armour, whereas the external skeleton in the termites is very imperfectly developed. Young and adult termites alike are naturally soft and "thin-skinned." They are of a peculiar white colour, and look as if they were gorged with milk. They are greedily sought after and devoured by the hymenopterous ants, by birds when they

THE CAPE ANT-EATER, ORYCTEROPUS CAPENSIS, GEOF.
From Cassell's Natural History.

are swarming, and by a large ungainly looking quadruped with a long snout, called the ant-eater or "aard-vark." As human food they are said by those who have had experience of it to be "delicious and delicate eating."

The plan of their domestic economy is akin to that of the honey bee. A termite community possesses its king and queen, and becomes thoroughly demoralised should the royal pair die without there being "certain 'complementary' individuals in such a state of advancement as admits of rapid development into royalties." Superfluous individuals swarm

off on the wing with the object of establishing new colonies in other places. These places do not include the higher mountain ranges, where rainfall is more abundant than on the plains.

The **work of ants** in the direction of soil-making is similar to that of earthworms, which are in their element where rainfall is abundant enough to moisten the soil sufficiently to enable them to do their work. Reference has already been made to them at pages 43 and 46. The washings from old **ant-heaps** make the grass round their bases sweet, so that stock eat it more closely than the surrounding veld. When an ant-heap is broken down in a young plantation the **trees** grow stronger and more quickly on the soil which has been top-dressed by the *débris*, but on land under cultivation the benefit derived is usually only noticeable for one year. When the earthy matter composing the hill is broken down into fine powder and mixed with ox blood, it makes an excellent material with which to plaster native **floors**. The heaps, owing to their dryness and the large proportion of organic matter composing them, together with quantities of dry grass frustules collected in some of the galleries, burn readily. The old transport riders (or ox-waggon drivers) used to set one on fire and bake bread in the centre of it. Up-country ant-heaps are still employed for cooking purposes. (See pages 49 and 66, also Appendix B.)

Drift sands occur on the **Cape Flats**, and at certain places along the south coast of Cape Colony, but most conspicuously and extensively on the peninsular area to the west of **Port Elizabeth** The position is shown in the accompanying **plan**.* Drift sands occur when very fine sand lacking cohesion is cast up on the shore, and dried and blown inland by strong winds. If in considerable quantity, it steadily advances inland, being supported by fresh storms of sand blowing on behind, and in its course covers up fertile soil and ordinary vegetation, and in time a sandy wilderness is produced, the surface of which changes so frequently and to such an extent under the influence of strong winds, that vegetation cannot

* Copied from a plan presented by J. S. Lister, Conservator of Forests, Midland Districts, along with a Report on the Drift Sands, submitted to the Harbour Board of Port Elizabeth in September 1890.

readily establish itself. Drift sand is a danger to property of all kinds located near it—railways, houses, and in the important instance under consideration, even the city and harbour of Port Elizabeth.

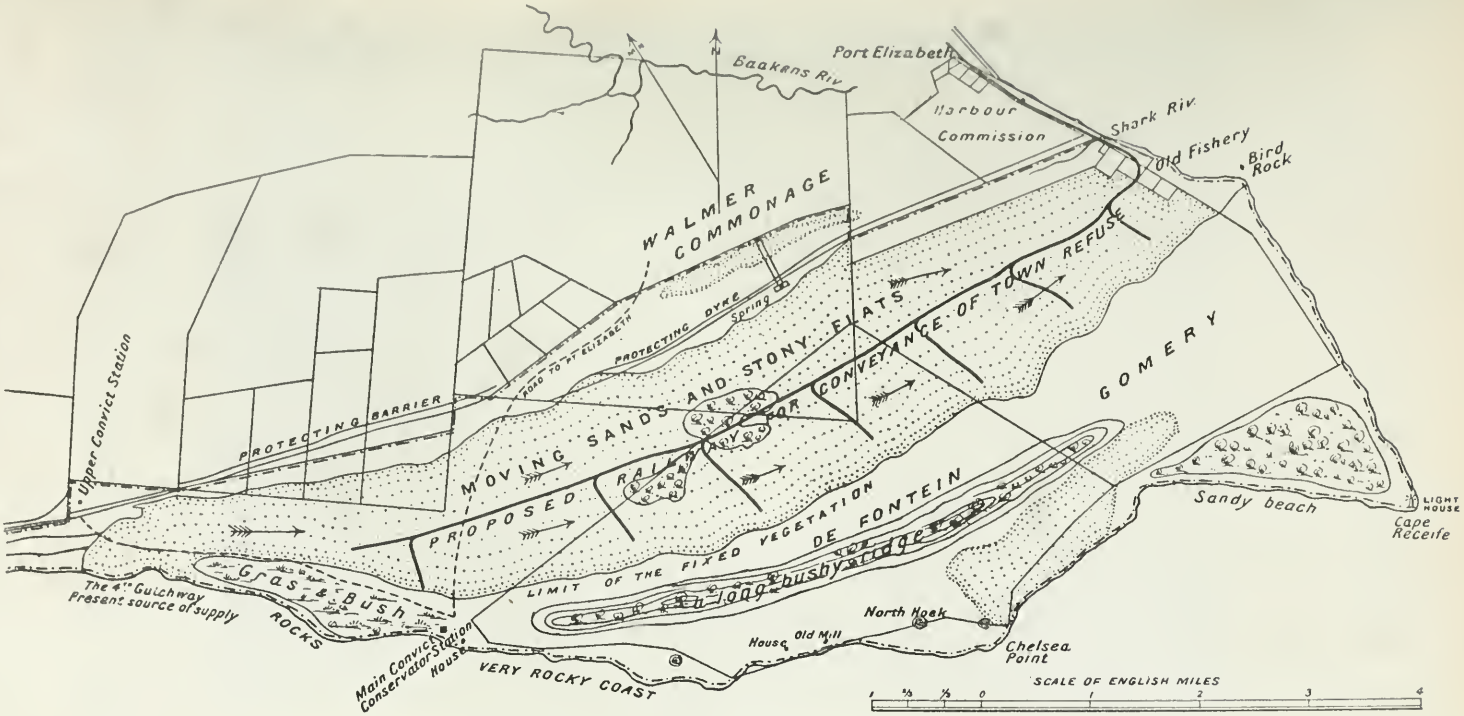
The area in question extends to upwards of 22 square miles (nearly 2½ × 10 miles), or 14,500 acres. The surface has assumed a wavelike appearance, owing to the sand forming in elongated irregular mounds or dunes at right angles more or less to the direction of the prevailing wind, the bottoms of the intervening spaces or valleys being stony beds on which no sand rests. The ridges run nearly north and south, the wind and the moving sand coming from a point south of west. The object in view is not only to fix the sand on the ridges, which extend to about two-thirds of the total area, but to turn it to profitable account by growing trees.

Extensive work in this direction has been carried out on the west coast of France between Bayonne and the mouth of the Gironde, where towards the end of last century an area of 300 square miles of country was rendered worthless by the presence of shifting sand. There the sands have been fixed, and successful forests of the cluster or maritime pine, *Pinus pinaster*, Sol., established. The necessary preliminary or temporary fixing was done by broom, *Sarothamnus scoparius*, Wimm., *Spartium scoparium*, L., which grows rapidly and forms a suitable nurse for the young pines. Sea marram (Gourbet), *Ammophila arundinacea*, Host., a reed-like grass, was also planted to bind the Dune Littorale or barrier erected to prevent the ingress of fresh supplies of sand from the shore.*

Assistance was sought from the published accounts of these and similar works carried out in Australia and New Zealand, where sands have been successfully fixed by planting marram grass, or *Ammophila*, but pines, excepting the Aleppo pine, *P. Halepensis*, have failed, and a more effective and better method of accomplishing the temporary fixing has been adopted.

In 1876, 4,000 tons of street sweepings and refuse were

* Sand Lyme grass, *Elymus arenarius*, has been extensively used for a similar purpose in Holland, and also on the Norfolk coast.



PLAN OF THE DRIFT SANDS NEAR PORT ELIZABETH.

spread over 80 acres of drift sand on the **Cape Flats**, and it was clearly demonstrated that no better method than the utilisation of **town manure** could be adopted for the preliminary stage of the operation.

The Port Elizabeth sands are now under the supervision of T. B. B. Hare, District **Forest Officer** in the Eastern Conservancy. The work was taken over by the Forest Department from the Harbour Board about two years ago. Forty tons of city refuse are delivered daily by rail, for which the Forest Department has to pay 3s. 9d. per truck of 4 tons for haulage. This is distributed over the land by means of a light portable railway, each train of three or four trucks being drawn by a team of four **mules** and worked by **convicts**, for whom the convict branch of the Colonial Office receives from the Forest Department the sum of 1s. per day. Eleven mules and fifty convicts are employed to do the work of hauling and spreading, and the area covered daily is 1¼ acres.

The work might proceed more rapidly but for the extraordinary action, or probably more accurately inaction, of the **municipal authorities** of Port Elizabeth, who permit an additional 20 tons (estimated) of garbage to be deposited at two centres (Brickmakers' and Coopers' Kloofs) within the city, there to form sources of danger to the health of the community. Not only do such putrid heaps of decaying filth pollute the atmosphere by giving off pestilential effluvia, but the soakage of the moisture escaping below, on a slope like that at Port Elizabeth, poisons both water and soil at a lower level for considerable distances.

The work has been begun at the **eastern end**, and the area reclaimed is steadily extending westward against the wind. To have begun in the west at Governor's Kop, where the sand came in from the sea (until it was stopped by a wattle barrier, gradually raised till it is now 30 feet high), would have been impossible, owing to the sand covering the railway, and the removal of the injury to the harbour would have been delayed for a number of years. Lister calculated that it would take sixteen years to complete the work, and that the capital outlay would amount to £56,400 sterling, which would ultimately be recovered mainly by the sale of forest products.

PLATE 22.—MULE TRAIN AND CONVICTS SPREADING TOWN REFUSE *Face page 72.*

On the steep side of a Shifting Sand Dune, Port Elizabeth. Stony flat or bare rock surface in the foreground.

Experience has shown that the time required will be longer, and the amount of outlay probably considerably less.

The **system of working** is extremely simple. A mixture of suitable seeds of trees is sown broadcast, after being put into boiling water and allowed to stand for forty-eight hours during winter or three or four hours during summer, to encourage germination, and the refuse is spread over it to a depth of about half an inch (see the accompanying plate). The sowing of grass seeds and of common rye has been discontinued, as they tended to choke the young trees, and it was found that enough oats in the horse manure in the refuse grew to accomplish the object aimed at. The rush-triticum, *Triticum junceum*, Linn., grows well near the gulch at high-water mark, but neither this, the French marram grass, nor pype grass, *Erharta gigantea*, are now sown.

The **trees** which have given the best results so far are the broad-leaved wattle, *Acacia pycnantha*, Benth.; the Port Jackson wattle, *A. saligna*, Benth.; the pseudo or mock acacia, *Robinia pseudoacacia;* and the tamarisk, *Tamarix gallica*, L., the latter growing very well from cuttings.

Brushwood is laid on the surface at exposed places, the stems towards the prevailing wind. It is also stuck up on end like a fence, with openings left so that the sand passes through and lodges on the other side.

Some of the older inhabitants in Port Elizabeth remember when there was no drift sand at the place where the reclamation work is going on, and a hundred years ago the whole area was a dense bush. The sand area, which began in the west, spread eastward owing to the bakers and lime-burners, soon after the middle of this century, cutting the bush for firewood, and leaving the surface unprotected.

CHAPTER IV.

GENERAL FLORAL FEATURES.

Main Particulars for which the Cape is Conspicuous—Four Distinct Floral Regions: (1) The South-Western, (2) The Semi-Tropical, (3) The Karoo, (4) The Kalahari—Diversity of Vegetation—Relationship of the Cape and the Australian Floras—Botanical Winter at the Cape—Devices by which Plants Resist Drought—Conspicuous Orders of Plants—Aromatic Character of Karoo Bushes—Rhenoster Bush—Sweet and Sour Veld—Silage—Tendency of Soil to Wash Away—Irrigating the Veld with Summer Flood Waters, and its Results—MacOwan on Stock-Food Plants—*Pentzia*—*Diplopappus*—*Selago*—Salt Bushes—Spek-boom—Prickly Pear—Aloes—Agave or American Aloe—The Harpuis Plant—More Worthless and Poisonous Plants—Preservation and Restoration of the Veld.

THERE are few regions of the globe which can be pointed to as providing such a wide and varied **field of interest** to the student of science as South Africa. The hidden treasures, geological and mineral, are vast and various, and the surface features present a wealth of variety which is quite unique. The flora of Cape Colony, with the exception of the tropical division, is to the ordinary observer **conspicuous** in at least **four main particulars**—its deficiency in trees; its want of luxuriance in growth; the dull and sombre shade of the foliage; and the brilliancy and diversity of successive crops of flowers of numerous species. The wonderful **variety** represented **in the flora** is due to an aggregation of a number of novel and interesting circumstances. (1.) It is believed that Cape Colony has fallen heir to representatives of the floras of two or possibly three great epochs in the world's botanical history. When most other parts of the earth's crust have been submerged in the great process of sedimentary rock formation, since the upheavals which followed the Devonian geological age, when the sandstones of Table Mountain were formed into solid rock, for some reason which has not yet been

LAND SURFACE FEATURES

Scale 1 : 5 600.000

English Miles

The Edinburgh Geographical Institute


Sand
Molope
Sand
Kuruman
Koranna
Upington
Land
Groot D
Kenha
Inat Kolks
Vermak
Pan
Zwartkop
Onderste
Doorns
Karre
Williston
Zak
Drooi Fr.
Vieuwve
Prince
Ladismit
Groote R
Port Beaufort
Clanfann
Bay

revealed, South Africa has been saved, and the flora with it. (2.) There is great diversity in the character of the soil, and this is made still more conspicuous by marked differences in elevation above the sea. (3.) The climate also varies to such an extent that it is impossible to consider the flora of Cape Colony as a whole. It has been found necessary to divide the country into at least four areas, which differ so much from one another that they require to be considered separately.*

(1.) **The South-Western Region,** forming a belt averaging about fifty miles wide, extending round the elbow of the west and south coasts, from Olifants River to within a few miles of Port Elizabeth, is a comparatively low-lying country, which is more or less irregularly and unequally supplied by winter rains,—a privilege denied to the greater part of the Colony.

(2.) **The Tropical or Semi-Tropical Region** is a spur or continuation of land growing vegetation similar to that in the area of the tropics of the geographer, which extends in a belt of nearly twice the breadth of the western region from the Natal border to Port Elizabeth. Its inland boundary is a chain of high mountains, rising from 5,000 to 10,000 feet in height, from the base of which the country slopes gradually to the sea. The surplus of the rainfall of about twenty-six inches is drained off by numerous rivers, which develop at times (during summer, when the rain mostly falls) into torrents which have cut for themselves deep channels, and given the surface a broken appearance. The vegetation there possesses more of the shade of green familiar to Europe than the other parts of the Colony. The surface of the ground is divided between grassy downs and bush, which varies much in size and density in different parts.

(3.) **The Karoo Region** forms the central area of Cape Colony, being shut in from the sea by the two belts already mentioned, with the exception of the west coast from the Olifants River to the Orange River. The elevation is much

* For admirable accounts of the botanical position of the country, see a chapter on "The Flora of South Africa," by H. Bolus, in the Official Handbook of Cape Colony, and a pamphlet on "The Cape Flora as it strikes a Stranger," by P. MacOwan, to both of which the author acknowledges indebtedness.

higher than the coast country. The northern portion, which is sometimes separately classed as the **Region of Composites**, lies to the north of the second great chain of mountains, and at an elevation of from 4,000 to 5,000 feet above the sea. It drains towards the north, in virtue of a gradual slope towards the Orange River. The predominating and constantly prevailing aspect of the country is that of a heathy tract, or dry elevated moorland, covered with small shrublets of a dull-green hue, the few intervening plants of different growth which occur being too small or too few to alter or modify the general appearance. The Karoo country is dependent exclusively upon summer rains, which are so light that only plants possessing special adaptability to semi-desert conditions can survive the annual period of drought.

(4.) **The Kalahari Region** lies mostly to the north of the Colony, and extends in that direction till it reaches the tropics. Its central southern border runs considerably to the south of the Orange River, until the meridian of longitude on which Kimberley stands is reached. There it recedes to the north of the river. The surface of the soil is mostly sandy, and surface water is extremely scarce. The rainfall is confined to summer showers, and is not so inconsiderable as the want of water on the surface would indicate. The nature of the soil permits of the rain sinking in rather than running off, as it does in the Karoo, where the surface becomes baked and hard. The Kalahari is essentially a grass country, interspersed with isolated shrubs or trees. Thick bushes, and even dense forests, lie to the north. The south consists of open plains. Grass does not grow into a close mat as in Great Britain, but in tufts, leaving bare spaces between, "twa-gras," a species of *Aristida*, being the most common.

The wonderful diversity of conditions which are to be found in these various divisions throughout the year leads to the maintenance of a unique **diversity of vegetable forms.** Of the 200 natural orders into which, following Bentham and Hooker, the plants of the world have been divided, 142 are represented in South Africa; while Australia, which is five times the area of extra-tropical South Africa, has only ten additional orders, or 152 in all. The number of endemic genera in South Africa is 446, while in Australia there are 520.

The **distant relationship of the flora** of the south-western region of Cape Colony to that of South-Western Australia is very striking, the natural orders being very much the same. There are, however, very few identical genera in the floras of the two countries, and no identical species. Sir Joseph Hooker accounted for this rather surprising state of matters, seeing the climatic and other conditions of the two continents have so much in common, by conjecturing that at some very remote time Australia and South Africa belonged to a great **Southern or Antarctic Continent**, the central part of which has become submerged—a time so vast that most of the genera, and all of the species, have become materially modified, although they may yet be classed under natural orders common to the two countries. The adaptability of the indigenous flora to South African conditions may be illustrated by the slow progress which has been made by about 200 species of plants belonging to foreign vegetation, which have been introduced. Most lurk by roadsides, or near human habitations. Few are found in the open country, or making headway against the indigenous flora. The prickly pear, *Opuntia*, is a striking exception to this general rule.

It is natural for plants as well as animals to have periods of activity and periods of quiescence or rest. In cold localities the **period of rest** is winter, when of the requisites for plant growth a sufficient degree of warmth is not obtainable. The South African botanical winter is not due to cold, but to deficiency of moisture. In the south-western district the period of rest is during the droughts of November till May—a time of great heat and brilliant sunshine, which, if associated with humidity, would produce a most luxuriant tropical vegetation. In the drier districts the period of rest is longer, and conforms more to what we Europeans regard as the natural order of things, owing to the absence of winter rains. The rainfall is so deficient and uncertain, as a whole, that vegetation has **developed various means** by which long periods of dry and scorching weather may be endured without serious consequences, and provided resources which can be drawn upon at the shortest notice, to enable the plant to fulfil its procreative functions during a brief period of prosperity. One means of self-preservation is by restricting the expansion

of the foliage. This applies to the great majority of Australian and Cape plants. The leaves of some genera are merely green needles, with a hard cuticle almost incapable of exhalation; others, including the heaths, have each leaf rolled backwards upon itself, so that it becomes cylindrical, and protects the stomata or breathing pores.

Another great family, the *Mesembriaceæ*, including much of the succulent flora of the Karoo, accomplish a similar object by developing fleshy leaves, an admirable provision of Nature in the interests of herbivorous animals, which not only find in these attractive and nourishing food, but in some of them a sufficient amount of juice to enable them to exist without water in regions in which it is impossible to procure it. Others, again, lay up stores of plant food and moisture in the form of bulblets, callosities or enlargements, great and small, on their fibrous roots. The numerous species of *Oxalides* are good representatives of this class, the store of nourishment laid up in this way from the accumulations of the previous season making the plant independent of everything but the early winter rains, which are necessary merely to soften the surface soil. It is in virtue of those devices of Nature, by which the scarcity of one year or season is supplied from the bounty of the preceding one, that the desert aspect which the Colony periodically assumes is almost like magic changed into that of a flower garden within a comparatively short time.

The numerous species of bulbous plants contribute largely to the condition of things just referred to, *Amaryllideæ* and *Irideæ* particularly, *Babianæ*, *Morææ*, *Ixiæ*, *Gladioli*, and among *Liliaceæ* the *Lachenaliæ* and *Ornithogala* being liberally represented. Some bulbs grow to an enormous size, that of *Brunsvigia Josephinæ*, Jacq., weighing 15 lbs. to 18 lbs.

For fifty years, embracing the end of the last and the beginning of this century, there was a rage in Europe for Cape bulbs and Cape plants of many species—pelargoniums, heaths, proteas, &c. Subsequently came the horticultural fashion of palm and orchid culture. The hot moist atmosphere of the tropical conservatory was incompatible with the life-conditions of the temperate Cape flora, and by degrees the old-fashioned "Cape house," with its proteas, heaths, diosmas, oxalises, and irids, disappeared. The rising school

Photo. by Wilson, Aberdeen, N.B.

PLATE 23.—ARUM LILIES.

Face page 79.

of gardeners demanded something tropically gorgeous, and a thermometer up to 80°. By this freak of fashion hundreds of lovely Cape plants became lost to European gardens. It is only within the last eighteen or twenty years, mainly by the collecting efforts of the staff of the Cape Town Botanic Garden, that the Cape bulbs and plants have come again into notice and culture, and have gained part of their former popularity through their reappearance at Kew, and the establishments of Max Leichtlin of Baden, Krelage of Haarlem, and De Graaf at Leyden.

Of the **gay plants** not yet mentioned, the numerous species of **terrestrial orchids** take a foremost place in the gorges of the western mountains. Conspicuous among these is the *Disa grandiflora*, the finest representative of the genus in the southern hemisphere. Among the various species, the most delicate shades of blue, brilliant orange, golden yellow, and white are liberally represented. The so-called "arum lily," *Richardia africana*, with its pure white bugle-shaped spathe, is the most conspicuous adornment of low-lying moist land. And on the slopes of the poor sandy mountain-sides, near Sir Lowry's Pass, the showy white **everlasting flower**, *Helichrysum vestitum*, with narrow velvety leaves, decorates the landscape, in its season, as if a shower of snow had fallen. As much as 200,000 lbs. weight of dry flower-heads has been sent from Caledon district in one season. In 1895 the price was 9d., and the year before 1s. 6d. per lb., but it has dropped as low as 4½d. The flower-heads are collected by children, and all sorts of frail and needy people, from September till the end of December, and about 2,000 flowers go to the pound weight of the product ready for market. They are used largely for church decorations and immortelle wreaths. In Russia they are much patronised by the Greek Church. The great European markets are London and Hamburg, from which they are distributed to all parts of the Continent.

Following soon after the appearance of the bulbous plants comes an endless variety of **heaths**, but mostly confined to the south-western district of the Colony. "Of 784 *Ericaceæ* described by Bentham in the Prodromus, 455 belong to the Cape," but "only about half-a-dozen representatives are found east of the meridian of Port Elizabeth." In a few localities,

"on isolated mountain tops," nearly up to the tropics, lingering species of heath may be found in the central upland plateau. **Proteaceæ** exist in three types—a large and a small type of those which exhibit the characteristics which are generally associated with the name of *Protea*; and a third, in which the famous silver tree, *Leucadendron argenteum*, of the Cape peninsula appears.

A peculiarity of the South African flora is the large number of the slower-growing trees and bushes which are protected by numerous hard sharp **thorns**. If not protected by some means, they would be seriously injured by the animals living too freely upon them during times of scarcity. Other means of protection are employed in rare instances. **A wild** variety of the **water-melon**, *Citrullus vulgaris*, Schrad., seen lying about on the veld is quite safe from extinction, owing to being intensely bitter. There is, however, another variety, indistinguishable in appearance, but with perfectly tasteless pulp, found abundantly in the northern Karoo, and throughout the Kalihari. Without its service, that waterless tract would be for part of the year quite impassable for a waggon-span. The oxen eat the watery pulp, and sufficiently quench their thirst.

Most of the **valuable Karoo bushes** give off a sweet aromatic perfume when bruised between the fingers, and the flavour appears to be agreeable to the palates of herbivorous animals. The mild degree of bitterness which characterises the extractive matter of some plants is rather appreciated than objected to by them. The plants which animals neglect are deficient in these characteristics.

The most conspicuous worthless plant of the "Boschjesveld" (bush country), which has been called the curse of the Western Province, is the **rhenoster** (*rhinoceros*) **bush**, *Elytropappus rhinocerotis*, Less. The soils on which it flourishes are not the richest, although its growth is considered to be an indication that the soil is suitable for cropping with grain in such districts as the Ruggens of Caledon and Bredasdorp. It does not take kindly to the rich vine soils, such as the Constantia red soils or the soils of the foot-hills about Worcester, Montague, and Robertson, where salt bushes begin to appear. There the **melk-bosch** (milkbush), *Euphorbia*,

takes its place, and occupies the surface that would probably otherwise be vacant. Along with it, growing freely in the veld, is associated the **boter-bosch**, *Cotyledon fascicularis*, Ait., with a thickish and bright-green leaf, and a stalk like a large geranium. Animals, and also Hottentots, draw a portion of their food supply from it.

The **rhenoster bush** has spread more widely and more quickly than exotic plants generally do, on account of its having been carried through the Colony by the brandy distilling Boers of old time, who used it as dunnage in packing the casks on their waggons. The Government was at one time urged to bring in legislation to eradicate it. This would have proved an impossible task had it been tried, as the plant seeds freely, and, as is the case of many other weedy plants, much of the seed remains in the ground in a dormant state for years. Its presence is not an unmixed evil. Where it supplants valuable fodder-plants it is most objectionable, but where it occupies a surface which would otherwise be bare it is productive of good. It prevents the washing and blowing away of loose surface soil; it gives shade and shelter to grasses and other useful minor plants, while all the time it is adding to the accumulation of valuable plant residue in the soil. Important points in its favour when regarded as a weed in cultivated land are that it is extremely easily uprooted when the ground is first ploughed, and it gives no further trouble during the period that the land is in crop.

The veld is familiarly classified into **sweet** (zoet) or good veld, **sour** (zuur) or poor veld, and half and half (gebroken) veld, occupying an intermediate position in the matter of quality. To a stranger it is a little difficult at first to realise what guides an observer in classifying a given area. These terms refer to the nature and quality of the natural plant growth, with which probably the climate has something to do, excessive heat and want of moisture hastening the development into indigestible woody fibres of tissues which under favourable circumstances would have remained longer succulent. On deep rich alluvial soils, or on land of good quality, generally "good veld" predominates, and food plants are succulent and palatable. Plant growth is inferior on thin or poor soil—defective in some essential plant-ash constituent, particu-

larly bone-earth (phosphate of lime), which is very generally deficient in the soils of the Cape Colony. **The heaths**, for example, which, unlike the common heather, *Calluna vulgaris*, of the Scottish Highlands, are of no value as food, are characteristic of sour veld. The quantity is not deficient, but, on the contrary, rank in many parts. Grass grows woody, long, and straggling, and is unattractive to stock. There is a want of the close, dense mat which is characteristic of good British pasture. Apart from its naked-eye aspect, sour veld betrays itself by the influence it exerts upon live stock. Animals brought from sweet veld suffer from what is termed **veld sickness,** which results from insufficient nutrition and the hard and irritating nature of the food consumed. Animals reared on sour veld thrive after a fashion, but are liable to suffer from what is known as lam-ziekte (lame-sickness), which results from the want of enough lime-phosphate in their food to make their bones strong and healthy. They lie down, and cannot be induced to rise. They may be kept alive for weeks if food be brought to them. It is unfortunate that a widespread impression prevails that lam-ziekte is produced by some poisonous plant, at the identity of which many wild guesses are made. Where the food is very coarse and inferior, the **incisor teeth wear** quickly, and not only do they become short, but the spaces between them widen and they become pointed. At certain seasons, too, they loosen, and the animals cannot feed properly. The worst of the sour grass veld, situated within a range of about forty miles from the coast, is regularly **burnt** off to clear the surface of the remains of the previous year's growth before the spring grass appears, and sheep farmers say it would be impossible to keep sheep if the pasture were not treated in this way. It may be perfectly true that burning improves the quality of the early grass, but it is certain at the same time to encourage the growth of woody, inferior foliage towards the end of the season and to aggravate the condition which it was expected to remedy. Over a considerable area, at least, a more profitable and at the same time more satisfactory way of disposing of the excess of vegetable growth of one year before the next begins to spring, would be to make it into **silage**. It ought to be cut while green, before it becomes woody, and put into good

large circular stacks, twenty feet in diameter, the building being carried on for a number of days to permit of the stack settling down after a temperature of about 130° F. has been reached, so that sweet and not sour silage may be the resulting product. With a stack of this size the material itself does the work of weighting for all but the top layer, and a few stones thrown on without planking are sufficient to prevent serious loss. When small quantities are to be preserved, it is necessary to sink a pit or **silo** in the ground. If possible it should be on a steep bank, so that the green material may be carted to the top of the upper wall and tipped over without being lifted, as is necessary when a stack is made. The natural descent of the ground permits of the silage being removed by an opening in the opposite wall, and of being carried away also without requiring to be raised the height of the wall. When silos are only twelve feet in diameter, and of similar depth (the minimum size a silo should be made under any circumstances), even although the sides be made perpendicular and smooth, and the material be rammed well at the edges and trodden as completely as possible, it is necessary to weight the top to the extent of 100 lbs. per square foot of surface to prevent moulding and decay.

Sour veld, such as is seen in the Maclear district, is improved by the **trampling of stock** and by close grazing, results which follow fencing into moderate-sized camps. The trampling is similar to but not so effective as the influence which would be exercised by cutting at the proper season for the making of silage. **Silage**, given in moderate quantities (40 lbs. to 50 lbs. a day to a horse or an ox), is a safe and palatable food for all classes of farm animals, and being of a succulent nature, it is of special value during periods of drought, particularly to she-goats, ewes, and cows giving milk. It has a decided pull over roots and the common green forage crops, in that it will remain good for a number of years if not wanted, and frost cannot injure it. It must not be supposed that by being made into silage inferior grass is improved in quality, for that is not so. Though animals decline to eat the coarse grass when old and woody on such land as we are now considering, they would be only too pleased to find it in an earlier and softer green stage during the months fo winter scarcity.

One of the great **defects of the vegetation** of Cape Colony is that it does not fully occupy the surface of the soil with a close and dense cover,—a condition so familiar to every one in Great Britain. Even in the districts where grass grows it is found in tufts with intervening spaces of bare soil. This uncovered and unprotected condition permits the **washing away** of the surface soil, and is largely responsible for the unusual **nakedness,** so to say, **of the rocks** of South Africa. The periodical **burning of grass** and bush rather aggravates the consequences of the wasteful process of denudation. Sheep, goats, and cattle following each other in line as they do, **make roads** through the veld which, under the potent influence of heavy thunder rain, soon wear into drains and finally into sluits, and even large river beds (page 59). This ultimately leads to the loss of the finest portions of the soil carried off by the rivers, which assume the colour of pea soup. The land so affected tends to become too dry, not only through water escaping readily in place of sinking into the land, but the subsoil moisture is also reduced through the lowering of the water table. Much can be done to prevent the rain forming a head of water by a little labour expended on stopping channels immediately they begin to form by means of banks of sods. The water thus brought to rest soaks into the ground, and adds to the store of moisture, which is drawn from during the rainless season. The work of checking the too rapid flow of water is contributed to by the roots of the shrublet *Lasiocorys capensis*, Benth., belonging to the order *Labiatæ*, and thus related to mint, thyme, lavender, and sage. This plant possesses a strong tap root and numerous side roots, and it grows into a bush from a foot to two feet and a half high. It springs up luxuriantly in the washed shingly *débris* of waterways, and its roots hold what soil remains and collect fresh silt, which ultimately raises the surface and impedes the course of the water. The foliage is slightly bitter, so that it is left untouched by animals until the end of the season, when the more attractive food is exhausted. It is then freely consumed, but the plant benefits by the absence of injury during the period of its growth.

There is no way by which the veld can be so inexpensively and effectively improved in grazing qualities as by allowing the **flood waters**, charged with fine sedimentary matter, from

PLATE 24.—A FARM ON THE SOUTHERN BORDERS OF THE GREAT KAROO. *Face page 84.*

A typical Stone-faced Earth Bank of a Water Dam in the foreground, Sheep and Cattle Kraals in the background, and long strong Rands or Ridges good for Farm Stock, including Goats and Ostriches.

higher elevations to flow over it. Excellent examples of the results of this practice were seen on Culmstock, Charles Southey's place, and at Varkens Kop, belonging to William Southey, in the Middelburg district. These are merely illustrations of many properties favourably situated for irrigation along the foot-hills of the range of mountains which there runs east and west. At Varkens Kop the summer flood water of the Great Brak River was diverted from its course by a masonry dam, with a drop of about ten feet deep on the lower side.

It is most important that the high flood water which falls over the weir should descend upon a rocky bottom, if such is to be found in a convenient situation, as the great volume and force of the water are certain, sooner or later, to give trouble by forming a pool and undermining the wall, if a concrete or other artificial floor has to be resorted to.

The dam and channel in question cost about £200, and the water spreads for a distance of five miles over the flat country below. In short, the conditions were restored which existed before the Great Brak River was formed, and that not so long ago. This recent formation of a river is no solitary instance, but a state of things extremely common throughout Cape Colony. The other Brak River, which flows between De Aar and Britstown,* has been entirely formed within the last forty years. At the point referred to the water flows between banks about 15 feet deep and from 100 feet to 150 feet apart.

The results of the flooding are that the Karoo bushes die off, and in about three years a dense cover of fine nutritious grass springs up, mostly consisting of blaauw seed grass. Land which in its original state fed one sheep on three acres will, after flooding, keep seven or eight sheep on the same area. In carrying out this important improvement it will be necessary to guard against contamination of the land by liver-fluke, which gives rise to "rot" in sheep. If water drains from hollow marshy places, and is permitted to stagnate in depressions or hollows in the veld, then liver-fluke is certain

* This is stated on the authority of Hans Brits, after whom the latter place was named.

to appear in the sheep stock. The means of prevention by drainage are discussed under "rot" in sheep. The work of watering the land in this way has only recently been instituted by English farmers who have come to the districts where it is possible to carry it out. Many farms capable of similar improvement are likely to remain in a state of nature while their present old-fashioned Dutch owners continue to occupy them.

In his excellent **brochure** on "Plants that furnish Stock Food at the Cape,"* **Professor MacOwan**, in discussing the most useful shrubby plants for sheep, places first in his list in order of merit—(1) *Pentzia virgata*, Less.; (2) *Adenachœna parvifolia*, DC.; (3) *Diplopappus filifolius*, DC., not only on account of their good qualities as food, but also because of their abundance and distribution over wide areas.

The **pentzia**, which is familiarly known as "good karoo," tends to grow socially, and sometimes so luxuriantly as to cause the partial or complete exclusion of other boscage. The soils of rich argillaceous flats, not deficient in lime, favour its growth.

Diplopappus, the "draai-bosje," takes its place on thin stony ridges or hillsides, and grows best on a southern exposure. This bush gives a "strong aromatic taste and smell" to the flesh of animals which are fed upon it, but the bitter and objectionable flavour can be got rid of by keeping the sheep upon other food for a fortnight. Both plants produce abundance of seed, which grows freely, but the **pentzia** also extends by natural layering, the longer shoots bending down till they reach the soil, and then throwing out roots at the tips. When the veld is overstocked, and the bushes are eaten back, they are unable to extend by either method of propagation, and will decrease rather than increase in number. Where growing and extending naturally, they form a useful check to the surface erosion aggravated by the trampling of sheep, and still more of goats, by throwing their trailing branches over and shutting up the roads made round and among the bushes by the animals as they go in search of food.

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* A reprint (to which the author gratefully acknowledges indebtedness) from "The South African Agriculturist's Almanac."

The **aarbosje**, or "water-finder," *Selago leptostachya*, E. Mey., is a useful forage plant for goats, being a stand-by in times of drought. It is found generally on gebroken veld, and is the only one of the common Selagos that is of value as food.

Two of the most valuable **salt bushes** of Australia, *Atriplex nummularia*, Lindl., and *A. halimoides*, Lindl., have been successfully grown in Cape Colony by E. G. Alston, who first cultivated them on the salt or brak lands surrounding Van Wyk's Vlei, and then distributed the seed at his own charges to numerous farmers in different parts of the Colony. The colonial species, *A. halimus*, L., var. *capensis*, "vaal bosje," or grey bush, compares favourably with the imported species, although it is more salt than they are, and stock can in consequence eat less of it. Goats browsing do it much more injury than sheep, as, standing on their hind legs to reach the tender topmost shoots, they trample down and break the brittle side branches, which is much more injurious than nibbling the shoots.

AUSTRALIAN SALT BUSH.
A. nummularia, Lindl.—(The Male Plant).

The Australian salt bushes are decreasing rapidly in Australia through too close injudicious pasturing with sheep, while they are extending and establishing themselves at the Cape. Seed has actually been sent to Australia from the Cape by special request. Salt bushes are particularly valuable under conditions such as prevail in the Karoo. They not only grow in soil impregnated with soda salts, on which few useful plants can establish themselves, but they thrive

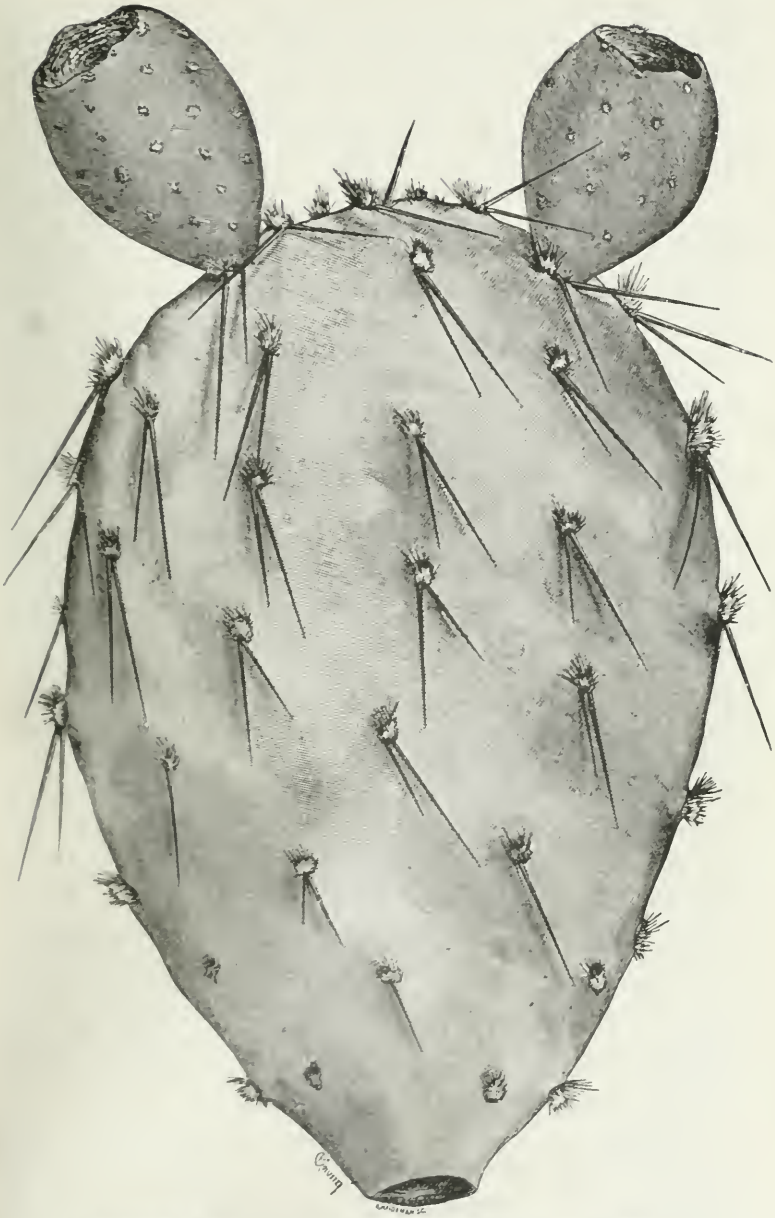
where the climate is too dry for grass to live, and transform districts that would be worthless desert into good stock country. Few sheep can be kept, probably one to twelve acres, but they do well, and, contrary to the general belief that there is safety in numbers, in the matter of parasites at least, safety to stock comes from their limitation.

MacOwan mentions in order of merit the following plants as growing along with the vaal bosje, and being eaten by sheep:—*Kochia pubescens*, Moq.; *Caroxylon Salsola*, Thunb.; *Tetragonia arbuscula*, Fenzl.; *Exomis axyrioides*, Fenzl., and several species of *Glinus* and *Galenia*. The vaal bosje is the only one which can be readily propagated artificially.

Several species of *Mesembrianthemum*, which are distinguished by glittering pimples dotted over the leaves and stems, mingle with the salt bushes and aid in furnishing the surface. All are, however, not confined to really brak land, as the grand purple-flowered *M. floribundum*, Haw., and *M. obliquum*, Haw., yield excellent pasturage for ewes and lambs upon flats where the soil shows only traces of soda salts.

Spek-boom, *Portulacaria afra*, Jacq., is a fleshy, rounded-leaved, scrubby, soft-wooded tree or bush, which is recognised as a very valuable food plant for sheep, cattle, and even horses. Successful efforts have been made to grow it in Namaqualand from cuttings. As these are liable to rot when put in green and newly severed, they should be spread out for a fortnight to allow the wounds to dry. Where animals are well fed and pampered, they sometimes lose taste for this excellent natural food. In the neighbourhood of Oudtshoorn, on a farm where, in the spring of 1895, ostriches were dying in hundreds, clumps of spek-boom were within easy reach, but the birds would not touch it, having been accustomed to feed on lucerne. Nevertheless, when birds are brought up to eat it they thrive well, and seem fond of it. The spek-boom is a bush which recovers rapidly from the injury done by too close browsing by stock, if a season's respite be granted to it. When spek-boom and the *Mesembrianthemum floribundum* are present, stock care but little about their daily visits to the water-vlei.

The **prickly pear**, *Opuntia Tuna*, has become one of the curses of large areas of grazing land, particularly the midland and south-eastern districts. The Report of a Select Com-



A SPECIES OF PRICKLY PEAR—LEAF-LIKE FLESHY STEM-JOINT AND FRUIT.

Reproduced from U. S. A. Agricultural Report 1887.

mittee of the House of Assembly, dated 1891, estimated the annual loss in money, from farm animals dying through eating the leaves and fruit, at £200,000. There are two varieties, the *kaalblad* and the *doornblad* — the latter covered by large numbers of strong, pointed thorns, and the other almost thornless. It probably would be more accurate to say that from seeds of the same fruit at times both thorny and thornless specimens spring. The prickly form is by far the more abundant. Nearly all graminivorous animals eat opuntia greedily when relieved of its natural thorny defence, and the naked variety is thus destroyed wholesale while young. The kaalblad opuntia is the true cochineal cactus, and specimens of the insect may be seen living upon it in the Cape Town Botanic Garden.

In spite of all that may be said in favour of the prickly pear, there is no doubt the **injury done** by it is so great that it would be well for the Colony to get rid of it entirely, even at a considerable pecuniary sacrifice. But it has now spread so widely, and established itself so completely, that extermination would be a matter of great difficulty if not impossibility. Its **pear-like fruit**—from which it derives its name—is sweet and attractive. Great numbers of birds and beasts eat it freely, and drop the seeds in their solid excrement all over the district. It also grows readily if a small piece of the leaf-like fleshy stem-joints is left about on the surface of the ground.

The fruit is covered with multitudes of minute hard sharp-pointed prickles, which produce violent inflammation and swelling in the tongue, throat, and whole intestinal tract of animals consuming it in the natural state. **Cattle** get so fond of it, even when suffering acutely from the injury it produces, that they have been known to remain beside a pear-tree with the tongue hanging out, and to continue to eat the fruit until they actually died of the effects. The **Kaffirs** get over the difficulty of the prickles by rolling or rubbing the pears backwards and forwards in the dust underneath the hardened sole of their foot.

Perhaps the most serious drawback to the Colony is the **demoralisation** this fruit gives rise to among the native population. They will do little or no work for the three months—February, March, and April—the time the fruit is at

PLATE 25.—KAFFIRS CUTTING THE FLESHY LEAVES OF THE PRICKLY PEAR *Face page* 91.
As food for Cows and Ostriches, at Heatherton Towers.

its best. This is a specially serious matter with the tobacco-grower and the wine-grower, as these are busy months with both. They also manufacture a spirit from the fruit of the prickly-pear, which they drink in large quantities at the season, making any return to work impossible while its influence lasts. During periods of drought, the fleshy succulent prickly-pear leaves have occasionally been utilised by being deprived of their spines by scorching over a fire and by cutting up the mass with a slicer resembling a turnip-cutter. Then the food may be given with safety to all sorts of farm stock. **Cattle** will eat 40 lbs. per day of the pulp, and it proved a useful stand-by in the drought of 1895 for feeding ostriches. It should be mixed, however, with some nourishing concentrated food, like beans or grains of sorts, as it does not contain sufficient nourishment in itself to support animals, especially if they have got into low condition. Given alone and in large quantity, it is liable to induce scour. The plant was first spread in the colony by **transport riders**, or "togt-gangers," who, both intentionally and also inadvertently, dropped the seeds at outspans, from which they have extended. Government has taken neither of the steps urged upon them, viz., the compulsory eradication of the plant, nor the subsidising of those who undertake the work, probably because the opinions of Members of Parliament were too much divided as to the practicability of the scheme submitted. Government has, however, supplied a large quantity of a so-called **scrub exterminator**—consisting of arsenic dissolved by boiling with soda, which has been doing good work in the hands of a few individuals who have tried it It is said to act when applied to living plants during winter, when the sap is not running, but to ascertain this condition would require more than the usual intelligence displayed by native workmen in its application. It serves the purpose admirably when the plants are cut close to the ground and thrown into heaps. A spray of the exterminator so browns the surface and shrivels the plant that it can be burnt in heaps, and all traces of it destroyed.

The **aloes plant**, *Aloe ferox*, L., belonging to the natural order *Liliaceæ*, possesses an arborescent trunk, sometimes twelve to fifteen feet high. It is often found growing on poor rocky places, from which the soil has been, to a large extent, washed

away. The appearance presented by a number of aloes plants growing at a distance is so much like Kaffirs standing, that during the Kaffir wars false alarm was not infrequently experienced by the Colonial troops on suddenly coming upon a stretch of aloe-bearing veld, until the sight became familiar. The plant has a strong resemblance to the leafy parts of a large pine-apple, and the leaves, which, as time goes on, tend to grow in a bunch at the top, are protected by claw-shaped spines, like those of the brier. It is sometimes planted to form a **kraal fence**, and, being a perennial plant, it flowers annually, and does not die off after maturing its seed, like the so-called American aloe. Its beautiful bright-red flowering spikes, three or four in number on each head, lend beauty to the landscape, which at that particular season is otherwise unadorned. The **aloes harvest** takes place during August and September. A hollow is scooped out in the earth, about the size of a shallow hand-basin, and round this the leaves which have been cut off are built, with the wounded ends inwards, in such a fashion that the juice as it runs out falls into the hollow. The sun's heat during a couple of weeks hastens the flow of sap, and dries it up into a cake, which is ultimately removed, the adhering earth brushed off, and in fragments it is packed in boxes, and sold for about 4½d. to 5d. per lb. In some districts a **goat-skin** is put in to form a lining to the pit, and the juice is removed in a viscous condition and boiled, but so unskilfully is the work executed, that the power to crystallise like hoar frost (after being dissolved in alcohol, and exposed to admit of evaporation) is lost, and the market price thereby lowered to less than one-fifth of the price of Barbadoes aloes in the London market. Aloes is used for **staining leather harness** and for making into horse **physic** balls, and also, it is said, in the manufacture of Mother Seigel's Syrup. The amount exported, as given in the last available returns, was under 400,000 lbs., considerably below the half of the amount exported in 1885.

The **American aloe**, above referred to, *Agave americana*, is not a true aloe, but more nearly related to the fibre plant *Fourcroya*, grown in Mauritius, and to New Zealand flax, *Phormium tenax*. It is a strong, vigorous plant, which grows well in all parts of the Colony, including the Karoo. As in

India, it is found to be a valuable plant to grow in rows to form fences. The sharp pointed and rigid leaves stand out like so many spears, and, when the plants grow up so that they close in the rows, make it quite impossible for stock to get through. Excellent **shelter** for stock is afforded in high and exposed veld by agaves planted in two rows to form a cross, so that from whatever direction the wind blows, the animals can always find a sheltered corner in one or other of the four angles. The great drawback to the agave as a fencing plant is that, after a few years it throws up a tall flower-bearing stem, and after ripening its seed it dies, leaving an opening in the fence. Ultimately the blanks are closed up by numerous small plants growing from suckers, but the fence is defective for a time. The tendency to seeding can be checked, it was said, by setting the plants more closely together in the rows than the usual three feet, and at the same time laying them at an angle of 45°

In times of drought and scarcity of food the leaves of the agave have been cut up into small pieces by a chaff-cutting machine, or by hand knives if only on a small scale, and given to cattle, ostriches, or, in fact, to any farm stock. In addition to the **fibre**, which is used both in America and India for rope-making, &c., there is a large quantity of succulent matter in the leaves, particularly near the base, and this forms excellent food for stock, which eat it readily and thrive upon it. It does not contain such a large percentage of water as prickly pear, and it is not so liable, when given in quantity, to induce scour in animals feeding on it. The black population use the leaves for **fuel** after they have been exposed for four or five months to dry thoroughly. **The seed** is excellent food for ostriches, and cattle find it out and eat it greedily when it falls beside a fence. The seed-bearing stems, after they become withered, can be used for light temporary **fencing posts**, and will last for six or seven years.

Altogether, the agave is a most useful plant, a good stand-by for the farmer in seasons of scarcity, and being so easily propagated, it is a marvel that it is not grown to a greater extent in the Colony.

The **harpuis** (resin-pimple) plant is a species of *Euryops*, a showy composite with gay yellow blooms and a foliage not

unlike that of a soft, rapidly grown, bushy, young pine-tree. In certain areas near Queenstown it threatened to take possession of the entire surface, to the exclusion of valuable forage plants. It should be remembered that its only important use is the supply of brushwood.

When it seemed as if large tracts of country were about to be given over to this worthless weed, a scale insect made its appearance. It has multiplied so rapidly, and done its work so thoroughly, that in many of the worst centres harpuis is almost totally destroyed,—a work which has well-nigh rivalled the feat of the *Vedalia* and *Rodolia* ladybirds in devouring the *Dorthesia* or *Icerya*, as it is now called—the Australian "bug" —on orange-trees. It is possible that this is not the first time the harpuis has thrown its unwelcome mantle over certain areas favourable for its growth, nor yet the first time that the scale insect has done its work. History in plant life, as in other matters, often repeats itself. The fact that a few old plants were to be seen among a comparatively young growth rather indicates that they formed centres of distribution or re-infestation, and were probably the remnants of a former growth. After Nature has done her share in the destruction, all stray plants that have escaped the scale insect should be carefully destroyed.

Though the last-mentioned plant is objectionable enough to the stock farmer, it is so in a negative way. Its shortcomings lie in monopolising the land which might with advantage have grown useful food plants. It differs from another class of plants, which not only occupy the surface, but are **actively injurious** in one or other of several ways. To the latter belongs the **bitter Karoo bosje**, *Chrysocoma tenuifolia*, Berg, which fortunately is only eaten in times of scarcity, as it produces stomach and biliary disorders. It is extending largely, like another worthless bush, *Relhania genistæfolia*, L'Her, when the veld is overstocked. There is a **thorny fig**, *Mesembrianthemum spinosum*, L., of the Karoo, the flowering branchlets of which harden into sharp hard spines, which effectually prevent stock from browsing upon it. Another very thorny plant, *Asparagus stipulaceus*, Lam., is a source of annoyance and loss to Angora goat breeders. The withered thorny branchlets break off in winter with a mere

touch, and adhering to the hair of the **goats**, reduce it seriously in value.

Burweed, *Xanthium spinosum*, is another plant well known to cause injury to the **wool** of sheep, by adhering to it and felting it together, and subsequently giving considerable trouble during the process of manufacture.

Many **leguminous plants** are known to be **poisonous** * to animals at certain seasons, producing paralysis of the limbs, due to cerebro-spinal pressure, and at times giddiness and sleepiness or death. The injury is believed to be brought about by certain alkaloids, which are, however, not present in injurious amounts in all the species of the order, as quite a number of well-known legumes may be used as food for man and beast with perfect safety. The Cape is not without its poisonous legume any more than India, Australia, or America. The **t'nenta**, *Lessertia annularis*, Burch., is an insignificant purplish-flowered species, at times seen in quantity in the gebroken veld, where, if consumed, it poisons goats and sheep. A somewhat similar condition of helplessness from intoxication, or semi-paralysis, results when cattle feed upon **dronk grass**, *Melica dendroides*, Lehm.

All species of farm live stock are not liable to suffer in the same degree from vegetable poisoning. The leaves and bark of the **wild tobacco** tree, *Nicotiana glauca*, may be eaten by goats without serious consequences, while the bark and seeds are most poisonous to young ostriches—one seed is said to be certain death to a chick up till a month old.

Perhaps the most widely distributed and deadly origin of stock poisoning to be found in South Africa, is the tall, handsome "tulp-bloem," or **Cape tulp** (the Dutch for tulip), *Moræa polyanthos*, Thunb. This contains a "virulent irritant," which, if taken in sufficient quantity, induces violent inflammation of the stomach and bowels, and in serious cases, of the liver also, giving rise to *biliary hepatitis*, and usually death within twenty-four hours. One species of tulp, under

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* See a valuable contribution to the bibliography of this subject by R. S. M'Dougall, M.A., B.Sc., entitled, "*Lathyrus Sativus*, the Vetchling, with a Comparative Review of the Poisonous Properties of some Allied Leguminous Plants." — *Transactions Botanical Society of Edinburgh*, December 1894.

the name of "slangkop" (snake head), or **poison onion,** *Ornithoglossum glaucum*, Sal., which comes up in September and disappears in December, is particularly prevalent and destructive in the vicinity of Mafeking. It is also to be seen near Kimberley, on the red sandy soils on which the kameel thorn, *Acacia giraffæ*, finds a natural habitat.

Cattle bred on the ground do not eat tulp unless they are very hungry. Then they are not safe. Cattle that have not been accustomed to it, and oxen turned out from the yoke after dark, are most liable to suffer. There is a sudden formation of gases in the stomach, and the animal becomes hoven. **Relief is got** through the administration of stimulants and astringents, or repeated doses of milk consisting of a bottle at a time. Some farmers boil "besom-riet," *Restio scoparius*, Th., and administer the decoction. It has no medicinal value. A more reasonable treatment is to give a quart of strong decoction of the astringent bark of the "doornboom," *Acacia horrida*, W., and this sometimes relieves the intestinal irritation. If an ox eats only a little and recovers he will most probably suffer from an acute attack of diarrhœa. Sheep cannot be kept during the tulp season on land on which tulp grows freely.

The **introduction of live stock** to the "Boschjesveld" (bush country) has destroyed the old balance of nature, and by the persistent eating back of the good bushes (frequently by a larger number of animals than a given area could properly support) their expansion has been checked, and they tend to decrease in numbers as well as in bulk. At the same time the worthless plants seed freely, and being unmolested by animals, increase both in size and in numbers. Much injury has already been done in this direction, and if it be permitted to go on, many of the most valuable Karoo bushes are liable, like the Australian salt bushes and kangaroo grass, *Anthistiria ciliata*, Linn., to extinction on the veld, and to be left merely as botanical curiosities in protected corners. **Fencing** into moderate-sized camps, to give control over the animals, is the first essential in any system of restoration. Different descriptions of stock should be **grazed** in successive seasons. If sheep and goats are in occupation this year, horned cattle should follow them next season, and at intervals,

according to the condition of the growth of the good species of plants, a year of complete rest should occur, to enable the bushes that have been browsed closely to recover their foliage and to mature their seed. During this period, or, in fact, at any time, an incessant war ought to be waged against injurious and worthless plants of all kinds with the available surplus labour which on a large farm is frequently considerable. At the same time a few seeds of valuable plants, which spring up readily like *Pentzia*, may be scattered where the surface of the soil has been moved. It has not been the practice to farm veld in this way, but rather to leave it to nature; but nature is all against the farmer, and in favour of weedy plants under circumstances such as have been described. As the natural influence at work is accumulative, the time seems near at hand when the treatment of the veld will require to be as much the care of the farmer as the crops of arable cultivation. There has been a cry that the land is overstocked, and the numbers of stock have certainly been shrinking in recent years. No doubt it is true, even in places where, under more enlightened management, a larger number and in better condition could have been kept.

Group of Mares on De Beers Horse-Breeding Farm.

CHAPTER V.

GRASS AND GREEN FORAGE PLANTS.

Position occupied by Grass in the Veld—Rooi-Grass—Steek-Grass—Bolus's Enumeration of Common Species—MacOwan on Poisonous Grasses—Couch Grasses—Copper-Wire Grass—Para Grass—Position of British Grasses—Red Clover—Erodium—Green Barley—Green Rye—Ergot—Lucerne—Dodder—Tree Lucerne—Stink-Clover—Yellow Boer Clover—Bur Clover.

ALTHOUGH South Africa is not poor in numbers of species of grasses, having, according to Bolus, fifty-seven genera and seventy-eight species in the grassy uplands of the composite section of the Karoo division, yet grass is not, on by far the greater area of Cape Colony, a conspicuous feature of the covering of the landscape. It is conspicuous in the humid eastern coast districts, and again up-country at a considerable elevation above the sea, as in the Kalahari region and the so-called "new veld," where summer rains are most abundant, but in the Karoo districts proper it appears in sparsely scattered tufts among the bushes, consisting to a large extent of annual grasses which spring and fructify in a comparatively short time, and are ready to die after having fulfilled the reproductive function.

The most valuable indigenous grass is generally acknowledged to be the glaucous bluish *Anthistiria ciliata*, Retz—a grass of large size, with abundant leaf foliage of superior quality, but a wiry stem and a hard flower head as it reaches maturity. It takes on a brownish-red colour in winter, when all grasses growing on dry veld wither and become brown, and has in consequence earned the name of "rooi-grass" or red grass. It is a valuable pasture grass, makes into excellent hay, and is equally well suited for preservation as silage. A dwarf rooi-grass, which yields sweeter pasture, appears in certain parts. Grass is often of good quality where mimosa

is abundant, and it is frequently specially sweet, *i.e.*, less hard and fibrous, where the bushes are large.

"**Steek-grass**" is the colonial name applied to a number of species of the natural order *Gramineæ*, having long sharp awns attached to their seeds, by which they adhere to the wool of sheep. The hard, bristle-like appendages (often associated with so-called "carrot-seed," *Tragus racemosus*, the saw-toothed glumes of which have great holding power) mat the wool into a condition resembling felt, and reduce its market value materially. The most baneful influence, however, to the interests of the stock-farmer is due to the irritation produced by the sharp points of the seeds, which, aided and directed by the awns, find their way to the skin, most abundantly about the neck and shoulders, and produce irritation and discomfort, and frequently death. The awns in most cases are rough, and gradually work in as the sheep moves, but some acquire a twisting motion with the alternations of dry and moist atmosphere, and have thus an additional boring action given to them.

In **Australia** much damage of a similar kind is done to sheep and to their wool by the seeds of a wild geranium, *G. dissectum*, L. (an excellent food plant while green, and abundant in some pastures), and the "three-awned spear-grass," *Aristida ramosa*, R. Br.

The **two grasses** which so far have been observed to do most injury in Cape Colony are *Aristida congesta*, R. and S., which mats the wool, and *Andropogon contortus*, Willd., the sharp seeds of which, with their twisted awns, easily pierce the skin. As the seeds when ripe do not readily fall off, they remain on the stalks in a favourable position for becoming attached to the wool of passing sheep, being carried and dropped in the veld.

Plants which possess such special advantages over other plants as to means of distribution are usually annual in their habit of growth, and produce well-matured, vigorous seed, as everything depends upon it for the existence of the species. Remedial treatment should consequently be directed against the plant in the early stages of its growth. The swarms of **locusts** have taught the stock-owners a useful lesson in this respect. By devouring the steek-grass before it produces its

seed they free the pasture of the pest for a time, although it asserts itself once more within a few years.

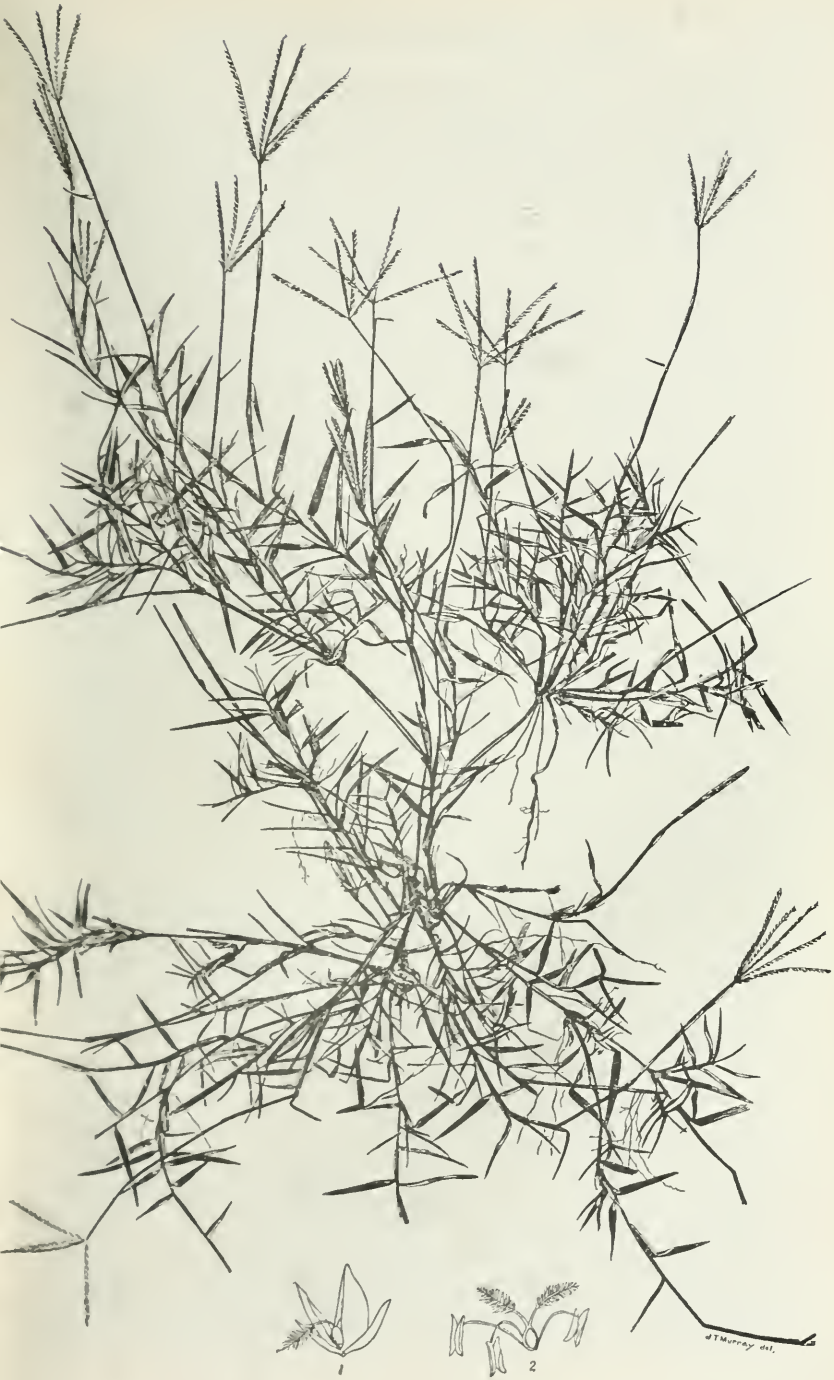
Something can be done to check the increase of steek-grass, and to minimise its injury, by the method of depasturing. Those portions of the veld most liable to steek-grass should be closely eaten down early in the season by sheep, and the flocks removed before the seeds ripen. Burning the full-grown grass before the seed falls is another successful method of reducing its amount.

A species of *Aristida*, "twa-gras," is the most abundant grass, so far as is known, in the Kalahari region and in the upper region of the Karoo, 4,000 to 5,000 feet above the sea, distinguished as abounding in composites. **Bolus** says that in the parts he has visited "those most abundant in individuals appear to be *Andropogon marginatus*, *Anthistiria ciliata*, *Aristida vestita*, *Danthonia disticha*, *D. villosa*, *Eragrostis brizoides*, *E. striata*, *Festuca scabra*, and *Melica dendroides*, Lehm.—the 'dronk-gras' of the colonists."

MacOwan* contributes an interesting note on the **poisonous** nature of some grasses at certain stages of their growth. It would appear that the giddiness and intoxication, described by one farmer as a "wild delirium," from which animals suffer after eating dronk-gras, is similar to the effects produced after the seeds of darnel rye-grass, *Lolium temulentum*, L., have been consumed. These do not stand alone. *Festuca quadrivalvis*, a Peruvian grass, is deadly poisonous to cattle; *Stipa viridula*, var. *robusta*, is the "sleepy grass" of New Mexico, which induces profound slumber for twenty-four hours in cattle incautious enough to eat it. Another species of Stipa in Mongolia intoxicates horses; and even the blow grass of the Scottish hills, *Molinia cærulea*, when in flower, is reported to be dangerous to horses, and *Bromus catharticus* derives its name from its purgative qualities.

The grass which forms the closest covering in the veld, although it is by no means so largely represented as the rooi-grass, is the **small couch grass** or quick, of light cultivated soils—the dúb grass of India, *Cynodon dactylon*, Pers., called Bermuda grass in Australia. It is supposed to have been

* At p. 117, vol. v., of the *Agricultural Journal*, Cape Town.



Dúb Grass—Cynodon dactylon, Pers.

introduced into South Africa, although its cosmopolitan character makes the tradition doubtful. It is of a decidedly **stoloniferous** habit, and does not spread so much by seed as by creeping stems, which root at every joint and make it a troublesome weed in cultivated land. If the soil be thoroughly turned up to the summer's sun or to the winter's frost, couch grass can be pretty easily killed, but the working of the land under any other conditions simply tends to increase the amount by breaking the underground stems, and thereby increasing the numbers of centres from which future development takes place. In the Oudtshoorn district, where quick is troublesome in the lucerne camps, it is readily disposed of by first ploughing in May or June and sowing a grain crop, which is reaped in December. After watering the field, which is then hard and dry, to make it possible to plough and to cultivate, there is time to summer-fallow and thoroughly clean the land before the next sowing season. Both the stems referred to and the aboveground development supply excellent food for stock. In those regions where there is sufficient moisture for grass to grow, but subject to periodical droughts, couch grass occupies an important place in permanent pasture, having great power of maintaining itself. It is in such places that its cultivation ought to be encouraged. It is improved rather than injured by trampling and close grazing.

On account of the seeds being so unreliable, the most successful method of propagating it in a small way, as in the formation of a lawn, is to bury in shallow furrows about four inches apart pieces of the plant chopped up into short lengths, but moisture must be available for the first few days after planting, either supplied by rain or by artificial means, else the chips die as the plant dies during the fallowing process.

A troublesome couch grass in some soils is the **buffalo grass,** *Stenotaphrum glabrum*, Trin., a much stronger plant than dúb. The stems are also prostrate, but a greater proportion remains on the surface. Both of these couches are excellent lawn grasses, and are employed in the Colony as such, each forming a dense mat under foot.

Fiorin or white bent grass, *Agrostis alba*, L., var. *stolonifera*, has been naturalised in the humid district near George,

and found to be a troublesome weed in cultivated land, but an excellent pasture grass for the encouragement of milk secretion in cows. It is unfortunately, although in all respects a grass of good quality for grazing and fodder purposes, one of the grasses most liable to be attacked by **ergot,** and its inclusion among British permanent pasture mixtures has in recent years been discontinued to a large extent in consequence.

MacOwan states he has observed ergot on eight species of South African grasses, but most prominently on *Gymnothrix hordeiformis*, Nees, a strong grass, with a long cylindrical spike of florets, growing frequently beside streams and vleis. Although there may not be enough ergot in the pastures to induce the worst forms of ergot poisoning, still when ergot is about there is every chance of it giving rise to abortion in cattle, sheep, and horses. The only effective prevention is to cut over the flowering culms of the coarse grasses which would run to seed.

"Koper-draad," or **copper-wire grass**, *Andropogon excavatus*, becomes so hard and bristly as it matures that it has been favourably mentioned as a suitable material from which to manufacture paper, yet in the early stages of its growth it is of great value as a pasture grass. It was observed on the grassy veld near Queenstown on 15th August, coming up the first of all the various species represented, and the succulent young leaves were being greedily pulled four to six inches long from their sheaths by the sheep after the withered growth of the past season had been cleared off by burning.

Bromus Schraderi, Kth., is the so-called **Australian prairie grass** or *Bromus unioloides*, a robust annual, with great power in developing seed and establishing itself in land under cultivation. It came originally *via* California and Australia from the seaport of Para, in tropical South America, and it has been conjectured that the title Prairie grass, and, directly or indirectly, also the Boer names Para, Paarde, Perde, Pere, &c., have been corrupted from the word Para. It requires too much moisture to suit the drier parts of the Colony, but it grows well in the New England district at high elevations, where the rainfall is comparatively heavy. It is sweet and tender, and greedily consumed by stock, and in composition

it is a grass of the first quality, containing 12.45 per cent. of albuminoids and an ash rich in phosphates. It produces a large and conspicuous **seed,** which weighs about 16 lbs. to the bushel. The seed stems stand up three feet high, and the root leaves are numerous and broad.

The seeds of a worthless annual weed, *Bromus mollis*, or the "**goose grass**" of the rye-grass field in Great Britain, have been sold in the Cape as the valuable prairie grass. It also seeds freely, and has great power of maintaining itself, but it is deficient in root leaves and is unattractive to stock.

It is only on the high plateaus approaching 5,000 feet above the sea that the best **British grasses** could have any chance of growing unless under irrigation. Both of the **rye-grasses,** *Lolium perenne* and *Lolium italicum*, were seen doing well at Southey's farm in the Middelburg district, but the experience at Oudtshoorn with these and with **Timothy,** *Phleum pratense*, was that the produce became hard and unattractive to animals unless water were available at all times. In the same district **red clover,** *Trifolium pratense*, did not compare at all favourably with lucerne, not only on account of its liability to suffer from drought, but owing to the seed being so much smaller that it had greater difficulty in becoming established as a crop. Experiences in different parts were not by any means uniform. On William Frame's farm, near Queenstown, red clover and also perennial rye-grass were found growing apparently as perennial plants on a rich moist piece of meadow land, which could be put under irrigation at any time. Nevertheless, red clover is not to be compared to lucerne in the matter of suitability to South African conditions.

A **wild** colonist from Europe, allied to *Geranium*, *Erodium moschatum*, Willd., of large size and succulent habit of growth, is regarded in the cultivated districts of Koeberg and Malmesbury as the sweetest and most valuable plant in the temporary pasture of rich well-manured soils, where it springs spontaneously. All herbivorous animals are very fond of it while it is young. If cut when in flower, it makes excellent hay, and it is also well suited for storing in silo. The **seeds** are troublesome if they are permitted to mature. On handling, an elongated awn is observed to twist spirally like a corkscrew, and then

it measures along with the seed nearly one inch in length. This motion is undoubtedly intended to plant the seed as it falls; and to retain it in its position a number of hairs project like bristles from the seed, with an inclination towards the awn and away from the boring point, which touches the ground first as the seed drops. The seeds have proved a source of loss to the Cape farmer by becoming fixed in the wool, and they also get into the eyes of sheep, where they give rise to serious irritation.

Forage Crops.

Green barley is extensively grown in the Colony in winter, as a green forage crop for the use of all species of herbivorous live stock. Wherever irrigation is possible and feasible, the climate is never too cold to prevent the growth of barley, which is considered the best winter forage crop in South Africa. It is often **sown** about the first week of February, and it occupies the position as a winter food which roots do in Great Britain; but with one important disadvantage, that the yield per acre is far inferior to that given by roots. Apart from the smaller yield per acre, there are proportionately fewer animals of all classes artificially provided for during winter in the Cape than in Great Britain, a condition of things which will probably change as systems of management develop and improve.

The species most extensively cultivated is Scotch "bere" or "bigg," *Hordeum vulgare*; but the so-called "barley-wheat," a naked variety of common barley, *H. distichum*, is increasing in favour with those who have had experience of it. It not only gives a larger yield, but it can be eaten later in the season than the common Cape barley without injuring the mouths of sheep feeding upon it, owing to its not becoming hard and woody so soon as the other. It is given with excellent results to ewes with early lambs, and to milch cattle. Even horses, which are more ticklish to manage than other stock in the matter of food, thrive well when fed largely if not entirely on green barley. If subjected to much road work in a Cape cart, horses thus fed are liable to become loose in the bowels, but those at work on the farm and running on the veld do admirably.

Rye, *Secale cereale*, as a forage crop might be grown much more extensively for green winter food than it is. It is a hardier plant than barley under adverse conditions of growth, and locusts do not so easily injure its roots permanently. It possesses another advantage in the case of stock not wholly dependent upon green food. If animals require to run on the dried and withered veld in spring, and only get the green grain as a supplement to their natural food, they are less liable to be unsettled by rye than by barley, and they take more kindly to the veld on being turned out from a rye-field than from a barley one. A **giant variety**, called Saldana-Bay rye, is in favour on deep rich soils. It is most prolific, yielding fifty-fold, and growing five and even seven feet high. Probably rye might be more grown but for the colonial **prejudice** against giving rye-grain to horses unless when mixed with oats. Rye and a number of colonial grasses are subject to the attack of a fungus, *Claviceps purpurea*, Tul., the resting form or sclerotium stage of which is called **ergot**. But it does not appear to produce in the Colony the serious consequences of ergot poisoning in cattle and sheep which have been experienced in Kansas, in New Zealand, and in Ireland.

Lucerne, *Medicago sativa*, or the alfalfa of the United States of America, is without exception the most valuable of all green forage plants in dry and sunny climates liable to suffer from drought. It was cultivated by the ancients, and it is grown at the present time in all parts of the world. In the climate of Great Britain clovers grow so remarkably well that they successfully compete with lucerne, and there it does not assume the place of importance which is almost invariably given to it in warmer climates. It grows on a great many varieties of soil, provided there be present a good supply of **lime**, and not an excess of dense impervious clay. Fully 50 per cent. of the **ash** of lucerne is lime. Potash and phosphoric acid are the next best represented constituents, there being about 14 per cent. of each. It has great power of resisting the effects of drought, as has been demonstrated at Rothamsted, by Sir J. B. Lawes and Sir Henry Gilbert, in virtue of its strong vigorous tap roots, often as thick as a man's wrist when the plant is of mature growth, going down in search of moisture. If a natural water supply be found percolating

LUCERNE OR ALFALFA, MEDICAGO SATIVA.

U.S.A. Bulletin No. 1. 1895.

through a porous stratum, at a depth of six or eight feet from the surface, no artificial watering is necessary. The roots sink to fifteen feet, and even twenty feet, under favourable circumstances. However excellent lucerne is as a drought-resister, the area in South Africa is insignificant where **irrigation** is not necessary for the existence of the plant, or to secure a satisfactory yield. There is no crop which more freely responds to careful cultivation and judicious watering; and although it is harmful to irrigate so that the surface soil runs together and becomes hard, yet the strength of lucerne roots makes it better able than most crops to withstand the pressure of the soil as it contracts and cracks on drying. It is not so with the young plant soon after germination, and in Cape Colony the seed ought to be **sown** at a time when the necessary moisture is likely to be provided by rains, and the application of irrigation water to the surface delayed as long as possible. The amount of **seed** sown per acre in the Colony varies between 7 lbs. and 20 lbs. per acre, an unusually wide margin. Not only the surface **soil**, but also the subsoil, should be in a loose condition, to encourage the descent of the tap roots. A good development of **root growth** implies a large amount of manurial root residue for the use of the succeeding crop, as well as power for growth in the existing one. Immense crops of green food can be got from lucerne when it is cut five or six, or even as many as eight or nine, times during one season.

Three **cuttings** may be obtained the first season, yielding four tons of hay; but under favourable conditions, ten and even twelve tons of hay may be gathered per acre, when the roots are at their most vigorous stage of growth. As the plants become old, some die, and there is a natural tendency for the crop to **become thin** upon the ground, although on rich soil, under favourable circumstances, lucerne growing in rows will spread naturally, and cover the intervening spaces for a time. Lucerne is **best cut** the first year to allow the plant to grow undisturbed by animals grazing, and to develop its roots. It is a general rule that this development is in proportion to the bulk of growth aboveground. When **grazed,** it is best to eat it off within a comparatively short time, when it has reached a good size, and then lay it in to rest and

a.

b.

Originals lent by Sir J. Bennet Lawes, Bart., and Sir J. Henry Gilbert.

Face page 108.

PLATE 26.—LUCERNE ROOTS GROWN AT ROTHAMSTED IN RICH SOIL TO A DEPTH OF TWO FEET.

a. Shows Roots of 1 year's growth, with wart-like nodules, the habitat of the organisms engaged in the fixation of free nitrogen.
b. Represents the upper section of Roots of 4½ years' growth which sink deeply, but from which the nodules were lost along with many fibrous roots in removing the soil.

sprout afresh, while the animals are moved on to other areas. In this way a number of animals may be kept in three paddocks, all at different stages of growth, and moved periodically in rotation from one to the other. More satisfactory results are thus obtained than by pasturing stock all the while on the same area. Lucerne is equally well adapted for making into **sweet silage** or into **hay**, both products being highly appreciated by all sorts of herbivorous animals. Care has to be taken not to lose the leaves, which, freely exposed to the sun, become hard and brittle, and liable to break off and get lost. If the crop be handled in the early morning, while the leaves are flexible with the moisture from dew deposits, no loss need result, although the length of the working day for lucerne is thereby made very short. A satisfactory method of saving the leaves has been introduced with decided success in some parts of Australia. The crop is put without much delay into small cocks in the field, and left there without being moved till it is ready to carry. Baling machines on wheels are brought alongside, and the cocks carefully lifted into the baling presses, and compacted by horse- or hand-levers into bales of convenient dimensions for handling, weighing 1½ cwts. to 2 cwts. each. Various species of **dodder**, *Cuscuta*, attach themselves by twining round the plant, and suck the juices from it; but if milled or husked seed be used, and attention be paid to the cleaning of it, no loss from this cause need be sustained, as dodder seed is small, and can easily be removed in the process of cleaning.

A **parasitic fungus**, *Rhizoctonia medicaginis*, which attacks the root stock, and kills the plant, has done much injury to lucerne crops on the Continent of Europe. A dressing of five or six tons per acre of **slaked lime**, in the condition of a finely divided powder, is the most effective remedy, together with changing the crop on the affected ground for a few years.

The **cultivation of lucerne** may be said to be merely in its infancy in Cape Colony. It is true that most satisfactory results on a large scale have been secured in the district of Oudtshoorn, largely associated with the feeding of ostriches in small lucerne camps, described in Chapter XI. But the farmers throughout a large area of the Colony, suitable for

lucerne cultivation, are not yet aware of its merits as a pasture and forage plant.

The one important **drawback** to lucerne as a green fodder plant is that its roots remain dormant during winter, while green barley makes steady progress. Its growth is, however, all the more rapid and luxuriant in spring, and its yield being so much more abundant than that of any grain crop, the defect mentioned can be more than made up for, in competition with other fodder crops, by storing it in silo during the summer months. As irrigation extends, the importance, or rather the indispensable character, of lucerne as a fodder producer and as a soil restorer will gradually be realised.

Although it was grown in Grahamstown in a small way by a good many people as early as 1860, it was only **introduced into Oudtshoorn**, where it was first grown on a large scale, about 1870, and at first the **price** of the **seed** was 2s. per lb., but now 3½d. to 4d. per lb. will purchase it. **Richard Gavin**, one of the most extensive and most successful advocates of lucerne culture, believes in a liberal allowance of seed—as much as 20 lbs. per acre, on account of the tendency of quick grass, *Cynodon dactylon*, to oust it. For a number of years after its introduction large profits were made by growing seed, but the best land in the district, with the accumulated fertility resulting from the decaying roots, and the manure of the large numbers of stock kept, has become too rich to produce seed. The plants develop herbaceous tendencies rather than seed-producing properties.

The seed is **sown** in spring between 15th May and 15th June, and water is not led on to the land until the beginning of August, when the plant is big and strong. A wheat crop, thinly seeded and planted on a well-worked soil, proves an excellent nurse for the young lucerne plant. It is necessary to break up lucerne leas when the plants become thin on the ground, as they naturally tend to do, and all the more rapidly so when the soil is not in every way suitable. **Restoration** in this fashion is necessary every seven years in many countries where lucerne grows satisfactorily. The suitability of the Oudtshoorn district to this crop may be learned from the fact that lucerne is still growing which was sown in 1879.

In California a common method of **restoring** the waning

strength of a field of old lucerne beginning to get thin on the ground is by ploughing or cutting up the surface sod, to divide the roots, and then rolling and irrigating it. With so much quick or couch grass as exists in the Colony, this method would not in most places prove satisfactory, as the creeping stems of the dúb would be cut up and planted at the same time.

The **hay harvest** begins 25th September, and goes on till February or March. The crops are cut as the flower begins to open wide. The lucerne cut one day, if heavy, is merely turned over the following morning, beginning at 4 A.M., and ending before the dew lifts, and it is ready to stack next morning. In place of turning, if the crop be thin, the swathes are gathered into little cocks to prevent the excessive action of the sun, which is injurious.

If the crop be cut at the proper time, lucerne hay can be put in with a greater percentage of moisture in it than most fodder crops, without injury from heating or **fermentation**. A gentle sweat is thought by some to improve the quality by softening the stalk, but if fermentation fully develops, and the temperature rises much, the quality is reduced. When the crop is cut too green, it is liable to go wrong in this way, and after cooling down, to become dry and hard.

Lucerne grows excellently in the limestone soils near **Worcester** and **Robertson**, as many as nine cuttings being sometimes taken in one season. To the south of the first range of mountains there are few places where lucerne will grow, unless where limestone appears in the formation, as in the vicinity of **Mossel Bay**. It refuses to grow in the **Ruggens**, near Caledon, after the second year, except in the ostrich camps in which the birds have been supplied with broken bones. In the **Bedford** district there is ample scope for the cultivation of lucerne on lands that can be irrigated, as with the rapid extension of the dairy industry, lucerne will become invaluable both as a winter and a summer food for cows.

In the district of **Stellenbosch**, sowing is done in September in preference to May, as the land is found to be too wet during winter for the young plant. In **Aliwal North**, and in the Middelburg district, where the soil is often

more dense and intractable to manage, becoming hard and brick-like after being irrigated, lucerne is best **sown** in February, so that the summer rains keep it going without surface watering till the roots get down and become established. The great difficulty is experienced in getting the plant to start, after that the dangers are not great. Another reason why sowing is not done in spring is that **annual weeds** come up in some places in such abundance at that season, that it is found best to move the surface to encourage the weeds to germinate, to clean the land when the weeds are young, and to sow in the latter part of summer when the weedy growth is not active. Sown for this reason in February, there is yet time to grow a crop to cut before winter.

On the **Irene Estate**, a little to the south of Pretoria, in the Transvaal, lucerne was found doing remarkably well on rich alluvial soil. Irrigation is not there necessary in summer, as rain is sufficiently abundant, but it is watered in August after frost has disappeared. Cutting is done eight times during the season.

Lucerne being a leguminous plant, has the power, through the medium of wartlike processes or callosities on the fibres of the roots, of fixing the free nitrogen of the air, and taking it into its own circulation in virtue of some symbiotic action existing between the organism which does the work of combination within the warts and the circulation of the plant itself (see Plate 26). Such a quantity of nitrogen is thus stored up in the roots of lucerne, that the land under this crop steadily becomes richer, although the entire growth which shows aboveground may have been removed in successive seasons.

Tagasaste or tree lucerne, *Cytisus proliferus*, Var., from the high mountain slopes of Palma in the Canaries, has been tried as a forage plant in Cape Colony, but the climate is too dry. It is poisonous to horses, inducing similar symptoms to those occurring from poisoning by the allied *Cytisus laburnum*. With a crop which grows so well as common lucerne this plant is not required in Cape Colony.

The so-called **stink clover**, *Melilotus officinalis*, a connection of Bokhara clover, *M. alba*, gives a sweet scent to newly mown hay, but is not eaten by cattle except when it is very young, or if the animals are starving. It is an annual and an

objectionable weed in arable land, unless in a vineyard where it acts the part of a fixer of free nitrogen, and can be destroyed at any time by the horse-hoe when its services are no longer required. It is usually to be distinguished from Boer clover by a purplish stripe up the centre of the leaflet.

Yellow Boer clover, *Medicago nigra*, is sometimes called the old Dutch clover or Cape clover. The flowers are single, while the stink clover possesses a spray of flowers. The pod of Boer clover forms a spiral bur which adheres to the wool of sheep and lessens its value. Animals are fond of it, and ostriches are liable to eat it out of a pasture. This plant grows naturally, and the seed is not sown.

Bur clover, *Medicago denticulata*, does not stand so erect as Boer clover. It produces excellent food for stock, but it is not cultivated owing to the injury produced by the bur adhering to the wool of sheep.

It should not be forgotten that all the various clovers, and nearly all the other plants of the natural order Leguminosæ—whatever their merits may be as food—are more than plants of other natural orders productive of soil fertility, owing to the power which they possess of utilising the free nitrogen of the air, and leaving it stored in their roots for the uses of succeeding generations of crops.

OFFICIAL RETURN OF CROPS CUT GREEN.—1893-4—94-5.

	Names of Crops.		Amount in Muids*—Colony Proper.	Transkei and Walfish Bay.	Total in Whole Colony.
1894-5	Wheat	Bundles	116,654	20,805	137,459
1893-4	„ (Figures Imperfect)	„	...	...	...
1894-5	Barley	Bundles	2,413,257	53,444	2,466,701
1893-4	„	„	1,812,000	52,531	1,864,531
1894-5	Oat hay	„	393,020	118,530	511,550
1893-4	„	„	784,259	97,872	822,131
1894-5	Rye	„	212,642	1,525	214,167
1893-4	„	„	201,944	10,600	212,544
1894-5	Mealies	„	248,667	35,496	284,163
1893-4	„	„	173,851	44,350	218,201
1894-5	Kaffir corn	„	8,310	10	8,320
1893-4	„	„	4,155	5,900	10,055

* 1 Muid = 3 Bushels.

CHAPTER VI.

WEEDS OF ARABLE LAND OTHER THAN GRASSES.

Thistles—Sorrels—Coco or Nut Grass—Dubbletje—Cockscomb—Stramonium—Irrigation—Bur-weed—Charlock—Fathen—Wild Oat—Wild Vetch—Dagga or Indian Hemp—Goudsbloem.

THE Texas poppy, *Argemone mexicana*, L., is popularly reckoned among **thistles** at the Cape. It has a pretty yellowish flower, but is a very objectionable weed which no stock will eat. The **Canada thistle** of America, *C. arvense*, is also present in the Colony, and is productive of a considerable amount of inconvenience at times. Its history is somewhat unique. In certain seasons no thistles appear. In other years, when untimely rains fall, the plant sometimes takes the upper hand in arable land—for example, in the Caledon district—and for three years nothing else can grow. At the end of that time it dwindles or disappears. This is a parallel to the state of things which exists upon strong bush land in **New Zealand**, if recently felled and burnt off, and the sowing of grass seeds not done at once.

On land which is permitted to fall back into the natural state of the veld, the growth of a dense crop of thistles is productive of good rather than of injury.,

Of the numerous **sorrels** for which Cape Colony is renowned, a number are objectionable weeds in garden cultivation, growing and seeding freely, and, owing to the presence of their corm-bearing roots, being impossible to eradicate. Two species may be mentioned that are particularly troublesome—one with a very pretty pale yellow flower, *Oxalis cernua*, and another with a red flower, *O. purpurea*, L. The sorrels are quite different in every respect from the common dock sorrel, *Rumex acetocella*, with the one exception that it also is a troublesome weed. Its seed is frequently distributed in horse manure, having passed through the alimentary canal of some

animal without suffering injury, and probably prepared, during its passage, for speedy germination.

Coco or nut grass, *Cyperus rotundus*, Kth., sometimes erroneously called Indian quick grass, is one of the most universal and most objectionable weeds of cultivation. It seems to thrive best on the heavier classes of land, and where crops are irrigated. Efforts to eradicate it, directed frequently, too, during winter against the corm, which so far resembles a young onion, have proved unsuccessful, chiefly owing to the fact that the plant propagates its species much more readily by seed than by the budding of the tuber.

The successive steps in the **process of extermination** are to prevent the plant seeding, to encourage the germination of the seeds already in the ground by frequent hoeing or moving of the surface, and to get rid of the bulbs themselves by turning them up to the sun during the summer season. By these means land can be effectively cleared of the pest in one or at most in two years. As the seeds pass uninjured through the digestive system of the horse, manure made by animals eating nut-grass hay should not be applied to land until it has been frequently turned and well rotted.

The **dubbletje**, *Emex centropodium*, Meisn., is excessively troublesome as a weed when once established in arable land. In appearance the foliage strongly resembles that of dock-sorrel. Ostriches are particularly fond of its young and tender shoots. It produces an extremely prickly, fleshy bur, which, on becoming dry and hard, is most troublesome to the bare feet of Kaffirs and of dogs.

Fathen, or mealy goose-foot, *Chenopodium album*, L., is also a troublesome annual when it gets established in quantity on arable land. It must be destroyed before shedding its seed, else a fresh crop will come up annually for years afterwards.

Cockscomb, *Amaranthus hypochondriacus*, L., like the poisonous stramonium, is to be seen springing on the manure of old cattle kraals, as well as in cultivated fields. It derives its plebeian name from the dense red inflorescence which ultimately produces little black seeds. **Frost** kills the plant, but the seeds remain for years in the ground. When a seed germinates late in the season, and there is a danger of frost coming, the plant, as if to dodge the danger, seeds when it is yet quite small.

NUT-GRASS OR COCO, CYPERUS ROTUNDUS.
2. A String of Tubers. 3. A Flower Magnified.
Copied from U.S.A. Agricultural Report 1887—reduced one-fourth.

The **stramonium** just mentioned, "stink blaar," *Datura tatula*, L., grows a large fruit capsule. If eaten freely, it brings on paralysis in young ostriches. This is somewhat like the effects produced upon poultry and even upon ostriches which have eaten freely of **pumpkin pips**. They become crazy and paralysed in the use of their limbs for a time. Once they acquire the bad habit of eating pips it is difficult to break them from it. The juice of the leaf is used as a remedy for sore eyes in sheep.

Irrigation is a fruitful source of the distribution of weeds when weeds are permitted to grow on the banks of supply watercourses. The seeds of the **bur-weed**, *Xanthium spinosum*, is frequently so distributed, and once permitted to shed seed on land, a crop of young plants will spring up under favourable circumstances any time during at least the following five years.

Charlock, wild mustard, or "romines," *Sinapis arvensis*, L., is a widely prevalent weed of the corn-fields of Cape Colony. It is also noted for the length of time its seeds remain in the soil without germinating.

The **wild oat**, *Avena fatua*, tends to increase in quantity on lands which are too frequently cropped and are becoming poorer, as for example in the Koeberg district. In some parts of the Western Province the wild oat comes up so abundantly that it is cut for hay, and as in California it produces fodder of good quality if its cutting is not too long delayed. If permitted to become ripe, it is liable to irritate the mouths of horses consuming it.

A **wild** purple-flowered **vetch**, *Vicia sativa*, L., var., which twines round and binds the common grain crops—oats, wheat, and barley—into a dense mat, is considered one of the worst weeds of cultivation in the Queenstown district. Although its appearance in quantity is ruinous to the crops mentioned, it has a few **redeeming qualities**. It does not come up with the mealie crop. Stock are fond of it while it is young and succulent, but as it approaches maturity its stems become hard and woody, and it does not make into good hay. Although destructive to the crops among which it grows, it is an active agent in the valuable work of the fixation of free nitrogen by means of numerous elongated paplike warts, purplish in colour,

and clustered often in twos and threes, and most abundant on the large fibrous lateral roots, not many appearing on the tap root. The **seeds** lie in the ground for years, and a fresh crop of vetches comes up each season even when the plant is not allowed to seed. It can only be got rid of by two or three years of bare fallowing, although heavy kraal manuring checks its growth considerably.

Dagga, or Indian hemp, *Cannabis sativa*, L., the "hashish" of the Egyptian fellah, is a weed allied to flax which grows in gardens. It is collected, dried, and smoked by the lower classes of Hottentots, who are rendered stupid and incapable of connected work while under the influence of it. There are various methods of smoking it, but probably the most elaborate is that in which it is placed in a hole in the ground, and the smoke is drawn up while water is held in the mouth. This is run out along a straw held by the lips, and the bubbles of air and smoke break off like little beads as the descent of the straw is made.

The **goudsbloem**, or Cape weed of Australia, *Cryptostemma calendulaceum*, R. Br., with a yellow flower somewhat like a dandelion, but with a dark centre, is one of the most conspicuous plants in arable land lying down to pasture. As in Australia, it is most relished by animals after the leaves, which also somewhat resemble those of the dandelion, become dried up in the sun.

CHAPTER VII.

FORESTRY.

Three Kinds of Forest Growth in Cape Colony—Forests of Knysna and Amatola Mountains—Forest Scenery—Most Important Indigenous Timber Trees—Yellow-wood—Stinkwood—Sneezewood—Ironwood—Assegai Wood—Scrub Forests—Mimosa Thorn—Forest Aspects near Cape Town—The Oak—Cluster and Stone Pines—White Poplar—List of Naturalised Trees—Species of Eucalyptus—Beefwood—Australian Wattles—The Forest Department—Schedule of Reserved Indigenous Timber Trees.

THE wooded area of Cape Colony includes **three** distinctly **different kinds** of forest growth. (1.) The remains of the primeval evergreen forests of South Africa, which at one time covered much of the surface of the country now bare and barren. This consists of high, heavy timber trees, and is now confined to sections of the mountain ranges near the sea-coast, and always facing southward. (2.) The coast scrub of indigenous small timber trees and bush. (3.) The areas, like the Cape Peninsula, and many small centres throughout the Colony, where imported species of trees have been planted. In addition to these three very different combinations of tree growth, the so-called "**mimosa thorn**," *Acacia horrida*, and a few other less numerous species, mostly acacia, dot the landscape in certain areas where sufficient subsoil moisture exists for their growth, and even form clumps of bush.

According to the Cape Official Handbook published in 1893, the indigenous heavy timber forest area of the Colony which had then been surveyed extended to 550 square miles of country. Since the passing of the **Forest Act** in 1888, this has become public property, controlled by the Forest Department of the Colonial Government. The area is gradually extending as the work of demarcation goes on from year to year. The **two main centres** in which it is represented, and which differ very considerably in some respects, are (1)

Knysna, in a central coast district of the Colony; and (2) the **Amatola Mountains**, north of King Williamstown, in the Eastern Province. It appears in smaller areas to the north-east in the Transkei. It is also present in Natal and in the regions farther north-east.

At Knysna the forest grows at sea-level, and up to fully 2,000 feet above it. The main portion, at an elevation of about 600 feet, forms a belt ten miles broad to the south of the Outeniqua Mountains, stretching eastward from George for over one hundred miles.

The **soil** in the tree-covered area is "extremely fertile," owing to the accumulation of humus and to the forest-covering preventing the washing away of the soluble mineral and finely divided earthy matter from the surface. A great contrast exists between this and the soil of the barren country lying outside the forest area.

The region is humid. The **rainfall**, which varies from 20 inches to 40 inches, is somewhat evenly distributed throughout the year, and it helps to regulate the temperature, which in consequence ranges between the mean temperatures of the South of England and the South of France—viz., from a little over 50° F. to a little over 60° F.

The **Amatola forests** are farther inland, and are on the whole about 2,000 feet above those of Knysna, running from 2,000 feet to 4,000 feet above sea-level. On the Drakensberg, still farther north-east, the elevation reached by heavy timber goes up to 4,000 and even 6,000 feet. As the distance from Knysna increases in this direction, the winters become more and more dry until winter rains disappear.

The Amatola forests contain more heavy timber, and are also more open than the Knysna forests, areas not covered with trees growing good grass for grazing purposes.

Though the **two forests** are in many respects **similar**, "a distinct change of trees occurs with the change of climate to dry winters. The stinkwood, essenwood, quar and witels of Knysna disappear, and are replaced in the Amatola forests by sneezewood, Kaffir-plum, white ironwood, Kaffir-boom, and wild lemoen."

The natural **forest scenery** of South Africa is very grand and beautiful. A profusion of interstitial decoration, consist-

PLATE 27.—A ROAD THROUGH THE FOREST. *Face page* 120.

PLATE 28.—BIG YELLOWWOOD TREES.

Face page 121.

ing of tree ferns and gigantic creepers, which latter droop to the ground from the tops of the highest trees, together with "masses of gorgeous flowers, such as the *Calodendron* in the eastern forests and the more richly beautiful and scented vlier at Knysna."

The following are the **most important** of the **indigenous timber trees** of South Africa: *—

Common Name.	Botanical Name.	Weight of a Cubic Foot (dry) in lbs.
Stinkwood	*Ocotea bullata* (E. Mey.)	49
Sneezewood	*Pteroxylon utile* (E. & Z.)	68
True Yellow-wood	*Podocarpus Thunbergii* (Hook.)	37
Outeniqua Yellow-wood	*Podocarpus elongata* (L'Hérit.)	29
Black Ironwood	*Olea laurifolia* (Lamk.)	61
White Ironwood	*Toddalia lanceolata* (Lamk.)	57
Wild Olive	*Olea verrucosa* (Link.)	71
Assegai	*Curtisia faginea* (Ait.)	58
White Pear	*Apodytes dimidiata* (E. Mey.)	52
Kersewood	*Pterocelastrus variabilis* (Sond.)	52
Wit Els	*Platylophus trifoliatus* (Don.)	38
Saffraan	*Elæodendon croceum* (DC.)	54
Vlier	*Nuxia floribunda* (Benth.)	47
Red Els	*Cunonia Capensis* (L.)	47
Essenwood	*Ekebergia Capensis* (Sparrm.)	40
Hard Pear	*Olinia cymosa* (Thunb.)	68
Buckenhout (Cape Beech)	*Myrsine melanophleos* (R. Br.)	45
Kamassi	*Gonioma Kamassi* (E. Mey.)	58
Mountain Pear	*Cathastrum Capense* (Turcz.)	56
Cape Chestnut	*Calodendron Capense* (Thunb.)	39
Kaffir-boom	*Erythrina caffra* (Thunb.)	16
Kaffir-Plum	*Harpephyllum caffrum* (Bernh.)	39

Yellow-wood forms "about eight-tenths of all the large timber in the forests" of Cape Colony, and "in the best forests about one-half of all the trees are yellow-wood." There are two varieties—the Outeniqua, common or bastard yellow-wood, of large size, and the true yellow-wood, which is a much smaller tree, with wood of a shorter fibre and closer grain, although very much like the other in general appearance. Some of the Outeniqua trees grow to very large dimensions, "one known as the 'Eastern Monarch' measuring 23 feet in girth and 80 feet in height." The wood,

* Taken from the chapter on "Woods and Forests," by D. E. Hutchins, in the "Official Handbook of the Cape, &c.," to which the author is further largely indebted.

which is of a light-yellow colour, makes excellent joisting and flooring. It is also used for railway sleepers after being creosoted. The mature wood is becoming fashionable for furniture making, as it stains and polishes well, and can be made to imitate walnut, mahogany, and ebony, and some specimens taken from old trees are naturally dark and ornamental. Unless the timber is **felled** at the right season—May, June, and July—and allowed to lie under shelter for a year to season, it is liable to decay rapidly from dry-rot.

Stinkwood or laurelwood derives the first and more common of these names from the offensive smell given off by the timber when newly cut. The smell, however, soon goes off. The laurel-like leaf is "spicy and aromatic, and tastes like cinnamon when chewed." The **wood** is almost equivalent in strength and durability to teak, and being also beautiful in appearance—white, mottled, and black—it is held equally in high esteem by cabinet-makers and waggon-makers. It is good enough to export, but the supply is limited in amount. It forms only about 9 per cent. of the timber in the Knysna forests. The **habit of growth** of the tree is very peculiar and interesting. The seed is seldom fertile, and the growth of wood is mostly the product of coppice shoots. "The main trunk of the tree dies from the top downwards, and from the base is produced a sheaf of young shoots round the dead trunk." If the old trunk remains standing while decay goes on, as it tends naturally to do, "the young shoots put out roots which run down the parent trunk and eventually reach the ground, where they take root."

Sneezewood is classed with jarrah and greenheart as one of the most imperishable and valuable timbers grown in South Africa or in any country. The length of time required to induce decay in the heartwood is not yet determined. It is invaluable for fencing posts, as it has not been known to rot, although in use since the early days of the Colony. It is not attacked by the white ant of the tropics nor by marine borers. It owes its safety and its durable qualities to the presence of a pungent **essential oil**, which also gave origin to the name of "sneezewood," as it sets up irritation in the nostrils, followed by "violent fits of sneezing," when fine saw-

PLATE 29.—TYPICAL BUSH FOREST.

Face page 123.

dust is accidentally taken into them during the operation of cutting it up.

As machine bearings, it is superior to *lignum vitæ*, and it **wears** longer than either brass or iron. If it has a defect, it is in its being so **hard** and difficult to work. It makes excellent **furniture** with a "mottled curly grain resembling satinwood." The tree is not one of the largest of the heavy timber trees. It does not grow in Knysna, but belongs to the Eastern Province, where it was used in large quantities as firewood until its real value was demonstrated. Now it is not only a scarce but a dear commodity.

The heartwood of **ironwood** is almost as imperishable as that of sneezewood. It is much used for making the frameworks of ox-waggons, and in spite of the difficulty entailed in working, it is considered excellent for cabinet-making purposes. The tree grows a long straight bole 2 to 3 feet in diameter, and 20 to 60 feet high, terminated by a spreading crown of numerous branches. It is abundant in Knysna and in the Amatola forests.

Assegai wood is the most valuable of the waggon woods for making spokes and felloes. It is "extremely tough and strong, heavy and elastic, close-grained and durable, if exposed to only moderate damp." The colour is bright red, but it soon fades if exposed to the air. The tree is becoming scarce at Knysna, but in the Amatolas, trees of 40 to 70 feet high, and 2 to 3, and even 4 feet in diameter, may be found.

The **scrub forests,** such as the Addo Bush, near Port Elizabeth, are of little value except as fuel copses. Although occupying the largest forest area along the eastern coast-line of the Colony, and lining the valleys of the rivers, they are not worth the expense of surveying and management on the **Continental plan,** such as that adopted by the Forest Department in connection with the management of the heavily timbered country. They are not liable to the wholesale destruction by fire which is the terror of the forest departments of most countries in which there are very dry seasons.

The **mimosa thorn** or "doornboom," *Acacia horrida*, Willd., is the most common scrubby-tree or bush marking the course of the Karoo rivers, and on the open veld main-

taining its existence in virtue of its numerous strong white thorns. Its wood is hard and durable, and useful for minor farm purposes. The **leaves** as well as the pods afford food for goats and sheep in times of drought and scarcity. It has been explained in another place that it periodically suffers from a **scale insect.** It serves as a host for species of Loranthus and **mistletoe,** very abundant in some districts. It is from several species of Acacia,* chiefly *A. saligna*, growing in Central Africa, that the commercial **gum-arabic** is derived. The brown colour of some gums is due to the presence of a **fungus** which can be artificially cultivated in the laboratory, and Dr Edington's researches point in the direction of certain organisms which injuriously affect the animals of the farm being found in a similar condition in Cape gum.

Another species, *A. caffra*, Willd., mingles with mimosa, and resembles it in habit of growth and general appearance, but it is not so numerously represented, nor does it extend so far as *horrida* from river banks.

The **camel thorn**, *A. giraffæ*, Burch., grows to a tree of considerable size, with a clean upright bole and spreading head. It is seen in the north of the Colony, and forms a conspicuous feature in some of the heavy bush country lying still nearer the equator. In the neighbourhood of Kimberley, where at one time it was abundant on the bright red sandy soils that appear in that district, it has been almost destroyed by cutters of firewood. With a little care and protection the "kameel-doorn," which is a handsome as well as a valuable addition to the natural adornments of a level and monotonous landscape, would yet re-establish itself in soil suitable to its growth.

The stranger who lands at Cape Town sees little of the two forest areas described, as the **indigenous trees** which at one time covered the slopes of **Table Mountain** and the adjoining mountains have been destroyed, with the exception of a remnant of large timber-trees left in the deepest gorges where forest fires cannot penetrate, and from which it would be difficult and expensive to remove timber. The Forest

* *Acacia verek*, Guill., gives the best white Egyptian gum of commerce. *A. stenocarpa*, Hochst., gives the brownish gum of Nubia and the east coast. *A. gummifera*, W., gives Barbary gum, &c.

Department has done much to provide a new and modern European covering of tree-growth, although its operations are, in spite of all precautions, liable to be retarded by fires, which there is too good reason to believe are at times the work of native incendiaries.

The **three trees** which have been introduced with greatest success in the immediate vicinity of Cape Town are the oak, *Quercus pedunculata*, the cluster pine, *Pinus pinaster*, and the stone pine, *P. pinea*. Oaks shed their leaves during winter,

Broken Bush of so-called Mimosa, Acacia horrida, Willd.*

but only for a few weeks. The growing season is in consequence longer than in Europe, and the growth is almost twice as rapid. The wood of the conifers under the circumstances is naturally inferior, and the bark is deeply indented, and presents an exceptionally rough appearance to the eye.

The oak has been naturalised at Cape Town for upwards of two hundred years. It grows with astonishing vigour and

* The most numerously and most widely represented tree in Cape Colony. The **thorny spines** which serve to protect it from destruction by the browsing of animals during times of drought and scarcity, and the **seed pods** which supply nutritious food for live stock, are both clearly illustrated.

rapidity in the western area, in which winter rains fall. It grows freely in South Africa generally, even where winter rains do not occur, except, of course, on the dry Karoo. The foliage produced is dense, and the fruit exceptionally large and well matured. The appearance and also the market value of a vast number of the oaks near Cape Town have been injured by the objectionable practice of planting the young trees at too late a period, and "cutting their heads off as if they were truncheons."

The **cluster pine** is a more recent importation than the oak. It, like the stone pine, produces seed freely and in abundance, and is spreading rapidly on Table Mountain and on the worthless Cape Flats. The wood is coarse, and requires to be protected by creosote to preserve it from rapid decay when used for outside purposes. The **stone pine** is liable to the attacks of a fungoid disease, which is a serious drawback to its usefulness. The wood, though slightly more durable, does not grow so quickly as that of the cluster pine.

The **white poplar**, *Populus alba*, also grows well in the Cape Peninsula, particularly on black soil flats, where it acts as a check to forest fires. Although the four naturalised trees mentioned are the most abundant and the most in evidence, many other well-known **European** and **Australasian** species have been successfully introduced. The following list is made up of the names, selected from a list of over one hundred and fifty, of the species most in demand which have been sold or supplied from the Tokai and the Kluitjes Kraal nursery plantations to the public :—

Botanical Name.	Common Name.
Aberia caffra	Kei Apple.
Acacia dealbata	
„ *decurrens*	Black Wattle.
„ *pycnantha*	Pycnantha Wattle.
„ *saligna*	
Casuarina quadrivalvis	
„ *suberosa*	Suberosa Beefwood.
Cupressus macrocarpa	Cypress, macrocarpa.
„ *pyramidalis*	„ pyramidalis.
„ *sempervirens*	„ Common.
„ *torulosa*	„ Twisted.
Eucalyptus amygdalina	Giant Gum.
„ *cornuta*	Cornuta Gum.

Photo. by Wilson, Aberdeen, N.B.

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PLATE 39.—AVENUE OF FIRS AT RONDEBOSCH.

Botanical Name.	Common Name.
Eucalyptus citriodora	Scented Gum.
„ *calophylla*	Calophylla Gum.
„ *corynocalyx*	Sugar Gum.
„ *diversicolor*	Diversicolor Gum.
„ *eugenioides*	
„ *globulus*	Blue Gum.
„ *goniocalyx*	
„ *Gunnii*	
„ *longifolia*	Longifolia Gum.
„ *leucoxylon*	Leucoxylon Gum.
„ *microcorys*	Microcorys „
„ *marginata*	Jarrah (true) „
„ *melliodora*	Melliodora „
„ *obliqua*	
„ *resinifera*	
„ *robusta*	Robusta „
„ *rostrata*	Rostrata „
„ *siderophloia*	
„ *tereticornis*	Tereticornis „
„ *viminalis*	Viminalis „
Hakea suaveolens	Common Hakea.
Leptospermum lævigatum	Australian Myrtle.
Lycium horridum	Cape Box-Thorn.
Pinus Canariensis	Canary Island Pine.
„ *Halepensis*	Jerusalem Pine.
„ *insignis*	Insignis „
„ *Pinaster*	Cluster „
Populus monilifera	Cottonwood.
„ *fastigiata*	Lombardy Poplar.
Quercus pedunculata	Common Oak.
Robinia pseudoacacia	Robinia.
Salix viminalis	Common Osier.
Tamarix orientalis	Tamarisk.

Many species of **Eucalyptus** have been successfully grown in Cape Colony, in Natal, and in the Transvaal. The wonderful results in tree growing obtained near Johannesburg have already been referred to in Chapter II. Of all the species of Eucalyptus which appear in the foregoing list, the **blue-gum**, *E. globulus*, introduced in 1828, is the one of largest and most rapid growth. After the first crop has been cut it springs quickly as coppice shoots, and under favourable circumstances yields at the rate of ten tons of dry wood per acre annually, the second growth frequently being better than the first. The wood is mostly used for pit props and

firewood. Much of it has been sent from the Government plantations at Worcester to the Kimberley diamond mines. The wood, when dry, is difficult to work, and it is extremely liable to split while seasoning, especially if it be not cut at the proper season, but when this danger is avoided it forms useful tough wood for waggon work and other purposes. Now that the first planting rush is past, and people are becoming less anxious for rapid growth of trees when secured at the sacrifice of the quality of the timber, the following species of Eucalyptus are most rapidly supplanting the blue-gum in public favour—*E. rostrata*, *E. cornuta*, *E. marginata* (jarrah), *E. amygdalina* (giant gum), and *E. robusta*. Near Johannesburg gum-trees were mostly planted in rows at a **distance** of 3 feet and 4 feet **apart** each way, but this was found to be much too close to secure quick returns, and probably 6 feet, or even 9 feet, according to Sutton of Natal, would be a much more satisfactory width between the rows.

Young gums are liable to be killed by the **frost** which occurs in the higher regions of South Africa, but after they have been established for a few years they become hardy and able to resist it.

Although gum-trees are generally successful, there are places where they do not thrive. At **Pietermaritzburg** they die off after coming to a good height, and on the hard irony soil near **Port Elizabeth** gums do badly. The trees which seem best able to overcome the soil disadvantages of that portion of the Colony are species of **cypress** and the **Norfolk Island pine**.

A species of **beefwood**, *Casuarina equisetifolia*, Forst., with erect, short, needle-like leaves jointed like an equisetum, produces a red wood (resembling beef), which, when carefully seasoned, is useful for many farm purposes. The wood of the long pendent leaved species, *C. quadrivalvis*, Lab., which also grows well in the Colony as an ornamental tree, is worthless.

The **Australian wattles** have acclimatised readily, and are represented by a good many species. The common wattle of Westralia, *Acacia saligna*, is of those useful for the production of **tan bark**, the one which thrives best. It grows better

PLATE 31.—PARK GATE, MOSSEL BAY.
Norfolk Island Pine and Blue-Gum in the foreground.

Face page 128.

than either the *A. decurrens*, var. *mollis*, or *A. pycnantha*, which in their native places yield the largest percentage of tan. The price of bark remains about £4 per ton, and at that figure it does not leave a satisfactory return for its collection, the cost of which averages about 2s. 6d. per 100 lbs. The "hardy Port Jackson wattle, *A. falcata*, and *A. cyclopis*, grow freely anywhere in South Africa."

For the purposes of **forest management** the Colony is divided into **four conservancies**, each placed under a conservator, who annually reports to Government through the Department of Agriculture.

The following is a list of the divisions referred to, with the last published annual statement of the **receipts** from forest produce, and **expenditure** of each conservancy attached :—

Conservancies.	Revenue.	Expenditure.
The Western . . .	£5,892	£13,339
The Midland . . .	4,664	7,785
The Eastern . . .	5,779	3,966*
The Transkei . . .	2,348†	4,742
Total . . .	£18,683	£29,832
Total adverse balance for one year		£11,149

The excess of expenditure over receipts must not be looked upon as loss, but as an investment by Government of capital of a substantial and useful kind, which will in due time yield satisfactory returns.

The **system of forestry** adopted in Cape Colony is fashioned after the most scientific Indian and Continental methods, which involve protection against fire and other sources of preventable injury; the survey of areas under control, and the subdivision of these into sections, so that a regular working plan or succession of crops, extending over a lengthened period of years, may be adopted. The **felling of timber** is not now wasteful, indiscriminate, and general as it used to be, but is confined to certain areas, which in turn are reconstituted by resowing or replanting. **Resowing** is in favour, owing to being so much less expensive than replanting

* Exclusive of expenditure on drift sand reclamation.

† Includes £339 from fines imposed.

—the figures in one return made in connection with work done at Kluitjes Kraal in 1894 being for sowing 126 acres of cluster pine £1. 7s. 6d. per acre, and for planting a similar area £8. 17s. 8d. per acre. The **broadcasting** of seed gives, owing to the rough nature of the ground, better results than **drilling**, although if, by the use of better drills or other means, this difficulty could be overcome, a great saving of seed would be made by the use of the drill; and, moreover, the luxuriant weedy growth which at present absorbs so much of the energy of the Forest Department to keep it in check would be more easily combated.

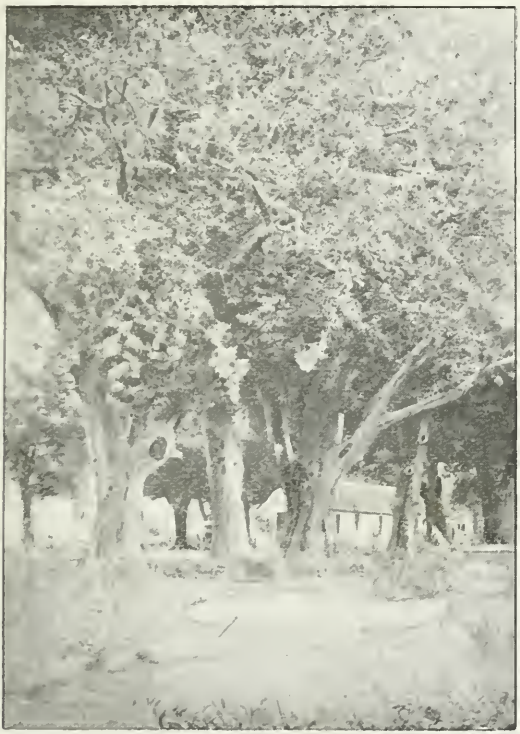
The **Forest Department** is only in its infancy, and once it has got into better working order, a greater return than at present for money expended may be confidently anticipated.

Home-grown **seed** is being collected at a reasonable cost, of better quality than seed that at one time had to be imported at very high prices. Seed of *Acacia pycnantha*, which cost to import 5s. per lb., is now sold by Government at 3d. per lb.

Private enterprise in the growth of trees is encouraged by the public being able to purchase from the **Forest Nurseries**, such as those at Tokai and Kluitjes Kraal, in the Western Province, a suitable selection of species for any locality at the moderate average cost of ·8d. each; and it is satisfactory to know that the demand in this direction has rapidly increased during recent years.

The **natural aspirations** of the Department are to provide in the first instance such timber as is suitable for home consumption, in place of consumers having to depend upon the imports, which are larger than they ought to be if the home product had a fair chance in the market, and ultimately to develop an export trade in certain forest products, for the growth of which colonial conditions are specially adapted. With a view to these ends, it is to be hoped that Government will make no unnecessary delay in providing **timber stores**, such as is advocated by the conservator of the Western Conservancy, in which colonial grown timber may be kept and seasoned, so that when supplied to the public it may be delivered in a condition which will give general satisfaction. To settle all points of uncertainty about the time and method of handling and seasoning the timber, an extensive series of

experiments would require to be carried out. Owing to the nature of the climate the greatest care will be necessary in the seasoning of the wood, to retain its keeping power, and to prevent the formation of cracks, which render wood valueless for many purposes. The Department is already well supported by an admirable **Forest Act**—that of 1888—and it only now wants a little time and the means of putting its products on the market in the best possible condition to enable it to become, as is the case with the Indian Forest Department, a source of revenue rather than a burden to the Exchequer.



Old Oaks at Lourensford.

Photo. by Dr Hugo.

Revised Schedule.—Reserved Timber Trees, Appended 1889 to the Forest Act of 1888.

Botanical Names.	English Names.	Dutch Names.	Vernacular Names.
*1. Acacia caffra, Willd.	——	——	Umyamanzi.
2. ,, giraffæ, Burch.	Camel Thorn	Kameeldoorn	Mookaaba.
3. ,, horrida, Willd.	Mimosa Thorn	Doornboom	
4. Apodytes dimidiata, E. Mey.	White Pear	Witte Peer	Umdakana.
5. Burchellia capensis, R. Br.	Wild Pomegranate	Buffelshoorn	
6. Buxus MacOwani, Oliv.	Cape Box	Buig mij niet	Gala-gala.
7. Buddlea salviæfolia, Lamk.	Sagewood	Saliehout	Gwangi.
8. Calodendron capense, Thunb.	Wild Chestnut	Kastanjehout	Umbaba.
9. Canthium obovatum, Klotzsch.	——	——	Quar.
9A. Cathastrum capense, Turcz.	Mountain Hard Pear	Haarde Peer	
*10. Celastrus acuminatus, L.	Silkbark	Zijdebast	Umnama.
11. ,, peduncularis, Sond.	Blackwood	Zwarthout	
12. Celtis rhamnifolia, Presl.	Camdeboo Stinkwood	Camdeboo Stinkhout	Umvumvu.
13. Cunonia capensis, L.	Red Els	Roode Els	Umqwashube.
14. Curtisia faginea, Ait.	Assegaiwood	Assegaihout	Umgxina.
15. Ekebergia capensis, Sparrm.	Cape Ash and Dog Plum	Esschenhout	Umqwenyuizinja.
16. Elæodendron croceum, DC.	Saffronwood	Saffraanhout	Umbonowana.
17. Euclea lanceolata, E. Mey.	Bush Gwarri	Bosch Guarri	Umgwali.
18. ,, pseudebenus, E. Mey.	Cape Ebony	Ebbenhout	
19. Gonioma Kamassi, E. Mey.	Kamassiwood	Kamassihout	Kamassi.
20. Grewia occidentalis, L.	——	Kruisbeisje	
21. Halleria elliptica, Thunb.	Septee	Oudehout	Imavet.
22. Harpephyllum caffrum	Kaffir Plum	Kaffer Pruim	Umgwenye.
23. Hippobromus alata, E. & Z.	Horsewood	Paardepis	Ulwatile and Umnukambila.
24. Ilex capensis, Sond. & Harv.	Whitewood	Wittehout	
25. Kiggelaria Dregeana, Turcz.	Wild Peach, Natal Mahogany, and Fatherland's Redwood	Wilde Perske en Vaderlands Roodehout	Umveti.
26. Lachnostylis hirta	Coalwood	Koolhout	
27. Leucadendron argenteum, R. Br.	Silver Tree	Witteboom	
28. Milletia caffra, Meisn.	Kaffir Ironwood	Kaffer Yzerhout	Umzambit & Umtiza.
29. Mimusops obovata, Sond.	Red Milkwood	Roode Melkhout	Umtunzi.
30. Myrsine melanophlæos, R. Br.	Cape Beech	Beukenhout	Isiqwane isqlati.
31. Nuxia floribunda, Benth.	Wild Elder	Vlier	
32. Ochna arborea, Burch.	Redwood and Cape Plane	Roodehout	Umtensema.

33.	Olea laurifolia, Lamk.	Real Black Ironwood	Regte Zwarte Vzerhout	Igqwanxe.
34.	,, verrucosa, Link.	Wild Olive	Olyvenhout	Umquma.
35.	Olinia cymosa, Thunb.	Hard Pear	Harde Peer	
36.	Oreodaphne bullata, Nees. ...	Laurelwood	Stinkhout	
37.	Osyris compressa, A. DC. ...	Cape Sumach	Bergbast and Pruimbast	N'tekaza.
38.	Pittosporum viridiflorum, Sims....	—— ...	—— ...	Umkwenkwe.
39.	Platylophus trifoliatus, Don. ...	White Els	Witte Els	
40.	Plectronia Mundtiana, Pappe ...	Rock ,, ...	Klip ,, ...	
41.	Podocarpus elongata, L'Hérit. ...	Common, Bastard, or Outeniqua Yellow-wood	Geelhout	Umkoba.
42.	,, Thunbergii, Hk. ...	Real Yellow-wood	Opregte Geelhout	Umceya.
43.	Protea grandiflora, Thunb. ...	Waggon Tree	Wagenboom	
44.	Pterocelastrus variabilis, Sond. ...	Candlewood	Kaarshout	
45.	Pteroxylon utile, E. & Z. ...	Sneezewood	Nieshout	Umtati.
46.	Rhus lævigata, L.	Red Currant	Kirrichout en Bosch Taaibosch ...	Umhlakoti.
47.	,, lancea, ,, ...	Karoo Tree	Karreeboom	
48.	,, viminalis, Vahl.	Karoowood	Karreehout	
49.	Royena lucida, Thunb.	Blackbark	Zwartbast	
50.	Salix capensis, ,, ...	Cape Willow	Wilde Wilgeboom	
51.	Schotia latifolia, Jacq.	Boerbean	Boerboon	Umgxam.
52.	Scolopia Zeyheri, Arn.	Wolf's Thorn and Thorn Pear ...	Doorn Peer en Hoenderspoor ...	Iqumza elinameva.
53.	,, Eckloni, Harv.	Red Pear (Knysna) and Mountain Saffron (East)	Roode Peer (Knysna) en Berg-Saffraan (Oost)	Iqumza.
54.	Sideroxylon inerme, L.	White Milkwood	Witte Melkhout	Umqwashu.
55.	Strychnos Atherstonei, Harv. ...	Cape Teak	Kajatenhout	Inama.
56.	Strychnos sp.	Coffee Hard Pear	Koffie Harde Peer	Umnonono.
57.	Toddalia lanceolata, Lamk. ...	White Ironwood	Witte Yzerhout	Umzani and Umngumaswile.
*58.	Virgilia capensis, Lamk.... ...	—— ...	Keurboom	
59.	Widdringtonia juniperoides, Endl.	Clanwilliam Cedar	Cederboom	
60.	Xylosma monospora, Harv. ...	Lemonwood	Limoenhout	Lamuni.
61.	Xanthoxylon capense, Harv. ...	Knobwood	Paardepraam	Umnungu Mabele.
62.	Zizyphus mucronata, Willd. ...	Buffalo Thorn	Buffelsdoorn	
63.	—— ...	Bogwood	Witte Salie	Omkobeza.

Terblanz; * Red Candlewood; Blackheart; Oak; Gum; and all planted trees.

* This tree is unreserved in the Knysna, George, and Humansdorp Divisions.

CHAPTER VIII.

VITICULTURE.

Introduction of Vines and Winemaking—Census Returns, 1891—Wine-growing Centres—Yields of Wine—Government Efforts to Introduce Improvements—Baron von Babo's Teaching and its Consequences—Groot Constantia Wine Farm—Selected Levures—Regulation of Temperatures—The Orchard—Farmers' Visits—The Wines Made—Cultivation of the Vine—Planting—Pruning—Horse-Hoeing—Topping—Manuring—Sulphuring—Calander—Phylloxera—Grafting upon Resistant American Stocks—Government Plantations—Ways of Grafting—Varieties of Grapes Grown—Sweet Wines—Dry Wines—Fruit Acid—Sugar—Prices of Fustage—Wine *versus* Brandy—Manufacture of Cognac—Cape Brandy.

Vines seem to have been **introduced** into Cape Colony by the early settlers, who, going from European wine districts, naturally took with them vine-sticks with other household gods, and in less than thirty years the number of vines planted exceeded half a million. Though wine and brandy had both been made years before the arrival of the **Huguenots** in 1688, they are entitled to the credit of introducing greater skill in the art of wine making, and of increasing the varieties of vines of superior quality. Coming largely from the south of France, where the heavier classes of wine are made, the grapes they produced were naturally rich in sugar.* In this way the Cape became famous for its **sweet wines**, and at one period of its history sweet Constantia was regarded as one of the greatest delicacies of the London season. It is only recently that some of the less sweet northern French varieties from which **light wines** are made have been introduced.†

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* The climatic conditions, which resemble those of the south of Spain, and also the system of short pruning, *en gobelet*, have no doubt a certain amount of influence in developing sugar.

† "Steen" and "Groen Druif," or Green Grape, besides several Chasselas varieties, the commonest of which is known as "French

Light wine has come into favour, and as the happy combination of soil and climate for growing suitable grapes for its manufacture is only realised in certain favoured spots of the world, this branch of the industry is at a premium. Early in the eighteenth century **shipments** of wine began to be made to Europe and to the East, where the Dutch had a large trading connection, and the industry rapidly grew into one of the most important in the colony. At **the census** of 1891 the vines in Cape Colony numbered 78,574,124, yielding 4,964,616 gallons of white wine, 1,047,906 gallons of red wine, and 1,423,043 gallons of distilled brandy, in addition to more than a million and a half lbs. of raisins. The corresponding figures for the year 1894-95, considerably affected by the ravages of the phylloxera, are—Vine stocks, 86,858,008; white and red wine together, 5,389,727 gallons (against 6,012,522 gallons in 1891); brandy, 1,376,013 gallons; and raisins, 2,603,684 lbs. The well-known **wine-growing centres** are in the Western Province, the climatic conditions of the Eastern Province being less favourable for the growth and maturation of wine-producing grapes. The chief wine districts are situated in the divisions of The Cape, Stellenbosch, Paarl, Robertson, Worcester, Oudtshoorn, and Ladismith.* The first three are classified as the **coast districts**, and the remainder as the **inland districts**. Within these divisions there are marked differences in results, owing to differences of soil, climate, and exposure. The Cape peninsula, with its insular climate, is specially favoured, and the length of the ripening period is prolonged to the advantage of the wine as compared with conditions existing at the Paarl. The grapes begin to colour at the same time, but the Paarl grapes ripen nearly a month earlier. With a southern exposure the grapes ripen more slowly and more perfectly than when the vineyard

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Grape," were among the earliest introductions. They have always, till comparatively recently, been used for sherries, and demanded heavy fortifying with spirit to ensure keeping, and to meet the prevailing taste for something strong.

* Caledon, Malmesbury, and Prince Albert are sometimes mentioned at the end of the above list, which is given in order of importance, but Caledon makes only a little brandy, scarcely any wine, and the wine product of the other two places is insignificant.

faces the north, and it has been remarked that the best of the vineyards in the coast group are found on soils formed of decomposing granitic rocks. The average **annual yield** of wine in the coast district group is 1½ leaguers per 1,000 vines. In Robertson, Worcester, and Oudtshoorn districts the yield is nearly double this amount. While these figures represent averages, individual growers have at times produced in the Cape peninsula 4 leaguers,* and in the inland districts as much as 5 leaguers per 1,000 vines. The least of the

Colonial Measures.

1, ½ Leaguer, or about 63 Imperial Gallons; 2, An Aum, or 32 Gallons; 3, ½ Aum, or 15 Gallons; 4, An Anker, or 7½ Gallons; 5, A Keg or ½ Anker, 4 Gallons. (*All in round numbers.*)

average figures quoted are a long way more than double the corresponding figures in any or all of the wine-growing districts of Europe, which gives the colonial farmer an immense initial advantage. It only remains now for him to **improve the methods** of manufacture, so that larger quantities of wine of good quality and uniform character may be put on the market. There is undoubtedly much wine of excellent quality made in Cape Colony, but in small quantities by individual

* A leaguer is a measure containing about 126½ Imperial gallons, or 2 hogsheads.

PLATE 32.—GRAPE GATHERING, CONSTANTIA,
With a Flank of Table Mountain in the background.

Face page 136.

growers, each working according to a system of his own, or, more correctly, of his forefathers. **Dealers** buy up such wines and mix them, but however skilfully this may be done, the mixture is looked upon as a doctored article, and the charm of getting a special brand of a well-known sound wine is dissipated ; moreover, the middleman retains a substantial margin of profit to work upon.

Government has not been blind to the importance of aiding the wine growers in attempting to find means by which a higher standard of quality and greater uniformity of character might be secured in the colonial product, but official efforts in this direction, until quite recently, have not only been grievously unfortunate, but even calamitous to the industry. In 1884 the Government secured as "colonial viticulturist" **Baron A. von Babo,** the son of the late distinguished and venerable author of the standard work on viticulture in Europe, and head of the Austrian Proof Station at Klosterneuburg. Down till 1892 this expert, as head of the Viticultural School at Groot Constantia, taught a new doctrine of wine making, and in doing so no doubt demonstrated the absolute necessity of cleanliness in everything associated with wine production, and so far did much good ; but it is evident from the story of his career in South Africa that he lamentably lacked the practical experience and scientific knowledge which were necessary to success, and inaugurated injudicious experiments which were not only ruinous to the individual victims involved, but to the credit in Europe of the wine industry of the Colony. His **fundamental blunder** was persisting in his attempt to make low percentage beverage wines like French *vin ordinaire* and Rhein wines out of the heavily sugared Cape grapes in an unripe state and at the high temperature experienced in South Africa. Although he preached the doctrine of cleanliness, he had not grasped the importance of regulating the temperature of the fermentation vats and of the wine cellar. The resulting product was not able to endure the tropical heat when crossing the equator on its way to Europe, secondary injurious fermentations taking place. This was the fate of the wine consigned for competition to the Paris Exhibition in 1889, which did untold injury to the fair name of Cape Colony as a wine-producing country. The **evil influences** of this failure are

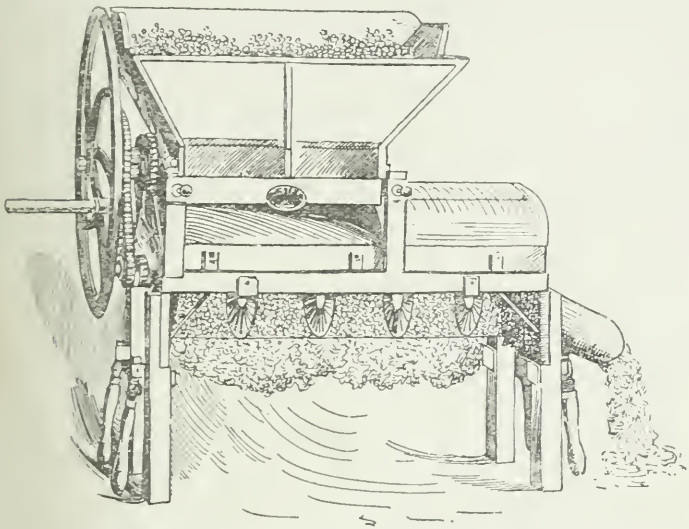
to some extent evident in the Colony to-day in the dogged opposition, or indifference, on the part of farmers to introducing changes in their antiquated systems of working, and the misfortune is that the distrust fostered by the Government effort in this special case is liable to extend to efforts for improvement in other directions.

As the **Groot Constantia Wine Farm**, though not now a Viticultural School with resident students, is still a centre where every one interested in grape growing may go to see new processes in operation, a brief statement of the results of management under the staff of German experts up till June 1893 will form a basis of comparison with things as they now are. The farm, which had acquired a foremost reputation in the history of Cape wine production, was purchased in 1885 at fully £5,000. The expenditure on buildings increased the capital outlay to £7,650. Other items, including the conspicuous sum of (in round numbers) £8,800 (or £1,100 per annum) for salaries and wages, brought the grand total of outlays for the period of eight years up to £24,480, from which, however, there stands to be deducted £4,600, the amount of receipts, to leave a net balance of £19,880 against the farm. Their financial statement does not go far to condone the viticultural results which have already been discussed.

Under the **new arrangement,** which has been in existence for nearly three years, the whole aspect of the situation has been changed. The practical management is now in the hands of J. P. de Waal, a young man of colonial birth and training. The salaries and wages have been reduced to £350, or less than one-third of the former annual amount. The wine is no longer undrinkable, but is able to rank with the best wines of the Colony, and to be spoken of in comparison with wines of former palmy days. Above all, the farm is now a financial success, and is rapidly becoming a centre of instruction in new and improved methods of working.

The Groot Constantia Government Wine Farm is situated about half-an-hour from Wynberg Station. The **area** extends to about 150 morgen, or 300 English acres. Fifty acres are under vines, and about thirty other acres are under general cultivation. A flock of goats and a small herd of milch cows are kept to aid in providing manure for the vine-

yards and thereby to reduce the manure bill. Although not extravagantly managed or kept in the "swept and garnished" style of a model farm, it is nevertheless intended to be a show place of the best and most **approved systems of management,** not only in the vineyard but in the cellars. The practice of planting vines wider apart than the old wine-growers did, is favoured, together with the extensive use of a light horse-hoe as a supplement to the scuffling-spade. In the process of wine-making scrupulous cleanliness is observed. The grapes are not now trodden under the feet of naked



The Grape Mill (*Fouloir égrappoir*) strips off the Grapes from the Stalks or "Rafle," and Pulps them without crushing the Pips.

black "boys," from whose skins streams of perspiration used to drop into the grape juice, but a *Fouloir égrappoir*, or grape crusher and stalker, is employed, and "the crushed grapes are delivered into the kuip or fermenting tub free from the objectionable stalk, and with such rapidity that an entire charge can be made in a very short time, the levures added, and the process of fermentation begun without delay and without piecemeal additions of other must."

Pure selected **levures** or wine yeasts were brought to the notice of the Cape Government by George Payne, a

connoisseur in wine, who recently visited the wine districts of the Colony, and who, it may be mentioned in passing, was much taken by the native qualities of well-made Constantia wine. Selected levures may be defined as concentrated forms of the fermentative principles of various well-known European wines; and the idea in using them is to get the process of fermentation more completely under control than is the case when dependent upon the native organisms present on the skins and stalks of the fresh grapes. It is also believed that greater uniformity in wines of different characters will be got by the employment of these regulating media, which may be compared in their action to that of yeast in brewing beer. Little more can be said than that levures are on their trial, that so far they have not been shown to do harm, that they have in certain cases influenced the nature of the bouquet, generally beneficially, and, most important feature of all, that they have been known to "accelerate the fermentation, and consequently the maturing of the wine." It still remains doubtful whether the general introduction of the system would be beneficial to the Colony, or possible on a large scale.

The importance of a **uniform temperature** for fermentation is recognised—the most favourable for the development of *Saccharomyces ellipsoideus* or the yeast plant of wine fermentation, being about 80° F., but in practice, if the temperature is within the range from 80° to 90° F., it is regarded as satisfactory. **The attemperator** or cooling worm, consisting of a coil of 1½-inch tinned copper piping, through which cold water is circulated, has been introduced into the fermenting vat. The temperature of the fermenting room is kept down as nearly as possible to 70° F., and never permitted to exceed 74° F., by free ventilation, while the concrete floor, with a fall from the centre ridge towards each side, is flushed at intervals with water. The cellar proper (which should always be separate if possible) is kept about 60° F. by closing the doors and windows by day and opening them at night.

In the vineyard are demonstrated the advantages of **grafting** the best varieties of European vines (which are all liable to suffer from the Phylloxera) upon American stocks, which do not succumb to the evil influences of the insect, even when their roots are attacked by them. The benefits of

PLATE 33.—THE FARMHOUSE, GROOT CONSTANTIA (the Government Wine Farm near Cape Town).

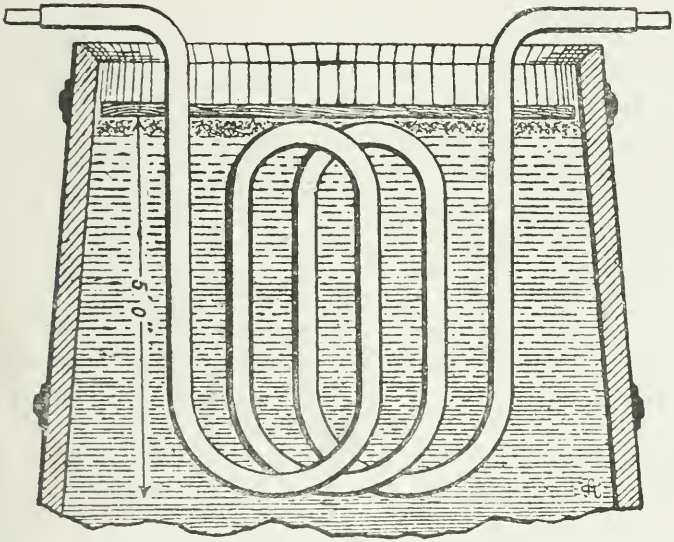
Face page 140.

PLATE 34.—HERMITAGE GRAPE VINE, *Face page* 141.

shelter to young vines have also been shown by planting narrow strips of common rye, as *wind-schanzen*, about 25 yards apart, at right angles to the line of the prevailing winds.

An orchard is being improved and extended, which aims at collecting and maintaining, for reference and determination of nomenclature, types of all the varieties of fruit-trees suitable for the colony.

Farmers are encouraged to **visit** the farm and cellars, with the object of seeing personally the methods of working



An Attemperator or Must Cooler, showing the upright position of the coil of piping through which cold water is made to flow.

adopted, and of learning what are the advantages to be derived from the new modes of management. While such object-lessons may continue to do much good to those who have considerable practical experience of the industry, and who only require hints or "tips" from time to time, the farm might with advantage be used as a **school**, in which advanced students of agriculture might be periodically brought for a short course of theoretical and practical training. Certain specialised branches of the rural economy industry can be

taught efficiently in this way. Dairying and viticulture are two of these in which Cape Colony is specially interested.*

The **wines made** are six in number—Sauvignon blanc, and Stein, representing white wines; Pontac and Hermitage, red wines; sweet Constantia and Constantia Berg, sweet wines. A portion of the vintage, which by the last report amounted to about 100 leaguers, is offered to the public, in small or sample quantities, at prices ranging from 10s. 6d. up to 14s. per dozen bottles. The remainder has been stored, and some of the best, ready for drinking, has been valued at £30 per leaguer—an immense improvement upon £5 and £6 per leaguer, which were common prices for good sound wine in the Colony in 1893, or £4, which is now reckoned a fair average price through a series of years. About ten years ago the price of wine of similar quality went down to 20s. and 30s. a leaguer, and led to numerous mortgages being given on properties, which have never been cleared off.

To those desirous of learning the details of the wine industry of Cape Colony, a brief account of **approved methods of cultivation** of the vine should not prove uninteresting.

The greatest amount of **planting** is done in July. The soil requires to be trenched to a depth of 2 to 3 feet, and manured. Stirring the subsoil when it is rather poor is frequently a better practice than mixing it with top soil. Ploughs and subsoil stirrers are at times called in to do the work in place of the spade. The best results are obtained when the soil is left to settle and to aërate for a few months before planting takes place. Unless there be a good development of deep roots, which this preliminary preparation of the soil is meant to encourage, the crop is liable to suffer from drought during the frequently recurring periods of deficient rainfall. The sticks, 18 inches in length, are separated from the parent vine by a clean oblique cut made immediately below an eye or bud, the upper end being dressed in like manner by a cut made immediately above an eye.

Close planting was the approved practice till recently—3 feet or 3½ feet apart each way—and on poor soils and in hot

* This subject is more exhaustively treated in Chapter XXV., which deals with Agricultural Colleges and Schools.

localities and places exposed to the influences of strong winds, this is still considered the best width. On good soils, and with the additional vigour given to the European vines by grafting upon American stocks, better results are got by increasing the distance between the plants. Widths of 4 feet by 4 feet, 5 feet by 5 feet, and 4 feet by 6 feet, have each their special advocates. In the case of the latter, for example, two turns of the horse or mule hoe one way, and one turn the other way, move nearly the whole surface, with little overlapping, at an extremely small outlay, and leave only little areas near the roots of the vines to be worked by the scuffling-spade.

The saving of expense, and the facility with which the vineyards can be kept clean, are probably not the greatest advantages to be claimed for this comparatively, for the Cape, new method of working. The **fine tilth**, which is formed by the regular use of the horse-hoe every ten days during summer, is the greatest safeguard against drought, and has enabled farmers to plant vineyards successfully on light and dry soils, which, under the old system, when spade-work had to be solely depended on, were regarded as unsuitable for the purpose. Grapes will not shrivel, even with a three months' drought, if the surface be thoroughly cultivated. The growing of field or **garden crops** between the young vines, until they come to fruit-bearing, is not looked upon with favour by those who follow the best practice, unless the crop be used as green manure for the land. Crop growing impoverishes the soil, and retards the development of the young vine, which ought to be encouraged to grow as strongly as possible both below and above ground. For this reason **pruning** is not done for the first year, or two years. The low gooseberry bush shape, adopted in France, and known as *en gobelet*, to preserve the grapes from chills at night, is that seen in the Colony, the prevailing high winds making trellises and other high methods of training vines, dangerous.

In pruning for the first time, three to four arms are left springing as closely as possible to one another from the top of a single trunk or stalk, so that the vine may be led to develop into the shape of a wine-glass, having a hollow in the centre to admit the sun and air. In subsequent prunings, a strong gardener's pruning-knife being generally used, the

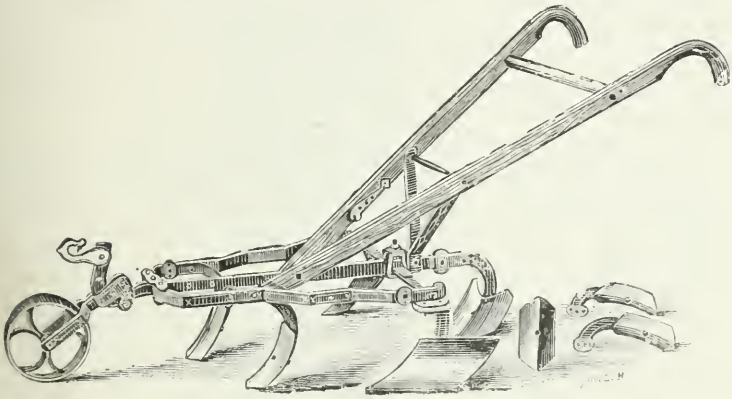
bearers of the current year's growth are cut back to two eyes each. This keeps the branches from growing too high, and it maintains their strength, while it also adds to the longevity of the vine. Vines are to be seen at Paarl in full bearing, which were planted in 1707.

Pruning is carried out at two periods. A first or **early pruning**—the removal of all superfluous shoots and suckers—is done as soon as convenient after the grape harvest, usually in April (the second month in autumn, corresponding to the European October), but not later than 15th May, otherwise the wound dies in, and does not heal, as it ought to do. After early pruning, the activity left in the plant leads to the formation of sufficient callus-tissue to protect the wound. The second, or **fruit pruning**, is done as soon as the vines show a tendency to run—usually in August or at the end of July. To prune earlier would encourage earlier growth, and lead to the exposure of the young shoots to the inclement weather of spring.

The loosening of the soil during early winter, which was once performed by digging, can now be accomplished by the **horse-hoe**, throwing up the soil into ridges between the rows and drawing it away from the stems of the vines about the end of April after the early rains; at the same time accomplishing the secondary purpose of exposing the trunk roots to the air as a preventive of fungoid attack. The levelling of the ridges after the period of rest is over is also easily accomplished by the hoe in question—the two in greatest favour being patterns known as the "Iron Age" and "Planet Junior." In addition to this systematic pruning, **topping**, sometimes called summer pruning, is done three or four times during the season by aid of little sticks with sharp edges used to chip off the young tender shoots by a sharp horizontal stroke, to check the development of long trailing bines.

In the practice of **manuring**, recent developments are introducing new methods and new materials. Green manuring by sowing lupins or vetches in May and ploughing them down in July has been shown to increase the vigour of the vine and the yield of grapes, although no improvement in quality has been recorded. Some growers favour the practice of spreading the manure on the surface and burying it by working the soil. This must have a tendency to develop surface roots which

must be a drawback in times of drought. The two methods by which the manure is deposited at a considerable depth are no doubt suitable to the combination of conditions relating to soil and climate in most parts of the colony. The more recently introduced practice, which has come in with the tendency to substitute horse or mule labour for spade labour, is the burying of the manure at the bottom of **furrows** 18 inches deep, usually during May and June. In the case of table or export grapes the alternate rows are manured every second year, but wine grapes are only manured every three or four years. The old practice of **digging a pit** from 12 inches to 22 inches deep for every four vines every second



"Iron Age" Horse-Hoe.

year, and burying in it from half a basket to a bushel of well-rotted compost manure, still finds many advocates. In this way only one-fourth of the vine roots are disturbed every second year, so that eight years are taken to get over the whole ground. When properly carried out there is little to be said against the practice other than that, owing to the employment of spade labour, it is expensive and may have to yield to a system which calls in the aid of machinery. The roots become very numerous and active in the vicinity of the supply of manure, and of course if the "boys" make mistakes and dig the holes in the wrong places, much damage may be done to the crop. The points of importance to study are to have the work done early, and to leave the pits partially open during

winter by covering the manure with a thin layer of earth so that they remain receptacles for rainwater which might otherwise run off.

Some wine growers confine themselves to vegetable **compost,** and object to apply animal manure to wine grapes on the plea that it injures the flavour of the wine, but this appears only to apply to undecomposed manure. Complaints have been made against an **earthy flavour** in some Cape wines similar to the earthy flavour of Australian wines. The application of fresh animal manure strengthens this flavour or is credited at times with giving origin to it by stimulating the development of an excess of albuminoids. **Tannic acid** is employed during the first fermentation to precipitate the excess of albumen. It is derived from a natural source by adding a varying proportion of skins according to circumstances, including the variety of wine being made.*

It is now pretty generally believed that solid and liquid **animal excrement** improves the quality of the compost, provided it is well decomposed. Prunings kept till they are dry and brittle and easily broken down, and all sorts of vegetable refuse from the vineyards and sweepings from about the farm, are put into the live-stock kraals, where they are trodden and well mixed in a compost heap, and allowed to lie for a year and more. The mass is usually applied in the form of a loose dark powder. The mixing or making of the manure frequently takes place in a heap which is built of layers of different materials in a hollow place, and at intervals is turned over and watered to promote decay.

Potash is also applied to the surface in the shape of the ash from vine cuttings. This is particularly necessary in the growing of the two best export grapes, viz., Barbarossa and red

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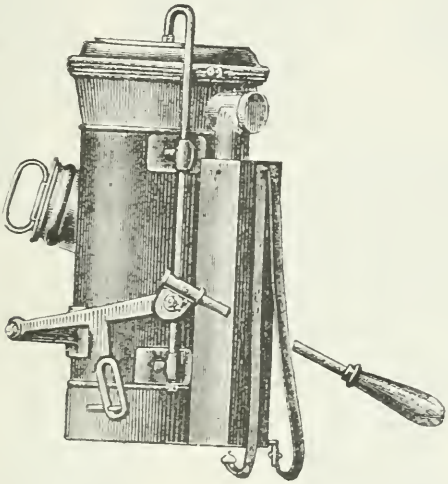
* It has been stated that "the addition of a little gallic acid to a sample of clean sherry will immediately produce the so-called *gout du terroir*, or earthy flavour. Tannin easily changes under given circumstances into gallic acid. It is therefore very probable that the objectionable taste referred to is caused by conversion of the tannin derived from the stalks and skins of the grape into gallic acid, through assumption of a molecule of water. This would be in accordance with Schiff's researches on the constitution of the bodies in question."

Haanepoot.* In some places **cows** and pigs are permitted the free run of the vineyard after fruit gathering until pruning begins in July. Cattle are fond of Haanepoot leaves, but not of the bright-red leaves of Pontac.

Sulphuring is a most essential operation as a safeguard against oïdium and all forms of fungoid attack so ruinous to the vine plant as well as its fruit. The work must be done in dry weather, and the finely divided flowers of sulphur blown in at the base of the vine by a labourer working a pair of bellows with the nozzle turned up so that a regular coating is dis-



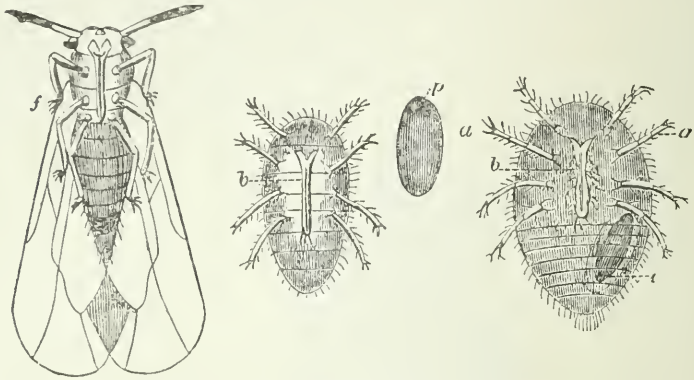
VERMOREL'S TORPILLE OR SULPHUR BELLOWS. (See Appendix C.)

tributed over the entire surface of the plant. This is a great improvement on the gunny shake-bag, which wastes 30 per cent. of the sulphur as it is being dusted on; but the latter has still to be used where, by the carelessness or stupidity of the "boys" entrusted with the work, the powder-bellows cannot be kept in working order. The first dressing should take place when the shoots are six inches long, and regular dressings every ten days should follow until the grape is coloured. No injury need be feared from an over-dose, whereas the con-

* The latter vine is the muscat of Alexandria, and its Dutch name, which means cock's-foot, is taken from the palmate shape of the leaf.

sequences of a deficiency in the amount applied may be serious.

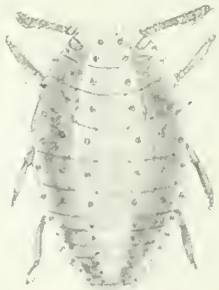
The insect pest of the vineyard known by the name of the **calander,** *Phlyctimes callosus*, has been successfully checked at Groot Constantia by the application of a moderate dressing of lime to the soil, which seems to have had the double effect



PHYLLOXERA VASTATRIX, J. E. PLANCHON.

Female specimens and their eggs. *a* and *a*, antennæ; *b* and *b*, horns or suckers; *c*, egg plainly visible in the body of the insect; *p*, the egg; *f*, winged form of insect. All greatly magnified.

Copied from the late W. Thomson's "Treatise on Grape Vine," 10th ed.



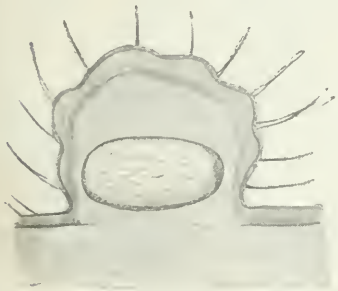
PHYLLOXERA ROOT FORM MAGNIFIED.

PHYLLOXERA MATURE WINGLESS FEMALE MAGNIFIED.

of destroying the insect at that stage when it takes shelter in the ground and of increasing the vigour of the vines, so that they are the better enabled to resist parasitic attack.

The dread enemy of the grape vine, *Phylloxera vastatrix*, has become thoroughly established in Cape Colony. It first appeared in 1885, and in spite of all efforts to check its pro-

gress it has penetrated into almost every vine district of the Colony, and it is only a matter of time till it will be found in every vineyard. The Cape peninsula, owing to its isolated position, and to the prevailing strong winds coming from the sea, and not over phylloxera-infested country, is, with a few more or less isolated centres, at present free from its ravages. Some females are winged (see accompanying figure), and easily carried by the wind. This accounts for the rapidity with which infected areas expand, and also for the difficulty of effectively checking its advance. When a vineyard is attacked, patches from which the leaves begin to fall off early are seen, and when investigation is made the yield of grapes will be found to have decreased. The heavier parts of the



Section of Vine-Leaf Magnified, and Eggs of Phylloxera.

Vine-Leaf injured by Phylloxera.

soil, from which the largest crops used to be obtained, generally suffer first and most seriously. In such places cracks open to a considerable depth in dry weather, through the shrinkage of the clay, and the insects dropped by the winds find by them a much more easy entrance to the roots than on light soils that do not open. It is probable that, apart from this, heavy soils form the more agreeable habitat for the pest. The fact of its preference for heavy soils is now so well recognised that in Hungary vineyards are being planted as a matter of safety on sandy soils which were formerly regarded as not good enough for the purpose. The frequent use of the horse-hoe, with the object of maintaining a tilthy surface, is probably the best mechanical means of **prevention.** This recommendation

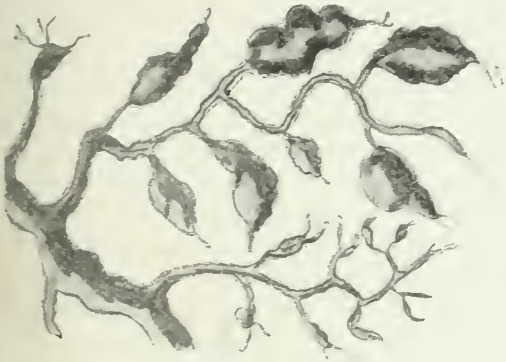
is made in full knowledge of the fact that the phylloxera insect has never been found on the ground surface. When affected spots appear in a field the insects can be killed by injecting into the soil small doses of bisulphide of carbon (not enough to destroy the roots of the vine), or by using the sulpho-carbonate of potash in solution, but the cost of either remedy is prohibitive if carried out on an extensive scale, and repeated after every new infestation. A young Dutchman, Charles Neethling, at Stellenbosch, had practised successfully an ingenious plan of retarding the extension of infected areas for a considerable period, but the labour and expense involved

GRAPES (RAISIN BLANC) GROWN IN WHITE SAND ON MOWBRAY FLATS in imitation of the Hungarian practice, with the object of securing immunity from phylloxera.

made it impossible for adoption on a large scale. A trench is dug round an infected spot, well back among the uninfected vines, and for a time kept full of water by day. The earth is scraped back to the depth of a few inches round the base of the stalk of each vine, and a layer of sand is deposited in the hollow and covered with manure, surface soil, and soil from the trench. New roots develop near the surface, protected from the ascent of the phylloxera by the layer of sand, and these feed the vine and keep up the yield of grapes while the deep roots are being destroyed.

All European varieties of vines succumb readily to the injurious action of phylloxera insects living on the bark of their

roots. Many **American vines,** which have had longer to contend with this pest of American origin, grow without seeming to suffer from its presence. The bark with them is thicker and more robust, the result, no doubt, of natural selection—a case of the survival of the fittest. As the real injury is done to the roots of the plant, it has been demonstrated in Europe, Australia, and in Cape Colony that the most susceptible of choice European vines can grow with perfect safety, and without injury to the quality of the fruit or the wine, if grafted on the **resistant American stocks.** Of a large number that have been tried the Riparia and the Rupestris have proved the most suitable for Colonial conditions. The **Riparia** is



Rootlets of Vine Magnified, Exhibiting Galls produced by Phylloxera.

Phylloxera Larva Magnified.

a trailing and climbing plant with large leaves, suitable for deep and heavy soils. **Rupestris,** which has had the greatest success, is smaller and better fitted for loamy and light soils. It grows more in the form of a bush, and the leaves are small and resemble those of the apricot. **Solonis,** the third most successful resistant stock, is a small-leaved variety of Riparia.* In addition to conferring immunity from the ravages of phylloxera, grafting on American stocks increases the **vigour** of the resulting plant. Not only do the roots and stem grow larger, but bearing commences the second year after grafting, and the yielding power is decidedly greater than

* The **resistance** of Solonis is only 15 as against 19 in the cases of Riparia and Rupestris, 20 being immunity.

in the case of ungrafted vines. The stem above the graft grows thicker than that below, owing to the greater strength of the colonial or European vine, and also owing to roots springing from the base of the colonial graft, it having been covered by soil used to protect the graft from drought until united. In December the earth is drawn back, and these roots are cut. If done earlier a second crop of adventitious roots would probably form. The relative thinness of the American vine stock entails no disadvantage on the graft.

The Government has established a number of **nurseries or plantations** for the rearing of American phylloxera-proof vines for distribution in the colony—two in Stellenbosch district, two in Paarl, and one in Worcester, but the results attained cannot be pronounced to be entirely satisfactory. The Colony does not seem to have thoroughly grasped the overwhelmingly serious nature of the consequences of the spread of phylloxera; yet most assuredly it is only a matter of time, and that not very long either, when the whole wine-growing industry of South Africa must become involved. Eight millions of **vines** have been **destroyed** out of seventy-eight and a half millions (1891 return), at a moderately estimated **annual loss** of £32,000, and yet little more than 1,250,000 American stocks have been planted. One of the greatest industries of the Colony is threatened with sudden destruction, and no adequate attempt is being made to apply the well-known simple and only remedy. The cost of replanting the vines is a serious task in itself, involving an enormous expenditure of money—estimated at as much as £30 per acre when well executed, and when everything is paid for at market rates. But the Government offer to vine-growers, if they choose to take advantage of it, phylloxera-proof plants at 1s. per 100, carriage free to the nearest railway station. To encourage the development of private enterprise and self-help, the number of vines that may be supplied to each individual have been limited to 500. So long as all vineyards are not affected by phylloxera, it is quite natural that many farmers will be chary about taking even resistant vine stocks from nurseries situated in infected districts. The stake at issue is much too important to permit of the course being followed of leaving to private individuals the duty of taking the initiative in providing

means to combat the evil, although the Government ought to be ready to retire from the work as soon as it is shown that commercial enterprise is willing to take it up. If the wine trade connection be lost, the Colony may be long before she recovers from the consequences. An immediate and **strenuous effort** should be made to produce American resistant stocks by the million, and to this end a working gardener who is not afraid to take off his coat should be placed in charge of each station, and every encouragement given to him to become totally absorbed in the work. Something more might be done to induce farmers to purchase American grafted vines at the low price fixed by Government, and they might also be instructed how to form nurseries of American vines in their own vineyards. Complaints were made that farmers planted out for bearing the few American stocks which they secured, in place of attempting to use them for the production of scions; but this is no excuse for the lack of provision to meet an urgent demand which is sure to come sooner or later.

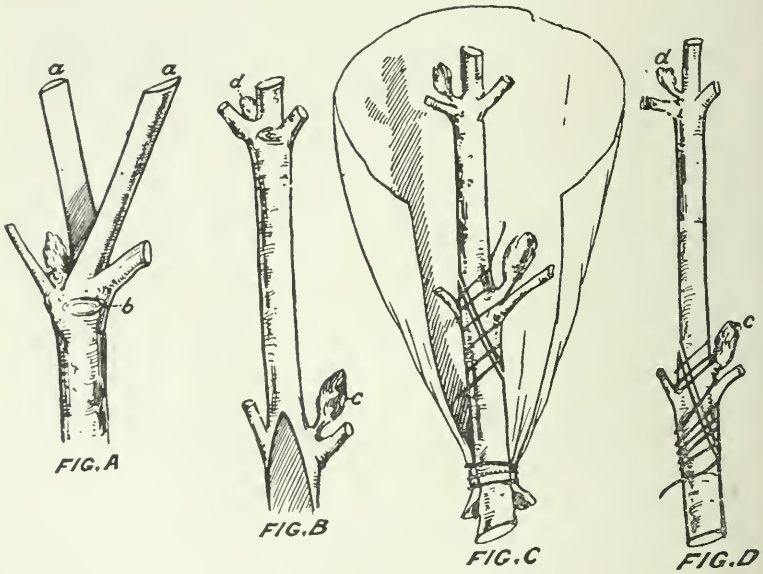
A quarantine station for imported vine stocks has been established at Fort Cunynghame, in the Eastern Province, six hundred miles away from the vine-growing centre of the Colony, with the object of preventing the introduction of *Peronospora viticola*, and other **fungoid diseases** not yet proved to exist in the colony, and 525,000 imported cuttings of American vines were planted there in 1892-94. The additional precautions are practised of having all the cuttings dipped in lime and sulphate of copper solution (Bordeaux mixture) before leaving Europe, and of having them repeatedly sprayed with the same after planting.

The **sites for nurseries** have, unfortunately, not always been well chosen. Parijs station, near Paarl, is on one of the poorest soils that could be found, and located so that the wind sweeps it from end to end; while close at hand, near the base of the Paarl mountains, soil of the most excellent description for vine-growing and well sheltered could have been obtained.

The blunder made in the selection of this station is one of the best possible illustrations of the necessity for the establishment of a Department of Agriculture on the lines laid down in a later chapter. The interests of the Colony should be safeguarded by the Department being able to call

for and willing to act upon the best expert evidence, from officers in its own employment, on this or any subject coming within its sphere of influence.

There are **four ways of grafting** practised in the Colony. **1st**, Grafting on rooted cuttings during winter, and planting again in the nursery, which is the most approved method. **2nd**, Grafting similarly, but on plain cuttings which have no roots, so that on planting, the grafting and rooting take place simul-



GREEN GRAFTING.—I. **Hungarian Method.**—In Fig. A the internode *a b*, between the third and fourth leaf-buds of the American stock, is cut horizontally one inch above the node *b*, and split. Fig. B, the scion or graft cut into the shape of a wedge, less than half an inch long, at the lower end, two buds, *c* and *d*, being left uninjured. After being placed in position, the two wounded surfaces are held together by an indiarubber band, and the whole of the parts involved are protected from the sun by paper tied on below the joint, as seen in Fig. C. In the II., **Austrian Method,** two slanting cuts are made, the scion and the shoot to which it is to be joined being about the same thickness, and the joint made as seen in Figs. C and D.

taneously. **3rd**, Grafting in the field on to growing vines which have been planted out the year before. This is a favourite practice with farmers, although the results are frequently very unsatisfactory, especially on heavy soil. It is necessary to throw up the earth in ridges to cover the bases of the scions, and protect the grafts from drought. The heavy soil dries and cracks, and the graft suffers from the want of

protection. The grafts are sent out from the Government nurseries before grafting time, and have to be buried in bundles for a month until August arrives, when the variations in the temperature are not so extreme, at least for so many days, as during the preceding two months. Then the land is in better condition for working and the September spring growth is nearer at hand. **4th**, Green grafting on the parent plants from early in October till the beginning of December, when the tender shoots are growing vigorously. The parts are held by thin elastic bands which decay and fall off, and shade is given by little pieces of paper tied over the junction with woollen thread.

Of the **varieties of grapes grown** *Cabernet-Sauvignon* yields the best Cape claret; *Hermitage*, which is much more widely cultivated, makes also a good claret. *Sauvignon blanc* yields a light sauterne or chablis. *Stein* produces a light sherry, or a heavy wine if fortified by alcohol or if the grapes are left till they are fully ripe. *Pontac* makes Cape port, a dry wine of good medicinal qualities, equal to the best European port if kept for eight years. From *Riesling* hock is obtained; and light white wine from the Green Grape, or "Groen Druif," a sort of *Chasselas*.*

The finest **sweet wines** are still made in Constantia district, from Pontac, Frontignac, Muscadel (red and white), and Haanepoot, besides several other varieties of great merit. Fashion is rather against sweet wines at present, although many of them are most seductive and highly prized by ladies who do not care for fashionable wines. They are not regarded as wholesome to drink, unless in very limited amounts. Certain growers who have made sweet wines for years still continue to do so, but the margin of profit is less than in the case of other wines, unless the quality is very superior. The expense is greater, and only one leaguer of sweet wine can be got from grapes which would produce three leaguers of dry wine. In olden times, when sweet wine was made thicker than it is now, the proportion was one to four. To secure a large

* For an account of the processes of fermentation in wines, see the chapter on "Wine Production" in the author's work on "The Rural Economy and Agriculture of Australia and New Zealand." Sampson Low, Marston, & Co., London.

percentage of sugar the grapes are not gathered till quite ripe, and they are partially sun-dried before the process of wine-making begins.

In the manufacture of **dry wines** the question of the amount of sugar is an important one, and the grapes must have reached a certain degree of ripeness if the formation of acetic acid (vinegar) is to be avoided during the process of fermentation. It is in the determination of such points that practical experience and sound judgment are of so much importance as guides to success. In a very dry season there is an excess of **fruit acid**, and with more than 0.5 per cent. of fruit acid the wine will be coarser than desirable—the saccharometer showing 18 per cent. of **sugar**. By letting the grape get riper the sugar is increased to say 19 per cent., and the fruit acid is relatively reduced, so that a softer wine is the result. Fruit acid never disappears from wine at any stage, although acetic acid can be got rid of by treatment with gypsum (sulphate of lime); but the product is then more suitable for the brandy-still than to be drunk as wine. In making white wines with over 20 per cent. of sugar in the grape the glycerine is lost to a large extent, and the wine becomes less soft and round. With 26 to 27 per cent. of sugar, softness due to the sugar is obtained instead of through the glycerine, which is the softening medium in dry wines. Owing to climatic differences, the rate at which **fermentation** proceeds in the Colony is more rapid than in Europe. This not only increases the difficulties and dangers in the process of wine-making generally, but it renders the production of light wine similar to the lightest of French wines practically impossible. Such difficulties make it all the more necessary that the process of wine-making should be well under control. To this end the close fermentation **vat** must ultimately wholly replace the old-fashioned tub with an open mouth, so that nothing but filtered air free from the germs of injurious fermentations may find access. **Prices of "fustage"** having much decreased, do not form an insurmountable barrier to the necessary change. "Stuk-vats," or the large vats, made of American oak, and good to last for a hundred years, with a capacity of five to seven leaguers, in which wine is stored in the cellar, can now be bought for £30 in place of £50, the former

A Colonial Wine Cellar or Store. Showing Wine Vats and Riders (or Leaguers).

Supplied by E. K. Green & Co., Cape Town.

price. They can be secured in good condition, second-hand for £12 to £15. New seven-leaguer fermentation vats can be got for little more than the latter sum.

One of the chief aims of the Agriculture Department of Government should be the **regeneration of the vineyard** and the encouragement of the production of wine rather than of brandy. Nations which use light wine freely as a beverage are never what may be termed drunken, and the same may be said of wine makers. **The brandy industry** is from every point of view the most unsatisfactory in the Colony. The margin of profit to the producer has practically disappeared, and much brandy is now actually being produced at a loss. The far-reaching immoral influences which it originates are much to be deplored. In place of Cape brandy those who prefer to make a distilled spirit rather than wine, might, with advantage to themselves and to the Colony, be induced to take up the **manufacture of "Cognac."** There is an increasing and practically unlimited demand for it in Europe for making champagnes and for other purposes at three times the price now got for Cape brandy. It is made from wine heated by a jet of steam driven directly into it in place of from the outside of the vessel. When Cape brandy is stilled, fusel oil and the higher alcohols come over as well as ethylic alcohol, and remaining in the product, take years to mature, before it can be drunk with safety. The profit meanwhile disappears. It will probably take some time and trouble to convince the British buyers that Cognac is made from wine and not from brandy. The delicate ethers which have so much to do with producing a full aroma remain in Cognac, but are not to be found in Cape brandy with the fusel oil distilled out of it.

The ordinary simple brandy **stills** are of no value in the making of Cognac. Expensive **plant,** involving an outlay of £500 or £600, is necessary, so that it is not for the average wine-grower to attempt single handed the making of Cognac. It is yet to be settled whether the work of the distiller should not be entirely separated from that of the grape grower, or whether it will be possible to get farmers to combine in the distilling part of the business. An admirable Austrian apparatus for the purpose was found in the possession of one

cultivator, P. Rabie, near Worcester, but full advantage was not taken of its working capacity.

Brandy, dop or Cape smoke, is a product derived from Cape wines, in the making of which the grape stalks are removed. When new it is a crude and noxious spirit, containing large quantities of fusel oil and a number of other deleterious products of similar type. It is prepared in the commonest form of still by farmers in all the vine-growing districts. When kept in cask until it is old and mellow it becomes excellent, the fusel oil having changed, as in the case of malt whisky, into what may be regarded as the finest ingredient present. The industry is in a most unfortunate position from whatever point of view it is looked at. The farmers lose by it at current prices, and the drinking of it in the raw and fiery condition in which it is mostly consumed is ruinous to the working population, black and white, who indulge in it. It injures the digestion and it exercises a maddening influence on the brains of those who imbibe it freely. It is an untaxed article in the market of the Colony, and its price is so low that there are few who are so poor that they cannot secure it in injurious quantities to drink. In some districts two-thirds of the wages of a large part of the working population are spent upon brandy of the worst kind, and the drinkers may regard themselves fortunate if some poisonous abomination has not been mixed with it. Needless to say this not only entails an immense amount of immediate misery upon those who drink but, what is still more to be regretted, upon their families. Legislation with regard to brandy is entirely on wrong lines, and calls more loudly for adjustment than any other defective product of the legislative machine. It passes into consumption free of duty. £15 per leaguer, which is now above the average price, is only 2s. 4d. per gallon, or 4½d. per bottle, and it is frequently got from producers at this and even lower prices by a number clubbing together to take the minimum quantity a farmer is permitted to sell. Even retail it is sold after being doctored, and not thereby improved as a safe and wholesome beverage, as low as 6d. to 1s. per bottle. Children of ten years of age used till quite recently to buy and drink it freely. The law has made a slight improvement in this respect, but much of

importance yet remains to be done. Immature brandy is the curse of the Colony. No country in which grain is taxed and brandy is permitted to go free can ever hope to prosper or to take a first rank among civilised nations. Not only should the traffic in strong drink be controlled by well-conceived regulations under which it is sold, but a check ought to be put to excessive consumption by raising the price, not to go into the producer's pocket to stimulate further production, but to the funds of the national exchequer. This rise of price would fall mainly upon the consumer and not on the producer as is erroneously believed in the Colony. There ought to be an excise duty of at least half-a-crown per gallon on all brandy consumed in the Colony, and every farmer should be bound to take out a license for the sale of liquor, even when trading in wholesale quantities, unless he confines his transactions to dealing with men who pay licenses. Morality is becoming more and more loose among the white as well as among the black population. Young men marry girls who have been at service in the large centres of population, and are possessed of somewhat extravagant ideas, which might, however, in favourable environments tone down in time. But as a result of drinking Cape smoke which helps to aggravate other unsettling influences, many a one goes off to the mining centres in the north, leaving a wife and two or three children destitute or to the charity of some friendly society.

CHAPTER IX.

CAPE COLONY AS A CENTRE FOR PROFITABLE FRUIT GROWING AND FRUIT EXPORT.

Introductory Remarks—Erroneous Ideas of Cape Colony Fifty Years Ago and their Influences—Kimberley and Johannesburg Markets for Agricultural and Horticultural Products—Backward Position of the Fruit-Growing Industry—Advantages due to Seasons of Cape Fruit in the European Markets—Times of Maturity of the Common Fruits —Orchard Stock-Supply — Prospects for Skilled Gardeners as Emigrants—Table of Fruits Exported from the Colony and their Values.

THIS chapter, written by a British resident of thirty years' experience, contains so many interesting, historical, and other general references, that the author has adopted it as an appropriate introduction to his own chapter on the same subject.

There are some countries which do not seem to have made a successful draw out of the lucky-bag. They have a share of blessings, and apparently excellent conditions for success in the neck-and-neck race after wealth and prosperity, but somehow the advantages fail to work, and are more or less negatived by disadvantages which often are very difficult to define, and whose retarding power can no more be eliminated than can the inevitable constant of friction in a machine. It is thus with the Cape. There is no lovelier climate on earth. All the fruits and crops of the warmer temperate zone grow there to perfection. Health seems almost a matter of course. The laws sit easy on the shoulders of the subject. Yet with all these favourable conditions it has never appeared a desirable country of refuge to the European agriculturist when things went badly with his special industry at home. There are a good many reasons for this. Exploited originally by its former masters, the Dutch East India Company, not on its own merits, and not with a view to its individua prosperity, but solely as a tool required in the management of tropical Dutch colonies farther east, the country was practically closed to the outer world for a couple of centuries. It exported little or nothing, and therefore had to stand aside while the roaring stream of traffic rushed on to other lands. Besides, even long after its transfer to England, its acquired habit of self-containedness and easy *laissez-aller* were very little interfered with, and the Colonial Office, while not preventing enterprise,

did next to nothing to call it forth locally or introduce it from abroad. It was a land for the more adventurous class of tourists, the sportsman, and the missionary.

The notion which the average Englishman, a generation ago, had of the Cape, was truly curious when considered in the light which gold and diamonds have cast upon it of late years. The inhabitants were supposed to be all Boers, dressed in fustian if they were fairly well off, in leather crackers and *batjes* if less well to do, shod with *veldschoons*, and armed with a large waggon whip in one hand and a *sjambok* in the other. They all lived in the Karoo, which was everywhere outside Cape Town. The people who were not Boers were Hottentots, and this servile race spoke kitchen Dutch, wore nothing but a skin *kaross*, and rubbed themselves all over with sheep-tail fat and *bûchu*. Nobody but the Hottentots did any work, nobody ever bothered to grow anything for sale, pay any taxes, make anything, do anything, be anything, save give orders to the *schepsels*, sleep through the hot noon, smoke pipes and drink coffee. Every man had a *plaats*, which grew as much grain as he wanted, as many grapes as he cared to make into wine of a sort, as many fruit-trees as he had sowed pips, and the rest of the place was in a state of nature, unenclosed bare veld, not even fenced off from his neighbours, and given over to as many native sheep and goats as would keep him in milk and mutton, with perhaps a couple of dozen oxen. Did he desire to go on a journey, say to the Orange River, six hundred miles away, he loaded up a sack of meal and some coffee, a gridiron, a cooking pot and a kettle, spanned in his oxen, and started with a "Trek-jou" and a crack of the huge whip. He crept along, road or no road, some twenty miles at most, day after day, stopping whenever and wherever he pleased, quite at home everywhere, and victualled by his marksman skill—for was not the veld alive with springbucks, koodoos, and elands, to say nothing of elephants and zee-koes? There was no such thing as trespass, for the *woonhuizen* were about one to a dozen square miles, and when the country was so vast and the population so small what was the good of keeping people off your great wilderness of desert veld? So in three or four months he reached his destination, and when he chose went home again, just in the same easy-going way, a bit at a time. But one never worked hard, never had any definite object in life, never tried to take a new line in anything, but simply lived, enjoying the bright sun and genial climate, and letting things manage themselves.

Something of this sort used to be the prevalent and ludicrous conception of the Cape fifty years ago in the average Englishman's mind, when recalling what he had read in books of travel and sport. A land of pleasing drowsyhead it was, a country where it was always afternoon. Even now, after the changes of the last half-century, Johnny Newcomes are sometimes to be found landing with such Munchausen traditions, and are very much surprised to find that the upper and nether millstones of necessity are set pretty close together here, and grind exceeding small. All this long prevailing impression of the easy-going life lived at the Cape, and the belief in the utter fecklessness and lack of enterprise

among its inhabitants, did the country incalculable injury. It never seemed to loom in the far distance as a land of promise, or to beckon to the crowds of emigrants passing westward to the New World. Even the great Irish exodus sent few new-comers hither. What opening could there be in a land already parcelled out, and where it was supposed every man had his huge slice, and got out of it all he wanted by the labour of native serfs? And under this idea the outgoing English and Irish labourers trooped away to the States, to Canada, to Australia, and to New Zealand, where a free grant of land awaited them, and where they knew that each would get his slice on the sole condition of tilling it for his own profit. There certainly was a spasmodic effort in 1820 to fill up a part of the country by immigration from certain English manufacturing counties, just at the period when the inevitable struggle between old-established hand-labour and the new-fangled machine production was commencing, with its inevitable concomitants of falling wages and personal distress. True also that with the rank and file of weavers and pin-makers (a crowd exceptionally ill-suited for pioneering as agriculturists in a new land) there came out a contingent of better men, with traditions of the English country life in place of that of the factory, and also with some little capital. And but for the unhappy series of wars on the frontier, brought about by a one-sided false philanthropy here and the densest ignorance at home, the Cape East might then, that is fifty years ago, have started to the front as a progressive colony. But things have moved very slowly, and it has been left to the long-hidden mineral treasures beneath the soil to do for South Africa what neither Governments nor local enterprise nor happy climatic conditions have been able to achieve. First the discovery of diamonds on the northern frontier, then later the totally unexpected gold production in the Transvaal, revived the memory of the great exodus to the sister colony in 1850-51. There is one thing to be borne in mind concerning these unexpected blessings. They have been earned by our exceptional luck, certainly not by our exceptional desert. We neither toiled nor spun for them. They have dropped into our lap, instead of being won by our industry and enterprise.

The position of the Cape to-day is somewhat remarkable. There are the two great foci of enterprise northwards. The one, the close corporation of the diamond industry; the other, the open arena of gold production at Johannesburg. Towards these two points tend almost all the local enterprise of the country, and instead of the Colony having solely to look after its own maintenance, it has become the purveyor to an immense industrial population beyond its borders. The yellow harvests of the corn districts go thither. Thither go the slaughter-cattle in ever multiplying troops. The fishermen on the coast now send the major portion of their haul up-country in ice. The smaller industries of the farm have received a like impetus, as butter, poultry, eggs, and fruit of every kind, all go to satisfy the daily demands of the Transvaal mining population.

It follows that at the present moment there are in every direction openings for enterprise in various kinds of *petite culture*, openings such

as have never existed here within the memory of man. It is not as if one had to speculate upon the chances of perishable produce being got across the line and placed upon English markets in saleable condition, when, for everything that a man can grow to a moderate degree of perfection, there is an unfailing market just some forty or fifty hours distant from the coast, and the rail to expedite it all the way. It is said to be well for a man to have two strings to his bow. The up-country market is the Cape growers' first string, the export trade in fruit is the other. All the special appliances required for both lines of the enterprise are already provided. The steamship companies supply cold-storage on their vessels. A local firm has prepared refrigerating chambers for goods awaiting shipment. It would seem, therefore, that the only element required is an increase in the number of intelligent and practised growers. We want them from England, from the States, from California, in fact from anywhere where the skill and experience required has run for years into everyday practice. This is the immigration wanted just now at the Cape, to catch at the opportunity of the moment, and to turn skilled fruit-growing into gold. No question but that success awaits the man who knows how to deal with fruit-trees, to break his ground up properly, to drain, to prune, to gather, to pack for market up-country, or for market in Covent Garden, and who has the well-founded contempt for the slovenly style of letting things grow themselves, and taking as a crop what chance sends and insect plagues leave.

Then you will say, Are there no growers at the Cape? Truly very few: here one, there one, but by no means sufficient to give a character to this magnificent country as a home of fruit-growing,—not sufficient even to lead by example the prevailing carelessness into better ways. The growth of fruit here has been almost always a by-thing, or what we might call a toy pursuit of the landowner. A few trees, mainly seedlings grown from pips and fruit-stones, planted in holes dug in the hard untrenched earth, unpruned and untended, except for an occasional drenching from the furrow, used, generally speaking, to constitute a Cape orchard. So long as the owner had fruit for his own table during the season he was satisfied. The idea of growing fine choice fruits of named pedigree sorts in order to send them to market, attractively packed, so as to suit the dessert tables of well-to-do townsfolk who had no gardens, never entered his mind. Did you want fruit of him? Then you must buy it as a favour, and he would "spare it to you," and you certainly could not expect to get it twice, much less regularly through the season. Yet he would take the money, showing that the commercial instinct was not dead. The wonder is that so few ever turned to with a will, and put into fruit-culture the labour, energy, and forethought that goes to make a successful business. Things are a little better now. There *are* a few men, three times as many as there used to be, who now grow fruit to the perfection possible in this perfect climate, and all they send to market is eagerly bought up either for local consumption among the higher classes or for export to England. But they may be counted on one's fingers, in place of being numbered by hundreds, and scattered all over the country.

Then you will say, With what is the ordinary market supplied? Truly with fruit of the poorest quality—the product of seedlings instead of grafted trees—bastard refuse, without a name and without a single quality to recommend it. It looks as if it had grown itself, and this it mostly has. The ruling condition of the fruit, such as it is, is made worse by utter ignorance of proper packing and transit. Much of it is shaken down and tumbled into old paraffin cases and jolted to market in a springless waggon. Hence it must be picked only three-quarters ripe, so as to bear the rough usage without being turned to unsaleable pulp. One would think that the example of the few leading men aforesaid, and the high prices they pull off for their exceptional samples, would be sufficient to start a reform, but there are several causes operating in the other direction. There are the antiquated conservative ways of the small farmer at the Cape, arising out of the comparative isolation in which he lives, and which only has been broken in upon this last year or two by the establishment of Fruit-Growers' Associations in their very midst, through which an effective interchange of ideas has been brought about, and information given upon the subject of their special industry. Till these excellent associations sprung up, mainly through individual activity and personal influence, it was difficult to find a market-gardener who took in a garden periodical, or cared to learn what was done in other countries. Another cause materially checking the desire to improve the output is the immense demand that exists for cheap coarse fruit and windfall rubbish among the coloured populace of Cape Town. To them, so that the fruit is dirt cheap, it does not matter how dirty it is, nor are they disgusted at seeing the same baskets which brought the fruit to town piled up among the stable manure the cart takes back in the afternoon. In no other public of fruit consumers is quality so little thought of, and hence the producer has been satisfied to grow crops from seedling trees which are only fit for stocks. They sell somehow, so why should he trouble himself to produce a better article? However, things are on the mend. It may be a long time before really good or even middling fruit reaches the level of the street hawker, but the simple fact that the great market of Johannesburg discriminates keenly between good and bad, and pays accordingly, must inevitably react on the producer, and even more directly persuasive are the perpetual calls of the fruit agent concerned in export to Covent Garden. He knows good fruit at sight if any one does, and his determination to have it grown clean, ripened exactly to the export point, gathered delicately, and graded to size, will do more towards teaching fruit-culture than a legion of experts.

It is therefore just at this critical stage of matters that the English fruit-grower who now despairs of making profits at home is invited to come to the Cape and take his opportunity by the forelock. It is a pity too that the foreign capital which comes Capewards goes mostly into mining stock. It were well if some of it were invested in the healthier industry of fruit-culture. Perhaps ere long the one or two companies which have already got into working order will form an example to other

companies and friendly competitors in a trade which is practically illimitable.

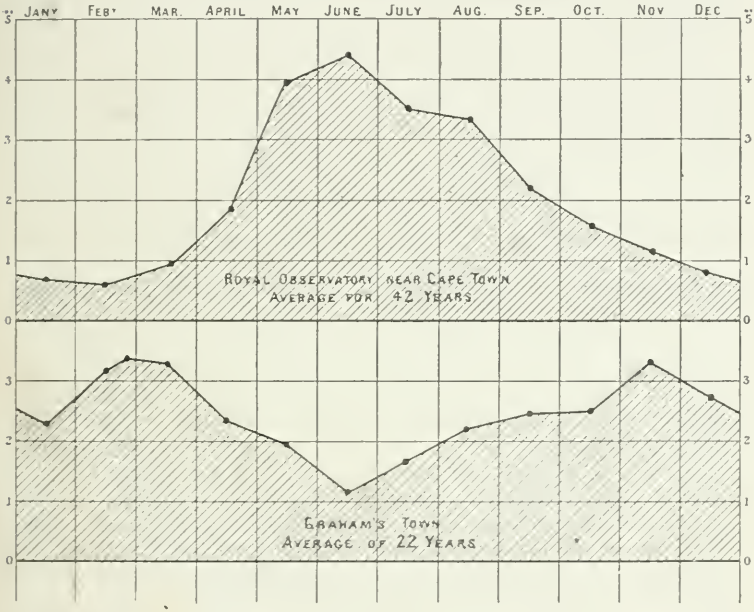
We have said that all the material appliances for a growing export fruit trade have been initiated here. It is not therefore as if new-comers, throwing their practical knowledge and their little capital into Cape fruit-growing, would find difficulties in the outlet for their produce. Let it be remembered that the Cape has one signal advantage for fruit supply to European markets which is not conceded to the clever and enterprising American grower. *The seasons fall conversely with those of England.* Consequently the only competitors in our special line and special time of exporting will be the Australians, who, however, are heavily handicapped by a one-third greater distance from England. Their seasons certainly do correspond with ours. The best way of making the comparison with the northern hemisphere quite clear will be by the following tabular arrangement :—

Cape.		Europe.
December January February	Summer	June July August
March April May	Autumn	September October November
June July August	Winter	December January February
September October November	Spring	March April May

This general arrangement must not be taken too absolutely. The seasons on the two sides of the Colony, west and east, are differentiated much as are those of India, by the rainfall occurring conversely. In fact the Cape is a monsoon country, the west having its maximum rainfall in winter, while the east has it in the warmer months. There is this peculiarity also in the east, that there are two wet seasons, namely, the November or spring rains, and the autumn rains in February. Nothing can show this peculiarity of west and east better than the two diagrams here given, which show the rainfall curve for the year at Cape Town and Grahamstown respectively.

From these peculiarities arise important results in fruit-growing. The most striking is the limitation of uniformly profitable wine, grape, and raisin production to the Western Province, which possesses the necessary hot and dry summers for the proper ripening of the fruit of the vine. In the east, with its dispensation of summer showers and frequent hailstorms, with much heavy rain in February, viticulture is reduced to a branch of gardening, and it is questionable if anything more than table-grapes for local consumption, such as the *Crystal* and *Sweetwater*, can

be successfully managed. Of course this is a general statement, subject to here and there an exception, dependent upon climatic conditions. For example, good results have been obtained in the somewhat intermediate climate of the Karoo, particularly at Graaf Reinet and its neighbourhood. The total rainfall throughout the Karoo averages low, say 16 to 19 inches annually, as compared with 28 to 30 inches in the normal eastern region. But the rule holds good in a general way, and a glance at Gamble's diagrams of rainfall, where the curve is plotted for a large number of places, so as to be readily comparable by the eye, will enable one to determine where viticulture on a large scale is climatically



NOTE.—The distances of the dots in each diagram from its zero line give the average rainfall in inches for each month. The slant lines between the dots are intended to guide the eye from one month to the next. (See also the Rainfall Maps, after Gamble, Nos. 12, 13, and 14, at the end of the vol.)

favoured, and where it will present special difficulties. In the former case the rain curve for January, February, and March—the ripening and vintage months—keeps at or below 1 inch ; in the latter it runs up to the monthly maximum for the year, say 3.5 to 4 inches. The Sundays River valley upwards from the Addo, and also perhaps the hot sheltered environs of Uitenhage, are the best examples of local eastern exceptions to the general rule. But even here grapes will have to be tended with very much greater care and intelligence than seems to be necessary farther west. The great difficulty will assuredly be the general prevalence of anthracnose, or *black-spot*, as it is sometimes called (*Sphaceloma ampe-*

linum, De By.). This plague, though far from being comparable in mischief to the Peronospora of the vine, which luckily we have not yet imported, is still an enemy to be reckoned with, and it will be necessary that all eastern vineyards be assiduously treated by spraying with Bordeaux mixture as a preventive of the scourge. There is little doubt that success will attend the proper application of this remedy, just as has been proved to be the case in Europe. But the additional charges for skilled labour in its use will heavily handicap the eastern producer, especially if he should incautiously cultivate the more delicate varieties of vine, say, for instance, the Cape western Haanepoot, known elsewhere as *Muscat of Alexandria*, a sort which is particularly liable to the attacks of anthracnose.

New-comers to a country who have been accustomed to the class of grape which is seen upon English dessert tables, will be surprised to find that nothing has ever been done at the Cape at all comparable to the minute care which grapes receive at home under glass at the hands of skilled gardeners, who have made this fruit a special study. As we have them, the grapes are fairly good, and up to size on the outside of the bunch, but, by carelessness and want of proper thinning, they are not half-grown or half-coloured in the middle. The plan has been to grow grapes for wine and for the table in the same vineyard, and with the same low average of attention. That is to say, the table grapes have practically grown themselves, instead of each bunch having been the subject of individual inspection and treatment with the thinning scissors. Perhaps some skilled gardener, who knows what a dessert bunch of grapes should look like, may find it worth while to show what can be done in this country, where the climate renders his glass-house and hot-water pipes unnecessary. Certain it is there is no lack of wealthy folk here who will buy grapes of English hot-house type at their full value. *Mutatis mutandis*, much the same thing may be said of other fruits—peaches and pears particularly. Our growers have had no high standard to work up to, and have been too easily satisfied. The comments of Covent Garden salesmen upon picked Cape samples have certainly opened their eyes somewhat, and given them to see that the fruit which has been taken as first-rate, levels down to scarce a second place when put beside first-class produce skilfully grown at home. We have taken things too easily, and left too much to nature, forgetting that the finest type of fruit is decidedly a product of art, for which nature provides only the raw materials.

In western markets, January gives the last of the strawberries and apricots which have been to hand for some five or six weeks previously. The earlier sorts of grapes, pears, and apples according to kind, also the earlier peaches, plums, and figs, fill up the list. From the conditions of the climate it is rather a cultural mistake to try and hurry things by planting what are known in Europe as early-fruit sorts. Cape conditions, at least in such parts of the country as lie upon the first plateau reaching inland all round the coast, are much more favourable to perfection in the later kinds. Farther up-country on the narrow second and the immense third plateau, which reaches a level of approximately 4,000 to 5,000 feet,

the conditions are considerably altered. But the gain expected from the growth of early sorts at this level is practically interfered with by the tardier approach of spring and persistence of a dry winter's cold. The results of the most experienced cultivators is decidedly against experimenting with early sorts in the hope of catching the high prices asked in an early market.

In February, the better sorts of apples, peaches, and nectarines come forward; and a glance at these will show conclusively that they are mainly *late* European varieties, and accentuate the caution we have given against early sorts, at least for market supply on the large scale. Grapes and melons are becoming plentiful, and begin to acquire their proper distinctive flavour, unless they have, as is often the case, been spoiled by injudicious irrigation. The fruits of keeping quality are now approaching the season for picking. As a rule they are left too long upon the tree for lack of two things,—first, want of practical knowledge of the precise degree of growth at which to take them, so that they shall best develop the richness and flavour that come by keeping; and second, want of something like a reasonable fruit-store, where they can be laid out properly, inspected daily, and kept at even temperature. It is pitiable to see good keeping sorts huddled up in boxes, a bushel or more together, in a galvanised iron shed open to the light and the weather, and varying in temperature daily from 80° to 90° at noon to 48° or 50° at night. This is another matter in which we want some gardening missionary to come over and teach us a gospel of better things.

In this month and in March begins the first drying season,—that is to say, fruit-drying in the sun, as opposed to fruit-evaporating, the more practical, more cleanly, manageable, and time-saving plan. Already very fair work of this kind has been done, and the Wellington dried fruits have quite reached up to the already high standard of the raisins produced in the Worcester district. The only reason why these products are unknown outside the boundaries of the Colony is that the amount produced does not bulk large enough, and that it is almost entirely consumed locally in the Colony. The output is not a hundredth part of what it should be, or what could readily be absorbed by the Cape consumer. Hence in this case, as in so many others, we stand in the somewhat absurd plight of possessing the finest country in the world for production, and yet are content to allow ourselves to be served by manufacturers and dealers who grow and fetch and carry for us away on the other side of the world. How long this anomaly is to last, and how long a Cape rural population is to think it no shame to have on their tables American dried apples and peaches, and positively to import American fruit pulp wherewith to make "Cape jams," rests with the coming race of fruit-growers whom we hope to attract to the country and help us to put a little life and stimulus into our easy-going, lotus-eating lives. Do not for a moment suppose the thing is here put sarcastically, or in an exaggerated manner. The whole output of first-class Worcester raisins was last year bought up, as a matter of course, by *two retailers* in Cape Town. The year before the same buyers collared it all. Is it not clear that our pro-

duction has yet to expand itself into wholesale proportions? Another retailer, on examining an exceptionally good sample of dried figs that ran the imported "Elemi" article very close, offered the producer an Elemi price. Picture his disgust on being advised that the total stock produced that year amounted to only *six* boxes. And so with the prunes, for we are content to buy Continental jars of "Prunes d'Agen" and "Prunes d'Ente" year after year, forgetting that no better prune-growing land than this exists on the face of the earth. Truly, in face of such facts as these, one

Photo. by Dr Hugo.

RAISIN MAKING, WORCESTER.

does not know whether to laugh, to cry, or to swear. But one thing is certain, that with present conditions at the Cape, with family grocers buying up all the raisins that a whole district produces, with farmers content with a dried fig crop which a man could carry on his shoulder, there must be a good many very fair fortunes lying about loose at the Cape, and only waiting for people with moderate commercial instincts, industry, and business capacity to come over and appropriate them to themselves.

March, of all the months of the year, shows the barest fruit market, at

least in the way of fresh kinds putting in an appearance then. The supplies are chiefly late apples and pears of the keeping sorts, and these, when they come to sale, bear plentiful testimony to the rough way in which they have been handled and stored. The outside skin is scratched, discoloured, and far from appetising. Ere long the dealers will learn that fruit ripened in the store-house must receive attention and handling somewhat different from that which is accorded to the year's crop of potatoes. A few peaches of late kinds come in and generally secure good prices. For the most part these are seedlings that have originated here many years ago, and, though fairly good, belong unfortunately to the series of clingstones. There is an opening for considerable improvement by selection of the improved modern late freestones. In all these fruits the variety of sorts presented on the market is very limited, and the knowledge of named kinds is generally absent. It is impossible to go to any retail dealer and ask for a *Bon Chrêtien* or *Ribston Pippin* apple. The seller would simply gaze at you in astonishment as if you were speaking a foreign language. All this will have to be changed, and no doubt with a continued demand for fruits by name the dealers will gradually learn something more about the details of their trade than at present they seem to think at all necessary. The month closes with the last of the grapes.

April, May, and June present few novelties. The guavas of many seedling kinds fill up a place which is hardly warranted by the intrinsic value of the fruit as at present grown. We have them from the insignificant bulk of a gooseberry to that of middle-sized apples. But very little attention has been given to culture, and still less to improvement of sorts. It may be said that the guava, as grown here, is often practically a wilding, and it would be well if nineteen out of twenty of them were destroyed, and selected grafted plants put in to take their place. Some day we shall get rid of the mass of bony seeds which fill up the centre of the market guava, and shall aim at making it a more presentable fruit. Walnuts and chestnuts now make their appearance. The former have not received fair play. They, too, have been propagated in our careless Cape way by seedlings, and it is only within the last twenty months or so that the fine imported sorts, in which the French growers have had such success, have been brought into the country. The remainder of the supply of these months is from Natal, whence our market is flooded with small pine-apples and bananas. The former are remarkable for being nearly all outside. Of late, a slight improvement has been observable in the quality of these fruits ; and when the matter comes to be inquired into, it is found that nearly all the finest fruit, classed roughly in the popular idea as Natalian, turns out to be the product of a few recently established plantations along our own eastern coast. There can be little doubt that this industry will increase year by year to very considerable dimensions. The growers have begun in the proper way, namely, by discarding the small, hard-skinned, and half-grown wilding pine, that has so long been foisted upon us, and going to Ceylon and the West Indies for the very best sorts procurable. From this source, too, will be obtained

large supplies of the Cape gooseberry (*Physalis*), which is perhaps the most delicious fruit for canning and preserves that the whole world has to show. We have been accustomed to despise it, simply because it grows wild without care or culture. The jam factories are, however, already increasing their output of it, and making it worth while for people to undertake its production as a *petite culture*.

With the last days of June and the first of July come in the whole tribe of citrus fruits, orange, lemon, naartje or tangerine, and pamplemousse. From the variations of climate and altitude which have been signalised at the beginning of this chapter, it follows that these fruits hold their place on the market continuously till December, their peculiar external character and power of ripening up after gathering rendering them comparatively easy of transport from long distances. The locally grown fruit is perhaps at its best in October,—that is to say, it can then be picked and marketed perfectly ripe, instead of gathering it green and trusting it to slow ripening in the store-room. Perhaps in the case of no fruit more than these has the public mind been so thoroughly awakened to the necessity of improvement, and of discarding the wretched seedling rubbish, full of pips and cased in the thickest of skins, which has for many years encumbered our markets. The importations of good grafted trees of the best sorts have been very numerous; and if the cultural conscience can only be aroused to the necessity of a vigorous crusade against the scale-insects, which up till now have had it all their own way, and also to the necessity of giving orchard trees something like fair play and reasonable care, there will be amongst us quite a new era of citrus fruit-growing. The great desideratum is that the spirited proprietor shall himself grow the oranges, instead of leaving them to grow themselves. At present our largest supply, in Cape Town at least, comes from Natal, and it is not particularly good. The best Cape grown oranges are from the district of Clanwilliam.

October brings with it the Japanese loquat, another fruit which calls for selective improvement. There is as yet far too much pip and too little flesh upon the ordinary loquat. Yet there have arisen in several private gardens seminal varieties showing a commencement of better things. These should certainly be increased by grafting, as far as possible, instead of reverting to the chance seedling mode of getting new trees.

With November come in the earlier figs and the strawberry. There is a future for the fig, and its selected Cape home and centre of drying for commercial purposes will probably be somewhere in the Karoo. It is true that we have not, native, any insects similar to the *Blastophaga*, which assists in the perfecting of the celebrated Smyrna fig. But in these days of quick steam communication it does not seem impossible to introduce this useful insect, just as we have successfully acclimatised the Vedalia. As to strawberries, the selection of sorts, grown chiefly at Stellenbosch, is very limited, and modes of culture anything but modern. As a rule, the beds are allowed to continue producing for far too many seasons, and the fruit consequently deteriorates in both size and succulence. New blood

and new ideas, with the habit of modern practice in strawberry-growing, as it is done in Kent and Surrey for the great London markets, is very much wanted at the Cape. The demand for the fruit is practically unlimited. The month closes with the early apricots, and this delicious fruit queens it right through December. If our growers would only learn the first principles of pruning this far too generously growing fruit-tree, keep its bountiful nature well under control, and thin its bearing to something like one-half, then truly would the Cape have such apricots as no other place in the world could show.

Whoever reads this little *resumé*, and begins to turn over in his mind the idea of coming out to the Cape to utilise there his practical knowledge of European fruit-growing, will naturally ask what conveniences already exist in the way of a supply of orchard stock. Every practical man would hesitate to bring out with him a lot of grafted trees, selected as best he could, for a country he had not even seen, and of whose climate and soil he had had no experience. But very recently there have been introduced into the Colony large numbers of the very best modern fruit-sorts of all kinds, by men who have themselves practically learned the capacity and conditions of the Cape as a fruit-growing country, and it is not too much to say that, by their industrious multiplication of these picked kinds, the market for first-class orchard stuff is now amply supplied. There is no reason now for continuing the old system of seedlings, unless out of pure wrong-headedness and refusal to take up with improved methods. So friendly is the climate here to the skilled manipulations of the nurseryman, that first-class grafted yearlings, thoroughly reliable to name and graft-stock, can be obtained at prices not greater than those ruling in England. To import for oneself on coming out to the Cape would certainly involve the loss of a season, to say nothing of difficulties in the way of immediately finding ground wherein to set out the consignment. Immigrants of the kind one would so gladly see spreading themselves over the best districts of the Colony, each with his market-orchard grown and tended in the way that means business and sound profits, would be wise not to start at once, but to spy out the country first for themselves, and for themselves see what our grapes of Eshcol are like, take stock of us and our little old-fashioned ways and conservative habits of working, and then only, when the land was no longer strange, and the altered climatic conditions have become familiar, to exploit their capital on some selected fertile piece of land, and add to the wealth of their adopted country—this goes without saying—by adding to their own.

A brief memorandum like the present cannot by any means give all the information that an English fruit-grower would find useful when he is thinking of looking out for fresh fields and pastures new. It would be well to note carefully the details to be found in the "Illustrated Handbook of the Cape." But perhaps the best idea of the way cultural matters go on here, and the peculiar conditions of Cape rural life, would be obtained by consulting the issues of the *Cape Agricultural Journal*, now in its ninth volume. At the basis of all calculations lies the fact that the Government, unlike those of Australia and New Zealand, have no available acreage

out of which they can make free grants to new-comers, and this is simply because the Colony dates back some two centuries before the time when the sister colonies began to be exploited by the intrusive European. All available land, at least within colonial boundaries, has long ago been taken up, and is in private possession. Purchase or tenancy at a moderate rent is therefore a prime factor in all forecasts of new cultural ventures. Suitable land, even such as has never felt the plough, but is simply sat upon by the proprietor, and goes with his pasture area, would sell at about £10 per morgen of two acres, provided it were within easy reach of a market by railway. The rent would perhaps be 10s. to 12s. per morgen. Mere wheatlands would fetch very much less, and if distant from the railway might perhaps be valued at 12s. to 20s. per morgen. Mashonaland certainly offers unlimited scope, but its market is yet to be made. Also it is only near the larger centres of population in the south-west that labourers can be found who have even a small degree of skill in the ruder operations of cultural work. Coloured men, the descendants of the old slave population, with a considerable amount of miscegenation, can be relied upon to trench, dig, and hoe orchard and vineyard, to plough and harrow, and to give the vines their annual prunings, and some of them have even recently learnt to graft with fair success. Of course all this is subject to a vigilant supervision, and subject also to the fact that the labourer's wants are so very few as to make him somewhat independent. He therefore favours his employer by working, when he is in the mind, at half-a-crown per day. The better men readily get another shilling, and are a good deal sought after. Mere farm labourers receive 25s. per month, with rations for self and family. As a rule these last are perfectly unreliable, and are unacquainted with the use of other than the simplest hand tools.

In conclusion, it is highly advisable for any one intending to try fruit-culture at the Cape to bank his capital on arrival, and arrange to receive the colonial rate of interest, meanwhile seeking out a situation with some one who is already owner of the land upon which he lives. This would be the best course, even if no salary and nothing but board were offered in the way of remuneration for services rendered. In a short time experience in Cape ways and Cape seasons would thus be gained, and the land spied out. It is much after this fashion that the best and wealthiest farmers among us have worked their way in and up. The European coming from an English farm and making a beginning without local knowledge, has much to learn and unlearn, or he will inevitably come to grief in a few years. And what is true of the larger venture of farming, is even more certain with the somewhat more refined economy of the orchard.

The following details as to the export of fruit from the port of Cape Town during the season of 1894 is drawn from the Customs returns. It is impossible to say accurately what proportion this bears to the quantity sent up to the ever-ready market of the Transvaal, but in the opinion of those qualified to judge it has already been tripled or quadrupled.

Record of the Cape of Good Hope day of small things, soon to be enlarged.

RETURN OF FRUITS EXPORTED DURING THE SEASON 1893-94.

Sorts of Fruits.	December.	January.	February.	March.	April.	Total.
Apples . .	..	...	89	41	50	180
Apricots . .	12	12	...	...	...	24
Gooseberries .	...	...	1	...	...	1
Grapes . .	...	443	3,139	1,800	901	6,283
Grenadillas .	...	1	...	...	...	1
Melons . .	...	4	113	...	...	117
Nectarines .	...	4	19	...	...	23
Pears . .	...	...	175	164	43	382
Peaches . .	..	530	46	...	...	576
Pine-apples .	...	...	...	7	...	7
Plums . .	...	...	1	...	...	1
Quinces . .	...	...	...	30	1	31
Tomatoes . .	...	13	43	1	...	57
Total packages .	12	1,007	3,626	2,043	995	7,683
Declared value .	£4	£182/7/6	£784/9/0	£476/6/3	£274	£1,721/2/9

CHAPTER X.

FRUIT GROWING AND MARKETING.

New Departures in the Fruit Industry—Home and Foreign Markets—Advantages of Cape Colony—Fruits Grown and Time of Ripening—Lessons from Foreign Experience—Points to Keep in View—Practices in Planting Orchards—Irrigation Systems Old and New—Peach Yellows—System of Thorough Cultivation—Injury from Hail—Apples—Pruning of Deciduous Fruit-Trees—American Blight—Codlin Moth—Pears—Peaches—Peach Maggot, or Orange Fly—Apricots — Quinces — Pomegranates — Plums — Figs — Oranges — Canker at the Root—Soot Fungus—The Australian Bug—Pineapples — Bananas — Loquats — Cape Gooseberry — Packing and Transport of Fruit—Imagined Boycotting of Cape Fruit—The Real Defects—Conditions Experienced on the Voyage and before Shipment—Successful Shippers—Means and Methods of Packing—Fruits Sent—Unique Flavour of Cape Grapes—Californian Fruit—Prospect of the Cape Fruit Industry—Necessary Improvement in Accommodation and Transport of Fruit—Methods of Spraying Fruit-Trees—Knapsack Hand-power Machines—The Strawsonizer—Biting and Sucking Insects—Materials Used for Spraying—Formulæ for Making Insecticide Fluids—Hydric Cyanide as a Means for Destroying Scale on Citrus Fruit Trees—The Wolfskill Fumigator—Fruit Growing in Wellington District—The Pioneer Fruit Driers' Company—The Wellington Fruit Growers' Association—A Horticultural Board *versus* A South African Fruit Growers' Union.

THE **fruit industry** is one which has recently attracted a considerable amount of interest in Cape Colony. The unremunerative character of the Cape brandy production, and the low price of Cape wines, together with the havoc worked by rust in the wheat crops, and by phylloxera in the vineyards, have made it necessary for cultivators to turn from their ancient practices to something which holds out better prospects of remuneration.

Not a few **enterprising farmers** are rooting out the dead vine stumps, and in place of replanting with vines grafted on phylloxera-proof American stocks, are occupying the ground

with choice varieties of fruit-trees. Excellent selections of the finest varieties of Europe, America, and Australasia are to be had grafted, on suitable stocks, from such places as the Nooitgedacht Nurseries of the Pioneer Orchard Company, near Stellenbosch; the nurseries of the Cape Orchard Company, in the Hex-river Valley; Pickstone's Nursery, near Wellington; Nelson's Nurseries, near East London, and others; or they may be imported directly from Tasmania and Australia at rates which tend to keep the Colony prices moderate. A general price—one year from the bud and two years from the seed—is 1s. 6d. each for all sorts sold in large numbers, up to 2s. when the quantities taken are small.

Although there is a local market for fresh, dried, and preserved fruit, which can be encouraged and greatly extended, yet for the double purpose of increasing the industry and maintaining stability of prices, the great hope of the colonial grower is directed to the foreign markets—chiefly at present the European markets, but later on those of America as well. To establish a footing in these centres, very different methods of working must be adopted in the future than have prevailed in the past in Cape Colony. The fruit must not only be of excellent quality (common fruit not being worth the cost of its carriage to Europe), but it should belong to varieties which are already known in the market. It should also be sent in prime condition, and in large quantities of uniform quality. These may be regarded essentials to success in developing an export fruit industry.

That South Africa possesses exceptional advantages for such a trade is being more and more realised. (1.) It is on the other side of the Equator from either Europe or North America, and fruits ripen at seasons of scarcity in these northern parts. The Cape supply may therefore be regarded as coming in to fill a blank in the markets rather than as in competition with any but Australasian fruits. In such a competition, the Cape, being so much nearer the markets, should have an immense pull over Australia. The full measure of the advantage will only appear, however, when trade is established on a large scale. (2.) Another decided advantage, although at the first blush the statement of it may seem paradoxical, is that fungoid and insect pests are so universally prevalent, that

it will be absolutely necessary for successful fruit-growers to acquaint themselves with the best of the preventive as well as of the remedial measures to be employed and to practise such systematically. There would have been less hope for the development of the fruit trade had these pests only appeared at intervals of a few years, as no one would, under these circumstances, care to gain the knowledge and experience necessary to combat them, and wholesale destruction of certain crops would probably occur every now and then, and confer upon more wary competitors market advantages, which might become permanent. It is the fact that individual fungoid and insect ravages are by no means uniform from year to year, but are cyclical in their times of attack—one year serious, and a few years trifling—the result mainly of varying climatic circumstances, which are at one time favourable, and at other times unfavourable to the increase of the numbers of the pest, whatever it may be. But the colonial fruit-grower may rest assured that if one pest is not on the war-path, so to say, for a season or two, he is almost certain to be favoured with a visitation of one or more of the other plagues. (3.) The next great advantage is that most of the **hardy European fruits,** and many of the sub-tropical, Asiatic, and American fruits grow remarkably well in South Africa.

The following are a few, mentioned at random, of the commoner species grown, with the dates of the ripening of the fruit, in the Western Province:—

1. Apples—January till August.
2. Pears—December till July.
3. Nectarines—Jan. and Feb.
4. Peaches—Jan., Feb., and Mar.
5. Plums—Dec., Jan., and Feb.
6. Grapes—Jan., Feb., Mar., and April.
7. Almonds—Feb. and Mar.
8. Walnuts—March and April.
9. Olives from the latter half of April till the end of May.
10. Chestnuts—April and May.
11. Oranges—June till October inclusive.
12. Loquats—Sept. and Oct.
13. Figs—1st crop, December; 2nd crop, February.
14. Cherries—Nov. and into Dec
15. Strawberries—Nov. and Dec.
16. Apricots—The latter half of Nov. till the middle of Jan.
17. Guavas—All the year round.

The **colonial fruit-grower** ought to derive valuable information and aid from the published experiences of Californian and Australasian fruit-growers, as the climate of South Africa resembles the climates of these distant parts more than that

of Europe. He will find also, if he has been at work for some time, and has been following old methods, that many of his favourite practices will require to be discarded.

To secure a large **quantity of fruit** of uniform quality, it is necessary not to plant too many varieties of the same species of tree, while to keep up a steady supply of a given fruit during the season, it is necessary to select varieties which ripen their fruit in succession throughout the period. **Different districts** exhibit special suitability for different kinds of fruits, and although several fruits may grow well in one district, and even in one garden, certain areas will naturally become famous for special products,—for example, Constantia for wines and export grapes; Ceres and the lacustrine formation about Worcester and Robertson, apples, pears, and walnuts; Wellington, apricots, pears, and plums; Stellenbosch and Paarl, peaches, pears, and plums; Bathurst, pine-apples, custard apples, and bananas; the Gamtoos River Valley, citrus fruits and walnuts.

The grower must not only study the characteristics of his locality, but within possible limits prepare to take advantage of the most remunerative of a number of different means for the **disposal** of his produce. The best returns are, as a rule, to be looked for from the shipment of fresh fruit for the table. If the fruit be over-ripe, and of a variety suitable for the purpose, it can go for canning; while, if the canning or jam factories are overstocked, it may be dried in trays at a minimum cost.

Deep **subsoil stirring**, or even trenching three feet deep and manuring with broken bones, when the planter can afford the additional outlay, is an excellent preliminary preparation to planting an orchard. The colonial method is usually not on such an extensive or thorough plan. To dig pits three to four feet wide, and about two to two and a half feet deep, in which to plant the young trees, is generally thought to be sufficient. This is done regardless of the facts that pits dug in a hard soil are likely to curb the development of root growth, and to hold stagnant water either after excessive rains, or after the soil has been irrigated, both conditions being inimical to healthy and vigorous plant growth. If the whole of the land, from want of funds or other cause, cannot be

uniformly moved, to dig a trench a few feet wide in the line which the pits would have occupied (running right down the hill, or in the direction of the natural drainage inclination of the surface if nearly level), overcomes the most serious objections to the pit practice. Drainage is thereby improved, and the root growth is not then cramped in every direction.

The usual **distance between** the rows and between the trees in the row is fifteen, twenty, or twenty-five feet, the intermediate width being probably the most satisfactory for most of the common fruits, except on very rich soil, in sheltered places, where trees grow large and more air space is necessary. The walnut is an exception. It ought to have distances of forty feet each way, with at first a plum, a peach, or an orange-tree planted half-way between.

In the climate of South Africa the temptation to use **irrigation water** to excess is great, and particularly so when cultivators are ignorant of alternative methods of working which secure the advantages derived from irrigation without their concomitant disadvantages. It is not uncommon to find men who water their fruit-trees every eight or ten days throughout the summer season, and are not quite certain that they have irrigated sufficiently, when in reality, with thorough cultivation, the yield of fruit would be greater and the health of the trees better without the application of water at all. Not only is the amount of water supplied usually excessive, but it is generally applied on a system which is altogether objectionable, and contrary to the best order of things. There is no other part of the soil so dry under natural circumstances as that in which the butt or bole of a tree stands, and through which the trunk-roots spread to the surrounding moister feeding ground, where the great supply of root fibres, ramifying from, and terminating the thick branches, are at work. Yet can it be believed, that the **common**, almost universal **practice**, is to dig a depression or hollow closely round the tree, and fill this with water, which soaks in at the one place where it is not wanted, and where it is liable to do positive injury by inducing canker in the roots? Once the soil has been thoroughly saturated a few times, it runs together into a dense condition, and on drying, becomes extremely hard and unsuitable for vegetation of any kind to exist in. It is then

almost absolutely necessary to keep wetting it again and again to soften it, if growth is to be made possible.

One unique advantage claimed for this system of watering is in the case of fruit-trees which are liable to come into **flower too early**, so that the blooms are destroyed by late frosts. By exposing the thick roots of a tree through scraping back the soil, and then running cold water into the hole for a few days in spring, the growth of the tree is checked, and its flowering delayed.

A modified form of the common system of irrigation is sometimes practised with orange-trees. A ring of earth is built round the bole to keep the water from actually touching the bark after the tree is a year or two old, but this does not prevent the main roots being steeped in too much moisture.

The unhealthy appearance of the fruit-trees, during recent years, in various parts of the Colony—at first generally believed to be due to the infectious American blight, known as **peach yellows**—has been satisfactorily demonstrated by MacOwan and Pillans of the Agricultural Department to be an unhealthy state, induced mainly by excessive supplies of water on the stiffer classes of soils. While the American peach yellows confines its attack to stone fruit, and never relents after making its appearance in an orchard, the colonial plague involves the orange, the apple, the pear, and the quince as well, and it sometimes disappears after a year, the leaves losing the brown abnormal colour, and resuming the natural one. The latter characteristic is satisfactory proof, whether the belief of MacOwan and Pillans be right as regards all cases, that the derangement is not the true peach yellows.

The **Californian method** of applying water in moderate quantities at the place where it is wanted, and in such a manner that the soil is not injuriously affected, must sooner or later assert itself in those parts, where it is found that trees do not bear to the best advantage without an allowance of more water than the rain supplies. The water is led on usually in three narrow channels or plough furrows running alongside each other, and parallel with the row of trees to be irrigated, but at a distance of probably six feet or more from the bases of the trees. The soil being well cultivated and open, the water sinks immediately in the region of active root growth. Little of the

surface is flooded, and the drying, hardening, and cracking, which might take place in and close to the channels, is prevented by a cultivator or harrow being drawn along after the water has thoroughly soaked into the ground. The channels are by this means obliterated, the hollows being filled with the pulverulent dry earth from the surrounding surface, which acts as a protection to the moist soil underneath.

Orchards were visited in the Western Province which were giving splendid returns of fruit without being irrigated, and some of these had previously been deluged unsatisfactorily for a generation or two, under the belief that it was impossible to grow fruit without abundance of water. In these orchards a **thorough system of cultivation** is now carried out in an untiring manner. One good deep ploughing is necessary annually, at a time when root growth is quiescent (except in the case of surface-rooted trees like those bearing stone fruits), and during the heat of summer the surface must be horse-hoed every eight or ten days. Some fruit-growers object to ploughing on account of a certain amount of injury being done to the surface roots, but the full effects of surface cultivation cannot be secured without the use at intervals of an effective plough.

The marvellous influence of frequent surface cultivation in preserving moisture, by checking the capillary action near the surface, and thus lessening the amount of loss by evaporation during hot weather, is not generally or sufficiently appreciated in South Africa. In many parts of the Western Province, fruit with an excellent bloom, and free from an excess of acidity, can be grown under this system, even in seasons when there is no rainfall the whole summer. Perhaps one of the most striking illustrations of the system of thorough working was witnessed at Johannesburg, in Nelson's Nursery Grounds. No irrigation was practised, and only the seed-germinating beds were watered. Soil dug up in a dry and pulverulent condition, then left for a few weeks and dug over a second time, absorbed so much moisture from the air, and attracted it from the soil below, that it came into excellent condition to receive seeds or young plants without rain having fallen.

No one will deny the advantage to be derived in the dry parts of the climate of Cape Colony from watering immediately after planting young fruit-trees, by way of consolidating the

soil about their roots and preventing the plants withering, but this may be accomplished without leaving a water-washed surface to become hard and road-like.

A good deal has been done in the way of demonstrating the best methods and the benefits of **pruning,** a practice which was almost unknown among the old Dutch population. Owing to the strong **winds** that periodically prevail in the Colony, the training of trees to grow high is objectionable, unless in certain sheltered and consequently favoured spots. Also, by way of protection against the wind, and more particularly the sun, the centres of the deciduous trees should, as a rule, be well cleared of surplus wood, to encourage the fruit to grow inside. Although a good amount of wood should be cut away, trees can easily be over-pruned; with the result that two or three very hot days come, as they frequently do, and there being an insufficient shade of leaves, the bark becomes scorched. Also, with the object of **protection against the sun**, trees should not grow on long standard trunks, but the branches should spring out near to the ground. There is always a saving of labour in the management of trees of moderate dimensions, unless they grow so low that horse labour cannot be employed in cultivating the soil.

Some orchardists strongly prefer the **pruning-knife** to the *sécateurs*, on account of its making a clean cut, without bruising the wood in the neighbourhood of the wound left on the tree, although using the sécateurs is easier work than pruning with a knife.

Hail is one of the most relentless enemies of fruit cultivation in South Africa. Not only is a crop of fruit ruined in a few minutes by a hailstorm, but the bark of the trees gets cut through and scarred in such a manner that the marks of the wounds remain for years. Although no section of South Africa is totally exempt from hail, that area in the Western Province which receives its maximum rainfall in winter, and has a comparatively very dry summer, is not so frequently or so destructively afflicted by it. The most serious accounts of injuries from hail during the fruit season of 1894-95 were received at the De Beers Nursery, near Kimberley. The heavy fall of hailstones, some measuring 1⅛ inch in diameter, lasted only twenty minutes, but in that time the entire crop

was destroyed, and tons of fruit were washed miles away in the flood.

The apple, belonging to the class of hardy fruits which naturally rest during a period of cold or a period of drought, does not thrive well in the semi-tropical regions of the Colony, although the tree grows vigorously and produces an abundant crop of fruit in the colder districts.

Grafting is the common method of propagation, upon stocks grown from seed; but owing to the prevalence of American blight, which harbours in the bark of Paradise and many of the old favourite stocks, it is now necessary to graft **choice varieties** upon disease-proof stocks, such as the Northern Spy. A good many excellent apples are to be met with which have been grown in the Colony for years, such as the large green American apple, Gloria Mundi, the Golden Reinette, and the Ribston Pippin, &c., while many of the best sorts have been destroyed by the blight. Their places can readily be filled by selections from the nurserymen's lists, which contain such well-known varieties as the Northern Spy, Rhode Island Greening, Bramley's Seedling, Warner's King, and many others. It is good practice to rear stocks for grafting from seed. The method of rearing fruit-bearing trees from seed is as disappointing in the case of the apple as in that of other fruits of which there are numerous choice and common varieties.

Deciduous fruit-trees which are to be **trained on the low-head system** should have the main stem cut over at planting to a height of about eighteen inches at most. The lateral shoots, which are thereby strengthened in growth, are kept low, and are made to spread by leaving the last bud always on the outer side. Much of the luxuriant growth of young wood which comes after close cutting back requires to be removed the second year, but a satisfactory shape is secured, and the subsequent annual pruning will consist of cutting back and thinning out, new or bearing wood being left evenly distributed over the tree, so that the fruit may also be properly distributed. The side buds in groups of three, or the lateral one of two, is the fruit bud. The terminal bud is that from which the next year's growth of wood is about to spring. There is a strong objection in the Colony to pruning or removing branches from apple-trees, as the wounded parts are so liable to become

affected by the American blight, and no doubt there is a good deal of sense in the objection; but pruning cannot be omitted if the best results are to be obtained. The selection of so-called blight-proof varieties does not overcome this difficulty, as the resistance only extends to the subterranean form of the *Schizoneura*. Plenty of space must be provided within the main upright-growing branches for the development of spurs thrown out from the old wood, as it is on these the fruit grows. If too long, they must be cut back; but Pickstone is of opinion that a greater number of buds should be spared in the Colony than the solitary two left in English practice.

American Blight (Woolly Aphis), Schizoneura lanigera, Hausm.
Woolly aphis; infested apple-spray, nat. size; wingless viviparous female and young clothed with cottony fibres above, and small egg-bearing female beneath the spray; pupæ with little cottony growth; all magnified.
After Buckton and Ormerod.

American Blight.—The apple-bark* plant-louse or woolly aphis, *Schizoneura lanigera*, Hausm., is easily distinguished by the cottony-like growth which projects from the insect, and readily betrays its presence. It is generally located in crevices, also where the tree has been wounded, and young bark has been recently formed in the vicinity of old or dead bark, under which the insect takes shelter, one chief attraction being the vulnerable condition of the part to the sucker of the aphis.

* One form of the insect attacks the roots and originates the development of warts of different shapes.

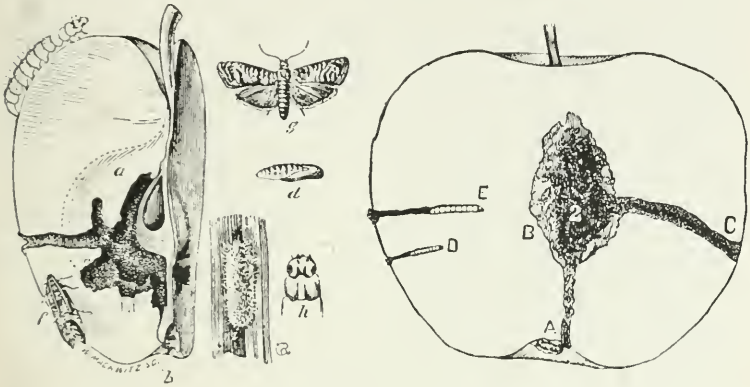
The injury produced is not only due to the quantity of sap abstracted, but also to the diseased growth which is set up. The tender woody layers underneath the bark become soft, pulpy, and abnormally enlarged. The bark over the swelling ultimately splits open, and exposes the tissue to further attack. At the end of summer these unhealthy growths dry up and die and form deep cracks. The efforts of Nature to repair the injury in the following season leads to the development of more young bark and soft tissue, which readily yields to the attack of an increasing number of insects. In this way "a constantly increasing diseased mass arises, which shelters the insects in its crannies, and finds food for them in its hypertrophied formations."

Underneath the wool the insects are mostly of a yellowish or reddish plum-colour. The winged specimens are described as "pitchy between the wings and green, or with the abdomen of a chocolate brown. The wingless females may be found packed closely together in the cottony masses, with the pale reddish young moving about amongst them."

Effectual sprayings with one or other of the solutions recommended later are the chief preventive and **remedial means** employed, together with the scraping away of all loose bark likely to form shelter for the pest.

The **codlin moth**, *Carpocapsa pomonella*, Linn., is the dread enemy of the apple-grower. The diseased condition known as "worm-eaten" is brought about by the caterpillar of this moth gnawing a passage from a discoloured spot on the skin to the middle of the fruit. One egg is deposited usually in the eye of the apple in the early stage of its growth. On hatching out, the young **larva** moves at first in the direction of the outside of the apple, as injury to the core at this time would be fatal alike to the apple and the insect. Only "when it is nearly full grown does it pierce the core, and feed exclusively on the pips." In consequence the apple falls, and the **caterpillar** leaves it and crawls to some convenient shelter, frequently up the tree, where in a crevice in the bark it spins a white web to cover itself, and to rest in for a few days, or it may be several weeks, till it assumes the form of a chrysalis. Some chrysalids develop into moths the same season, others remain in that state till the following summer.

The **habits** of the insect make it possible to successfully combat its attack by the timely use of one or more of the following **preventive measures**:—(1.) Banding the trunks of the trees about six inches from the ground with old sacking, woollen or other cloth, or even brown paper two or three inches broad, smeared with tar or grease to trap the caterpillars, and prevent them ascending. At first the smear was put on the bark of the trees, but this practice was speedily discontinued on account



CODLIN MOTH, CARPOCAPSA POMONELLA, LINN.*

(*a*) Shows the burrowings of the larva; (*b*) the point at the blossom end of the apple where it enters; (*e*) the larva full grown; (*h*) the anterior part of the body, magnified; (*d*) the chrysalis; (*f*) the cocoon; (*f*) the moth with closed wings; and (*g*) the same with expanded wings.

A. The blossom end where the larva is supposed to enter the fruit. *B*. Empty space where the shell containing the seeds was located before the entrance of the larva. *C*. The burrow or outlet through which the larva makes its escape. *D*. Young larva in burrow. *E*. Young larva approaching maturity and nearing the core.

Report of State Board of Horticulture, California, 1889.

of injury being done to the parts. (2.) Scraping annually in early winter, removing all loose bark of apple, pear, and quince trees in an infected orchard, and carefully collecting and

* "The **caterpillar** is about half-an-inch long, and slightly hairy, with three pairs of claw feet, four pairs of sucker feet beneath the body, and another pair at the end of the tail; whitish, with a brown or black head, and dark markings on the next ring, and about eight dots on the others. The food canal sometimes shows as a dark line along the back. The **moth** is about three-quarters of an inch in the spread of the fore wings. These have a light-grey or ashy-brown ground, with delicate streaks and broad markings of a dark tint, giving a kind of damasked appearance; and at the hinder corner is a large spot of a brownish-red or gold colour, with paler markings on it, and a border of coppery or golden colour around it. The hinder wings are blackish."—Miss ORMEROD.

burning the scrapings. (3.) Washing or spraying the bark of the trees with one of the mixtures subsequently recommended. (4.) Spraying with Paris-green two or three times in early summer, at intervals of ten days, beginning immediately "after the bloom has fallen, and finishing before the calyx end of the fruit has turned downwards. After the apples have changed their position, and the stem end is upward, the poison is liable to collect in the cavity about the stem, and render the use of the fruit dangerous to human life." (5.) Gathering infested fruit, and picking up all windfalls for immediate consumption or destruction. (6.) Disinfecting fruit-cases or hampers when returned from market by scalding, or by washing, or by dipping for two minutes in a lye of caustic soda, 1 oz. to 3 gallons of water.*

The pear-tree practically disappears in the semi-tropical area, except along the coast belt where the altitude is not more than 100 or 150 feet. The apple, on the other hand, begins to hold its own in this region at an elevation of 900 to 1,000 feet and upwards. In the inland colder parts pears grow admirably, and if a fresh-fruit trade is to be satisfactorily established with Europe, the pear holds out good hopes of forming one of the most important features of it; but this can only be under a system of skilled management, including the planting of the **choicest** of grafted French and American **varieties.** A few of those have already been successfully grown in the Colony, such as Williams's Bon Chrêtien, or the American Bartlett pear, a well-flavoured, juicy pear, excellent for either export or canning; but there are others in the nurseries of colonial nurserymen, which are worthy of attention, viz., Souvenir du Congrés, Beurré Superfine, Beurré Bosc, Beurré Clairgeau, Pitmaston Duchesse, Easter Beurré, &c. Propagation is accomplished by **grafting** on pear suckers, or on quince stock when dwarf trees are wanted to bear early. Pears can be grafted on apple stocks and *vice versa*, but the resulting trees are not healthy or long-lived. The soil on which pears are intended to grow should be trenched at least three feet deep, and well worked to a good depth afterwards. After young trees are planted it is admissible to grow market

* See Miss Ormerod's "Manual of Injurious Insects" (Simpkin, Marshall, & Co.); and Frazer S. Crawford's "Report on the Codlin Moth" (Government Printer, Adelaide, South Australia, 1886).

garden produce in the vacant spaces between the rows for a few years, a practice which cannot be too strongly condemned in the case of stone fruits, which grow their roots so near the surface that cultivation should not as a rule go deeper than three inches.

The varieties of the **peach** usually grown in the Colony by all but the few who have made fruit culture a special study are **seedlings**, and the fruit is of inferior quality, quite unsuitable for any branch of the export trade. Much discussion has taken place as to whether or not the Colony could produce peaches good enough to send as table fruit to the London market. Those who have adhered to the side which said no, based their opinion chiefly on the character of the seedling fruit, and on the destruction caused by the peach maggot. On the other hand, peaches of excellent quality have been landed and sold in London. Of **free-stone peaches** there is no lack of variety in the Colony, from which growers are free to make selections, the Royal George, Belle de Douay, Grosse Mignonne, Exquisite, Early Rivers, Palmerston, Prince of Wales, Muir, Early Crawford, Foster, and many others being offered for sale by nurserymen. Probably the yellow St Helena is the best self stock to graft on. Peaches do not thrive either in the highest and coldest parts, or on the hot and humid semi-tropical belt along the East Coast.

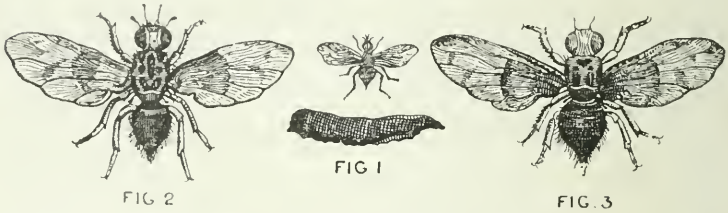
The **peach maggots**, probably better known as the grub of the light yellow-brown two-winged orange fly, *Ceratitis citriperda*, MacL., spread in 1895 to many parts of the Western Province, which had before that time been free from its attack. It is not a native of South Africa, and there is no conclusive proof that it attacks any indigenous Cape fruit. S. D. Bairstow, who wrote an interesting communication* on this pest, says he has personally known it for thirteen years in the Eastern Province, and that "Bishop Ricards remembered the maggot doing damage to fruit over forty years ago." Westwood describes the **larva** as "a white fleshy grub, destitute of legs, and possessing two small black contiguous hooks, which it alternately protrudes and retracts, thereby tearing the delicate membranes in which the juice is contained;" and the **pupa**

* *Agricultural Journal*, 4th May 1893, and republished, with other information, in pamphlet form by the Government.

as "a small, hard, brown, oval body, the outer surface scarcely indicating any trace of articulation, being the dried skin of the larva, within which the real pupa is enclosed."

The **fly** is now generally believed to be identical with *C. capitata*, Wied., and *C. hispanica*, which stamps it as one of cosmopolitan character. America is free from it, but the East Indies, the Azores, Bermuda, Madagascar, Mauritius, Madeira, St Helena, and the citrus-growing regions about the Mediterranean all suffer seriously from its ravages.

The area of infestation is extended so far as great distances are concerned by fruit containing the maggots being carried and distributed as fresh fruit. Once introduced it is difficult to keep under control, and no means has yet been found for its complete destruction, although it disappears naturally in

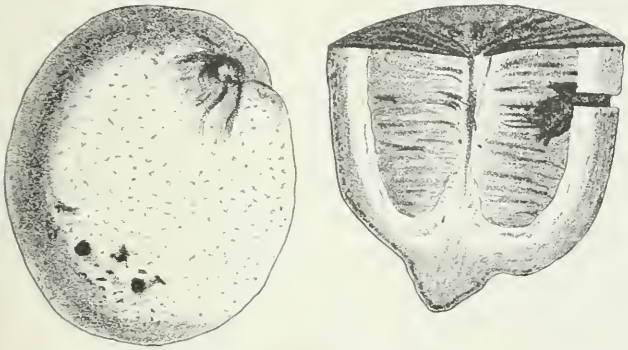


PEACH MAGGOT, CERATITIS CITRIPERDA, MACL.

Fig. 1.—Maggot Stage and Male Fly, Natural Size.
Fig. 2.—Male Fly, Enlarged. Fig. 3.—Female, Enlarged.

districts in which the fruit is periodically destroyed by frost. The female, when engaged in laying her eggs, which she plants by means of a powerful ovipositor, pierces the skin of the fruit usually, though not invariably, as it begins to get ripe and sweet, to a depth of over three millimetres, and in about fourteen days mature larvæ appear. In two days more the pupa stage is reached, and shelter found on the surface of the ground. Sixteen days later the perfect insect develops. The larva, after forsaking the fruit, can spring like a cheese maggot a distance of from three to fourteen inches. There is a **succession of broods** during the summer season, and in winter the insect hibernates and the immature forms are checked in their development, and those not destroyed remain dormant. It is not supposed that very large numbers survive the winter, but they rapidly increase during the warm fruit-

ripening season, each succeeding brood becoming stronger and more numerous. No properly effective remedy has yet been found to cope with the ravages of the insect. **Spraying** is of no avail, owing to the eggs being buried out of its reach in the fruit, and the laying season lasts so long that one would almost require to spray daily, an impossible task, to prevent the female settling. As the fly does not confine itself to one or to a few varieties of fruit, but freely attacks, in addition to peaches, all the citrus fruits, pears, apricots, figs, plums, &c., and even, it is said, pumpkins and water-melons, the maggots cannot fail to find abundance of food during the whole of the season of active growth. The appetite for so many varieties of fruit is of recent development, and not confined to South



LEMON BLOWN BY CERATITIS.

Africa. In Ligurian Italy, Dr Penzig points out that citrus fruits have been forsaken by it for peaches, the Surinam cherry, and the loquat.

The only hope of completely coping with the pest is by finding and introducing an **ichneumon fly** to play the part which the ladybird did so effectively with the cotton scale. Meanwhile something may be done to **reduce the numbers** by collecting and destroying all fallen and injured fruit, and by regularly cultivating the surface of the soil to disturb the larvæ and pupæ. **Pigs and poultry** might also be kept much more extensively in orchards than at present, and be sources of profit in addition to the benefits to be derived from their consumption of maggoty fruit and injurious insects. Concerted action on the part of the fruit-growers of a district

would be of great importance in such an attempt, but failing this, an energetic orchardist need not despair of deriving some benefit from his own individual effort, as the strength of flight of the fly is not so great or so extended, even when aided by the wind, that it is likely to travel far by this means.

The peach is **pruned** much after the fashion adopted in the case of the apple and pear, the long laterals from which the fruit-buds spring being shortened. As pruning involves the cutting of the bearing wood, it is necessary to observe the position of the fruit-buds ; and when these are located near the top of a branch it must be spared, so that an abundance of fruit may be secured. Summer pruning of the peach, as of most trees, is not permissible, as it encourages an additional and excessive growth of new and inferior wood. New wood, if well matured, springing from the main stem, and also encouraged to grow by the process of cutting back and thinning out of the main branches, is preserved as far as is necessary for bearing wood, but it is of a different character from that resulting from summer pruning.

The home of the **apricot** is usually credited to France, although there is little doubt it originally came to Europe from Persia. The trees growing in the Colony have mostly **sprung from seeds,** and the most of the produce, although very abundant, is inferior—little better than wild fruit. Of the selected or **improved varieties** there are a New—as well as Old—Large Early and a Large Late Apricot, and sorts like Oullin's Early, Powell's Late, Blenheim or Shipley, Royal, and the St Ambroise, and others, to choose from. For preserving, the Breda, a small, deep orange-coloured, but very prolific peach, well known in the Colony, should be mentioned.

The choice varieties grown in the Colony are usually budded on hardy apricot or peach stock, but in Great Britain plum stock is found to do well for this purpose. The **pruning** of the apricot is quite different from that practised on the peach. The great object is to keep the fruit as near the main stems as possible by pinching off the terminal bud of the short fruit-bearing spurs, or cutting short the long ones, which all spring directly from the main stems. All dead fruit spurs require to be removed to encourage the development of latent buds near their bases. Fruit growth is strengthened by cleaning away

all but a sufficient number of main limbs to make the tree symmetrical, and by checking the excessive rise of sap by topping these. In very rich soil, where woody growth is gross and excessive, the topping of the main stems leads to the development of brushes of soft new wood, and to the production of foliage in place of fruit. Root-pruning, done by digging down and severing a number of the main roots, is the best remedy against excessive luxuriance of growth.

The quince is probably more widely distributed throughout the Colony than any other fruit-tree. It grows readily from cuttings, and owing to the rigid character of its boughs, forms an excellent, closely-knit, useful garden fence, and produces an abundant crop at the same time. There are two common varieties—one of a yellow-flesh colour, and the other of a reddish hue. Both are in favour for making jelly and preserves.

The pomegranate is also used as a fence plant, but it forms a poor, thin, non-resisting fence as compared with quince. Although it grows very well, it does not occupy an important position among the fruits of the Colony.

The plum is represented by a large number of excellent varieties, from the cherry plum, which ripens earliest, or about the New Year, to Coe's Golden Drop and Blue Imperial, which come in at the end of the season. The gages are well represented by green, golden, transparent, Imperial, and Brahy's varieties. The Grand Duke, Large Black Imperial, Victoria, Washington, Jefferson, Diamond, Simon, Belgian Purple, and Blue Impératrice are mentioned at random from among a number of others equally well worthy of cultivation.

Plums generally give the best results when **budded** on peach stocks, or on stocks of the myrobolan, which belongs to a different early flowering and early maturing species from the common plum. The **fruit** is borne on the old wood on short spurs of an inch, more or less, in length, growing on laterals six inches to two feet long coming from the main stems. If the young perpendicular branches are cut back sufficiently during the early stages of their growth to keep the tree within bounds, the annual pruning will in a great measure be confined to shortening the laterals, always keeping in mind that sufficient room must be left inside to prevent crowding.

The fig grows freely except where it is subjected to severe

frosts. Most varieties represented in the Colony produce two crops in the year—a summer and an autumn crop—the latter, however, being inferior in size and quality to the former. Figs grow readily from grafts, from cuttings, or from suckers, which often spring in such numbers that they become a nuisance. Golding * mentions four common varieties grown in Cape Colony—the common brown fig, a small black early fig, a very sweet early green fig, and the large late Adam fig. Many other excellent varieties have since become well known—for example, the Castle Kennedy, a very large and luscious fig, the first fruit of which sells at 3d. each in the larger centres of population. The Brown Turkey, an early variety, the Brunswick, and the large white Italian, all figs for the table also the white Marseilles, a drying fig, are steadily making their way into public favour. A scale insect has in recent years attacked the fig simultaneously with many other fruit-trees, much to their detriment.

The orange is extensively grown in the milder districts of Cape Colony. Although it is a tropical or semi-tropical tree, after the first few years are past it can withstand a few degrees of frost during the winter season. In some of the colder upland districts young trees require to be protected by branches, or by Spanish reeds set up on end, to form a covering like a conical tent. The **lime** that grows in the Colony is not quite so hardy as the orange, but the naartje is hardier than either. A few orchardists have gone in for choice varieties, and the following have given excellent results:—The Bahia orange—called Navel owing to the extraordinary depression at one end, and characteristically re-baptized in the United States as the "Washington Navel"—is a well-known and extensively cultivated variety. There are also the Nipple, the Joppa, the Malta blood, and the St Michael's varieties.

The naartje or mandarin is a small sweet orange with a thin skin, which is often loosely attached to the fruit. The trees are smaller than those of the common orange, but are most prolific.

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* In an Essay on "Fruits and Fruit-Trees of the Colony," published in connection with the South African Exhibition, Port Elizabeth, 1885, to which the author is specially indebted for references to many of the common fruits.

It is astonishing how far behind the times the great majority of the Cape orange growers are in their systems of management. Most of the trees are seedlings, and the fruit is in consequence, though wonderfully sweet and juicy when pulled ripe, inferior in quality to the fruit of the cultivated varieties of the Mediterranean and America. It is argued that for the local market, which is by far the most important at present, the size and not the quality governs the price, and no advantage would be gained by taking the trouble (it is more a matter of trouble than expense) to secure finer sorts. But even on this low platform the argument is fallacious, as seedlings are long in coming into bearing. At least two years might be saved, as compared with the present condition of things, by a proper system of cultivation, including the budding (which is the most approved plan of propagation in the case of the orange), of the best varieties of oranges upon hardy native stocks. At one time the supply of oranges was much greater than at present, and the price went down to about 1s. 6d. per 100. Now 3s. and 3s. 6d. per 100, and up to 6s. and 15s. for out of season fruit (gathered about Christmas), may readily be got, unless where the relations of supply to demand are somewhat dislocated. The change was brought about by the Dorthesia or Australian bug completely destroying so many trees before its ravages were checked, and also to the injury done by canker at the roots, but the existing condition of things affords ample opportunity for adopting better methods of cultivation, and also encouragement to do so.

The natural shape of the orange-tree is conical, and it thrives and yields best when the branches come down pretty low, to shade the stem from the scorching influence of the sun, and to prevent the excessive evaporation of moisture from the earth in which the roots are distributed. A few growers, to protect the roots still further, and to retain more of the rainfall than would remain on a dry and hard surface, mulch the area under the trees with branches, weeds, or any refuse vegetable matter. On decaying, this accumulation is dug in as manure. The practice, although good in some respects, is open to objection. The most important of the objects aimed at, viz., the preservation of soil moisture and the conservation of rain water, would be secured by frequent surface

working with the horse-hoe, and the excellent harbour provided by the litter for weeds, for insects, and for larger vermin would be dispensed with. The importance of this suggestion may be taken into consideration in connection with the description of the habits of the orange-fly given at page 190.

Many orange-trees have during recent years been destroyed by the red scale, *Aspidiotus aurantii*. This is one of the small hard scales which adhere closely to the surfaces of the bark and leaves, and at the same time extract the juices of the tree, and in vast numbers close up the breathing pores, so that fruit-bearing very soon becomes impossible, and the tree itself is after a time destroyed. So closely do the scales attach themselves to the bark that ordinary soap and quassia dressings are of little avail. Repeated dressings of sulphur and lime wash (6 lbs. of each boiled together and mixed in 20 gallons of water), put on very carefully by a spraying machine, have been found successful; but the most effective and speedy remedy is to fumigate the trees (placed when not too large under cover of a gas-tight canvas tent), by enveloping them in an atmosphere of prussic acid gas. (See page 216.)

Two local remedies which have proved efficacious on a small scale are (1) washing the tree with **butter-milk**; and, as will subsequently be explained, (2) stripping off the leaves during winter, and rubbing the branches with **anti-friction grease**. A **black aphis**, *Myzus persicæ*, Salz., which increases in myriads on the orange foliage, is frequently a forerunner of an attack of orange scale. It weakens the vital powers of the plant sufficiently to make the establishment of the scale an easy matter.

Orange-trees badly attacked by scale are sometimes cut back and allowed to spring from the stump; but apart from the danger of killing old trees by this treatment, it is neither an effectual nor an advisable remedy. Unless all the trees in the neighbourhood were treated in the same way, the scale adhering to the feet of birds would find its way on to the young shoots, even if a few specimens of the insect were not left on the stump to form a still more direct and immediate source of reinfestation.

The **canker** at the collar, or gum disease, of the orange,

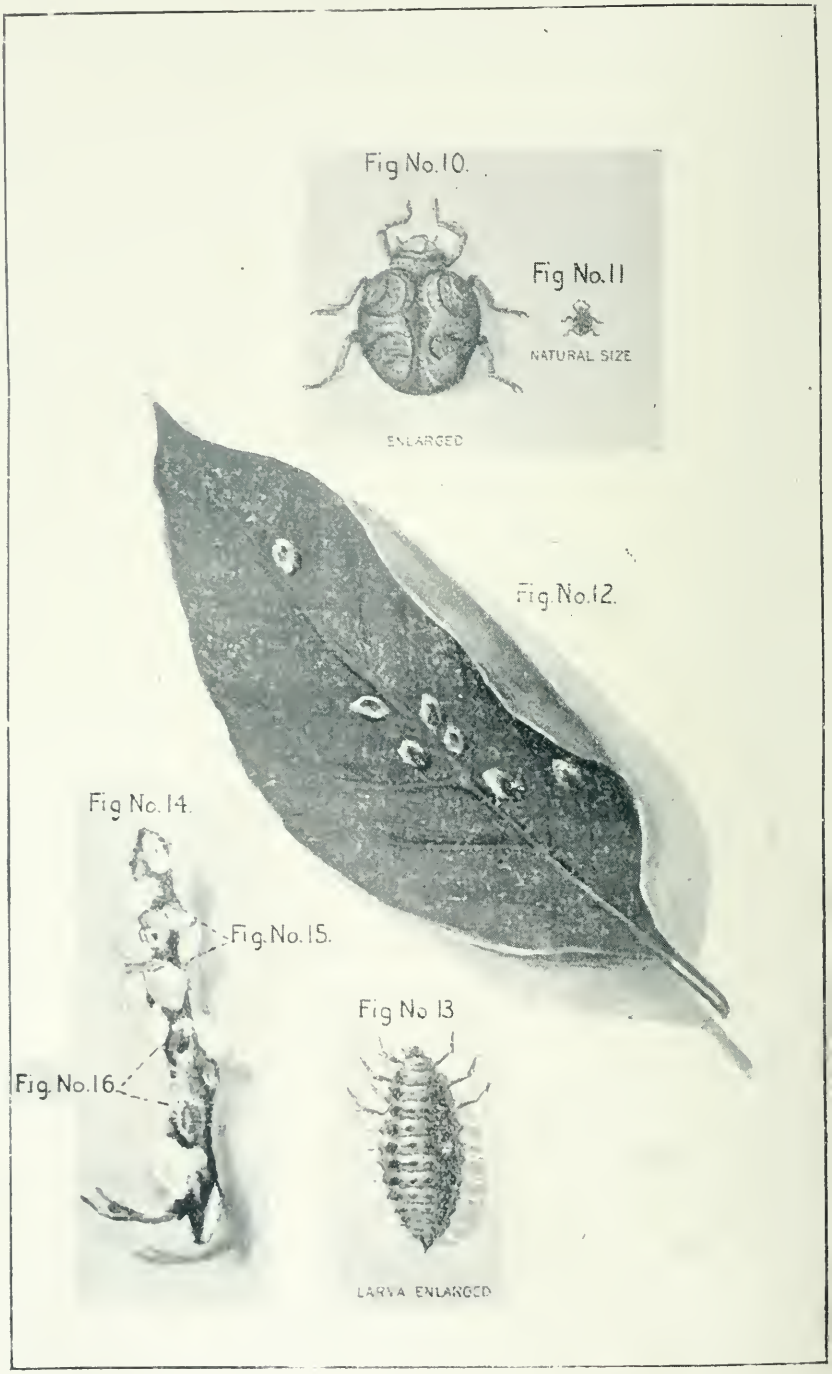

PLATE 35.—AUSTRALIAN LADYBIRD, VEDALIA CARDINALIS.

which has during recent years destroyed nearly all the trees in whole districts, still to some extent remains a mystery. No fungus has so far been identified with the mischief, although the appearances are very much like what a fungus would produce. Excessive and unintelligently applied irrigation has no doubt been the sole cause of death in many instances, yet the evidence is not conclusive that canker is altogether due to it. The remedies which have been tried are the opening up of the roots to admit air, when they are found to give off a fœtid odour; lime applied in good time to the soil has been found to act as a preventive, but above all is the use of Bitter Seville stock instead of the lemon stock.

The **soot fungus**, *Capnoidium citri*, Berkl., of the orange, myrtle, and olive, is not a parasite but an epiphyte, which does injury by closing up the stomata of the leaves and by preventing the sun from exercising its beneficial action upon their green surfaces. The black film is produced by the "mycelium of the fungus which grows upon the sugary excrementitious deposit made upon the leaves by several species of aphis." This syrup-like material gradually spreads over the surfaces of the leaves, and supplies a suitable habitat for the growth of capnoidium.

Remedial treatment is first directed against the aphides, which are the primary though the indirect cause of the disorder, and the trees are sprayed with one of a number of mixtures detailed further on in this chapter. After the insects have been destroyed, immediate relief may be given to the trees, if these are not too numerous, by syringing with warm water.

The *Dorthesia* (*Icerya*) *purchasi*, or **Australian bug,** a large woolly scale insect, which was introduced about twenty years ago, threatened to make a clean sweep of the citrus trees of

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KEY TO PLATE 35 OPPOSITE—BENEFICIAL INSECTS.

Fig. 10. *Vedalia cardinalis* (Australian ladybird); enlarged.
Fig. 11. *Vedalia cardinalis;* natural size.
Fig. 12. Pupæ of *Vedalia cardinalis* on an orange leaf; natural size.
Fig. 13. Larvæ of *Vedalia cardinalis;* enlarged.
Fig. 14. Branch infested with *Icerya purchasi;* natural size.
Fig. 15. Larvæ of *Vedalia cardinalis* at work.
Fig. 16. Larvæ of *Vedalia cardinalis;* natural size.

the Colony. Its attack gained all the more force from the fact that it lived on many species of trees, being specially devoted to the introduced Australian *Acaciæ*. About nine or ten years after its appearance, the ladybird *Vedalia* from California was introduced, as it had been into that state from Australasia; and the *Rodolia*, a native insect, increased much in numbers. So quickly have these tortoise-shaped, little hard-winged beetles multiplied and done their work of extermination of the scale, that a specimen of the pest will soon be looked upon as a curiosity. It is not unlikely that it may be destroyed altogether, and that with it will disappear the ladybirds which have proved so useful.

The pine-apple, *Bromelia ananas*, is a tropical, fruit-bearing plant, which grows well on certain soils in the Colony, within a moderate distance from the sea, where frosts are almost unknown. Its prickly leaves are familiar to most people, as they resemble the top-knot of bracts which adorn the fruit now so much used as a dessert. The district of Bathurst seems peculiarly well suited to its cultivation, plantations of fifteen to twenty thousand plants about three feet high being examined in a healthy and vigorous condition on the properties of the brothers Purdon. All cultivation was done by hand labour, although this appeared to be a case in which the horse-hoe might be used with advantage. The land was well manured at planting, but crops had been grown for a number of years without manuring, and without showing visible decrease. The pine-apple plant is **propagated by suckers,** which grow freely on plants of full growth, set in rows with spaces of four feet by three feet between the plants, and these will bear fruit in two years. The superabundance of suckers requires to be pulled off in thinning out annually, when the stems which have borne fruit are also removed. The **fruit** of the common variety cultivated is very small, usually under 2 lbs. weight, and the annual yield on the average is about five pine-apples per plant, fruit being produced all the year round. It is separated into **three classes** for marketing purposes, and sent inland to the large centres of population. The first class often sells at 6s. per dozen up to 9s. at times; No. 2 from 4s. down to 2s. 6d. per dozen; and the third class at a still smaller price. If means were

provided for **tinning**, a considerable trade in pine-apples might be done with Europe; but before any export trade in fresh fruit could be established, larger and finer varieties of pines will require to be introduced. It remains to be seen if pines imported from Ceylon or the Mauritius are hardy enough to withstand the influences of the winter climate of even the south-eastern coast regions. Some difficulty has been experienced by growers in getting information about the best varieties, or finding means of securing plants of them. If fruit from the above-mentioned parts be introduced, and be recognised as belonging to the quality sought for, plants may, by exercising a little care, be cultivated from the base of the bunch of leaf-like bracts attached to the fruit.

The banana, with highly flavoured fruit, may be regarded as the cultivated dwarf variety of the plantain, and to occupy similar relations to it in the matter of size and quality as the garden beet does to the mangel-wurzel. Both plants grow well in the Colony, in hollow warm places, not far from the sea, sheltered from wind and protected from frost. After producing a bunch of fruit, the stem, which reaches twenty feet in height in the case of the plantain, and only about six feet in that of the banana, dies, and is removed, its place being taken by suckers which spring in considerable numbers, and are planted out in forming a new or replanting an old plantation.

The loquat, *Eriobotrya japonica*, is a hardy, shiny-leaved, evergreen tree of Japanese origin. As its blossoms appear and its fruit matures in winter, these are liable to be injured by frost. The fruit, which is about the size of a damson plum, is yellow in colour, and it possesses an agreeable combination of a sweet and an acid flavour. The pips, from which the trees are usually propagated, are large in relation to the space occupied by the fleshy part of the fruit, which grows in clusters at the extremities of the branches.

The so-called **Cape gooseberry**, *Physalis peruviana*, though found growing wild in many parts of Cape Colony, and often more freely and abundantly in a state of nature than when an attempt is made to cultivate it, is not indigenous to the Cape, but a native of Peru. It is a herbaceous, perennial, shrubby plant, growing two to three feet high,

with a flower resembling that of the potato, and a round fruit not unlike a small potato-apple, but of a yellow colour, and enclosed within an inflated capsule. It possesses a pleasant flavour, and combines a subdued sweetness with a slight acidity, attractive to lovers of fruit, who may eat it as freely and with as much appreciation as the gooseberry. When the local price is good, the seed is sown in unoccupied corners of vineyards at the time when rains come—in the humid area of the Western Province generally in March. The best fruit grows on young plants. Second year's plants are liable to suffer from the attacks of red spider. Sixpence per lb. is readily got for the fruit in Cape Town; but 3d. per lb. still leaves about 1d. of profit, the cost of growing being estimated at 1d., and of plucking and cleaning (removing the capsule) at 1d. It is largely used for cooking with pastry; and made into jam it is unsurpassed for excellence of quality by any other preserve.

Having dealt at some length with the production of fruit, it remains for us to consider the conditions and the necessities for the **packing** and **transport** of the same, and the position which it occupies or ought to occupy in the great central market in London. The author heard many grumblings and much complaint by unsuccessful colonial shippers of fruit against the London fruit merchants and agents. Some asserted that a ring had been formed to **boycott Cape fruit,** it being supposed that for some mysterious reason the great London dealers did not want it, and objected to handle it. A little calm reflection and thoughtful consideration in the light of the facts of the case soon showed that the "devil in the hedge" was not a London but a colonial fiend. The **defect lay** in the original character of the product sent and in the condition in which it arrived. All sorts and description of fruit had been bought in large quantities by both London and colonial agents, packed without being properly graded or sorted—ripe and unripe together—in cases of many sizes and shapes, and shipped on a long and trying voyage without any special provision being made for the careful handling and storage which such a delicate commodity as fruit requires. It is no wonder that the shipping of Cape fruit in this rough and ready fashion proved unremunerative and disastrous to not a few who went into it, but the point most to be regretted is that

the good name of the Colony as a fruit-growing country has suffered, and the traders of the future will require not only to fight for a footing in the market, but to redeem the reputation of the Colony. Shippers do not seem to realise that London traders who deal in good fruit cannot touch an inferior article from whatever quarter it comes without losing credit, and that it is only natural that they should avoid the risk of doing so. Quite enough of **second quality fruit** is dumped into London by home growers without an increased contribution from abroad, but the limit to the amount of really **prime fruit** which the market can absorb and which the agents are only too anxious to handle at prices satisfactory to the consigners has not yet been reached or defined.

Many shippers have failed, but all have not done so, although those who survive have had to **buy** their **experience.** The trade has been in existence for a number of years, but not till the season 1894-95 (December till April) was any great measure of success attained. Even when every effort is made to send the finest fruit, the difficulties to be contended with are trying if not insurmountable. Fruit which requires to be packed for a number of weeks **loses the bloom** of fresh fruit, whatever method of packing be adopted, and however carefully it may be done. Apart from that, the conditions under which fruit is sent at present are far from satisfactory. The average **duration** of the **voyage** from Cape Town to London is twenty to twenty-one days, and two or three days more are required for distribution before it can reach the consumer—a long time for such a delicate article to remain in transit. In view of this unavoidable delay, the fruit requires to be picked **before** it is **quite ripe,** and under the circumstances stated it is impossible to prevent it shrinking in size. The position is aggravated by the far from satisfactory **conditions at the beginning** of the journey. If a shipper wishes to send a large quantity of fruit by the mail steamer on Wednesday, he requires to **pick** on the previous Friday or Saturday, and **pack** on Monday and Tuesday, at a period of the year when the temperature may range between 90° F. and 100° F. Those who are resident some way inland have in addition to allow time for a **railway journey,** of long or short duration according to distance, which requires to be made without protection for the fruit from the

scorching heat of the **sun**. At the docks it may also remain for another day in the sun before it is put into the **cold chambers** on board. Although the cold air is turned on immediately, the fruit is two or three days in the cold chambers before it is uniformly lowered to the **proper temperature** of 38° F. It is impossible to cool down more quickly, as if the air be reduced to 32° F., the contents of the outside boxes become frozen. Thus seven or eight days may elapse after picking before the temperature of the fruit is got down to the proper degree at which decay is averted.

The Cape Orchard Company,* under the able management of L. M. Dicey and P. R. Malleson, deserves credit as a pioneer of the fruit industry, as it has introduced and grown varieties suitable for the European markets, and also persevered in experiments to determine the best and cheapest methods of packing. The reward has already been partially reaped through the Company's mark, C.O.C., being known and sought after by retail buyers in London. H. W. Hawkins, of Claremont, holds, also on the ground of merit as a skilled fruit grower and packer, a similar position to that of the Orchard Company in the home trade.

Baskets were tried at one time for the conveyance of grapes, but the freight by sea being higher, and the shrinkage of the fruit greater, they were discarded in favour of **wooden boxes.** These contain from 20 lbs. to 25 lbs. of grapes, 24 peaches, 48 apricots, and 48 nectarines. It is found in packing that **wood-wool** is a better material than cork-dust for filling up the spaces in the boxes unoccupied by the fruit.

Of **grapes** the Haanepoot, a white variety, and the Barbarossa are considered the best for the British market. Next in order of merit probably comes the Pontac, known in Europe as Teinturier, a grape with small leaves which become red, and a red juice, rather an unusual characteristic even in grapes with red skins. If grapes are gathered too green, both the wood and the fruit withers, and "dropping" occurs, *i.e.*, the fruit shakes off in transit. Grapes have been successfully shipped from some of the leading **Constantia growers**, and pay well for production at 2d. per lb.—the price which the best of the

* To whose London agent, G. E. Hudson, Suffolk House, E.C., the author is indebted for much valuable information.

1895 crops realised. Something of the quality may be judged from the fact that a few of the finest samples sold at 30s. for a 20-lb. box—an indication that they must have gone into competition in the market with English hothouse grapes. Though the latter will always possess a more pretentious look, yet when properly handled, the colonial grapes grown in the sunlight under natural conditions ought to be superior in quality. Another most favourable characteristic of many South African grapes is the unique and most attractive **flavour** possessed in the greatest degree of perfection by the Haanepoot variety. This is a quality which is absent in British, French, and Spanish grapes, and forms a distinctive difference which will come to be of immense value when it is more widely known.

California sends very fine plums and pears during winter to compete with Cape fruit, but it does not seem to be possible for exporters there to ship grapes so that they will keep on the voyage.

Excellent Cape **plums** come to London, but the **pears** are usually indifferent, although a few very good Bon Beurrés have been received—sufficient to give a hopeful indication of future possibilities.

There is little question that the **fruit industry** of Cape Colony is only **in its infancy**, but shippers must get thoroughly to recognise the fact that only first-class fruit has any chance of success in the markets of the northern hemisphere. Cape fruit cannot present the appearance of British-grown fruit, for reasons that have already been explained; but it need not be behind in quality, while in flavour it may even be superior in some cases. To accomplish this possible and desirable end, **all concerned** in the handling as well as in the growing of the produce **must combine** in developing the best possible means of preserving its condition, and hastening its progress to market. They need not do so through a self-sacrificing spirit of philanthropy, but purely on business grounds. An important industry is being born, which will be able to pay its way, and do so all the better for the best of treatment. **Government railways** are now called upon to provide better accommodation for the transit of fruit by rail. Refrigerating fruit-cars must sooner or later be made avail-

able, but until they can be procured, the **trains** for conveying fruit should be **run during the night. The Dock Company** in Cape Town is also called upon to erect cold-store chambers for the reception of fruit, so that a shipper might send down each day fifty boxes to be immediately placed out of reach of injury from exposure to the sun, and remain until the whole consignment could be put on board. **Greater care** than at present should also be exercised during the process of **handling** at all stages of the journey to prevent bruising, which is fatal to fresh fruit.

There is no doubt but that the **fruit trade will develop** even under the present unfavourable circumstances, but it would certainly do so more rapidly, and with greater advantage to all concerned, if the suggested changes were carried out. The condition of **traffic** both by rail and sea is such that it could make room for a large fruit industry without inconvenience, and much to its advantage. The greatest amount of goods is carried up-country, and empty waggons are numerous on the return journey. The steamship companies also carry much more cargo by their outward-bound than by the homeward-bound steamers. The fruit trade is likely in time to become so extensive, that it already assumes a position of colonial importance rather than one of special interest to a class. The money earned by the extension of an industry speedily circulates through the whole community, and all classes in their different spheres and degrees are ultimately benefited.

The **district of Wellington** has taken a lead in the recent developments of the fruit industry, and deserves special mention, not only on its own account, but as an example for other districts to follow. P. T. Cillie, President of the Wellington Fruit-Growers' Association, was sent to California by the Cape Government, and spent the fruit season of 1893 in acquainting himself with the Californian methods of orchard cultivation, and the handling and marketing of fruit. The President's fruit farm, **Boven Valei**, which had about twenty-five acres under choice fruit-trees, is in itself an instructive feature. The soil is stiff, and better adapted to the growing of fruit-trees than vines, although phylloxera has not yet appeared in the district.

The pruning of apricots and nectarines, by the method described at page 184, is there found to be most important to protect the fruit from the south-easters during the spring months — September, October, and November. The old-fashioned **Boer method** of working, which included copious irrigation, and in the case of the best practice, ploughing only once in two years, had been given up for three seasons. Since that time **no water** had been applied, and the orchard had been **ploughed** once a year during August and September—four to seven inches deep—and the land frequently cultivated during the warm weather (care being taken that this is done after rain), as soon as the soil is dry enough to permit of men and horses going on it without doing injury by poaching the surface with their feet.

Manuring is done by kraal manure spread on the surface, and worked in by cultivating after the fall of the first autumn rains; then the orchard is left to grow green throughout the winter, and till the ploughing time arrives. Some hardy leguminous plant might be found, which, if sown, would tend to keep down weeds, and during mild weather carry on the useful and important work of the fixation of the free nitrogen of the air.

Wellington is a great **apricot** growing centre. The only disease which has yet developed on this tree is the shot-hole fungus, *Septoria cerasina*, which perforates the leaves; but spraying with a fungicide consisting of 4 lbs. of sulphur, 8 lbs. of lime, and 1 lb. of common salt in 24 gallons of water, proves an effective check to its ravages.

The district, like the rest of the Western Province, suffered severely in 1895 from the attacks of the **peach maggot**; but owing to the local facilities for fruit-drying, losses such as were realised in other parts were not there experienced, and prices little short of those of previous years were realised, viz., 8d. per lb. for dried peeled peaches, and 5d. per lb. for unpeeled.

Raisins sold at 5d. per lb., after taking twenty-five days to dry in the sun. The process adopted is slower than that employed in preparing raisins for the making of sweet wine. To crack the skins, and make them dry quickly, grapes are in that case dipped in boiling lye, consisting of 1 lb. of caustic potash to 10 gallons of water.

The **Pioneer Fruit-Driers' Company**, organised on the co-operative plan, with a capital of £2,000, has been in existence for two years. It has carried on a remunerative business, and by supplying a good local market, it has been a boon to the district of Wellington. The fruits, chiefly **apricots**, are cut in halves, and the stones removed by children, who are paid 6d. per 100 lbs. of fruit, and can at this rate earn 1s. 6d. to 1s. 9d. per day. The fruit is laid at once on to wooden **drying trays**, six feet by three feet, resting on trollies, by means of which the trays are taken into an open field and exposed to the full influence of the sun. After this, to restore the colour, the dried fruit is bleached in **sulphur** fumes—sixteen trays at a time, and 40 lbs. in each—in a close chamber built for the purpose a little way from the main building. **Air-dried fruit** is liable to be a little tough on the surface, and it requires to be piled in a sweating-room to let it ferment for eight days, and become soft and pliable.

The **prices** paid in 1895 to the farmers were 5s. per lb. for apricots and peaches, and 12s. 6d. per 100 lbs. for prunes, and the prices realised were 7½d. to 8d. per lb., as compared with 4d., the price per lb. of fruit dried by the old system. Nearly 80,000 lbs. of dried fruit were turned out during the season, packed in cases in a condition fit to be carried any distance. To secure uniformity in drying and also in appearance, the fruit is separated into uniform sizes by an American **fruit-grader** or riddle.

Similar co-operative companies will no doubt ere long be formed in other districts. The principle involved is good, as all interests are centred in the one set of individuals concerned, and each man reaps the advantage of being one of the number in proportion to the amount of his business.

The **Wellington Fruit-Growers' Association**, which had been formed nearly three years before, and only mustered seven members during its first season, possessed a membership of over a hundred in 1895. The Society has not yet adopted printed rules, but it is non-political, and it is intended for the dissemination of information relating to fruit, by means of reports and monthly meetings, at which questions are asked and answered, and discussions take place. Besides Wellington, the following places have started **distinct associations**,

in most instances with marked success:—(1) Constantia; (2) Stellenbosch; (3) Paarl (both agriculture and fruit); (4) Montague; and (5) Robertson.

A Horticultural Board for the Colony had been proposed, and one important question being discussed was whether the Government or the Associations ought to have the power of electing the greater number of the members of the central body to meet in Cape Town, consisting of one representative from each local Fruit-Growers' Association and two members to represent the Government. The **local branch** in each case was to consist of the local representative on the central board and two others. No doubt an organisation of this kind might confer certain benefits upon the struggling fruit-growers and upon the industry of fruit-growing generally, and be in a manner conformable to the usual custom of having Government interference introduced into it; but it seems to a stranger that all the purposes to which the Horticultural Board could well devote itself, and many more besides, could be better, more freely, and independently undertaken by a commercial, non-political, and independent body of fruit-growers, who might be well designated the **South African Fruit-Growers' Union.** Such a body, with aims and objects similar to those of the Californian Fruit-Growers' Union, would rapidly become a power for good. No Government support or assistance ought to be sought for further than the removal of unfair or burdensome disabilities, the lowering of the rates of carriage, and the improvement of the transport service by rail —objects which could much more readily be attained by an independent powerful organisation than by any Government-nurtured institution. [The chief function of a Horticultural Board would be to disseminate useful information, a function which as time went on, and other means of information became available, would steadily become of less importance. The commercial spirit would be wanting, and the real requirements of the fruit-growing community could not be satisfactorily attended to.] The central authority, in conjunction with its local branches, should unite the colonial fruit-growers as one man. It should not only find suitable foreign markets, but supply the medium through which the grower could place his produce upon these markets in good condition, and at a

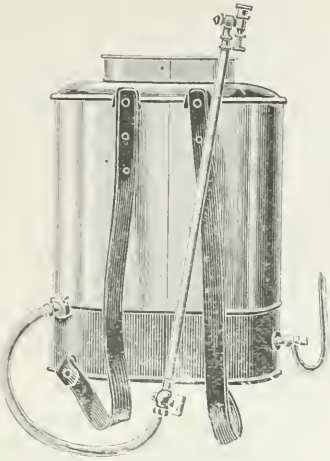
reasonable outlay. No body which is handicapped by departmental red tape could ever undertake such duties, or could ever gain the confidence of the shippers should the attempt be made. The executive should be elected by the members—in other words, the fruit-growers of the Colony—on account of their fitness for the work, and be directly responsible to them, so that they would only be retained as long as they were able and willing to give their best services.

This is not an enterprise which is to be established while sitting with folded hands, neither is it one in which to delay in the hope of receiving Government aid in its inception or its expansion. It can only be carried through to a successful issue by the energy and the strength gained by the combination of the individuals personally interested, encouraged and supported by Government giving facilities for development, and removing obstacles to progress.*

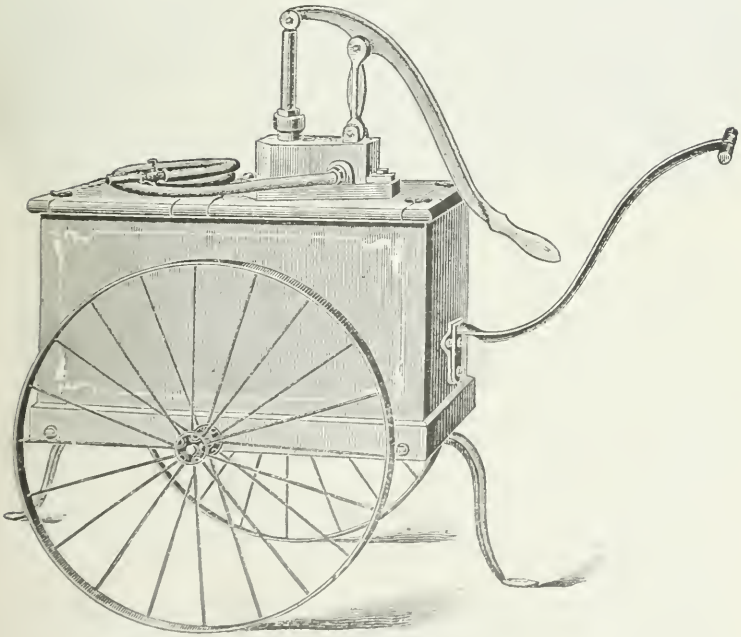
Recent years have seen an immense improvement in the means for and methods of **spraying fruit-trees**, rose-bushes, and such other cultivated plants as are liable to suffer from the attacks of insect or fungoid parasites. The old English **force-pump**, with plain jet, which showered a deluge of water in the neighbourhood of the object under treatment, with most unsatisfactory results, has given place to numerous hand-power and horse-power apparatus for delivering, not only water, but carefully prepared and scientifically proportioned solutions of materials known to destroy the pests without injuring the leaves. The great object in view is to get the solution broken up during its passage through the delivery nozzle† into an exceedingly fine spray, which envelops the entire leaf-surface—under side and upper side as well. Illustrations are given of two **hand spraying machines** — one

* Since writing the above the author has learned that the Horticultural Board has begun by securing a grant of £600 from Government, but this does not modify his opinion as to the best course to follow in a development of this kind.

† Three well-known American forms are the Cyclone Nozzle, invented by the late Professor Riley, Entomologist, U.S.A., and adapted by Vermorel to his knapsack spraying pump; M'Gowan's Nozzle, which is capable when required to do so of delivering effectively a larger quantity of solution than the former; and Nixon's Nozzle, attached to the Nixon Climax Spray Pump.



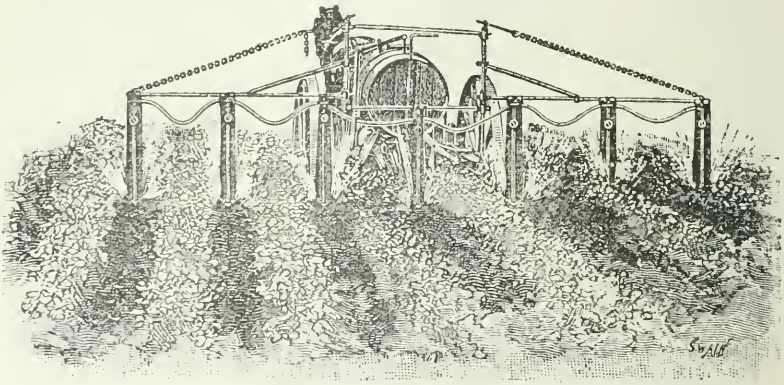
"ANTIPEST" SPRAYING MACHINE—STRAWSON.



THE PEOGE SPRAYING OUTFIT.
Agent—W. Roe, Graaff Reinet.

American and the other English—and also of the horse-power **Strawsonizer**, which has recently been prominently before the British public in connection with attempts to check the ravages of potato disease, *Phytophthora infestans.* By the use of different forms of delivery tubes, this implement can be made to spread the dressing over tall trees as well as over those of low stature.

The most recent and most useful forms of spraying machines dispense with the use of indiarubber valves and tubing, which are readily gelatinised and deprived of their natural elasticity by the ammoniacal solution of copper known as *eau celeste*, or by preparations of kerosene or paraffin oil.



THE STRAWSON HORSE-POWER STANDARD SPRAYER.

There are **two** distinctly different **sorts of insects** which are the enemies of the orchard and the greenhouse—**(1)** Those the larvæ of which chew the leaves or young shoots, such as the codlin-moth, bud-moth, cankerworm, and tent-caterpillar; and **(2)** those which live by suction on the juices of the plants infested by them, such as the numerous scale insects and plant lice. "They have the parts of the mouth consolidated and prolonged into a tube or sucker," which penetrates the vegetable tissues and reaches the sap, which the insect imbibes by means of it.

The methods by which the two different sorts of insect are attacked are as different in their aims as the insects are in their habits.

The **biting forms** of the insects can be destroyed by poisoning their food, either by vegetable or mineral poison spread over its surface. Till recent times **hellebore** powder was the great stand-by of the fruit and vegetable gardener, but now the two insoluble arsenites of copper and lime, in a very fine state of subdivision, are considered the most effective materials to use. There is little difference between them as regards results, although the copper arsenite, **Paris-green**, Schweinfurth - green, or Emerald - green, is slightly preferable to **London purple** or the arsenite of lime, as it is generally more free from soluble arsenic, which is injurious to vegetable tissue.* In the case of either salt, it is advisable to use it along with lime or added to Bordeaux mixture. By this means a base is supplied which unites with the free arsenic and renders the solution innocuous. As some of the powder is liable, when a parcel of it is opened, to fly about in the air, and to irritate the mucous membranes of the nostrils of the operator, it is well to purchase Paris-green in the form of a fine levigated paste, which when wanted can either be weighed or measured. It costs about 1s. per lb. put up in glass jars of 14 lbs. The heavy arsenic being only mixed with, and not dissolved in, the water, tends to sink to the bottom, and this necessitates constant agitation of the liquid while the dressing proceeds. A little well-boiled flour paste, being gummy, aids the water in keeping the poison in suspension.

The **sucking insects** are not injured by the poisonous dressings, which are only applied to the surfaces of the leaves, but they can be destroyed (suffocated) by closing up their breathing pores by means of a soapy or oily fluid, which on drying leaves a coating over the parts actually wetted by it.

As the **eggs** of insects are more difficult to destroy than the mature forms, it is necessary to spray a second time a week to ten days later than the first, to overwhelm the new broods which have meanwhile hatched out from the eggs which escaped the first dressing.

Spraying is not an operation which may be delayed with impunity until the insect or fungoid attack is well begun, or

* Paris-green is a double salt of arsenite and acetate of copper—an aceto-arsenite. It is not in such a fine state of division as the purple, and it is a little dearer, which are both drawbacks.

even noticed; it may then be too late to save the season's crop of fruit. It is an operation which should be carried out systematically at the proper time of year, in the same way as the good orchardist undertakes the cultivation and the manuring of his soil and the pruning of his fruit-trees. Spraying has been aptly likened to a system of **insurance**. It involves an annual tax in the form of labour spent in its accomplishment, but this, like an insurance premium, is a known and insignificant amount when compared with the total value of the property protected, and is a safeguard against disaster.

To obviate confusion, the carefully selected **formulæ for making insecticide fluids**, which have already been published by the Agriculture Department of the Cape Government, have been adopted with a few modifications.*

Paris-Green.—Strongest mixture—1 lb. to 120 gallons water. Average mixture—1 lb. to 150 gallons. Proportion not to fall below 1 lb. to 180 gallons.

London Purple.—Strongest mixture—1 lb. to 100 gallons water. Average mixture—1 lb. to 130 gallons water. Proportion not to fall below 1 lb. to 160 gallons.

The above strengths are for the first application. The second should be considerably weaker, say 1 lb. to 200 gallons, unless heavy rains have washed off much of the first deposit. Spray when the young fruit is about the size of peas, *i.e.*, as soon as the blossom is shed, and under ordinary circumstances make the second spraying a week or ten days after the first. In smaller quantities one may take as follows:—

For Apples.—1 ounce of either of the above to 12 gallons water.

For Peaches.—Paris-green for choice—1 ounce to 15 gallons water, choosing cloudy weather or late afternoons rather than hot sunny days, because of the tenderness of peach foliage.

In all cases these two arsenical powders must be kept well stirred up during the time of spraying.

These are excellently adapted to Vermorel's pump.

Paraffin Emulsion.—Craw's formula:—

Paraffin oil . .	$2\frac{1}{2}$ gallons (*i.e.*, $\frac{5}{8}$ of a tin as sold).
Common soap . .	2 lbs. (about $1\frac{1}{2}$ bars).
Water . . .	$1\frac{1}{4}$ gallon.

Cut up the soap into small bits, add it to the water, and boil till perfectly dissolved by the heat and stirring. Then beat into it the paraffin oil, little by little, using the dasher briskly. This stock will keep, and is

* Fuller information may be got in "The Spraying of Plants." By E. G. Lodeman. One of The Rural Science Series. Macmillan & Co., 1896.

used by mixing 1 gallon of it to 7 gallons of hot water, and spraying it on as hot as the hand can bear.

Paraffin Emulsion.—Hubbard's formula for orange scale:—

Paraffin oil . .	2 gallons (*i.e.*, $\frac{2}{3}$ of a tin).
Common soap . .	$\frac{1}{2}$ lb.
Water . . .	1 gallon.

The soap is to be cut up and dissolved as before, then added, boiling hot, to the paraffin with brisk agitation with the dasher. The creamy liquid then formed is diluted with nine times its bulk of water. This formula makes 3 gallons of emulsion, giving, when diluted down, 30 gallons of spraying wash. Apply on cloudy days or in the evening.

Milk Emulsion of Paraffin.—Hubbard's formula:—Equal bulks of milk and paraffin are measured off, and the former heated to the boiling-point. The two are then mixed and violently churned. After ten minutes the emulsion is formed quite suddenly, like the coming of butter, and as it cools forms an ivory-white glistening paste or jelly. If the churning has been continued long enough, the product is quite permanent when kept free from exposure to the air. It may be diluted to any extent with warm water, added gradually. One part to ten of water makes an effective wash.

The power of all petroleum hydrocarbons or their emulsions to spread filmwise over a smooth surface is the secret of the measure of success that has attended spraying for scale. They, in short, possess the power of overcoming the resistance of the ever-present film of adherent air which interposes and delays the actual contact and spread of fluids on the smooth surfaces of solid bodies. Few other fluids so readily wet the surfaces to which they are applied.

Rosin-Soap Wash.—Koebele's formula:—Rosin can be saponified just like ordinary fat if certain precautions are taken.

Caustic soda*	1 lb.
Black rosin	8 lbs.
Water	32 gallons.

The caustic soda is turned out of the tin, broken up, and dissolved in about a gallon of the water at boiling heat. Half the solution is then taken out and set aside, and the rosin is slowly added in powder to the remainder, which is boiled and stirred till complete solution is effected. Then the other half of the soda solution is added very gradually with constant stirring, and the boiling kept up until a little of the mixture is found to mix with water like milk. Any water added to keep up the bulk *must be hot*, otherwise the rosin will be thrown down, and will be very difficult to dissolve. Similarly, when the dilution to 32 gallons is effected, it must be made with hot water.

The above wash is perhaps somewhat troublesome to prepare, but Craw says of it: "When properly prepared, this remedy will be found one of the best for citrus trees, both from its effect on the tree and as an insecticide. It assimilates perfectly with water, making a milky solution

* This is sold in air-tight tins, and is quite a different thing from the Scotch soda used for washing purposes. The latter is of no use for this formula.

that will adhere to both the foliage and the wood, forming a thin varnish-like covering that completely excludes air from the scale insects and suffocates them. For the fluffy insects (*Dorthesia* and *Dactylopius*, or mealy-bug) it has proved the most penetrating of all washes, sealing up the eggs in a mass and preventing them from hatching. As far as my experience goes, we have no wash that is equally effective upon such scales as are located on the fruit itself. In the case of most other washes, the oil in the rind of the orange and lemon appears to prevent the adhesion of the wash to the surface."

The formula has been varied for use on the larger scale, thus :—

Caustic soda	6 lbs.
Black rosin	20 lbs.
Fish oil	3 lbs.

Water to make ultimately 100 gallons.

Twenty gallons of the water are brought to the boiling heat, and the soda then dissolved in it. The oil and powdered rosin are next added slowly, with constant stirring to mix and prevent burning, and the boiling continued for at least three hours. Hot water is then added up to 50 gallons, a little at a time. This mixture may then be run into a 100 gallon tank, and diluted to make up the full amount. No cold water must be added during the boiling, otherwise the rosin will precipitate.

Lime and Sulphur Wash.—This is something like the common sheep dip, and is effective both for insects and fungi. The effectiveness of it depends a good deal on the quality of the lime.

Unslaked lime	40 lbs.
Sulphur	20 lbs.
Common salt	15 lbs.

Water ultimately to 60 gallons.

Ten lbs. of lime and the 20 lbs. of sulphur are boiled briskly in 20 gallons of the water for at least an hour and a half. By that time the sulphur will be dissolved, and the solution will have a brownish-amber colour. Thirty pounds of lime are put into a cask, and on it enough water to slake it and dissolve the salt which is then added. This mixture is run into the boiler with the dissolved sulphur, and boiled for half an hour, adding sufficient water ultimately to make up the 60 gallons. The solution should be strained through a fine brass sieve, and be stirred when in use. It should also be kept covered up from the air, if not all used at once. There is a good deal of wear and tear of the brass nozzles with this wash, from the friction of the particles of lime.

Fungicide Spraying Formulæ.—There are only four mixtures which with small variations are the proper remedies against fungous parasites, and they all depend on the destructive power of salts of copper. The following are taken from the U.S.A. Departmental Farmers' Bulletin, No. 7 (1892).

Bordeaux Mixture, or *Bouillie Bordelaise*.—In a barrel of 45 gallons capacity dissolve 6 lbs. of best copper sulphate (blue-stone) in about 10 gallons of water, by placing the salt in a gunny-bag suspended just under the surface. This is better than using hot water boiled in an iron

vessel, for the iron inevitably brought away as rust alters the copper salt. In another tub slake 4 lbs. of quicklime, and add enough water to make a creamy whitewash. Put a fine sieve or a gunny-bag over the copper sulphate solution, and pour the lime-milk slowly in, stirring with a dasher. Then fill up to 45 gallons, churn it up well, and it is ready for the spray pump. If the copper sulphate be powdered, it will dissolve more rapidly. The lime must be of the very best, and fresh, to ensure which one should get it in the "quick" form and slake it for oneself. Note that the older formula for this mixture made it 50 per cent. stronger, but experiments have shown that results from the proportions given here were quite equal to those from the higher strength.

If required frequently it is an advantage to prepare **stock solutions** for the Bordeaux mixture, rather than to make it each time it is used. Fifty pounds of sulphate of copper can be kept dissolved in 50 gallons of water, so that its strength is known; and, by covering to prevent evaporation and chemical change, the lime can be kept preserved in the creamy condition, ready to be stirred and mixed with the copper solution, which should first be made up with sufficient additional water to satisfy the formula. No mistake must be made by way of adding too little lime, as a slight excess of lime is a guarantee of the safety of the mixture.

A still more simple method is to use "**Strawsonite,**" put up in bags of 10, 20, 40, and 112 lbs., and costing respectively 3s. 6d., 6s. 8d., 13s., and 36s. each. A measure dish with directions is placed in the mouth of each bag. The danger of making a mistake is thereby reduced to a minimum, as all the work necessary is to measure out the Strawsonite, mix it with water, and pour it through the strainer before introducing it into the spraying apparatus.

Copper Ammonia Carbonate.—Dissolve 3 lbs. copper sulphate in 2 gallons of hot water. Similarly dissolve 3½ lbs. of washing soda in 1 gallon of water. Pour the soda solution slowly into the first, and when all action has ceased, bring up the whole to 10 gallons, and stir thoroughly. Pour away the clear water when the sediment has quite settled. Pour on fresh water and stir up again. This is done three times in all, till the blue sediment, which is copper carbonate, is quite washed, and the clear water has no salt taste. You will then have about 1½ lbs. of copper carbonate in a paste. Dissolve it in 2 gallons of ammonia, or less if the sample you get is strong enough to dissolve all. The solution is then stored in well-corked bottles, and when wanted 1 pint is diluted down with 12 gallons of water for spraying.*

Eau Celeste.—Dissolve 2 lbs copper sulphate in 8 gallons of water. When solution is complete, add 3 pints of strong ammonia, and subsequently water to make up 45 gallons.

Modified Eau Celeste.—Dissolve 4 lbs. copper sulphate in 12 gallons of water, and stir in 5 lbs. of washing soda in powder till dissolved, to

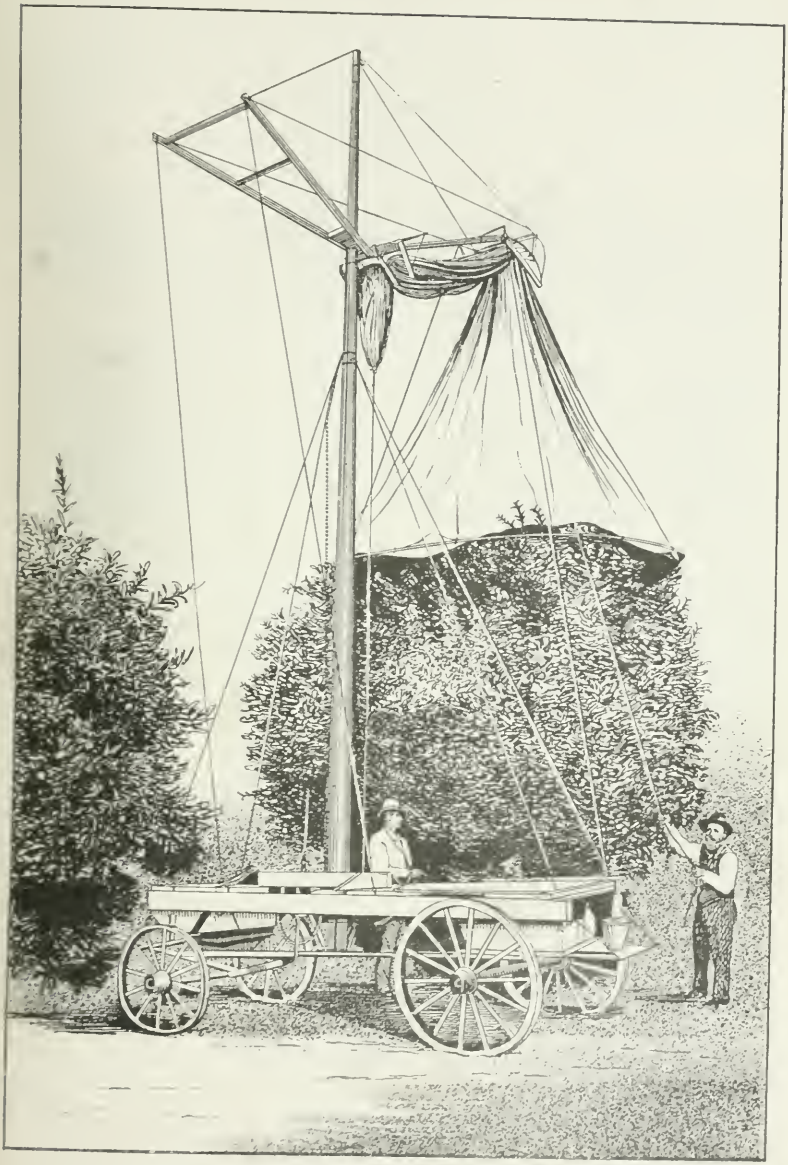
* Note that all ammonia solutions must be kept in a cool place. If they are exposed to heat—as, for instance, being set out in the sun—the escape of ammonia may drive the stopper out, or even burst the bottle.

precipitate the copper as green carbonate. Then add 3 pints strong ammonia, and dilute to 45 gallons This is a rather slovenly formula, and the sulphate of soda formed in the reaction is not an advantage.

These copper solutions are designed to kill the fungi of the potato disease, and those that produce the apple scab, the pear scab, pear cracking, and pear-leaf blight—classified as *Fusicladium* and *Entomosporium*.

In every case, the operator must bear in mind two things besides the killing the insects or the fungi. First, with the arsenious and copper washes, he must be particularly careful that the poisonous spray does not accidentally get carried over himself or his assistants; with the others the spray is not poisonous, but is offensive. Secondly, on finishing work the spray pump must be scrupulously cleaned by pumping fresh water through it—the suction and delivery hose unscrewed and drained, and the last contents of the pump got rid of by lifting the valve with the finger. Then, after drying the pump as far as possible, it is to be carefully oiled, and the plunger worked a little, so as to spread the lubricant over it. Neatsfoot oil is the best, paraffin oil next, vegetable oils the worst.

Within the decade gas has been shown to be the most effective means for the destruction of scale insects on citrus fruit-trees. Paraffin emulsions and rosin-soap solutions, especially when combined with arsenic, have been used with a considerable measure of success in the destruction of scale insects on orange-trees in America; but however well the work may be executed, a few of the insects or their eggs are sure to escape even repeated sprayings, and lead to renewed outbreaks of the pest at a later period. A most effective and complete remedy has been found in the use of hydrocyanic acid gas, or hydric cyanide, prussic acid—one of the most poisonous bodies known to chemistry. This fact necessitates great care in handling it, not only to prevent injury to the tree, but on account of the possible injury to the operator. The gas is readily made by the action of sulphuric acid upon potassium cyanide; and the proper means of using it to accomplish the desired effect upon the insects without injuring the foliage have been demonstrated by Professor D. W. Coquillett. Two dangers require to be avoided. (1.) The gas must be used dry, a condition which can be secured by passing it over strong sulphuric acid, or some other drying material, such as slaked lime or calcium chloride, contained in one of the two chambers of the leaden generating apparatus. If this is not attended to, and vapour permitted to rise with the gas and settle on the leaves, the moisture attracts and dissolves a



THE WOLESKIL' FUMIGATOR.

portion of the gas, which in that condition is most injurious to vegetation. (2.) The second danger, although not so serious in its consequences as the first, consists in a certain amount of the fine particles of the cyanide being carried up and lodged upon the leaves, when acid is applied directly to the dry pulverised cyanide. In the proper method of preparation—

"The cyanide is dissolved by boiling in water for a few minutes, taking 1 gallon for 5 lbs. weight. For every ounce of this solution use half a fluid ounce of sulphuric acid. It should flow into the cyanide in a very fine stream. The action is violent, and the gas comes off in the form of a dense white fog, resembling smoke. After passing through the drier or purifier, it becomes transparent and as invisible as air."

The poisonous gas is confined and diffused through the tree being operated upon, so that it envelops the scale insects, by letting down to cover the tree a gas-tight tent of thin oiled ticking, which is made fast round the edge, touching the ground by an upcast of earth. The gas is introduced by means of a hose-pipe let through the tent by an indiarubber mouth sewed into its side. Of many forms of simple and complicated apparatus for adjusting the tent over the tree, the Wolfskill has been selected to represent a successful mechanism for the purpose when large trees require to be treated. The smaller the tree, the more simple does the apparatus and also the operation become.

CHAPTER XI.

OSTRICHES AND OSTRICH FARMING.

Genera of Struthious Birds: Ostrich, Emu, Cassowary, and Rhea—Natural Habitat of the Ostrich—Introduction of Ostrich Farming—Parts most Suitable—Artificial Food—Water Supply—Fences—Area required per Bird—Jumping Powers—Richard Gavin's Farm—Numbers of Eggs—Incubation—The Nest—Danger of Birds Kicking—Distinguishing Characteristics of Birds of Different Ages—Health of Ostriches—Internal and External Parasites—Dipping—Sulphur taken Internally—Plucking the Feathers—Profits and Prices of Birds—Improvement by Selection—Points—Sorting of Feathers—Marketing—Numbers and Position of Ostriches in the Colony—Weights and Values of Feathers Exported—Value per lb. of Ostrich Feathers in Quinquennial Periods since 1850—The Home Market—The Plucking of Live Geese.

THE **African and Arabian ostrich**, *Struthio camelus*, is by far the most valuable species of the four genera of the struthious or running birds forming the sub-class *Ratitæ*. All have three toes, except the true ostrich, which possesses only two—a large central and a small exterior lateral one.

The **emu**, *Dromæus* (in two species), the purely Australian representative of the sub-class, is covered, male and female alike, with brown hair-like feathers. The feathers are not sent as such to the London market, but emu **skins** come, a few hundreds at a time, and sell at 3s., 5s., and 6s. each, and are utilised in the making up of many fancy-feather patterns.

The **cassowary**, *Casuarius*, of which there are no less than nine species, is found in the north of Australia, the Malay Archipelago, and the islands of the South Pacific. It most resembles the emu in its plumage and size, and stands about 5 feet high. It is entirely without wings, and possesses a large horny, brightly-coloured helmet on its head. A number of the species have wattles hanging from the neck.

The **rhea**, or **nandu**, of South America, possessing three species, is covered with feathers similar to the chicken feathers of the African ostrich, but the tail is absent.

The **ostrich**, like the other species of the tribe, possesses only rudimentary **wings**, and is incapable of flight, but the great speed and staying power of the bird in running render this form of progression unnecessary in its case. The wings, in addition to being ornamental to a degree, are useful to the bird in turning, and while practising the gyrations for which it is distinguished. The **breast** is rounded and full, and not of the narrow, keel-like form that prevails among birds which fly; and the **barbs** of the **feathers** are equally balanced on the two sides of the quill. The ostrich is nearly double the **weight** of any of the other three genera named. Its **head** and neck are bare of feathers, and in its natural state it is extremely shy. Although the proportion by weight of its brain to its body is remarkably small, yet it is not the stupid bird which it is generally supposed to be. Its **natural habitat** is the desert or semi-desert Karoo, to which, when left by man to its own devices, it had retired for safety from the numerous enemies which beset it in the more productive parts of the continent.

Although **ostrich farming** is a large and important industry in Cape Colony, its introduction is of comparatively recent date. It was long believed impossible to tame the ostrich, and that if individual specimens were tamed, they would not breed in captivity. The first official record of domesticated ostriches being farmed occurs in 1865, when eighty were entered in the annual returns of live stock, and the yield of feathers from them at 120 lbs. Between 1857 and 1864 encouraging experiments had been made in capturing and taming wild ostrich chicks, but it was not until Arthur Douglass of Heatherton Towers, in the Albany district, had in 1869 perfected and made known an **incubator** for artificially hatching large numbers of eggs, that ostrich farming extended generally, and the birds became thoroughly domesticated through constant association with the attendants required in the work of **artificial rearing**. Even now, when birds are permitted to hatch their eggs, the chicks require to be brought to the homestead on the third day, and a Kaffir boy must during daytime be in constant attendance upon the young brood, else they grow up wild, and remain unmanageable, and consequently valueless, unless for shooting like wild birds for

the plumage of a single season. Since the decline in value of ostrich feathers, which has taken place in common with the decline in the general level of prices of commodities in other parts of the world, and the consequent narrowing of the margin of profits accruing to the ostrich farmer, artificial incubation has gone out of fashion. It is also thought that, owing to the ample measure of exercise which the old birds give their young, and that with liver disease and so many parasites about, it is safer to adopt the natural method of rearing.

Ostriches **do not thrive** well under conditions of extreme cold or of heavy rainfall, and even on land suitable to them they soon do badly if overcrowded. On grass of strong growth, particularly that close to the coast-line on the sour veld where it becomes hard and indigestible, ostriches are not so successful as when fed on sweet Karoo bushes, although there are few parts in the Colony where they cannot be kept. One advantage which a dusty bush country possesses over a grass country lies in the feathers being preserved in better condition where the birds can take a dust bath than where they roll about in early morning on the dewy grass.

They are fond of all sorts of bushes which sheep eat, and when the country is devastated by swarms of locusts, ostriches, like most animals, consume locusts, but they are not, as a rule, insect feeders. They do not suffer from the attacks of **ticks** so much as four-footed animals, for they remove them from all parts of the body, which they can reach with their bills, leaving only the head, upper neck, and under the thigh assailable.

There is **no contagious disease** from which ostriches suffer, and the heart-water of sheep, or the various common bovine diseases, are unknown among them, although, as will be explained later, they are most susceptible, especially when young, to the attacks of **internal parasites**. These they pick up with their food from the veld, or take in with impure drinking water. Since ostriches have increased in numbers, certain worm parasites have spread to districts in which they were formerly unknown.

Young chicks feed at first on the solid excrement of the old birds, and they thrive particularly well when they have access to the residential quarters of the Kaffir population.

To supply a sufficient amount of bone-earth to satisfy the demands made on the system for material to form the skeleton, it is necessary in many parts of the Colony where phosphate of lime is deficient in the soil, to provide broken bones for the consumption of the birds, and on sour veld salt should also be given.

Ostriches do well when permitted to run over arable fields while out of cultivation, as they are fond of the numerous succulent weeds that are found in such places. Like pigs, they are particularly fond of arum lilies, which grow in great profusion in some parts of the Colony. Young birds are sometimes poisoned by eating "stink kruid," but old ones are more wary, and avoid it. Ostriches of any age will eat pumpkin pips, which, when taken in quantity, paralyse the limbs for a time.

During prolonged periods of **drought**, when the natural food becomes exhausted, it is necessary to supply the whole stock with some form of **succulent food** to prevent them dying of starvation, or suffering from stop-sickness or constipation. The power of digestion of an ostrich is proverbial, even to the digestion of horse nails and pieces of wood, but this vigour need not be looked for unless the bird be in good health and living on suitable food.

The succulent branches of the prickly pear or the leaves of the American aloe (agave), chopped into small pieces, serve the purpose admirably, and birds can be successfully carried through a period of scarcity on this food, supplemented by an allowance of 1 lb. of mealies daily. In the drought of 1895 some large owners (of 2,000 birds) were said to lose about one-fourth of the number, owing to their not making provision for feeding in good time. Ostriches are much like sheep in the matter of acquiring a taste for certain foods, and in refusing, when in very poor condition, to eat even good food with which they are not familiar. An ostrich which has been accustomed to live exclusively upon lucerne will die of starvation in a camp where spek-boom is abundant, although naturally the rounded succulent leaves of this bush are highly prized by ostriches reared on the veld.

In those districts where **lucerne** is extensively grown under irrigation, the ostrich farmer is independent of difficulties aris-

PLATE 36.—OSTRICH CAMP, HEN AND NEST, IN THE KAROO

Face page 223.

ing from climatic irregularities. Two hens and a cock can be kept during summer in a lucerne camp of less than half an acre, and are not able to consume the whole produce.

Ostriches thrive admirably on green lucerne during the growing season, and in winter time on lucerne hay cut into short lengths, and well wetted the day before it is to be consumed. A daily allowance of 3½ lbs. of hay, when birds are running on bare veld, will keep them in good condition. Oat hay treated similarly is found to be constipating, but this defect would be easily remedied by showering the hay-chaff with treacle water from a rose can—a dressing which would also make the hay more palatable. Birds fed during a period of drought are liable to injure their feathers by rushing against each other. Chick ostriches at all times, and old birds when on dry food, require to be supplied with water; but the latter do not absolutely need to drink if they be feeding on green herbage. There ought to be no muddy dams in an ostrich camp, as the birds get into them in hot weather to roll, and thus destroy their feathers.

Ostriches require to be **enclosed in camps**, and consequently the development of the ostrich industry led to the fencing of large areas of the Colony, and, returns from feathers, eggs, and birds sold being good, it also supplied the funds necessary to meet the outlay. Wire **fences** form by far the most available means to this desirable end, although, owing to their invisible nature, they are a serious source of danger to birds, until they become accustomed to them. A single wire fence of four or five wires (galvanised, in preference to annealed, so that they may be the more readily seen), 5 feet high, serves the purpose well, when birds are in camps on the veld, as the cocks soon find out which one is master, and the weaker ones keep out of his reach; but where birds are kept on lucerne on areas of less than an acre, it is necessary to place two fences a few feet apart from each other to divide the camps, so that the birds cannot get at each other.

On good Karoo-bush veld one bird should not be allowed less than 15 acres. **Camps** of 30 acres, or even 40 acres, for the accommodation of a pair of breeding birds, do very well, and it is most advantageous both to the veld and to the

ostriches if some other description of stock be pastured in alternate years. The bushes which ostriches eat closely then get a chance of growing, and cattle, sheep, and goats keep down other bushes that tend to grow too rank. Moreover, some of the parasites which attack ostriches disappear, or become reduced in numbers, during the period that the birds are on other veld. Cattle do well when pastured throughout the season on the same veld with ostriches, but under similar circumstances sheep and goats thrive badly. Although it is a common practice to place two hens with one cock, it is best to have only **a pair** of birds together, if the cock be quiet. If he teases the hen mercilessly it is necessary to give him two, or even three, hens, to divide his attention, and prevent him actually killing the one.

The idea which generally prevailed, only a few years ago, in this country, that anything in the shape of a fence, even a low bank, would turn an ostrich, not that it could not get over it, but that it would not attempt to do so, is quite erroneous. The author was shown at Richard Gavin's farm, near Oudtshoorn, the scene of two **marvellous jumps** made by birds from a kraal where they were being plucked. One was a standing jump made by a young cock under two years old. The distance was 5½ feet over a wire fence 4½ feet high. The other was a running jump made by an old cock over a 6-foot clay wall. The toe of one foot rested on the top of the wall, and the toe of the other about 9 inches down on the side from which he sprang. The usual way for a bird to get over a wall, if he be in no great haste, is to breast it and roll over.

On **Gavin's farm** of 200 acres, the wonderful results which can be achieved by growing **lucerne** under irrigation were amply illustrated. Ostriches formed the main permanent stock, and numbered 550. During the season previous to the author's visit, in addition to the birds, 117 oxen had been bought in, fattened, and sold off, between the 1st of August and the middle of the following June; and 50 sheep, 15 young cattle, and 10 horses had been kept all the year round. The produce of the farm included 40 tons of hay, or sufficient to feed the ostriches for about fifty days during winter, before the lucerne begins to grow.

The hen ostrich lays from 12 to 17 eggs of a yellowish-white colour, weighing, on an average, about 3 lbs. each. When two or three dummy eggs are left in the nest, and the real eggs are regularly removed, a hen will lay as many as thirty before stopping. When more than one hen claims the same nest, and laying continues after one pair of birds has begun to sit, the eggs belonging to the setting are marked, so that newly-laid eggs may be recognised, and removed before they begin to hatch. Although elliptical, they are more rounded than a hen's egg. The period of **incubation** is six weeks, and the hen sits during the day, while the cock remains on guard in the vicinity, and takes her place at night. Some birds remain off the eggs only for a few minutes, while others will leave them to cool for an hour or more. At times the cock drives back the hen somewhat roughly to her domestic duties when it appears to him that she has been too long away. The eggs may become quite cold to the touch, and not suffer in consequence, and when birds are not molested they usually bring out a chick for each egg, chipping the hard shells with their beaks at the proper time, to liberate those that have difficulty in escaping.

In well-managed camps, a proper place is prepared for the **nest**, after three or four eggs have been laid, by digging a hole 6 feet wide by 2 feet deep beside the original nest, and filling it with gravel, to secure drainage in the event of heavy rains occurring while the birds are sitting. After the birds become familiar with the alterations, the eggs are moved on to the place prepared for them. Birds that are well fed and attended to may have as many as three nests in one year; and two nests are quite common. The breeding season for ordinary stock is from the end of May till September.

To ensure the safety of the young chicks from **jackals** and **wild cats**, which are still numerous in certain parts of the Colony, meat, in which strychnine has been inserted, is left about on the veld to poison them.

After the hen commences to lay, the **cock bird** becomes **unsafe** to approach, unless one be armed with a long thorny mimosa branch, which, on being held out in the line of his eyes, will stop the charge of the most savage bird. The ostrich **kicks** forward and downward—in short, with his great

toes he attempts to rip open his opponent, after the fashion of an "old man" kangaroo defending himself against a dog. There is little chance when attacked of taking safety in flight if the shelter of a bush close at hand cannot be gained. A man well mounted on horseback can be easily overtaken, and instances have been recorded of old cocks kicking so high, and with such effect, as to break a man's thigh and the ribs of the horse underneath him with one blow. The only chance of escape when overtaken in the open without any suitable means of defence is to lie down flat, and even then some birds can administer a kick as they pass over a person. In such a case the bird is most likely to lie down and roll on the top of his victim, and no one need expect to escape without a thorough bruising. When caught by the neck an ostrich becomes helpless and amenable to treatment, but it is no easy matter to reach the neck of a bird actively engaged in an attack, and ready to kick the moment one rises from the horizontal position. When a person gets close to the nest, the bird seems to be afraid of injuring the eggs, and will not venture an attack, but as soon as retreat is begun one may expect to be followed.

The **hen**, which throughout the early period of hatching remained quite harmless and safe to approach, becomes even more savage than the cock as soon as she hears the chicks chirp in the shell. Ostriches are encouraged to attack people, in fact, tempted to do so, by men approaching them without suitable means of defence, and then having to run for a fence or dodge behind a bush. If ostriches are accustomed to turn for a thorn bush, they will almost invariably do so when a walking stick is held up, although it would be of little value in the case of a genuine charge.

Ostriches are spoken of as **chicks** as long as they retain their first feathers, *i.e.*, up to seven or eight months old. After this, till they are twelve months old, they are designated **young birds**. They are **plucking or feather birds** from one till they are four years old, and then they become four- or five-year-old birds. At **four years old** they come to maturity, and are camped off for breeding. The **distinguishing characteristics** of the different **ages**, which, however, do not follow an absolute rule in all birds, are given by Douglass as follows:—

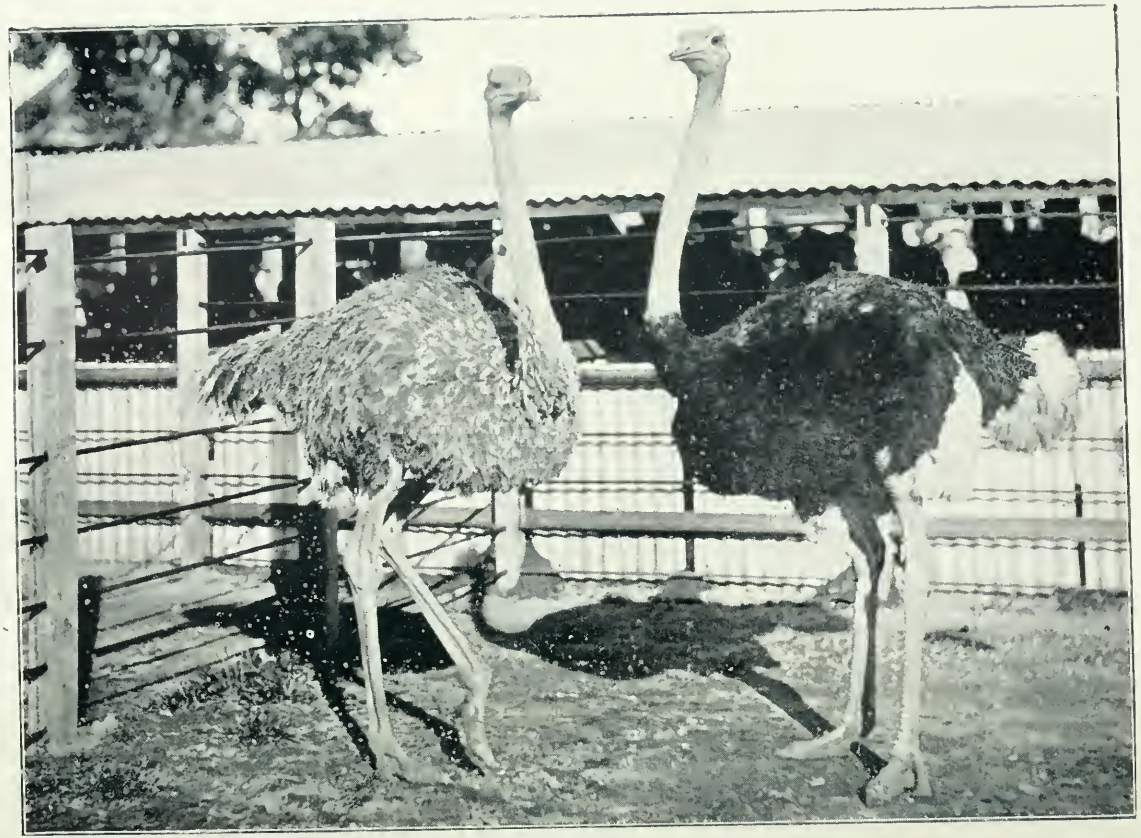


Photo. by F. W. Hepburn.

PLATE 37.—PRIZE COCK AND HEN OSTRICHES.
Bred by A. DOUGLASS, M.L.A., Heatherton Towers, Grahamstown.

Face page 227.

At **six and a half months old** the quill feathers will be ready to cut; some of the body feathers will have begun to change; some of the cocks will show yellow in the front of the legs.

At **a year old** the second growth of quill feathers should be showing; some of the cocks should begin to show black feathers; all cocks should show white on legs and bill.

At **two years old** all the chicken feathers should have gone from the back, and the cocks should show quite black, or nearly so. Most of the little white belly feathers should have been replaced by blacks or drabs, according to sex. [Exclusive of the white plumes, **black is the mature colour of the male**, and **drab** or dark grey that **of the female** and young male.]

At **three years old** there should not be a single chicken feather to be found on the body; the last place from which they disappear is where the neck joins the body. Every vestige of the white belly feathers has gone. The bird's plumage has reached perfection; some of the cocks will be red in front of the leg and on the bill.

At **four years old** the birds have reached maturity and the breeding organs are fully developed; the cocks in season will have the back sinews of the leg pink, the front of the leg and the bill scarlet, and much of the fineness of the feet, the leg, and the lines of the body will have gone.

At **five years old** and upwards the only distinguishing marks we know are a generally coarser look of the limbs and body, and an increased coarseness of the scaling in front of the legs and feet.*

The ostrich is generally supposed to **live** for **a very long time**, even a hundred years has been mentioned; but the industry in South Africa has not been long enough in existence to furnish reliable data. The author saw one bird which was over twenty years of age, and which showed no signs of failing strength or vigour.

Old birds are **hardy** and healthy when properly attended to, but there is great **mortality** among young birds. Until they pass three years of age they suffer much from **internal parasites**, especially during periods of scarcity of food.

Tape-worms of several species, but most frequently the broad one, are almost universally present in young birds of two and a half to three months old and upwards. They may be kept under control by the administration every three weeks of ½ oz. to 1½ oz. of turpentine, according to the size of the

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* "Ostrich Farming in South Africa," by Arthur Douglass (Cassell, Petter, Galpin, & Co., London, Paris, and New York), to which interesting publication the present writer acknowledges indebtedness, as well as to a visit to its author's property, Heatherton Towers, and lengthened discussions on ostriches and their management with his sons.

birds, while they are between the ages of four months and fourteen months; but it is now impossible to stamp out the pest, as knorhaans, paauws, guinea-fowls, and domesticated fowls are all liable to the attack, and have spread tapeworms everywhere. The worms are located in the small **intestines**, and are often present in large numbers. When ostriches come to maturity the worms generally disappear. Their presence is indicated by the feathers not lying as closely as they ought to do when birds are thriving, and the skin losing the greenish-yellow tint due to a thin layer of fat immediately under it, and indicative of high condition.

Another injurious **parasite** is the *Strongylus douglassii*, a minute, white, round worm, not more than a fourth of an inch long when full grown, which buries its head in the mucous membrane of the stomach and produces irritation and redness of the parts affected. The lowering of the digestive functions which follows leads to the bird's death from extreme poverty. The moving worm is easily detected if a piece of the stomach be held up to strong sunlight. It has thus been identified in chicks of six weeks old.

No means have yet been found by which the worms can be killed, but a few doses of turpentine and extract of male fern will relieve the bird from the reducing influence of tape-worm, and by liberal feeding its system may be built up so that the injury done by the strongylus can be reduced to a minimum.

A **swamp** in the neighbourhood of an ostrich camp is ruinous to the industry, as **mosquitoes** breed in large numbers in such places, and the birds pull their feathers to pieces in trying to defend themselves against their attack.

A disease known as **yellow liver** carries off many young birds of one or two months old. It generally occurs on land which has been long stocked with ostriches. A change of pasture, liberal feeding, and careful treatment seem to be the most that can be done when an outbreak occurs, yet it must be admitted that little is known of the nature or cause of the complaint. It is thought by some to be due to the **poisonous** influences of a **louse,** with a blue body and red legs, which adheres to the body of the bird, and takes shelter in its ears. This is a belief similar to one which is held in some districts of this country, viz., that in some way or

another the worms which produce gapes in chickens are intimately associated with **ticks** which fasten themselves to the combs of barndoor fowls. With the important association before us of ticks with Texas fever, it would be short-sighted to disregard such beliefs until it has been demonstrated that they are unfounded.

When birds get **down in condition, lice** are liable to become **numerous** among the feathers. They may be kept in check by providing dust-baths in which sulphur has been mixed, or by **dipping** with sulphur and lime. This is a practice which has come in recently, with the object of checking another external pest, the **ostrich fly**, *Hippobosca struthionis*, A. E. Janson, which strongly resembles the **tsetse fly**, *Glossina morsitans*, only the former is smaller, darker, and the more wary of the two. On lifting the wing of a bird five or six hundred of these may be seen to fly off. It is only recently that they have been introduced into the Eastern Province, where they are now universal. They came from the north by way of Colesberg, and are most detrimental to the interests of the ostrich farmer, on account of the injury they do, especially to old birds sitting on eggs, by unsettling them.

Dipping is done with birds of all ages in a tank 7 feet deep and 40 feet long, so that they must swim. The best time for the work is immediately after plucking. The materials used are sulphur and lime, 1 lb. of each, being well mixed and boiled with water, for every 6 gallons of solution. The bath should be used at a temperature of 90 to 100° F., immediately after being prepared, and when quite clear, so that no injury can result to the feathers. The smell of the sulphur remains for months on the feathers, and keeps the flies from settling on the birds. Flowers of sulphur administered internally, in doses of a table-spoonful daily for a week, and every alternate day thereafter for a time, has been found valuable as a protection against both internal and external parasites.

Great care is necessary while lowering a bird into the dipping tank not to rub the scales from the hocks or legs, because any **injury** to these parts is liable to be followed by acute inflammation, and the death of the bird. Skin or flesh **wounds** on the body of an ostrich are easily healed, but any accident to the limbs is generally fatal.

Plucking the feathers of birds that run on natural veld is done for the first time when the bird is about seven months old, by clipping the quills when these have become dry, so that no blood will come, and at the same time the tail feathers and drabs, two rows of body feathers from the upper side of the wing, and two rows below it, termed "önder-baatje,"* are pulled. Two months later, the stumps, then quite ripe for removal, **are drawn** by means of small forceps. Six months after the first drawing of stumps the second plucking takes place, followed by stump-extracting at the end of eight months,

PLUCKING AN OSTRICH COCK WITH A BAG OR HOOD OVER HIS HEAD TO KEEP HIM QUIET.

and so on, a crop of feathers being secured every eight months, or three crops in two years. The **relative values** of the pluckings are as follows, although the actual figures fluctuate with the prices in the market. If the first crop be worth 4s. to 6s., the second will fetch 15s. to 20s., the third £1. 5s. to £2, and the fourth, which is the most valuable of all, £3. 10s. to £4. When the author landed in the Colony, the **return** from a **troop** of ostriches kept naturally on the veld was generally estimated at about £2. 10s. per plucking; but owing to the rise

* The under-coat or waistcoat.

in the price of feathers before his departure from the Colony, £3. 10s. had been touched. When birds are **fed on rich food,** as on lucerne, a crop of feathers may be got in seven months. Cutting of both the tail and quill feathers is done at six months, and the stumps and short feathers are removed a month later. The high feeding tends to make the quills stronger, and as regards the finest plumes not worth so much per pound, but the quantity of produce is greater, and the total value per bird more. At Oudtshoorn 2 lbs. of blacks and drabs may be got from one plucking, while in the Eastern Province, where the system of management is not so intensive, the weight might probably not exceed 1¼ lbs. from a bird.

At **Graaff Reinet** it was reported that the practice is to take only one crop of feathers in the year, the stumps being left for six months to give the bird a rest from feather production. This course is also followed by some farmers in the case of show birds, so that greater length and luxuriance of plumage, like that found on wild birds, may be secured.

The **profits** from ostrich farming, even in the early part of 1895, were more remunerative than in the case of sheep-farming, considering the capital invested. A troop of ostriches such as one would see on an ordinary farm would then be worth probably £5 each all over. At one time **prices** were very different. Richard Gavin on one occasion sold twenty birds at £17. 10s. each. Eggs were worth £10 each, and a six weeks old bird was worth from £15 up to £30. These figures relate to the ordinary stock of a farm, not to specially selected fancy birds, the price of which at times went up to £1,000.

Much can be done by way of **improving** the quality of a breeding stock of birds **by careful selection** of those of best form which produce the finest quality of feathers, and by discarding those that are inferior in those respects. At one time there was a run upon light-coloured hens, which possessed more white feathers than dark hens, without sufficient care being bestowed in selecting for quality of feather. It is now found that dark hens of good feather exercise a beneficial influence upon their cock progeny, and quality has consequently taken precedence of lightness of colour. The cock must be depended upon to produce the best **white plumes**, as

the gloss of the female feathers is not so good. It is also important to select birds descended from parents which have been successful breeders. Douglass says, in writing of the **points to take** into consideration: "They should have a well-developed, muscular frame, large feet, thick powerful-looking legs, with great depth of girth, and a prominent bold eye. On no account have anything to do with a herring-gutted, fly-away looking bird. A bird, if in good condition, should be broad across the back, with a furrow running down the middle. The tamer and more domesticated they are the better, but by tameness is not meant want of pugnacity. The body feathers should be curly, rich in colour, with a shiny gloss on them. The great complaint against Cape feathers is a want of fulness, closeness, and breadth of fluff of the lower part, as well as a want of width at the crown." These defects can no doubt be got rid of by careful breeding, as many parcels of **Cape feathers** can compare favourably with the best **Barbary feathers**.

Feathers require to be **sorted** with infinite care into bundles, which are mostly sold by auction—Port Elizabeth and Grahamstown being the great markets for the Eastern Province. Reference has formerly been made to the part played by **Jews** in Oudtshoorn district. The system of selling the feathers on the birds before plucking-time, apart from the objections already pointed out, leads to careless management and less careful handling of the birds in plucking.

The **ostriches in the Colony**, by the returns taken 31st May 1895, number 253,463—an increase of over 21,000 within two years. Ostrich farming in South Africa is nearly all confined to Cape Colony. The **chief ostrich farming divisional areas** are mentioned in the order of their importance, with the number of birds stated in each case:—

Division.	No. of Birds.	Division.	No. of Birds.
Oudtshoorn . . .	54,663	Willowmore . . .	10,820
Albany	17,190	Graaff Reinet . .	10,283
Somerset East . .	16,745	Cradock . . .	9,298
Uitenhage . . .	12,650	Bedford . . .	6,082

Oudtshoorn is indebted for the premier position, with more than three times the number of birds possessed by any other division in the Colony, to the success of the cultivation of lucerne under irrigation.

The Edinburgh Geographical Institute
J G Bartholomew

The **subjoined table**, extracted from the **Statistical Register** of Cape Colony, shows the amounts of **feathers exported** and the declared **value** in alternate years :—

Year.	Weight in lbs.	Declared Value.
1882*	253,954	£1,093,989
1884	232,411	966,479
1886	288,568	546,230
1888	259,967	347,992
1890	212,276	563,948
1892	257,027	517,009
1894	350,404	477,414
1895	353,626	527,742

The next table † shows the **value** per lb. of **ostrich feathers exported** from the Cape, given in quinquennial periods. All kinds of ostrich feathers, including "Dark Chicks," worth 2s. per lb., and "Prime Whites," worth many pounds sterling per lb., are included, so the figures are only valuable as guides to the **relative values** from year to year :—

Year.	Average per lb.	Year.	Average per lb.
1850	£3 13 0	1875	£6 3 0
1855	6 0 0	1880	5 8 0
1860	8 8 0	1885	2 6 8
1865	3 14 0	1890	2 13 1½
1870	3 1 0	1894	1 7 3

The **London Feather Auction Sales** take place bi-monthly, and usually last three or four days, **buyers** from Germany, France, and America entering into competition with those in the home trade. The **dates** at which the six sales were held in 1895 were—4th February, 1st April, 10th June, 12th August, 7th October, and 9th December.

A **price list** of one of the leading firms of sworn brokers on the London market has been reproduced below, with the object of introducing the reader to the phraseology of the London feather trade, and of giving some idea of the numerous classes into which ostrich feathers are sorted to attract different buyers; as well as of showing the relative values per lb. of feathers of different descriptions.

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* This was the year of the highest prices, and also the year which reached the highest record value in total.

† Taken from the chapter on "Ostrich Farming" in the Official Handbook of the Cape and South Africa, but brought down to date.

Current prices of ostrich feathers, from Cape, Natal, &c. [a few days after the author's return to London], 10th October 1895:—

	Prices per lb. Oct. 1895.	Prices per lb Dec. 1894.
White primes and bloods, superior cut or light quills	£6 10 0 to £9 10 0	£8 0 0 to £10 0 0
Do. 1sts	5 0 0 „ 6 10 0	5 0 0 „ 7 10 0
Do. 2nds	4 0 0 „ 5 10 0	3 10 0 „ 5 0 0
Do. 3rds	2 0 0 „ 5 0 0	2 0 0 „ 3 10 0
Do. stalky and inferior	1 10 0 „ 2 0 0	1 10 0 „ 2 0 0
White femina tipped	3 10 0 „ 7 0 0	3 10 0 „ 7 0 0
Femina, light 1sts and 2nds, good	4 0 0 „ 6 10 0	3 10 0 „ 6 10 0
Do., do. ordinary or defective	2 0 0 „ 4 0 0	2 0 0 „ 4 0 0
Do., dark, ordinary to good	2 10 0 „ 5 0 0	2 0 0 „ 4 0 0
Do., 3rds or defective	1 0 0 „ 2 10 0	0 10 0 „ 2 0 0
Byocks	3 15 0 „ 6 5 0	3 10 0 „ 6 0 0
Black, long and medium	4 0 0 „ 8 10 0 (1 lot £11.)	2 0 0 „ 6 10 0 (1 lot £8.)
Do., medium good to fine	2 10 0 to 5 15 0 (1 lot £8.)	3 10 0 to 6 0 0
Do., do. ordinary	1 0 0 to 1 5 0	1 0 0 „ 3 0 0
Do., medium and short	0 15 0 „ 1 10 0	0 15 0 „ 1 15 0
Do., inferior or very short	0 6 0 „ 1 0 0	0 5 0 „ 0 12 6
Drab, long and medium	2 5 0 „ 3 10 0	2 10 0 „ 3 10 0 (1 lot £5.)
Do., medium	1 5 0 „ 3 10 0	1 5 0 to 2 15 0
Do., medium and short	0 10 0 „ 1 5 0	0 10 0 „ 1 0 0
Do., do. inferior or very short	0 2 0 „ 0 9 0	0 1 6 „ 0 9 0
Floss, black and drab medium	1 0 0 „ 1 12 6	0 12 6 „ 1 5 0
Do., black and drab medium and short	0 12 6 „ 1 0 0	0 4 0 „ 0 10 0
Spadonas, white and light	1 5 0 „ 3 0 0	1 10 0 „ 3 10 0
Do., femina	0 10 0 „ 1 5 0	0 10 0 „ 1 5 0
Do., drab	0 1 0 „ 0 5 0	0 1 0 „ 0 5 0
Boos white	2 0 0 „ 2 10 0 (1 lot £2. 15s.)	1 17 6 „ 2 5 0 Few super. lots £2. 7s. 6d. and £2. 10s.
Do. femina	1 10 0 to 2 0 0	1 7 6 to 1 12 6
Do. do. black butts	0 19 0 „ 1 4 0	1 0 0 „ 1 7 6
Do. femina and drab	1 0 0 „ 1 7 6	0 15 0 „ 1 1 0

"The sales commenced on 7th inst., and concluded to-day. In all, 3,146 cases Cape were offered, of which 3,140 cases were sold; and 39 cases Egyptian, of which 36 cases were sold. The weight of feathers offered was 60,365 lbs., against 66,700 lbs. in August. The sales opened rather flatly, but a better tone prevailed as they progressed, and with a generally good demand nearly the whole quantity offered was disposed of. White feathers were generally steady, occasionally the best lines were a little

weaker, but 3rds and medium feathers were fully 15 per cent. higher. White and Light Femina were very firm for good and medium, and common 10 per cent. dearer. Dark Femina, 5s. and 10s. per lb. higher. Byocks steady. Spadonas brought full prices. Boos of all kinds were in good demand, and generally 5s. per lb. higher for all kinds except Black Butts, which were 2s. per lb. dearer. Black were very irregular, and although some lines brought up to last sales, rates on the average declined — long and medium, 10s. to 15s. per lb., and medium and medium short about 15 per cent. Drab, long, and medium were about 10s. per lb. lower, medium were irregular at steady prices to 10s. per lb. decline, and medium short 10 per cent. easier. Floss in good demand, especially shorter lines, which advanced 5s. to 7s. 6d. per lb. The quantity sold realised £113,000."

Large consignments are now sent to London from **North Africa**—Tripoli, Mogador, and Egypt—and still more were sent when the Soudan was open. Very few ostrich feathers come from Australia and South America, and still fewer from California—the supply from that quarter being disposed of in the United States of America.

The term "**White**" refers to the long pure wing feathers of the male bird, "**Femina**" indicating the corresponding plumage of the female, hence the name. "**Byock,**" said to be a corruption of a foreign word for black and white, denotes the parti-coloured feathers from the wing of the male; only a few are found on each bird. "**Boos**" is used to distinguish the short and stumpy tail feathers of both birds—white from the male, and drab from the female. "**Spadonas**" refers to the imperfectly developed first year's crop from young birds. These feathers are pointed like a sword, hence the name, which comes from the Italian. "**Black**" is the long growth on the part of the wing near to the junction with the body of the male, the short and medium are the body feathers; and "**Drab**" is the corresponding growth on the female. "**Floss**" is derived mostly from the under-wing coverts of the birds, both male and female, and is of a soft nature.

The **variation in prices** which occurred between the end of 1894 and the end of 1895 will indicate the tendency of the fashion of the day. The rise in some classes was to a certain extent due to a revival in the feather trade with America, which had been at a very low ebb for some time. The largest and finest feathers, which were at one time all the rage, are now very much at a discount. Prices of these have

consequently declined, while prices of inferior "lines" have gone up. The feathers used for trimming hats are not now the long flowing "whites," sweeping gracefully in a horizontal position, but groups of small feathers standing up after the fashion of the Prince of Wales plume. The less expensive varieties of feathers are extensively used in the **toilet of ladies** for mantle and dress trimmings, boas, and muffs, and to wear in the hair, while the finest feathers of medium length are mainly seen in fans used in the ball-room and at the opera.*

The prices of ostrich feathers, being dependent upon the **whims of fashion**, which is liable to change, must remain somewhat uncertain. This should lead a farmer to provide more than one string to his bow, and adopt ostrich farming as one branch of his industry, not as the sole means of livelihood.

Apart from this being a judicious and safe course to follow by a person desirous of eliminating from the business of his everyday life all excessive market fluctuations, which lead to the introduction of something not far removed from gambling, we have already seen that decided advantages result from the annual change of stock on the natural veld, and we may therefore conclude that the profit per bird will be greatest when ostriches do not exceed a certain, and not an excessive, proportion of the stock upon a farm.†

Feather-beds are regarded as luxurious by the housewives in the rural districts of the Colony, and it is a common practice on a farm to keep a number of **geese**, and to pluck a considerable proportion of the breast and belly feathers five or six times annually, or every six weeks during summer. In some places the ganders are plucked even in winter, which appears to be an aggravation of what must be regarded as a painful if not in the eyes of the law a cruel practice, judging from the loud protestations of the creatures, and the rate at which they make their escape from their tormentors after the

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* The author is indebted for much information relating to the London Ostrich Feather Market to Hendrey & Martin, Colonial Brokers, 9 Mincing Lane, E.C.

† See also "Ostriches and Ostrich Farming," by Mosenthal and Harting. Trubner, 1879.

operation is over. Six or seven geese furnish 1 lb. of feathers at one plucking, worth on an average about 1s. 6d. One informant declared that she plucked 12 lbs. of feathers from 58 geese, and sold them at 2s. 6d. to 3s. per lb., but as regards recent times these may safely be taken as record or maximum figures. Some birds live till they are thirteen years old. Many die during seasons of drought from stop-sickness, induced by their picking up too much sand with the roots of grasses on which they feed at such times. To give a few mealies or a little barley is a good safeguard against the most serious consequences of drought or winter scarcity.

CHAPTER XII.

THE WILD GAME OF THE COLONY.

Migratory and Non-Migratory Species—Fact of Antiquarian Interest—Destruction of Game—Murrain of Cattle Spread to Game—The Eland—The Koodoo—Rhinoceros Birds—Black Skins of Antelopes and Large Game Generally—The Gemsbok—The Blue Wildebeest—The Hartebeest—The Springbuck—Blesbok and Bontebok—Small Antelopes—The Elephant—The Buffalo—Tsetse-Fly—List of Predatory Animals and Rewards offered for their Destruction.

It is impossible to make a definite statement as to the **geographical position** of much of the game of South Africa, as about four-fifths of it are migratory in habits. Not very long ago the black wildebeest or **gnu**, the **blesbok**,* the **quagga**, and the **springbuck**, grazed on the open plains of the Midland Karoo, the Free State, and the upper portion of Natal. As the pasture became exhausted, from overstocking or drought, they shifted their ground periodically from their favourite haunts, growing the sweet grass and bush of the Karoo, to the sour grass in such areas as are found on the borders of the Free State and Natal. The great consideration was an open outlook, unencumbered by bush.

The gnu, blesbok, and quagga did not extend far north of the Vaal River. The springbuck was more generally distributed, although most plentiful towards the west. The **blesbok** is still to be found carefully preserved in the Free State and in the Colony. The true **quagga** has altogether disappeared, and the **gnu**, *Connochætes gnu*, with the exception of a small troop in the Free State, is extinct. The gnu is interesting, on account of the extraordinary combination of characteristics, usually found in widely diverging species of animals, exhibited by it. It forms a connecting link between the antelope and the bovine families. The head is distinctly bovine in appearance, the mane and tail resemble

* "Bok" is the Dutch for "buck," and the two words are used indiscriminately in this chapter.

the corresponding appendages of the horse, and the limbs those of the stag, while the horns are like the horns of the buffalo. The horns in both male and female curve from their broad bases, first down and forward, the terminations being directed upward and backward. The size of the animal corresponds to that of a large pony.

There are still many troops of **springbuck**, the variety known as the "trek-bok" occurring in very large numbers in the direction of Namaqualand.

These were the most conspicuous of the migratory species of game. The practically **non-migratory** species were the eland, hartebeest, and koodoo. These included in their grazing grounds the bush veld, river banks, and broken country, where shelter and grazing suited them. An excellent instance of the sharp **division** of the **two varieties of game** could be seen to the east of Kimberley. There a range of hills divides the black country, "swart veld," from the bush veld. On the eastern side the migratory game was formerly to be seen in countless thousands, while to the west the hartebeest and koodoo used to consort with the eland, the elephant, and the giraffe.

An interesting fact, from the **antiquarian point of view**, is that where the migratory game prevailed the **stone weapons** found consist of small arrow and spear heads, with rough flakes, sharp enough to be used at one time to skin and cut up bucks. In the bush veld or big-game country are found small arrow heads and battle-axes. The latter, about the size and shape of an open hand, would make formidable weapons when mounted on handles. They consist chiefly of Lydian stone and jasper very rudely fashioned, the makers evidently being unaware of the ingenious yet simple mechanical contrivance used by the North American Indians in turning out their beautifully finished weapons.

A good general idea of the game, which originally belonged to a certain district of the country, can be got by examining the cave drawings and so-called "**bushman drawings**" or figures (already referred to in the opening chapter) chipped out on the hard smooth surfaces of rounded basaltic boulders on the tops of the look-out hills. The latter were probably executed while the aborigines were watching the movements of the vast herds of game on the plains below.

It seems marvellous how such **enormous numbers of animals** should have been all but exterminated within a few years. But the flesh could be turned to profitable account, being dried in the sun to form "**biltong,**" an invaluable adjunct to the commissariat of the hunter or wayfarer on the veld. It is not bulky, and it is light to carry. It requires no cooking, and when cut into thin slices made across the line of the fibre of the meat it is tasty, easily digested, and strengthening, and forms the great stand-by of the African traveller. The **skins** were easily dried and exported, or prepared by the African method of "braying" for nearly all sorts of purposes for which hempen twine and rope and even in some instances iron chains are used in this country. The **former settlers** in the outlying districts gave the creatures **no quarter**, and the very shyness and wariness of their dispositions led to their speedy destruction. The system followed by the hunter was to race on horseback after a mixed troop, jump off and shoot at a distance of from 300 to 800 yards into the "brown," and probably not one in ten of those mortally wounded was bagged. The number of cartridges carried by a man was generally fifty, and it was no uncommon thing for a sportsman (!) to return empty-handed.

With the game, the **vultures** are also disappearing, but this matter has been discussed in connection with other considerations.

The **non-migratory game** have had a better chance of escape. They were in smaller troops, and had, when disturbed, better opportunities for getting out of sight than those in the open country.

Another untoward circumstance is likely to militate against any attempt at the rehabilitation of wild game, and will probably lead to a further decrease in numbers. The **murrain** of cattle, described by Joseph Thomson, has spread to the wild animals. In some places the buffaloes have died out on account of it, and pigs and many antelopes, exclusive, however, of the hartebeest, have succumbed to it.

The **eland,** *Oreas canna,* H. Smith, in the wild state is generally supposed to be "**extinct** in Cape Colony, Natal, the Orange Free State, Griqualand West, and the Transvaal, and almost so in all the countries watered by the tributaries of the

From "A Hunter's Wanderings in Africa," by Selous.

Face page 240.

PLATE 38.—HEADS AND HORNS OF THREE LARGE ANTELOPES.

Fig. 1. Blue Wildebeest. Fig. 2. Gemsbuck (Horns 3 ft. 6½ in. long). Fig. 3. Eland Bull (Horns 2 ft. 3 in. long).

Photo. by W. Roe, Graaff Reinet. *Face page* 241.

PLATE 39.—ELAND ANTELOPES (FEMALES) IN A STATE OF DOMESTICATION, AND A JERSEY COW.

Limpopo to the west of the Matabele country," but it is reported to exist in Griqualand East, on the spur of the Drakensberg Mountains. It has been **domesticated** in Cape Colony, as may be seen from the accompanying plate (showing a group of five tame cows). Up-country elands are still plentiful north of the Zambesi River, and in the Kalahari Desert where they attain their greatest size and are devoid of the characteristic white stripes which are common to both males and females belonging to other districts.

The eland is the **largest** and most useful of the **antelope** family, and its members are ox-like in general proportions and appearance. The **finest specimens** stand 6 feet high at the withers, and measure 9 feet from the nose to the root of the tail. F. C. Selous records the girth of the specimen in the British Museum at 8 feet 2 inches, and the neck measurement midway between the jaw and the shoulder at 5 feet 1 inch.

They become very heavy, weighing 1,500 to 2,000 lbs., and fatter than any other large game. The **flesh** resembles beef in grain and in colour, but in flavour it is not equal to that of the buffalo, giraffe, or hippopotamus, and its good qualities have been rather exaggerated by early hunters and writers on large game.

It **roams in herds**, preferring dry and often sandy plains, although it does not shun thickly wooded country. It is slow in movement, and can generally be overtaken by a man mounted on a good horse. Cows possess greater speed and staying power than bulls, and "when pursued they often bound high into the air, higher than the backs of their fellows."

The eland is **gentle** in **disposition**, as is evident from its "soft brown eye," and there are few wild animals which hold out more encouragement for their domestication. The **horns** of well-developed males approach 2 feet 6 inches in length, and a cow's horns have been measured 2 feet 10 inches long. In form they are straight and erect, and each is conspicuously adorned with a spiral wreath, extending well up towards the tip in the case of the male. In the female this feature is but slender.

The animal is **distinguished** by a prominent **dewlap**, fringed with long hair; a black **mark** above the knee inside each fore-leg; a black **line** up the centre of the back and tail;

the **body hair** short, except on the ridge of the back, and of a reddish light **fawn colour** above, shading off to white beneath (or according to Selous, writing of an eland cow, "a light-red colour fading into a creamy-yellow shade"); eight or nine well-defined narrow **white stripes** falling from the backbone down each side, **reddish bands** taking their places over the neck; the **tail** thin and whiplike, terminating in a black tuft of hair; fine clean-cut **limbs**; and a small game-looking **head**, with in the male a dense dark brush of hair on the **forehead** and face.

Selous says: "What a grand-looking beast an **eland bull** is! He is one of those stately creatures that few reflecting men can slay without regret;"—and of **calves** a few days old: "Beautiful little creatures of a reddish fawn colour, profusely banded with perpendicular white stripes."

The **koodoo**, *Strepsiceros kudu*, Gray, one of the largest and perhaps the most handsome of all the antelopes, calls for little description with two such illustrations as the accompanying plates. These are reduced copies from J. G. Millais's new work, "A Breath from the Veldt," * and represent in a lifelike manner both the male and the female.

Plate 40 also shows **rhinoceros birds**, *Buphaga erythrorhyncha*, or "rhenoster vogels," feeding on the koodoo cow.

The **attitudes** of the rhinoceros birds were drawn, by the aid of a telescope, direct from nature, and show a party of these birds relieving an animal of ticks and other parasites. The birds possess tails of horny feathers and claws of extraordinary strength and sharpness, by which they can cling securely. They can hop backwards quite as well as forwards, and they often make long drops from the shoulder to the fore-leg or down the side of the animal. Among wild beasts their attention is chiefly devoted to the rhinoceros, the Cape buffalo, the sable antelope, and the wart-hog; whilst among domestic animals horses and oxen are their favourites. It is no uncommon sight to see an ox lying stretched on the ground on his back, exposing the under parts of his body to them. The flight of the rhinoceros bird strongly resembles that of our fieldfare, and its jarring cry of alarm is like that of the common starling when its nest is being robbed. All the birds utter it together when they wish to warn an animal of approaching danger, sitting in a line along its back and stretching their necks upwards preparatory to taking flight. It is only wild animals that they warn of the approach of danger; when feeding on domesticated animals they are comparatively tame, and suffer the close approach of man.—*Condensed from "A Breath from the Veldt."*

* Published 1895 by Henry Sotheran & Co., London, at £3. 3s.

By J. G. Millais. *Face page 242.*

PLATE 40.—KOODOO COW, AND RHINOCEROS BIRDS FEEDING UPON TICKS AND OTHER SKIN PARASITES.

By J. G. Millais. *Face page 243*

Bushbuck Antelope Bull, with Rhinoceros Birds giving an Alarm before leaving

The koodoo is still found in Cape Colony (although not in large numbers), in the vicinity of Uitenhage, Beaufort West, Fraserburg, Prieska, and in Griqualand West. It is more solitary in its habits, and not found so much in herds as the eland. It is "usually partial to **hilly country**, covered with dense thickets," but it is also common in thick bush by the banks of rivers, and in the wait-a-bit thorn-jungle on the edge of the flat and sandy Kalahari Desert. The **horns**, only present in the male, are cylindrical and twisted spirally, and have been seen as long as 3 feet 8½ inches in a straight line from top to base, which is equivalent to more than 5 feet along the curves. A long **beard** adorns the throat, and a **mane** the back of the neck. Selous says: "The **ground colour** of female koodoos and young males is a reddish or greyish brown, with eight or nine white stripes" (which are even more distinct than those of the eland) "down each side. But the old males become a deep blue-grey, which is owing, I think, as in the case of the eland, to the colour of the skin showing through the scanty hair." In writing of the eland he also says: "Old eland bulls, as well as old cows, have very little hair on their skins, and look a dark slaty-blue colour," also attributed by him to the same influence as that just stated in connection with the koodoo.

These simple statements open up a wide field of interest in connection with the **colour of the skins** of antelopes and other wild animals in Central and Southern Africa. The hair of a large number of species of antelope is light rather than dark in colour, with a **tinge of red** or russet brown; but it has probably not occurred to any one that underneath this light exterior hairy covering, Nature has for special reasons of her own placed a dark skin. In short, the colour of the skins of the animals in tropical regions seems to follow the same law as that of the skins of the aboriginal inhabitants, and to be almost invariably black or dark in colour.

During the author's **visit to India** in 1887 he made the discovery, from the European point of view, that underneath the white or light-grey hair of the **zebu cattle** was to be found, in all but a small percentage of cases, a **jet black or a dark skin**. It is interesting to recognise the similarity in the matter of colour in tropical Africa, and to find that, on such undoubted authority as that of F. C. Selous, the two largest antelopes are

black skinned; and further, that all the species of smaller antelopes which the author had the privilege of examining, are amenable to the same hidden influence. The rule does not hold good in the case of **feline animals**, which prowl at night and find shelter by day from the direct rays of the sun, but of those that **feed by day**, the buffalo, the elephant, the rhinoceros, the **zebra**, and many others are dark skinned. The fact that the skin of the zebra is uniformly dark in spite of the existence of numerous bands of white hair is peculiarly interesting, because with British cattle and horses a white spot of hair generally implies, though not invariably, a white spot underneath. The secret of the matter is that a dark skin is not injured by **sun burning** and blistering, as a light-coloured skin usually is, and the law of the survival of the fittest has done its work so well through past generations, that the beneficial condition of blackness is now all but uniform in tropical areas.*

The **lesson** for the South African farmer to learn is to select dark-coloured cattle, so that they may benefit by securing immunity from sun-blistering, and its injurious consequences on the animal's health and condition. Although Cape Colony is not tropical, yet, owing to the cloudless nature of the sky, the sun's influence is powerful. In dealing with the various breeds of cattle, reference is made from time to time to the importance of the consideration of colour.

The **gemsbok** antelope, *Oryx gazella*, belongs almost exclusively to the deserts of South-Western Africa. In Griqualand West and the Kalahari Desert to the west of that area, as well as in Namaqualand, it is still "fairly plentiful." It is usually very wild and prefers open country, or that which is merely covered with stunted bush. The body is heavy though symmetrical, and the tail long and bushy. The colour of the face, limbs, and belly is broken, and beautifully marked in a manner peculiar to this species, and the horns are very long, straight and slender, frequently longer in the female than in the male. Selous gives 3 feet 6 inches as the greatest

* The subject of black skins in cattle is treated at some length in the author's work on "Indian Agriculture," published at £1. 1s. by Oliver & Boyd, Tweeddale Court, Edinburgh.

By J. G. Millais, F.Z.S. PLATE 42.—SPRINGBUCK FEEDING. *Face page* 245.

Two Secretary Birds to the right and a South African Griffon Vulture, *Gypo Kolbii*, in the air.

length in his experience in the latter, and 3 feet 10½ inches in the former case.

The **blue** or **bastard wildebeest**, or brindled gnu, *Connochætes taurina*, a species included in the same genus with the almost extinct true gnu, is to be found on the western border of Griqualand West, along the eastern edge of the Kalahari Desert, and all over South Central Africa. Selous says: "It congregates in immense herds on the Mababe flats during the dry season. It is partial to open downs devoid of bush, or open glades in the forest, and is never met with in hilly country." It is very swift of foot and enduring.

The **hartebeest**, *Alcelaphus caama*, is one of the fleetest and longest-winded of South African antelopes. Its natural habitat is very similar to that of the gemsbok and blue wildebeest. It is still "fairly plentiful" in Griqualand West.

The **springbuck**, *Gazella euchore*, or "springer" antelope, named from the habit it possesses of bounding high into the air, meanwhile assuming many most extraordinary positions, which have been beautifully portrayed in J. G. Millais's artistic work, previously referred to (from which, by permission, the accompanying plate representing springbucks, secretary birds, and a vulture has been copied). The animal stands higher and is somewhat larger than a fallow deer. The greater part of the body is of a light fawn colour, but the belly and a narrow ridge running up to the middle of the back is white, and furnished with white hair, which stands up along the line of the back-bone. The horns are "simple and annulate, and curved to form a lyre-shaped figure."

Springbucks are plentiful in many parts of the Karoo country, and in total numbers in the Colony they far exceed all other species of antelope. They tend to increase since the institution by Government of a close time against killing them.

Millais says that "the true home of the springbuck is now found in the Kalahari, Damaraland, Ovampoland, and Great Namaqualand," from which latter place come many beautiful "karosses," or skin rugs, made by the Hottentot women, who preserve and soften the skins and sew them most neatly and strongly together with pieces of thin thread-like thong. Springbucks graze together in large herds of hundreds or even

thousands. They have great power of scent and observation, and, except when "trekking" in large numbers, so that they crowd each other, they are difficult to approach unless a man be well mounted on horseback. Shooting springbucks is done by riding after the troops, now very frequently confined in large camps within wire fences, and trying to cut them off by taking advantage of shelter to make a short cut in the direction in which the leading members of the troop are heading.

HEAD OF A STEENBOK.
Photo. by Percy Ashendon, Civil Engineer.

The **blesbok**, *Alcelaphus albifrons*, and the **bontebok**, *A. pygarga*, are both allied to the springbuck. The latter has already been referred to in Chapter I. The blesbok is larger than the springbuck, and it inhabits similar country to this more widely represented rival. It is so fleet of foot that no dog can catch it. There are several other small antelopes, as, for example, the **steenbok**, **rhebok**, and **bushbuck**, which are holding their own and rather tending to increase since a close time has been instituted.

The **elephant** and the **buffalo** are still found in considerable if not in large numbers, in the forests of Knysna and Humansdorp, and in the Addo Bush.

The **African elephant**, *Elephas africanus*, has not been subjected to the influences of domestication since the time of the Romans. It is a taller animal than the Asiatic species, but it does not stand more than 11 feet at the shoulder. It exhibits prominent **differences** in certain details of structure. The forehead is convex in place of flat, and the back concave rather than slightly arched. The ears are enormously large, completely covering the shoulders when thrown back, sometimes even 3½ feet long by 2½ feet broad. The tusks are heavy, and particularly so in the male, and they are freely used for digging up the roots of trees for food, in which service one tusk is generally much more worn than the other.

The **Cape buffalo**, *Bubalus caffer*, is nearly as large as and fully stronger and bolder than the Indian species, although it is not so dangerous as is generally supposed, except when wounded. The horns are broad and thick at the base, where they come closely together and form a most effective protective covering for the crown and upper part of the forehead. In this respect, and also in the way the flattened horns incline backwards and downwards, and finally sweep round to form graceful curves before the terminations occur, at a distance of about four feet apart from each other, the animal strongly resembles the Indian Jafarabadi variety of buffalo, which is above the average size. The cows are well known to possess superior milking qualities. The black skin, which is so thick and tough that in the early days it was made by natives into shields capable of turning musket bullets, is only indifferently provided with hair, and old animals become almost destitute of this covering. South African buffaloes have never been domesticated. They get into shallow, muddy pools, and carry away thin coatings of mud, which protect them at the same time from the attacks of gadflies, and from the direct influence of the noonday sun. They also participate in the pleasures derived from the friendly offices of rhinoceros birds.

The **tsetse fly**, *Glossina morsitans*, belonging to the subfamily *Muscinæ*, and closely allied to *Stomoxys*, is the fatal pest which destroys the horses of big-game hunters, and the

oxen of up-country transport riders, when they unwittingly come within the fly-infested country, which is generally in such a place as buffaloes prefer, viz., country covered with bush and near a river. It is believed that this fly follows the buffalo, and disappears from a district when the buffaloes are killed out or are driven away. It is most numerously represented and

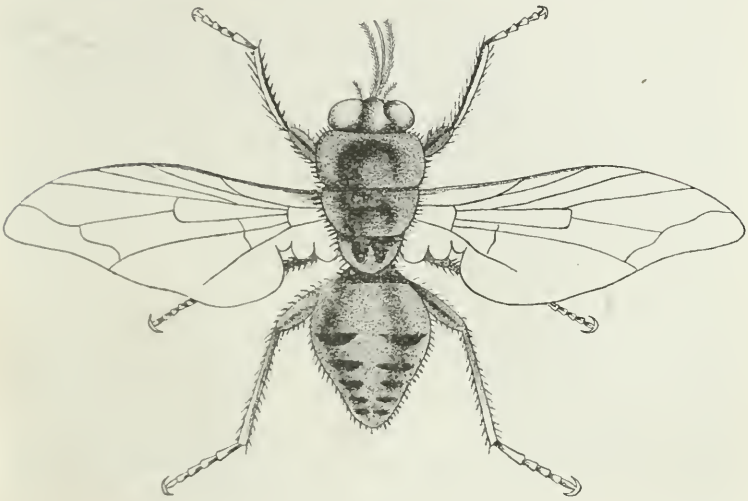
A Wounded Cape Buffalo.

After Selous.

most injurious in its action in certain areas in the basin of the Limpopo River. It is present in Zululand between the coast and the mountains down to the 28th degree of south latitude, but it does not appear in Cape Colony, unless it be in the harmless form in which the species is represented in Australia.

The **body** is not much larger than that of the common house-fly, which it also resembles in appearance. When

at rest, the wings, being longer, overlap at the tips and project posteriorly, giving it an elongated character like that of the common grey horse-fly, but with what may be described as a broad-shouldered appearance. It is of a "dull greyish colour, with bars of a pinky tinge across the body." Its proboscis is long enough to penetrate readily a thick flannel shirt, and the poison is supposed to be "contained in a dilated horny bulb" at its base. It is generally believed that man possesses immunity from the poisonous influences of its bite, and it is certain that it does not have the same effect on him



THE TSETSE FLY, GLOSSINA MORSITANS, Magnified.

as on the lower animals that suffer from its attentions; nevertheless it has been asserted that it is quite possible the fly is the direct cause of certain derangements commonly ascribed to fever. Certain constitutions are very differently affected as compared with others by the sting of the bee and the bite of the common horse-fly, and it seems quite possible that some men might suffer from the bite of the fly in the manner indicated, while others might escape. The bite alone is a source of intense annoyance to the traveller, and, contrary to the general belief, where flies are in large numbers, they do not desist during night—at least while the moon is bright. The bite of

the fly, though innocuous to every species of game, is fatal to all domestic animals, including the donkey, the dog, and the goat, which were once thought to be exceptions to the rule. In the matter of results something depends upon the number of flies that bite an animal, or in other words, the amount of poison that the flies succeed in introducing into its system. A few animals, not very severely bitten, have been known to develop the symptoms and afterwards recover, but no remedial or preventive medicinal treatment, not even inoculation, has proved of any avail to an animal which has been severely bitten.

The natives living in the fly country own **dogs and goats**, but the ancestors of these have been bred there for generations, and have become acclimatised. In a litter even of acclimatised puppies some always die of "fly" symptoms. Selous says that if a goat or a dog which has been bred and reared outside the "fly" country is taken in, "it will die in nine cases out of ten, and the original progenitors of the animals the natives now possess were no doubt such exceptions to the general rule."

Cattle and horses that have been bitten during the dry season, usually die soon after the commencement of the rains. The poison may begin to show its effects in a few days, or it may take months to develop. The usual visible **symptoms** are "swelling under the jaw and round the navel." The eyes and nose run, and the animal becomes steadily more emaciated, and ultimately dies of exhaustion, aggravated in the end by diarrhœa.

By **post-mortem** examination it is found that the muscles of the body and heart are soft and flabby; the lungs and liver are both affected. The fat is oily and of a greenish-yellow colour, and the blood thin and deficient in quantity. The symptoms are those of a persistent progressive anæmia, the poison, whatever it may be, acting by destroying the red corpuscles in the circulating blood, while concurrently there is an increase of the white corpuscles.

Since the foregoing was written, a **report** on the fly, **by Surgeon-Major David Bruce**, has been presented to the Governor of Natal. Doubts of the bite being poisonous, unless the fly had previously fed upon a diseased animal, are

expressed, but no conclusive evidence is advanced to overthrow the accepted theory in this matter. The fact that flies, living on the healthy blood of immune game, can poison domestic animals, is against the new suggestion that the "fly is merely a carrier of the disease from affected to healthy animals." The only important advance recorded is the **discovery** of a **blood parasite**, a *Hæmatozoon*, which ought to make it possible to adopt inoculation as a means of securing immunity.

Protection can be secured in a rough and ready way while passing through a fly country by smearing the skins of the animals liable to be attacked with a mixture of cow-dung and milk or with lion's fat.

Although the tsetse fly has been generally condemned and looked upon as an enemy of civilisation, it has in recent years proved to be the **salvation** of the remnant **of large game** yet remaining in Southern Africa. The wholesale slaughter which has been going on for years in most parts of the country is effectually checked in the fly-infected areas, owing to the difficulties which are associated with the absence of hunting horses and trek oxen. To this fly, which has been so universally maligned, the hunter of the future will be indebted for the preservation of numerous species of game, which, but for its good offices, would undoubtedly have become extinct before the arm of civilisation had reached far enough to establish close seasons, and regulate the times and manner in which legitimate sport might be indulged.

The following **list of predatory animals** (which appeared in a Government notice in August 1895, offering rewards for the destruction of vermin) indicates the species which still linger in Cape Colony in mountainous and little frequented areas where natural shelter is to be found :—

	Payable by Government.		Payable from Local Sources.	
	s.	*d.*	*s.*	*d.*
Wild dog	8	0	2	0
Tiger	5	0	1	0
Leopard	5	0	1	0
Hyena	5	0	1	0
Maanhaar jackal	3	0	1	0
Common red jackal	3	0	1	0
Baboon	1	0	0	6

CHAPTER XIII.

CATTLE AND THEIR MANAGEMENT.

Native Cattle—The Hottentot Ox—The Afrikander Breed—Lake 'Ngami Cattle—The Cape Cow—Damaraland Cattle—Polled Cattle—Zulu Cattle—Dutch and Shorthorn Cattle—The Ayrshire—The Devon—The Hereford—The Dexter-Kerry—The Dexter-Shorthorn—The Channel Islands Breeds—Milking Native Cattle—Hay Making—Village Cattle—Kaffir Servants' Cattle—Transport Oxen—Farming, Bathurst District—Transport Riding—Dairying.

LARGE numbers of cattle were found in the possession of the Hottentots when the first European discoverers landed at the Cape towards the end of the fifteenth century. They possessed, in addition, goats, sheep, dogs, and poultry. The horse they were ignorant of, and the ostrich had not been domesticated.

The **Hottentot ox** has been described as "a gaunt bony creature, with immense horns and long legs, but hardy, and well adapted to the wants of its owner, and corresponding somewhat to the appearance of the larger of the native cattle in Namaqualand and Damaraland at the present day." As these characteristics are greatly due to the nature of the climate and other natural circumstances, which so materially modify the different species of animals that live for generations under their influences, it is believed that in the east of the Colony, where the conditions were more favourable for the development of superior forms of bovine life, the cattle were of better quality from the European point of view. The natives used their oxen for riding, for carrying pack loads, and for racing. They even trained them as war oxen, and guided them in battle against their enemies by calls from a distance. **Both Kaffirs and Hottentots** exhibit great attachment to their cattle, and, observing with the greatest accuracy and minuteness the habits of the animals, acquire wonderful skill in their management. The Hottentots and Kaffirs are supposed to have gradually

found their way from North Africa, and to have brought their cattle with them. It is consequently not to be wondered at that these cattle belong to the same species as European cattle, and strongly resemble some of the types which are most directly representative of the original *Bos urus* of Cæsar, viz., the **Spanish and Portuguese cattle**, and the descendants of those breeds which are found roaming on the plains of Mexico and the ranches of the Western States of America. There they are bred under conditions not very dissimilar to those under which large numbers of cattle are kept in South Africa. The success in crossing with the native cattle, which followed the introduction of Portuguese cattle by the first settlers, is another strong argument in favour of their close relationship.

The Afrikander breed, which is regarded as the most direct descendant of the native cattle, crossed by imported Portuguese animals, is supposed to have derived the best of its foundation stock from superior cows captured from Bushmen in the neighbourhood of Mossel Bay in 1668. The breed might easily pass as indigenous, having so thoroughly adapted itself to conditions of soil and climate. None of the breeds now imported from Europe can compare with it in maintaining condition or even existence in the recurring periods of drought and scarcity of food to which the Colony, more particularly in the Karoo country, is subject. It is a slow-maturity breed, as may be inferred from the last-mentioned characteristic, and the **crossed** progeny by a Friesland or a shorthorn bull possesses greater size and increased aptitude to fatten, but while gaining in this direction loses in constitutional power to withstand the exigencies of the climate. The crosses produce more powerful draught oxen, but they are too heavy, and go back in condition, and cannot endure the hardships by the way like the pure Afrikander. While the veld-fed cross-bred bullocks rising four years old will yield 850 lbs. of dressed beef,* the Afrikander bullock will yield 600 lbs. to 700 lbs. The introduction of either shorthorn or Friesland blood greatly improves the milking qualities of an Afrikander herd, but this must not be carried too far if the cattle have to depend

* £1 per 100 lbs. of dressed beef is considered a good average paying price for the farmer to receive away from large centres of population.

entirely upon what the veld provides, unless in those districts where the land is of superior quality, and in that case it would probably be better to maintain the purity of European herds. Near Kimberley, cross-bred heifers of two years old realised, in 1895, £6 per head, or almost as much as oxen of twice the age. The typical Afrikander animal is of a rich dark-red colour, with gay upstanding horns, characteristics which have led some people into the belief that the breed must have had a cross of the English Devon during the process of its formation, but no satisfactory historical records exist in confirmation of the fact, although the traditional belief is widespread. One point against the truth of the tradition is that the type of the Afrikander is very different from that of the Devon. The cows are permitted to suckle their calves, and, like the calves of breeds that are treated similarly in Great Britain, they grow up more timid and less amenable to gentle control than animals reared under a more domestic system. This does not prevent their being broken in to work in a waggon or on the farm, but they are always more dangerous when roused to anger, and then they will charge recklessly and furiously like a wild animal. The cows also hide their calves for the first week or so, like the wild White Park cattle of Great Britain and the West Highland breed, and go to them from time to time to let them suck. The Afrikander is a compact, symmetrical animal, having well-developed fore-quarters, and a considerable elevation on the neck immediately in front of the withers, with an appearance strongly resembling a hump, but it is only a muscular enlargement, not a fleshy protuberance like the hump of the Indian zebu. There is one serious shortcoming when measured by a British standard, viz., the light, short, and drooping hindquarters and thin thighs. Splendid legs and feet for travelling, activity, strength, power of endurance, and constitutional vigour, are all conspicuous qualities. In a mixed lot of cattle living on the veld during winter, the pure Afrikander will generally be the one in best condition and with the sleekest coat. Excellent specimens of the breed may be found in the possession of up-country Boer farmers, who are slow to introduce new blood, and are in no haste for early development, or anxious for a cow to give more milk than her calf can readily consume. A few

herds are to be found which give more than an average amount of milk. These are supposed to have been dashed with a strain of blood from the Cape cow, sufficient to improve the milking qualities, but not enough to make any material alteration on the external form or appearance. The breed has a fixed type which distinguishes it readily from the thick-horned Kaffir cattle, which in comparison with it are broken in colour, and lack style and uniformity.

In some strains of native cattle in South Africa there is a strong tendency to the growth of large horns. The **Lake 'Ngami breed** possesses horns of such enormous dimensions and weight that one would imagine they would prove a detriment to the well-being of the animals. Selous states that he personally measured a pair of horns 13 feet in length from tip to tip, but even a better record than this by 1 foot 2 inches is recorded in "Big Game Shooting" in the Badminton Library, 1895.* The bases of the horns in these cases are almost as thick as a man's thigh, and the muscular effort in carrying them must be enormous.

The Cape cow, bred in the Cape Peninsula, belongs to a mixed breed famous for milking qualities, and though smaller in size, it retains a strong resemblance to the Dutch breed, which contributed largely to its formation. Evidences are also to be seen in certain specimens of the use of Channel Island, Kerry, and Ayrshire bulls. The merit of good performance is in this instance more in favour than purity of

* W. Cotton Oswell, in chapter v., "With Livingstone in South Africa," says: "By the shores of Lake 'Ngami a gigantic long-horned breed is found, stolen in a raid from the Ba-Wangketsi thirty years before our visit. They were originally remarkable for their heads, but in four or five generations, from feeding on silicious-coated reeds and succulent grasses near the lake, had developed wonderfully in horn and height. Through Livingstone I obtained one 6 feet 2 inches high, with horns measuring from tip to tip 8 feet 7 inches and 14 feet 2 inches round from one point to the other taking in the base of the skull. This animal had to be shot when he came into a region where the grass was short, as his horns coming to the ground before his nose prevented him feeding." The same writer mentions a miniature breed of cattle owned by a Kaffir chief, Sebitoani. He says: "They were most remarkably small things, like sturdy Durham oxen, 3 feet high. There was not the least difficulty in carrying them about bodily. Pretty little gentle beasts, when the men milked them they held them by the hind leg as you would a goat."

blood—a condition of things which has been previously observed in other parts of the world—New South Wales, for example—in connection with the breeding of dairy cattle.

Damaraland cattle are the best of animals for light bullock traffic. They are light and active, and their feet are hard and specially well adapted to work on the road. The horns are elevated and handsome. All ordinary combinations of colour of hair are represented, but black and tan, with a tan muzzle, is the most common and most characteristic colour.

One section of the **Pondo breed** is hornless, with a high projecting poll, and in common with polled breeds it has generally great potency in conferring this characteristic on its progeny. Even when crossed with the shorthorn, most of the calves are polled. The hornless condition is now considered a decided advantage, as animals without horns can get their heads into the thick bush and find food in times of scarcity in a way that horned cattle cannot. They consequently maintain their condition better. So much is this believed, that an increasing number of cattle are annually **dishorned** by placing a few drops of caustic potash on the budding horns when the calf is only a few days old. This is a simple, effective, and humane practice, as horned cattle are ready at all times to inflict injury on their weaker neighbours, and the operation of dishorning not only deprives them of the weapons of offence, but also of the inclination to use them.

Zulu cattle are diminutive, but hardy, active, and useful animals, working frequently under very trying circumstances. The Zulu country is within the area which is so much infested with ticks. At times the ears are reduced to mere stumps by the biting of the ticks and the after-effects that arise. The ticks break the skin inside the ear and give rise to suppuration. The injured part becomes fly-blown and maggots develop, which at times cause death by finding their way through the ear into the brain. In hot districts the smell which is meanwhile produced is like that of Kipling's camel, "most awful vile."

The Cattle of English East Africa and Urundi.*—The cattle met with on my journey were not specially studied, and therefore my im-

* By G. F. Scott Elliot, F.L.S., F.R.G.S., author of "Naturalist in Mid Africa."

pressions are to be considered simply as the observations of a passing traveller much occupied with other matters. Before I returned and consulted any authorities on the subject, it seemed to me perfectly clear that there were in English East Africa and Urundi two distinct races. One of these is seen in its greatest purity close to the east coast, and is apparently a Zebu race. According to Mr Hall, of Kikuyu, who has trained the cattle of that district, they are in many ways much like the little Zulu breed which produces some of the best draught oxen in Southern Africa, but to my mind they seemed more like the true Indian Zebu than any of the southern breeds. This race is, however, certainly not in most cases the regular Indian form, though whether the differences are due to crossing, or to having been separated and reared under different climatic conditions, is far too difficult a question for me to hazard an opinion on. The other race I found in its greatest purity in the mountains of Urundi, at a height of some 6,000 to 7,000 feet. Dr Baumann, who traversed this country, has given a photograph of one of these animals ("Zum Nilquelle"), and investigated their origin at great length. There is a figure, Tab. viii., in Stuhlmann's "Mit Emin Pascha," which purports to be one of this race. To my eyes it is not nearly so good an illustration of the pure race as I saw it in Urundi, but far more probably a cross with distinct Zebu traces. The race in Urundi agrees very closely with the description given in Bruce's "Travels in Abyssinia," and it seems to me quite certain that it represents the original cattle brought by the Wahuma when they first came down from Abyssinia. They are usually reddish-brown, somewhat slim and narrow, and with relatively longer legs and a more slender build than the Zebu. Their horns are truly astonishing in size, and some I saw must have been fully three feet six inches long, and nearly as far apart at the tips.

The following observation, whatever may be its value, is exactly according to my experience. The cattle are kept at night within the villages, and driven out every day to feed. On those paths which they traverse daily, the ground is a series of little ridges and furrows at right angles to the direction of the path. These ridges are about nine inches high and a foot broad, and I have on no cattle-tracks elsewhere seen anything to correspond with them. They appeared to me to show that the hoofs were all placed on nearly the same spot, instead of as usual at different intervals as on an ordinary cattle-track, which becomes poached up into an intricate honeycomb of steps. Probably this springs from their legs being much longer relatively to the body.*

Starting from these two extreme forms, one finds in Ankole, Karagwe, &c., animals much more like the Urundi breed, and I have seen even in Buddu an enormous beast with huge horns, but still with a distinct hump and obvious Zebu affinities.

* The conditions described are sometimes to be observed in Great Britain, when cows which naturally walk slowly are permitted to spread in many directions from a given centre on soil which is deep, and after rain, somewhat soft under foot. When the soil is hard, or when the animals follow each other in a line, they are more liable to form narrow paths in the direction of their course than the cross ridges described. R. W.

On the other hand, the **Masai cattle**, though much like the Zebu in many respects, differ from the cattle of the Wakamba, and tend towards the type found in Uganda, which latter appears to me a distinct blend of these two extreme races, and shows the extreme variety which one would expect. Heads very much like those of the **Guernsey** breed are very common in Uganda, but there is plenty of white in most herds, though perhaps less than one finds in Masailand.

Dr Stuhlmann seems to agree with me that these two races, one along the eastern coast and pretty close to it, and the other extending south from Abyssinia as far as Urundi, are all that is necessary to explain the cattle which I met with. One Usogawco accompanied me from Kampala to Ruwenzori and Tanganyika, and was a most gentle and intelligent beast.

The two most popular **European breeds** are the **Holstein**, Dutch or Friesland, and the **shorthorn**—the first introduced during the Dutch occupation, and still largely imported and highly prized. The second is of more recent British introduction. There exists great rivalry between the supporters of the two breeds as to which is the better of the two. The question resolves itself pretty much into one dependent upon local circumstances. On fine rich land, where there is a good climate, the shorthorn can usually take the lead as a general purpose farmer's animal in the production of meat and milk, but where dairying is the chief object, or if there be a certain amount of struggling to be done against the influences of the climate and a restricted supply of food, or food which is not of the best quality, the Dutch cow will give a better account of herself than the shorthorn. In some localities where both breeds do well—the district of Bedford, for example—the advocates on each side are pretty equally matched in enthusiasm if not in numbers. The fact should never be lost sight of, that well-bred cattle, like well-bred farm animals of almost any species from Europe, have been brought into their present state of advancement towards perfection without being subjected to the **struggles for existence** which country cattle go through, and this having gone on for generations, the instinct as well as the power of self-help has become to some extent lost. The incapacity of well-bred animals to struggle for themselves amounts to more than this. There is a connection, or, more correctly, a repulsion between early maturity and constitutional vigour exhibited in the direction referred to. As the quality of early

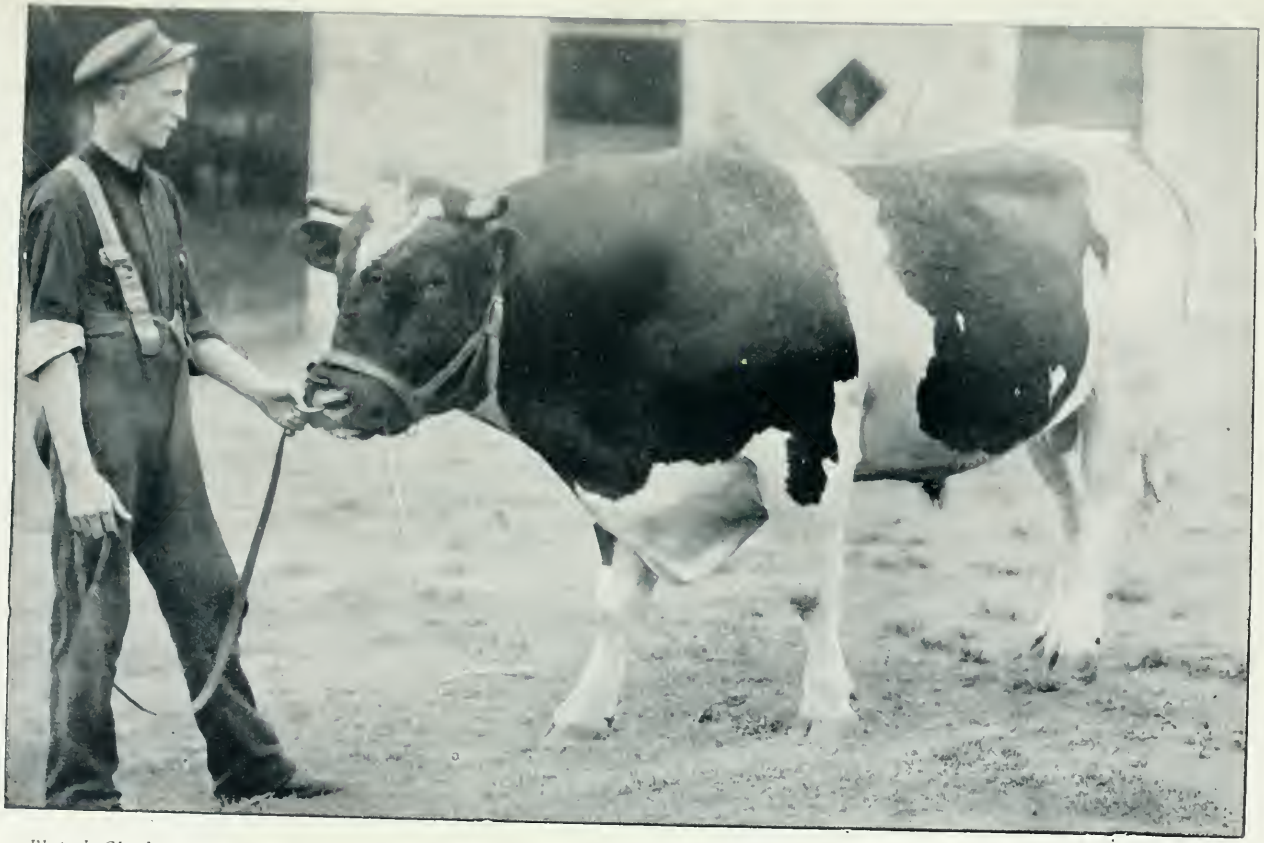


Photo. by Glassberg, Paarl

PLATE 43.—IMPORTED FRIESLAND BULL.
The Property of E. H. F. MELLISH, Cape Town.

Face page 258.

PLATE 44.—FRIESLAND COW, COLONIAL BRED. *Face page* 259.

This Cow, whose Milk record at full profit was 60 Bottles, or over 9 Gallons per Day, died in the act of calving the day after the Photograph was taken.

maturity advances, so must greater care and a better supply of food be provided for the animal, otherwise with ordinary treatment and ordinary food the results will become more and more unsatisfactory. Where the system of management is good, cows are supplied during winter with **green barley** or rye sown as a forage crop, or from the growth resulting from shaken wheat, the land being ploughed immediately after harvest. To this custom should be added the system of ensilaging green food during the period of the year when it is most abundant.

The most highly bred cattle, being in-bred, also suffer most from **disease,** a fact which reaches its full measure of significance in Cape Colony, where diseases are so numerous and so insidious.

Dutch cattle at the Cape are black and white, this colour being in fashion with breeders, although in Holland many pure-bred animals are fallow-coloured, red, and red and white. There are several strains of the breed in the home country, both large and small, due to the nature of the land on which they have been kept for many generations. Professor Overman claims that they have existed as a pure breed since about the time of Cæsar. The larger variety is the one in favour in Cape Colony, as it combines in quite an unusual way the qualities of both milk and meat production. The body is massive, but in symmetry the true type of the milking animal is seen, the forequarters being light and the hindquarters large and capacious. The horn is short and springs horizontally, usually assuming a downward inclination, especially in the bull. The average annual amount of milk given by good cows properly treated amounts to over 750 gallons, but records of 1,000 gallons and more have often been made. The quantity being so great, the average quality is below that of the milk of most of the British milking breeds, nevertheless 3 to 3½ per cent. of butter fat is present. The **calves** when dropped are of immense size, weighing sometimes over 100 lbs at birth, and their buttocks are so large that they frequently give trouble at calving time. When heifers are well fed, they take the bull at fifteen or sixteen months old, and calve when about two years of age. If they are poorly fed, they do not come into profit till they are a year older.

The Shorthorn.*—"In colour the breed is represented by roans and reds of various shades, light and dark, and also by red and white as well as wholly white specimens. The latter, and also the light or yellowish-light reds, are out of fashion with American buyers, who, on account of their numbers, tend to regulate custom in such things. Brindled colours are not seen in pure-bred shorthorns, and the same may be said of black. The skin, including that of the inner ears, is of a creamy-white or yellow colour. The nose, palate, lips, and eyelids should be flesh-coloured, and free from dark markings. A bright red nose is indicative of delicacy, just as black is considered to denote impurity—this, too, in spite of the acknowledged fact that black or dark noses existed in some of the best strains of blood mentioned in the early records of the breed.

"**The characteristic horns** are short and blunt, more or less curved in a downward direction, of a waxy yellow throughout (free from black tips), laterally flattened, and set on wide apart. It is essential that the **masculine** or the **feminine characteristics** should be naturally represented in individual specimens of each sex. **Shorthorns are descended** from the old North-East of England breed, variously designated the 'Durham,' 'Tees-Water,' 'Yorkshire,' or 'Holderness.' It was probably originally formed several centuries ago by crossing the aboriginal British cows with large-framed bulls imported from the Continent—Holland and Denmark. The dark noses referred to were no doubt due to their relationship with the ancient white cattle. Early shorthorns were good milkers, and it may be presumed they in part inherited that quality along with the shortness of horn from their Continental ancestors."

The drawbacks to the shorthorn as a milking animal are its tendency to run to flesh, and its substantial forequarters, which are not typical of milking characteristics; but certain strains produce much better dairy cattle than the great majority of the breed, and it is this class of animal which the colonial importer should be careful to select in view of the

* Quoted from the author's work on "The Farm Live Stock of Great Britain," published by Crosby Lockwood & Son, London.

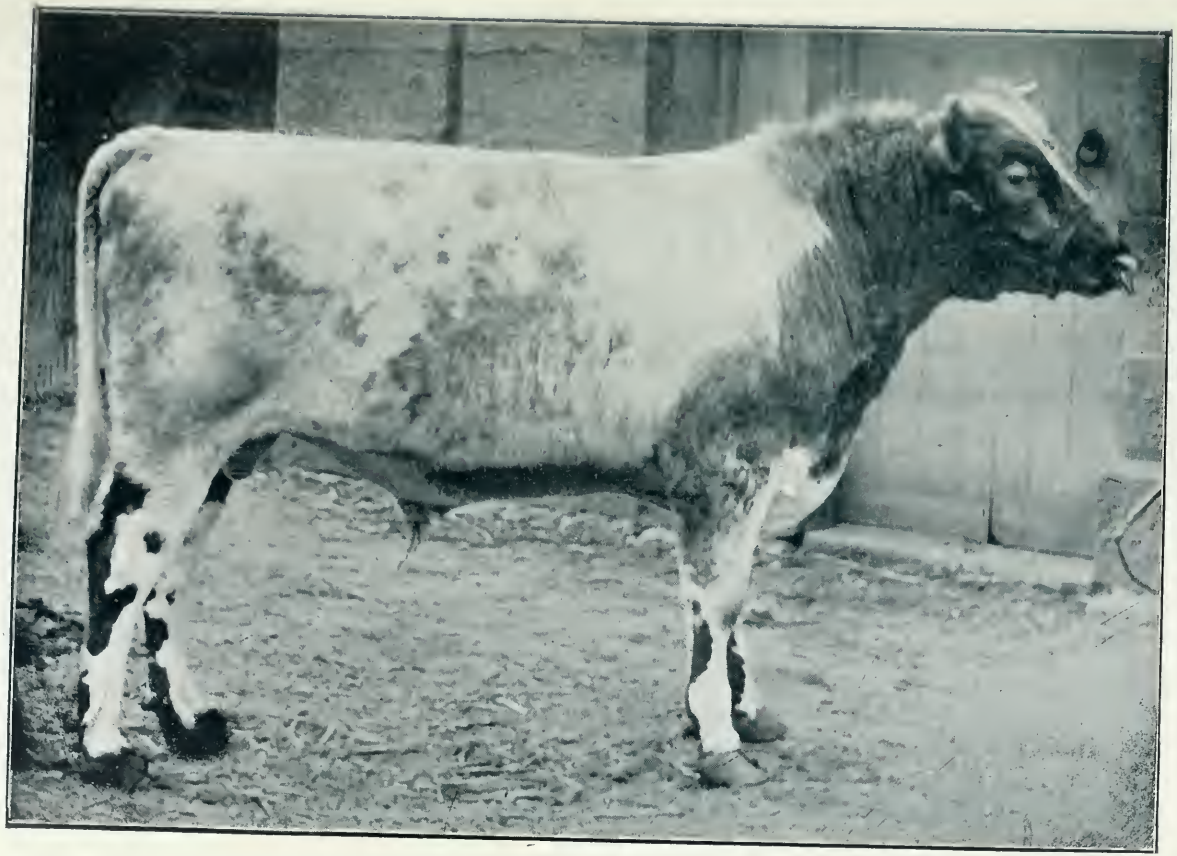


PLATE 45.—"ROYAL DALESMAN," TYPICAL SHORTHORN BULL FOR BREEDING MILCH COWS.
Sold for 105 guineas.

Face page 260.

progressive development of dairying. Useful yearling **bulls** suitable for the purpose of breeding good milking stock by colonial-bred cows can be bought in England and Scotland for £25 to £30 each. The cost of shipping being £30 each unfortunately increases the capital expenditure very materially. Another important matter which should not escape consideration is the **colour**. European cattle which possess white hair have usually white or fleshy-coloured skins underneath it, a shade which is less able than the darker colours of skin, which are generally correlated with brown or dark-coloured hair, to withstand the influences of the sun. It is a significant fact that dark brown is the favourite colour for native cattle among the Boer farmers, although probably it has not been previously pointed out that a light shade of skin is liable under South African conditions to be scorched by the sun while a dark skin would escape. It was known, however, that the tan-coloured teats of brown cattle are not so liable to crack and become sore under the influence of a hot sun as white teats are. Brown or dark roan shorthorns should certainly be preferred to light roans or whites. White cattle have long been in disfavour with American buyers, and they may be trusted to recognise what class of animal best suits their purposes and climatic conditions. The subject of colour of skin has been fully discussed at page 243.

The Ayrshire breed is not largely represented in the Colony, but in view of the fact that dairying is rapidly on the increase, and that this is perhaps the most perfect dairy cow among the smaller breeds, both in symmetry and performances, the points of the Ayrshire cow and their value in judging in the show-ring are given from a report by a committee of the Ayrshire Herd Book Society :—

"1. *Head* short ; forehead wide ; nose fine between the muzzle and eyes ; muzzle large ; eyes full and lively ; horns wide set on, inclining upwards, ... 10

2. *Neck* moderately long, and straight from the head to the top of the shoulder, free from loose skin on the under side, fine at its junction with the head, and enlarging symmetrically towards the shoulders, ... 5

3. *Forequarters*—shoulders sloping ; withers fine ; chest sufficiently broad and deep to ensure constitution ; brisket and whole forequarters light ; the cow gradually increasing in depth and width backwards, ... 5

4. *Back* short and straight; spine well defined, especially at the shoulders; ribs short and arched; body deep at the flanks, . 10

5. *Hindquarters* long, broad, and straight; hook-bones wide apart, and not overlaid with fat; thighs deep and broad" [but thin of flesh on the inner thigh or twist]; "tail long, slender, and set on level with the back, ... 8

6. *Udder* capacious, and not fleshy, hinderpart broad" [and rounded like the side of a cheese]. "The whole firmly attached to the body; the sole nearly level, and extending well forward; milk veins well developed; teats from 2 to 2½ in. long, equal in thickness, and hanging perpendicularly; distance apart, *at the sides*, equal to one-third of the length of the vessel, and *across* to about one-half of the breadth, ... 33"

[Small teats are now considered most objectionable, both in the market and the show-ring.]

"7. *Legs* short in proportion to size; bones fine, and joints firm, ... 3

8. *Skin* soft and elastic, and covered with soft, close, woolly hair, ... 5

9. *Colour* red, of any shade, brown, or white, or a mixture of these—each colour being distinctly defined Brindle or black and white is not in favour, ... 3

10. *Average live weight* in full milk about 10½ cwts., . . 8

11. *General stylish appearance* and movement, . . . 10

Perfection, 100"

One great drawback to the breed for the hot sunny climate of Cape Colony is the preponderating number of very light-coloured and almost white animals. Care would require to be taken not to select any for importation but those of dark colour.

The Devon breed is another which crosses remarkably well with Afrikander stock, and is in high favour in the comparatively limited number of places where it is known. It is the present-day representative of a breed of cattle that has long been noted for producing draught animals. In size it is greatly inferior to the Dutch and the shorthorn, but for activity and durability it more nearly approaches the Afrikander breed.

The North Devon is the original hardy type belonging to the elevated region in the north of Devonshire. As represented by the best specimens, this division of the breed is unsurpassed for compactness and symmetry of form. It is smaller than the Hereford or the Sussex, two

breeds to which it is allied. The colour of hair is a deep blood-red, and of the skin orange-yellow; inside the ears it is orange-red. The yellow is specially noticeable by its appearance round the eyes and muzzle. A small patch of white hair is a common marking on the belly in front of the udder of the cow or the scrotum of the bull. At times it extends till it reaches the forelegs, and by this it may be recognised as corresponding in a limited extent to the white under-line of the distantly related Hereford. The white hairs, sometimes mixed with the natural red brush of the tail, and also in patches on the body, are further proofs of the tendency to develop white markings. The head is adorned, in the case of the female, with particularly elegant, creamy-white, sharp-pointed, black-tipped horns of medium length, having a good elevation at the junction with the head, and curving upwards. In the bull, as compared with the cow, they are shorter in proportion to thickness, straighter, and less raised. The shoulder is specially neat and well formed, the barrel joining on behind, with scarcely a depression at the region of the heart-girth—a defective point in many breeds. The quality of the beef is excellent.

Hereford bulls cross well with native cows. As with the Devon breed, the red colour is favoured, and the white face is an attraction. It is, moreover, a larger animal than the Devon, and equally tractable in the yoke. It is next to the shorthorn the most widely distributed British breed of cattle, as it has a wonderful power of adaptability to varying surroundings. Neither the Devon nor the Hereford is famous as a milk-producer, although in recent years a decided improvement has taken place in this direction in both breeds.

The points of special and peculiar interest in the Hereford are, that the face, forward part of the back, as well as the throat, belly, inside and lower parts of the legs, and the tip of the tail are white, the greater part of the body being red or brown, varying from a light to a dark shade. The shoulder is particularly neat, and well covered with flesh, and the twist is also good. The great defect of the Hereford breed is its want of internal fat in proportion to its external appearance when ready for the butcher, *e.g.*, it is defective in internal "making-up." The setting on of the

tail is also frequently defective as compared with that of the shorthorn. The muzzle is flesh-coloured, and the horns are black tipped, of medium length, and in the female they incline slightly upwards.

The Dexter-Kerry, generally spoken of in the Colony as the Kerry, is to be seen in considerable numbers, not in herds, but as milch cows, where only one, or at most a limited number, is kept. The crosses for at least two generations retain several of the unique characteristics of the pure Kerry, and are usually spoken of as Kerrys. The pure Dexter-Kerry is a compact, substantial, low-set animal. It turns its toes in after a peculiar fashion, and it tends to walk over the outer digits, especially in the case of the hind feet. The breed and its crosses are famous for their good milking properties, in the matter of quality as well as quantity, even under circumstances which cannot be regarded as favourable for milk production. The oxen are too small and short in the leg for effective transport cattle, but they fatten readily and yield the finest quality of beef.

The Dexter-Shorthorn is a recently formed hardy breed of cattle, which has been reared on Major Barton's Straffan estate in Ireland. It combines in a marvellous way some of the most valuable characteristics of the two distinct and very different breeds which were employed in its formation. The stature and the milking properties—cows yielding 18 to 22 quarts of very rich milk per day—are those of the Kerry, but the marvellous substance and the faculty for beef production are decidedly of shorthorn origin. The **colour** is also that of the darker shades of the shorthorn breed—the black of the Kerry, on the one hand, and the white of certain strains of shorthorn on the other, being both absent. Should the breed progress as it promises to do, it will prove a valuable addition to the European breeds already represented in Cape Colony—its chief characteristics, even to the matter of colour, being suitable to South African conditions.

The **work of forming** the breed was begun by accident rather than by intent about thirty-five years ago, when a Dexter-Kerry heifer was put to a shorthorn bull. The invariable practice for many years was to castrate all the bull-calves, and to use well-bred shorthorn bulls on the

PLATE 46A.—DEXTER-KERRY BULL.
From the Herd of R. ROBERTSON, The Firs, Warwick, England.

PLATE 46B.—DEXTER KERRY COW.

Face page 264.

PLATE 47A.—DEXTER SHORTHORN BULL, "TINY TIM." Fifth Cross by Shorthorn Bulls from a Dexter Cow. Height at Shoulder, 4 feet ½ inch; Length, Shoulder-top to Tail-head, 4 feet 3 inches; Girth, 7 feet 3 inches; Dewlap, 13 inches from the ground.

PLATE 47B.—DEXTER-SHORTHORN HEIFER *Face page* 265.
Three years old, Five Crosses, from a Dexter Cow by Shorthorn Bulls.

Dexter-Shorthorn crosses. In spite of the fact that the cows in recent years have been working up to the possession of five and six pure shorthorn crosses in them, they tended in each succeeding generation to become shorter in the leg and more like the Dexter-Kerry in size. This tendency was encouraged by the selection of short-legged compact shorthorn bulls to use on the Dexter cows. With the object of fixing the new type, the old practice of using shorthorn bulls has recently been discontinued, and Dexter-Shorthorns, male and female, with five and six crosses of pure shorthorn blood in them, have been mated together. So far the first results are satisfactory, but the experiment has not yet gone beyond the stage of the first time of mating the Dexter-Shorthorns together. With so much shorthorn blood, and with such marked tendencies to retain the Kerry size and the Kerry milk-producing properties, little fear need be entertained of the ultimate results.

The only other cattle which it is necessary to mention are the **Channel Islands breeds**—the Jersey and the Guernsey, which usually go by the name of Alderneys. They occupy a similar position to that held by Island cattle in this country, being the cows of the men of means, who can afford to provide the attention necessary for their somewhat tender constitutions, and who wish to be provided with good supplies of milk, cream, and butter of a deep rich yellow colour. The Jersey is the smaller of the two, and also the more handsome and deer-like, though when bred in the Colony the representatives of the breeds become coarser and heavier, as they do when bred in England, but at the same time hardier than Island-bred cattle. The symmetry strongly resembles that of the Ayrshire, and the points, with the following exceptions, may be described in similar language:—Muzzle dark and encircled by short hair of a light colour; horns small, crumpled, yellow, with black tips; ears small and thin, and of a deep yellow colour inside; chest broad and deep; hide thin and mellow, and of a yellow colour; teats yellow; hair fine and soft, and of various, usually though not invariably, whole colours—fawn, silver-grey, dun, cream, or white, in addition to rare specimens, which are more or less black.

The Guernsey is a larger, stronger-boned, and coarser animal in appearance than the Jersey. Its outlines are not so regular or symmetrical, but in addition to good milking qualities—the sole possession of the Jersey beyond its good looks—the Guernsey adds no mean capacity for beef production when not giving milk. The meat is not of first-rate quality, being yellow in the fat like that of the Jersey.

The colours of Guernsey cattle are more "broken" than those of the Jersey, patches of white appearing on the predominating light-yellow, brown, or fawn. The muzzle is flesh-coloured.

Management of Cattle.

When **cows are milked** while running in the veld, where they sometimes travel as much as seven miles daily to feed and back again for water, they are brought up by boys in small clumps to the kraal, and milked once a day, the calves getting their only suck at the same time. The **calves** are kept apart from the mothers, and as each cow is tied up to a post in turn her name is called out, and a Kaffir boy, knowing each cow's calf at sight, cuts out the calf wanted from the mob of calves, freely using a long whip to facilitate matters. The calf is permitted to take the first milk, and when the cow has settled down to parting freely with it the calf is driven back by the liberal use of a light "knob-kerry," and the milker takes the middle portion of the milk, leaving the last for the calf to finish. It is generally believed that a native cow will not give her milk if the calf be not present, and when a calf dies a dummy has to be made by stuffing its skin, to prevent the cow going dry altogether. This is no doubt the result of training, as has been proved to be the case in India and in Egypt, and even in Scotland, where not so long since the dummy calf or "tulchan" * was in common use. The native boys who do the work have their own methods and ways of working, and it is almost impossible to introduce any modification of the system, which appears to have become a part of themselves. It would be practically impossible to get

* Carlyle in "Oliver Cromwell's Letters and Speeches," in discussing the "Tulchan-Bishops," gives an interesting account of the term, which was derived from the dummy calf. The word survives only in legal literature.

PLATE 48. JERSEY CATTLE, AND TABLE MOUNTAIN FROM NEWLANDS.

Face page 266.

PLATE 49.—AN AFRIKANDER COW BEING MILKED BY A KAFFIR BOY.

Face page 267.

them to let the calf have its share first, and, as a matter of economy, to milk the latter or richest portion which is left in the udder. A Kaffir would do it if you told him and stood by till he finished, but he would not comprehend the meaning of it, and would return to his own old way again next day. The Kaffirs do not **drink sweet milk**, as it is considered indigestible, and liable to pass too rapidly through the alimentary system without giving nourishment, but they put it for a few days in a gourd-calabash until it sours and becomes in warm weather a most palatable and refreshing beverage.

It is a **usual practice** in some parts of the bare, open grass-country **during winter** time to send the cattle to farms where there is tall bush. There grass and leguminous plants are protected by the overhanging bush, and supply the necessary winter food, but in spite of all this cattle become very poor at this season, and the time will come when a portion of the luxuriant growth of grass which cannot be used up in summer will be cut and made into **hay** of excellent quality for the use of cattle and other farm stock. This practice has already been successfully tried on an extensive scale at the **De Beers stock farm**, near Kimberley. The grass is cut down by mowing machines, which work well enough on selected places in the veld, and the weather is such at the time that all further working consists in simply raking the hay together within the next day or two and building it into stacks—200 tons being put up in the summer of 1894-95 at an outlay for extra labour of only £36. Owing to the drought it was worth £3 per ton, or £600, in Kimberley market the following winter.

The teeth of sheep and cattle often get loose in winter when they are in poor condition, owing to the want of soft green food and to a scarcity of salt.

Village cattle are usually provided with a common grazing ground, and are attended in a lot, each owner contributing a small sum towards the wages of a herd, and also in certain cases paying a nominal rent to the municipal or other local authority, under whose regulations the cattle are kept. In such a place as Worcester it was interesting to see the commonage herd, amounting to a few hundreds, brought

home at five o'clock, and each animal wending its way unattended through the streets to its own stable.*

It is a common practice to allow **Kaffir servants** to graze a few **cattle**—ten or even twenty each—as a portion of their remuneration, and on large grazing farms up-country, in the Transvaal, the Kaffirs' cattle at times rival the master's in numbers. One old Kaffir, who has been all his life on a farm near Pretoria, owns 500 head of cattle.

Until the railways were made nearly the whole haulage of the Colony was done by **transport oxen**, and the main thoroughfares of traffic followed unmade roads, or simply tracks in the veld, so numerous that they formed a regular network all through the country. This state of matters is largely accountable for the rapid rate at which all forms of contagious disease among cattle used to spread, and it also made it extremely difficult to enforce regulations with the object of checking the spread of disease. Interference with the movements of cattle not only meant inconvenience to stock farmers and butchers, but a dislocation of the carrying trade as well, and consequent dissatisfaction and opposition. Young farmers in certain districts laid themselves out to do transport work, and not only neglected their farming operations, but got into indolent habits, so that when the railway supplanted the ox-waggon they, not having acquired a taste for agriculture, or experience of manual labour of this kind, could not or would not work on the farm. Transport riding, although a hard life, is a free and easy, hanging-on, and lazy one. The remuneration was tempting in the early days of the diamond fields—as much as 25s. and even higher rates were paid per 100 lbs. for carriage from Grahamstown to Kimberley. The **farming** in the **Bathurst district** has suffered from the influences alluded to. It is also a district in which the farmers have had exceptional trials and difficulties, and have been driven or induced to change their systems too rapidly. It was at one time an excellent sheep country, but the heart-water disease made it impossible to farm sheep at a profit, and cattle were resorted to. A period of prosperity

* A similar condition of things is characteristic of the famous town of Erzeroum, and on a small scale may be seen at Newcastleton and certain other rural villages in Scotland.

PLATE 50.—TRAVELLING BY OX-WAGGON IN SOUTH AFRICA.

Face page 268.

Photo. by W. Roe, Graaff Reinet. PLATE 51.—BULLOCK WAGGONS FORDING A RIVER. *Face page 269.*

followed, as breeding oxen required little supervision or outlay, and yielded large prices for transport purposes, while the transport work itself brought much money into the district. The collapse of the transport trade, followed by serious losses of cattle from red-water, simultaneously with losses from horse-sickness, has effectually depleted the coffers of many farmers not well trained to turn to agricultural pursuits; nor do the prices of agricultural produce offer much inducement for them to do so even if they were willing. The development of a dairying industry, which had begun, has been checked for a time at least by the ravages of red-water, and nothing is left for the moment capable of being carried out on a large scale except fruit culture, which, however, seems to be promising.

Experienced **transport riders** do the most of their work at night, and thereby prevent much death among their oxen from chills, and from the general exhaustion which would follow continuous struggling in the hot sun. Natives, much to their advantage, are now following this example. The practice is to inspan an hour before sunset, and to go on till say eleven o'clock, then outspan for a few hours, tying up the cattle in the yoke where they lie. A start is again made in the early morning—probably about three o'clock—in time to have the oxen in motion before the occurrence of the period of cold which precedes the dawn. By this means chills are avoided, as the sun is well up and the air warm before the next outspan is made. The cattle are then allowed to disperse on the veld to feed and drink. While resting at night they get an opportunity of chewing the cud. They at times do this on the road if they are not pulling hard, and if the neck-strap of the yoke is not exercising pressure on the gullet. Sixteen is the usual number of a span of oxen, though on very heavy roads twenty may be yoked together. Up-country in wet weather as many as five spans are sometimes yoked to a waggon to get it out of the mud. The "voor-ossen" and "achter-ossen," or the first and last pair, being picked specimens, used to be worth in the good old early days as much as £16 each, and the whole span would average about £12. Now good transport oxen are only worth £6 or £7 each. Oxen are broken in to work at

two or three years old, and are now sold to the butcher at six or eight years of age. In the busy times they were worked as long as their teeth remained good enough to enable them to eat to keep themselves in working condition.

Though the numbers of cattle have not fallen off so much as those of horses and swine, there has been a considerable decrease in recent years, a tendency which is altogether in the wrong direction in a Colony which has such extensive possibilities as a stock-rearing country. The numbers of cattle taken during the census of 1891 were 1,557,166; in 1892-93 the estimate was 1,313,298; in 1893-94, 1,299,291; and in 1894-95, 1,290,461.

Dairying.

The dairy industry has grown in a most satisfactory manner within recent years. Encouraged by the success of Victoria in developing a large export trade in butter to Great Britain, the Cape Government in 1892 sent Alexander Macdonald, the Agricultural Assistant stationed at Grahamstown, to Europe to inquire into the most recent advances in the dairy world, and to procure the most approved modern appliances. As a result of this action, two travelling dairies have been fitted out, one in the Eastern Province and the other in the Western Province, and instruction not only in the theory but also in the best practices of butter- and cheese-making has been provided for farmers within easy reach of their homes. This has proved perhaps the most successful effort, so far as it has gone, ever made by the Cape Government in the interests of agricultural improvement. The Boer, as well as the English farmers and their wives and daughters, have taken to the work with so much success that it may be said an important industry, capable of great extension, is being developed in the Colony. The butter which was made before this time could not be put on the market in large samples of uniform quality, and the market rate was governed by local demand. In seasons of plenty it went down in price until it fell below a figure that left a profit to the farmer—as low as 6d. and 9d. per lb. in out-of-the-way places. Experiments in the **storing** of butter in **refrigerating chambers** during the period of plentiful supply, and keeping it for sale at a later

FOLD

OUT

period, were reported in 1895 by the Agricultural Assistant at Grahamstown. The butter was sold at 1s. 11d. per lb., which left 5d. per lb. of profit after all expenses of storing were deducted—*i.e.*, from about 1½d. to 3d. per lb., according to the length of time—two or four months—the cold chamber was in requisition.

The interest in butter-making has been successfully fostered by Government giving prizes of £2. 10s. to £10 at **butter-making competitions** at agricultural shows, and also large **money prizes** for butter exhibited after having been kept for a week without being previously salted.

By the last published **statistical returns** 1,782,464 lbs. of butter and margarine, valued at £85,246, were imported into the Colony within the year, although an import duty of 3d. per lb. on butter and 12 per cent. of the value of margarine is charged. The money paid for margarine amounted to £25,000, or nearly one-third of the whole. In a stock country like Cape Colony, there is no insurmountable reason why it should not in time be an exporter rather than an importer of butter, following the excellent example set by the Australasian colonies—the development of whose butter trade with Europe within the last eight years has been phenomenal. And it would not be contrary to the prevailing South African opinion of the duty which Government owes to a new industry if Government bounties were offered for a few years, on lines somewhat similar to those adopted in Victoria, to encourage exportation.

The great **advantage of an export connection** to the farming community does not lie in a high price for produce shipped abroad, for such prices are usually moderate, but in maintaining a more uniform market at home by providing a ready means for the disposal of surplus produce. Export encourages the extension of production, and enables a farmer to produce on a wholesale scale at wholesale (*i.e.*, moderate) rates of expenditure, so that he is in a better position on the whole with a larger growing business than if he were working merely for a local and limited market, and receiving a higher return per unit.

The success of the new dairy industry prominently in the **Bedford district** is a hopeful indication of the future possi-

bilities of an export trade to be established after the advantages of **co-operative dairying** have been fully realised. One defect of the creamery system adopted in the Bedford district is that it is not on the true co-operative plan, under which each man concerned participates in the profits in proportion to the amount of his milk supply, and only milk producers who send milk are permitted to be members of the company. This arrangement entirely eliminates conflicting interests, and encourages all to work in the interests of the common good, as they are identical with their own. No doubt the arrangements in the neighbourhood of Bedford, in the numerous creameries which have been there established in recent years, have been productive of good, but they lack the important element of finality and stability which could be better associated with genuine co-operation.

The **practice** is for the farmer to run the milk warm from the cow through a centrifugal separator, so that the separated milk may remain on the farm for the feeding of calves and pigs, and for consumption by the native population, who prefer it to ordinary skimmed milk. This preference is no doubt due to the fact that during the subsequent keeping of the separated milk in their gourd calabashes, there is much less chance of butyric acid fermentation (which produces bitterness) being set up than in the case of skim-milk which had been exposed for a considerable time to atmospheric influences. The cream only is sent to the creamery, but owing to the want of community of interests, each man's supply requires to be churned by itself at great labour and expense. One shilling per lb. is paid for the butter, and the profits go to the individual or the company which owns the creamery.

It was at one time believed that something in the South African climate or in the pasture rendered it impossible to make **cheese** of first-rate quality, but the success of a limited number of private individuals, and more recently of the dairy experts in charge of the travelling dairies, has clearly shown that only skill and the necessary dairy conveniences are required under the somewhat trying conditions prevalent in the Colony to command success.

The **mechanical milk separator** has no doubt a promising future in Cape Colony, a future which may emulate the mar-

vellous success in recent years of the Laval hand separator in India. Machines capable of doing excellent work can now be had, from the "Humming-bird" hand separator, which can be easily worked by a lady, to the steam-power machine, doing hundreds of gallons per hour.

After a few partial successes and many failures, at last **a mechanical milking machine** has been invented, which can extract the milk of one up to ten cows at a time in the short space of five minutes, agreeably to the animals, and without doing any injury. The great advantage, from the consumer's point of view, is the gain in cleanliness, a matter as important in Cape Colony as in Europe. Although, partially owing to their greater cost, and partially owing to the presence of Kaffir milkers, mechanical milking machines are not so likely to become as widely distributed as mechanical milk separators, yet, in dairies kept for the supply of milk to large centres of population, they will no doubt prove to be an important convenience as well as an immense safeguard in the interests of the community against filth and against numerous contagious diseases which are so frequently spread by a contaminated milk-supply. (See Appendix E.)

CHAPTER XIV.

DISEASES OF CATTLE.

Nature of Diseases—Boer Remedies—The Veterinary Staff—Necessity for Scientific Research—Tuberculosis—Lung-Sickness—Anthrax—Stijf-Sickness—Gall-Sickness—Liver Disease in Calves—Red-Water in Cattle—American Experiments on Texas Fever—Influence of Ticks—Rinderpest.

The diseases of farm animals may be said to be well represented in Cape Colony. Most common forms familiar to stockowners in Europe are to be found, although a few of these are of a decidedly milder type than we are familiar with. As in Australia, pleuro-pneumonia is not so deadly as in Great Britain, although large numbers of cattle die annually of the disease. The Colony also possesses a number of diseases which are not met with in Europe, and are either peculiar to South Africa, or are only heard of in some other distant part of the world. Heart-water in sheep and horse-sickness are, so far as we know, exclusively African; while red-water, which is entirely distinct from the red-water due to poor feeding in this country, appears to be identical with Texas fever and the red-water of Queensland, being intimately associated with the presence of large numbers of **ticks** (*Ixodes*) adhering to the skins of cattle grazing in those areas which are subject to the disease.

Diseases of the **malarial fever type** are particularly prevalent, owing to the nature of the climate supplying suitable conditions in the high temperature of the South African summer, and the moisture which comes in the form of heavy dews and mists or fogs at night. The great range of temperature brings about directly, and also indirectly, numerous derangements of the liver, very frequently as a secondary associate to disorder of the stomach and intestines.

If diseases are to be counted by the hundred, the **common**

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PLATE 52.

DUNCAN HUTCHEON.

The Colonial Veterinary Surgeon who was the Author's companion during most of the time spent in the chief Live Stock Districts of the Colony.

remedies practised, and also firmly believed in by the farming population, amount to thousands. There never was a country where local remedies were more numerous, and in a vast number of cases, it might well be added, more worthless. The best that can be said of many is that at least they can do no harm. A moment's consideration of the composition of the following mixture, used as a cure for loose teeth, will show how harmless and at the same time how useless certain of the remedies are. The amounts are—one bucket of salt, two buckets of bran, and half a bottle of paraffin oil, for 800 to 1,000 sheep. The salt might be useful to a very limited extent, but three drops of paraffin oil per sheep could have absolutely no effect whatever.* The giving of a mixture of eight bushels of salt to one bushel of sulphur per 1,000 sheep every third day is an example of a valuable and simple preventive and alterative treatment. The sulphur is an excellent purifier of the system. It encourages the growth of wool, and is the best known simple preventive of parasites generally. The salt also acts as an anti-pest, and at the same time supplies a most necessary saline ingredient to the blood in a country which is in many parts deficient in a natural supply of salt.

Another practice, the wisdom of which may be regarded as somewhat doubtful, is the mixing of household ashes with salt, and making the mixture into a paste, to prevent the ingredients washing away readily. No doubt this is a saving of labour, or an encouragement of laziness, as the case may be; but it is probable that the sheep would be fully better off did they not consume the potash present in quantity in the household ash.

It is not difficult to see the reason why simple **home remedies** should be resorted to, because, owing to the population being widely scattered, and to the impossibility of getting veterinary relief in time, if at all, farmers are thrown much more upon their own resources than they are in Great Britain; but the extraordinary nature of the position is in the persistence with which worthless remedies continue to be practised and recommended when one would expect individuals

* One pint bottle (12 oz.) contains 5,760 minims, drops, or liquid grains of water at 60° F.

with well-developed powers of observation, as farmers usually are, to distinguish between what is valuable and what is worthless. It would seem as if they started with the assumption that most animals when they become ill die, and that those which recover are saved by the remedy which promptly receives the credit of it. Animals are often half killed by drenching, and then permitted to recover from the maltreatment and the ailment at the same time. There is no limit to the variety of materials used for this purpose. Practically, anything at hand will do. If a man is out shooting, and one of his animals suffers from a functional derangement, he administers gunpowder; if on a journey, the anti-friction grease which he uses for his waggon wheels is substituted; and if at home, paraffin would probably get the preference over a number of other alternative remedies, each of which, in the absence of the others, might have secured attention.

The leading idea of the uneducated Boer farmer is to find remedies for the diseases that appear among his stock. He has not grasped the spirit of the comparatively new science of preventive medicine, regardless of the fact that precautionary measures are capable of being carried out wholesale, and at wholesale cost, whereas remedial measures are of the nature of a retail business, and naturally limited, even when successful, to contracted spheres of usefulness. The difference between the two amounts to the difference of keeping an enemy out of the camp, and the forcible ejection of him at considerably increased risk and increased expenditure of energy when he has gained an entrance. It was no uncommon occurrence to hear a Boer farmer argue that his knowledge of disease is greater than that of the Colonial Veterinary Surgeon, because he could make up his mind, while looking at an animal, what the disease in question was; while the latter frequently could not tell the cause of death until he had examined the animal's inside. So many diseases show similar external symptoms that it is often impossible to be absolutely certain of the cause of death without conducting a *post-mortem* examination. The praiseworthy scientific caution displayed in not jumping to conclusions without sufficient evidence, and the natural reserve in expressing opinions, which are inherent qualities in a man of science, are too often mistaken for want of

knowledge; and the hasty conclusions and confident assertions of the quack doctor gain a popularity which is denied to the man who digests his thoughts and weighs his words. One farmer, in all seriousness, associated the increase of disease with the presence of **the Veterinary Adviser**—familiarly called the "Bok" or "Buck-doctor," from early associations connected with the stamping out of contagious lung disease in goats—and suggested that if he were got rid of, the diseases which had appeared, or had seriously extended since his coming, would disappear also! Whatever local opinion may be of the direction from which relief from diseases among farm stock may be expected, the great hope of the colonial farmer should rest on the extension of **prophylactic** rather than on remedial **treatment**. And this remark applies as well to the prevention of injury due to parasitic infestation—internal and external—as to those ailments which are known as diseases, the causes of which are often more obscure. But before any important advances can be made in this direction, much work has yet to be done in investigating the nature of the diseases to be dealt with. A number of well-known diseases represented in South Africa possess local peculiarities, and the nature of others, which are inherent to that part of the world, remains undetermined. At present the qualified **staff of veterinary surgeons,** consisting of the Colonial Veterinary Surgeon (Dr Hutcheon) and seven assistants,* are employed in giving veterinary advice and assistance to farmers in all parts of the country free of charge, or at the Government expense—rather a unique arrangement. A vast field of investigation lies open, and almost daily evidence is forthcoming of the necessities of a more extended knowledge of the diseases from which many thousands of animals die annually, to enable the veterinary surgeons to give valuable assistance when they are called in. Nevertheless, it is somewhat strange that, with one or two insignificant exceptions, really no systematic attempt has been made to investigate the at-present-hidden nature of so many diseases from which colonial stock suffers.

The Bacteriological Institute is engaged mainly in one great line of research on certain diseases, the local aspects of

* J. D. Borthwick, J. F. Soga, O. Henning, J. W. Crowhurst, H. A. Pattison, M. A. Hutchence, and J. W. Dixon.

which are pretty well understood, but there are other forms of disease with regard to which a certain amount of preliminary investigation on the spot where they occur is necessary. Whether the Government may or may not find it expedient to continue to retain a staff of veterinary surgeons engaged in general practice, the **veterinary department** can never assume the position of importance and of usefulness which the clamant needs of the Colony demand until its best energies are devoted to **original investigation** into the nature of those diseases which remain for the present more or less hidden mysteries. It has already been demonstrated in connection with the inquiry made at Koonap into liver disease in calves, that farmers are to be found who are willing to offer ample facilities for the investigation of diseases on their farms ; but to carry out experiments in a perfectly independent and satisfactory manner Government must bear the burden of all expenses. The work is done in the interests of the community, and the public purse ought to supply the necessary funds. A moderate outlay in the direction indicated would lead to more satisfactory results being obtained from current expenditure, for it must be evident that the country does not reap full benefit from the services of men who, at the charge of the Colony, go to inquire into and to recommend treatment for diseases which they do not understand. It would also be the means of removing a solid and reasonable doubt in the minds of the Boer farmers regarding the skill of the veterinary staff. While common diseases remain uninvestigated, the practitioner when called in must either show his ignorance, which would be fatal to his reputation, or under great disadvantages try experiments which, in the event of failure, would have the same effect. Though little progress has been made in the original investigation of disease, a good deal has been done in the matter of finding means to cope with the attacks of **internal parasites**, yet the work in this direction is far from complete. With the increase of live stock in a new country there is, as a rule, concurrently a great increase of parasitic pests, and where there is any tendency to overstocking, the pests become all the more numerous and more destructive. Overstocking crowds the animals on a limited area, restricts the amount of food, and makes the pasture foul. It also leads to stock thriving badly,

and whenever an animal falls into low condition, it becomes a more ready prey to most classes of parasites. The climate seems also favourable to the increase of parasites. Periodical and even annual droughts reduce the condition of stock, and make them susceptible of parasitic attack, and the system of running sheep closely together in flocks and kraaling them at night also directly and indirectly leads to the increase of parasites. The system of watering stock from stagnant dams encourages probably more than anything else the dissemination of those parasites which pass a portion of the cycle of their life-history away from the body of the animal host. Where well-water is to be had, the danger resulting from the drinking of

DAM OF STAGNANT WATER ON THE KAROO.

stagnant water made putrid and unwholesome by the droppings of animals coming to drink can be overcome, but in many places it would seem as if it would be necessary to try means in other directions by which parasites may be kept in check. One of the best preventives is obtained by divisional fencing, so that a change of pasture can frequently be secured. The internal parasites of farm animals do not make all species indiscriminately their hosts, but each species of parasite is, as a rule, although there are exceptions, confined to one class. By changing the stock at suitable times from one portion of veld to another, while stocking the land which had been cleared with animals of a different species, parasites which are

dependent upon an animal host can be reduced in numbers to a very large extent. In the case of those pests which propagate independently of the animals of the farm, the difficulty of coping with them is infinitely greater. With the others the change of stock means a period of starvation, and if this be continued long enough the parasites die, and the veld becomes clean and ready to receive the original stock once more. In another respect the change of stock leads to a decided improvement in the natural herbage. Different species of animals have special favour for different species of plants, and the change of stock gives a rest to those plants which for the time being are not in favour with the stock on the ground. Mixing various species of stock in grazing confers in a modified fashion the advantages to be derived from change of stock.

There are a few **diseases** which, either from their peculiar nature or from the amount of mischief they bring about, are worthy of being briefly and **generally mentioned,** but no attempt will be made to describe exhaustively either symptoms or treatment. The object will have been gained if an interest be awakened and a desire to learn stimulated in those whose duty it is to become familiar with the numerous diseases that affect farm live stock in general, but those of South Africa in particular. The shelves of the Department of Agriculture at Cape Town hold a wealth of information in convenient pamphlet form, to a large extent from the reliable pen of the Colonial Veterinary Surgeon, ready for distribution to farmers, on nearly all the most important diseases represented in the Colony. Should enterprising inquirers after knowledge desire to go further afield, they could not do better than read the voluminous works of Professor Williams, the Principal of the New Veterinary College, Edinburgh.*

Tuberculosis in farm stock, which is the bovine form of the disease known as phthisis or consumption in the human species, is peculiarly interesting to the general public, owing to the liability which those who drink the milk and eat the flesh of tuberculous animals have of contracting the disease. More especially is this the case when from any cause the system is run down, or the mucous lining of the alimentary canal is

* Veterinary Medicine and Veterinary Surgery (7th and 8th editions), each 22s. 6d. net, J. Menzies & Co., Edinburgh.

in a catarrhal or weakened condition. Useful progress has recently been made in determining the nature of this disease, and it is now regarded as one which human efforts might by proper means nearly eradicate. Koch's discovery that the temperature of an animal suffering from the disease, however slightly, rises after its injection with tuberculin, while the temperature of a healthy animal so injected remains normal, has made the diagnosis of the disease both simple and certain. Professor Bang, of Copenhagen, who has conducted during a number of years many interesting experiments with dairy cows, has demonstrated that calves born of tuberculous cows can be reared free from tuberculosis if kept apart from diseased animals and fed on boiled milk which may be drawn from tuberculous cows. This disposes of the old idea that the disease very frequently descended for constitutional reasons from the father or mother to the progeny. Although an animal may not inherit the disease from its parents, the offspring of a diseased parent is liable to inherit a constitutional tendency to take the disease when exposed to its influences. The production of tuberculin will naturally form a portion of the work of the extended Bacteriological Institute of the future. With the object of getting rid of tuberculosis among cattle, it has been proposed that all suspected herds should be inoculated every six months, and that all which respond to the action of the tuberculin should at once be placed apart from the healthy section of the stock and kept by themselves. Many such will look healthy to the eye, and yet have entered the early stages of the malady. All unthrifty tuberculous cattle should be killed without delay and destroyed, but the flesh of those which are only locally affected may, as a rule, be used for human food with comparative safety. The eradication of tuberculosis is of such absorbing personal interest to all, and of such pecuniary interest to the farming population, that it is worthy of Government consideration to the extent of grants as compensation to those whose animals have been slaughtered for the public safety.

Cattle which run at large on the veld, practically in a state of nature, rarely if ever suffer from the disease. Even animals kept in open yards in England, under conditions which correspond closely to those that cattle in kraal are subjected to, rarely suffer. It is in the badly ventilated dairy in which

cows are stalled closely together, as is often the case in the dairies engaged in the production of the supply of milk for towns, that the disease once introduced is likely to spread—in the very position, in short, where its presence is most objectionable. Although the great majority of Cape cattle may be regarded as quite without the sphere of the disease, those shut up in close houses are as liable to its attacks as the cattle in Great Britain. As it is rapidly on the increase in this country, the Colony ought to be alive to the growing danger of importing it.

Lung-sickness, "longziekte," or *pleuro-pneumonia*, a highly infectious lung disease in cattle, is one of the most severe stock scourges in the Colony. The *post-mortem* reveals pleurisy, accompanied by pneumonia, consolidation of the lung substance, which presents in section a marbled appearance due to the infiltration with lymph of the interstitial tissue of the lung, so very well developed in the ox. Microscopical examination of a section of the lung shows the lymphatic spaces and air-tubes completely plugged with an inflammatory coagulated exudate, while the epithelial lining of the bronchial walls is healthy and natural. The latter condition readily distinguishes true pleuro-pneumonia from **broncho-pneumonia**, the "corn-stalk" disease of America, which any animal is liable to contract if exposed to inclement weather. In this disease, which is not infectious, though several animals in the same herd and exposed to the same conditions may suffer from it simultaneously, the bronchial tubes are the primary seat of the disorder, not the lung parenchyma nor the pleura. The epithelial cells forming the bronchial lining are shed, and mixing with the catarrhal products in the tubes, also help to fill them up.

Regulations have been from time to time drawn up with the object of checking or stamping out the disease, but not being stringent enough, they have only proved vexatious and of little value; but that the disease can be stamped out has been demonstrated in Great Britain by the successful efforts of the Board of Agriculture, which cleared the country of pleuro-pneumonia in 1893. The method employed—viz., the slaughter of all diseased and in-contact animals—would hardly be possible in the Colony, nor is such an extreme measure as whole-

sale slaughter necessary. A judicious combination of **inoculation and slaughter** would ultimately attain the same end at much less cost, on account of there being fewer animals for which compensation would require to be paid by Government.

Inoculation without slaughter of those which refused to react to the inoculation would not accomplish the object, as certain animals which recover from mild attacks of the disease can carry about latent diseased nodules in their lungs, which are liable at any time to become active, and to lead to an outbreak among the other members of the herd which come in contact with or breathe in the same atmosphere as the affected animals. Some 12 to 20 per cent. of the cattle exposed in the vicinity of diseased cattle, on account of some natural immunity, do not take the disease, yet few resist the influence of skilful inoculation, unless they are suffering from the disease at the time, and even then a limited number react if the disease be in an early stage. Even those which have been previously inoculated give the reaction, though in a mild form, after a second inoculation. A few animals actually contract true pleuro-pneumonia through the medium of inoculation, although such cases are extremely rare. In what has already been said rests the weak point of inoculation. Once the operation has been successfully carried out, an animal, however exposed to the presence and influence of diseased cattle, will not, for a considerable time at least, contract the disease. The system of ingestion is altogether less satisfactory than inoculation, and experience has shown that the most suitable and safest spot to operate upon is the inner side of the tail, a short distance from the point. **The lymph** can be got from the clear serous exudate from the lung of an animal which has died of the disease, but it is best obtained from the clear serum found in the interlobular spaces of lungs secured in the early stages of the inflammatory process, the animal having been purposely killed and properly bled. In the Colony it is manufactured at the Bacteriological Institute on a large scale, and sent out in hermetically sealed tubes to those who care to pay for it. A piece of clean white woollen yarn, after being soaked in the liquid, is inserted for the distance of about an inch underneath the skin of the **tail**. If the instrument used for introducing the yarn goes deeper than the skin, it is liable to injure

the bone and induce disease of the part, which, if not attended to, might cause death from mortification. Should any injury to the bone occur, or should the swelling which naturally takes place go far up and threaten to extend to the body, the point of the tail should be amputated. If this is not done the tail becomes gangrenous. A large portion frequently sloughs off, and thereby saves the animal's life. This accounts for the large number of cattle with truncated tails seen in the Colony. When cattle are running at large in the open veld, it is difficult to watch with sufficient care the rise of temperature and the local enlargement which take place. Still, when the work is skilfully performed, not more than 1 or 2 per cent. of casualties occur.

In 1893 over 36,000 cattle are reported to have **died** of pleuro-pneumonia in the Colony, a serious drain upon the resources of the stockowners. There is no doubt whatever about the possibility of getting rid of the disease, but the difficulty would arise in the opposition of farmers and transport riders to Government interference with the movement of cattle. At present diseased cattle are left to wander about in the veld in such a manner that it is wonderful the losses are not infinitely more numerous than they are. The period of **incubation** is very various and uncertain. The specific germ of pleuro-pneumonia, like that of rabies, cannot be cultivated artificially in the laboratory. There are several important points which remain in doubt with regard to lung-sickness, but there is one which has been fully demonstrated, viz., that **no cure**, medicinal or otherwise, exists for the disease. An animal which has partially recovered must always remain a centre of danger, and should not be retained among healthy animals.

Anthrax, locally termed "**meltziekte**" or "gift-ziekte," is a disease which, in its well-known erratic and spasmodic way, appears from time to time in all districts of the Colony, and among all classes of stock. One of the most serious outbreaks, extending over a number of years, occurred among horses in Griqualand West. The disease is produced by the rapid multiplication or growth of a rod-like vegetable **micro-organism**, allied to the *Fission-fungi* and distinguished as *Bacillus anthracis*. The great difficulty which is met with in combating this disease arises from the fact that this organism can live and multiply,

apart from animals altogether, in soils rich in humus, such as in meadows or low-lying vleis which retain a good supply of moisture. The spores of it, following the natural law in relation to lower organisms of this kind, have great power of persistence, only developing into mature forms under favourable circumstances as regards heat, air, and moisture. Natural atmospheric changes of heat and cold will not destroy them, and they remain for years ready to be picked up and swallowed by animals grazing over land which has become impregnated with them. This is the most usual way of infection, but in addition to the organisms or their spores being taken up by the animal, it is a generally accepted opinion among scientific men who have studied the question, that there must be some lesion in the mucous membrane by which they get access to the circulatory system, else they are liable to be destroyed by the gastric juices and prove innocuous. Being of the nature of a blood poison, the disease is readily contracted by accidental inoculation, as while one is engaged in skinning an animal which has died of anthrax, or by people consuming the flesh in an imperfectly cooked condition. It is somewhat anomalous in this connection that, on anthrax breaking out in horses or in cattle or sheep, the attack is generally confined to the one species, and does not extend to the others. The disease is known in two forms in the Colony—(1.) **Splenic apoplexy,** or the true meltziekte, sometimes designated intestinal anthrax, in which there are no local swellings, but the blood is much affected and the internal organs generally congested, the spleen being three or four times its normal size. Death usually occurs within an hour after illness is noticed. (2.) Gift-ziekte might be described as **localised anthrax**; it is contracted frequently by accidental contagious inoculation. It is recognised by local external swellings, most frequently about the under surfaces of the body. It does not run its course so rapidly as the other form of anthrax, and after the death of the animal there is not the same danger of contaminating the surface of the ground with the anthrax bacillus. It is most frequently met with among horses, when it is commonly recognised as malignant pustule. The administration of carbolic acid internally, and the local injection of it hypodermically,

have been successful in curing a large percentage of horses suffering from this form of the malady. In true anthrax little can be done in the way of **treatment**, owing to the extraordinary rapidity with which it runs its course; but it is possible to reduce the amount of anthrax in the Colony by preventive means, such as carefully burning all carcases of animals which have died of the disease, or burying them five feet deep in dry sandy soil, unsuitable to the propagation of the organisms, and by spreading quicklime about the place. Although the **germs** do live and propagate in the soil, giving evidence of their presence through fresh outbreaks during the summer and autumn months, there is no doubt but that the true fountain-head is the blood of diseased animals, from which the supply is replenished from time to time as they die and remain unburied. If the supply of germs from carcases were completely stopped, the outbreaks of anthrax would steadily grow less, and might in the end disappear altogether.

Stiff-sickness or "stijf-ziekte," and "lam-ziekte" or paralysis, would appear to be two forms of the same disease. The first, chiefly affecting the fore-limbs, is much the more prevalent of the two. The second form involves the spinal column and hindquarters, and is generally accompanied by a greater or less amount of serous effusion into the spinal canal, which, as it tends to gravitate towards the brain and *medulla oblongata*, produces paralysis more or less complete. Stiff-sickness and lame-sickness are "*enzootic* diseases confined to certain localities, and due to certain peculiarities of soil and climate." They are characterised by a "congested and inflamed condition of the articular extremities of the bones of the limbs and their cartilages and of the vertebral column." These diseases generally appear "during the winter and spring months, after the grasses have shed their seeds, and before the fresh grasses have sprung up," and also during periods of drought. **Cattle** are most subject to them, and they suffer most severely, but sheep and goats, and even horses, in some localities become affected. Young and growing animals and milch cows are most liable to the disease. Full-grown oxen as a rule escape. Animals do not die so much from stijf-ziekte as from poverty due to the difficulty experienced in moving about in search of food, but the recoveries from lam-ziekte are comparatively few. The

Colonial Veterinary Surgeon traces the **inciting cause** to "defective nutrition of the bones," due to the absence of a proper supply of **phosphates** in the food, the soil on which it grew being deficient in phosphate of lime. It is a fact that animals living on food grown upon rich land do not suffer, and that the recurrence of the disease in a herd of cattle is prevented when supplies of **bone** are consumed by them. In those districts where the disease prevails, the bones of dead animals are greedily eaten by stock. It is a regular practice with many to supply bones to their animals in a finely ground condition as meal, or better, as flour, and usually mixed with common salt. Experiments initiated by the Veterinary Department, and carried out by J. D. Borthwick, in the summer of 1895-96, go not only to confirm the good opinions held relating to the efficacy of bone meal as a remedy, but they have also demonstrated that cattle improve much in condition and in appearance when it is supplied to them. In out-of-the-way districts, where facilities for grinding do not exist, the bones can be made into a condition which renders them easy of reduction by burning them and wetting them with dilute hydrochloric acid, or by throwing them into a pit with quicklime. Change of veld is a useful precaution, having not only a preventive but also a curative effect. To give plenty of exercise, especially in the earlier stages of an attack of stijf-ziekte, is a beneficial treatment.

There is a very general belief among farmers that the disease is contagious, but this seems to have arisen through cases of anthrax—a disease readily communicated to healthy animals—having been mistaken for lam-ziekte. Others believe that the disease is due to poisonous plants which the cattle eat. But unfortunately for this theory the first symptoms are not a deranged digestion, but a peculiarity of gait; and although it is generally only on certain parts of the veld that animals develop the disease, healthy animals brought from a distance do not suffer so quickly as those which have grazed on the same land for a time. Although the want of "bone-earth" in the food is no doubt the main cause, it is possible that in the consequent enfeebled condition of system some other evil influence which is not yet understood is also at work in bringing about the acute symptoms of the disease.

Gall-sickness is a term indiscriminately applied by farmers to derangements of the liver, brought about by many exciting causes—rich food, little exercise, and hot weather being three of the most common—and too often when the liver derangement is merely a secondary symptom, both in the matter of time and of importance. The number of deaths in Cape Colony from gall-sickness, as the term is commonly understood, amounts to over a quarter of a million of cattle, sheep, and goats annually. Dr Hutcheon points out that the horse, having no gall-bladder to leave in a distended condition on the liver to attract attention, is not included in lists of casualties from gall-sickness, although the horse in reality is more liable to suffer from derangement of the liver than other farm animals. **True or black gall-sickness** or biliary hepatitis in grazing cattle is comparatively rare. It is characterised by inflammation of the liver parenchyma and catarrh of the bile ducts, and by a thickened condition of the bile, which, in place of flowing naturally, is reabsorbed into the blood, giving rise to the condition known as jaundice. The malady is generally fatal unless treatment be applied at a very early stage.

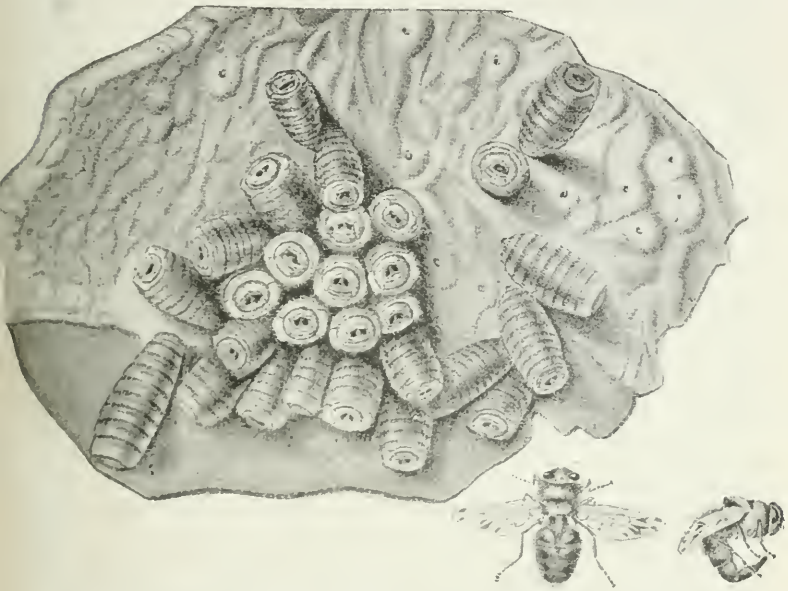
The more skilled of the old transport riders, when they had got a day or two on their journey in a country known to be dangerous, gave each animal as much calomel as would lie on a shilling, and twelve hours afterwards 1 lb. of salts and 1 oz. of ground ginger. In consequence these men saw more rarely than their neighbours the characteristic weakness of the loins and the madness which not infrequently occurs before death.*

An inflamed and **congested condition of the liver** is quite common in the hot climate of South Africa in the case of highly fed stalled cattle, such as milch cows. It is usually amenable to ordinary treatment, viz., a dose of calomel (60 grains for a cow or an ox), followed after a few hours by Epsom salts and ginger. When an outbreak of what may be termed gall-sickness occurs from a **derangement of the**

* The practice, although known in Natal, was by no means general in South Africa, and to Dr Hutcheon must be awarded the credit of introducing into Cape Colony the general use of calomel in the treatment of gall-sickness. He recommends a dose of 10 grains for a calf, and 60 grains for a full-grown ox or cow.

digestion, due probably to the want of water, or to some indigestible food or poison-plants, the chief thing to do is to change the pasture, and thereby to introduce those animals that have not suffered to new conditions.

There is one form of liver disease common to horses, cattle, sheep, and goats in which there is mental derangement leading to **delirium and coma** before death. In the case of the horse, this disease—the nature and cause of which have yet to be determined—has usually been attributed by colonial farmers



Bots adhering to the Cuticular Lining of the Stomach of a Horse. The male bot-fly is seen with expanded wings, and the female with folded wings.

From U.S.A. Report on Horse Diseases, 1890,

to bots. In autumn the gad-fly lays its small, yellow, elongated eggs on the hair of horses, on a part of the skin convenient for the horse to bite or scratch frequently with his teeth—usually about the shoulders and surrounding parts. The eggs, on hatching, produce larvæ, which, on being swallowed by the horse, attach themselves by hooks to the mucous lining of the stomach, there to remain for about eight months to grow and mature; not by sucking the blood of the horse, but by absorbing, through the entire surface of its grub-like body,

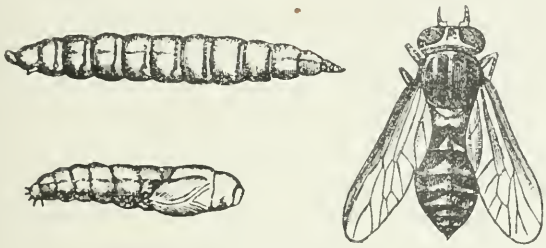
nutritious juices from the food undergoing digestion in the horse's stomach. All horses grazing at large have bots, and they do comparatively little harm, unless they are in abnormal numbers. Little or nothing can be done, as they are extremely difficult to dislodge until their proper time comes; then they let go their hold and pass out in the dung, in which they are protected for a time. Ultimately they develop into gad-flies, and begin anew the cycle of their life-history.

The horse **gad-fly,** better named the horse bot-fly, *Gastrophilus equi*, attacks the horse while grazing late in the summer, its object being, not to derive sustenance, but to deposit its eggs. This is accomplished by the ovipositor of the female, and the ova (eggs) are glued to the hairs by a sticky secretion. The parts selected are chiefly those of the shoulder and inner part of the fore legs, especially about the knees, for in these situations the horse will have no difficulty in reaching the ova with its tongue. Eggs are also deposited on the mane, so that they may be within easy reach of other horses, which from time to time naturally scratch the necks of their neighbours. When the animal breathes upon or licks those parts of the coat where the eggs have been placed, the moisture of the breath or from the tongue, aided by warmth, hatches the ova, and in from five to twenty-one days from the time of the deposition of the eggs the larvæ have made their escape. The maggots wriggling produce itchiness, which the animal attempts to relieve by licking. In this way the maggots are transferred to the mouth, and ultimately to the stomach along with food and drink. A great many larvæ perish during this passive mode of immigration, some being dropped from the mouth, and others being crushed in the fodder during mastication. It has been calculated that out of the many hundreds of eggs deposited on a single horse scarcely one out of fifty of the larvæ arrive within the stomach. Notwithstanding this waste the interior of the stomach nearest the gullet (which at this part is not vascular but whitish to appearance) may become completely covered with bots. Whether there be few or many, they are anchored in this situation chiefly by means of two large cephalic hooks. After the bots have attained perfect growth, they voluntarily loosen their hold, and allow themselves to be carried along the alimentary canal until they escape with the fæces. In all cases they sooner or later fall to the ground, and when transferred to the soil they bury themselves beneath the surface, in order to undergo transformation into the pupa condition. Having remained in the earth for a period of six or seven weeks, they finally emerge from their pupal-cases as perfect dipterous (two-winged) insects—the adult horse bot-fly. It thus appears that bots ordinarily pass from eight to ten months of their lifetime in the digestive organs of the horse.—COBBOLD.

The general unskilled opinion is that these bots, penetrating the walls of the stomach, and escaping into the abdominal

cavity, cause death. Dr Hutcheon contends that the bots only begin to move and to penetrate the mucous lining of the stomach after death, and that during his fifteen years of colonial experience, in which he has embraced every opportunity of making *post-mortem* examinations of such cases, he has not met with one case in which the cause of death could be attributed to bots. In this contention Dr Hutcheon is supported by the leading authorities in Great Britain and in the United States. Death in the majority of the so-called suspicious cases arises from acute indigestion associated with disease of the liver.

The **true gad-fly** of the ox, *Tabanus bovinus*, Linn., is sometimes mistaken for the horse bot-fly, but it differs in this respect that the larva is not parasitic on the horse, but is a



THE TRUE GAD-FLY OF THE OX, TABANUS BOVINUS, Linn.
Larva and pupa, life size.

After De Geer.

harmless vegetable feeder. The female visits the horse not to lay her eggs but to pierce the skin with her mouth lancets, and to draw blood upon which she feeds.

Another common form of liver disease in horses, in which the **organ becomes atrophied,** is due to the periodical state of starvation to which the animals are reduced before the spring growth comes. The liver, as well as the other organs and parts of the body, shrink as the animal becomes poor. After this has been repeated for a number of years, the liver remains permanently smaller, and ultimately becomes leathery and inactive.

Liver disease among calves, "liver-ziekte," has been known in the Colony for at least fifteen years. It was first recognised in the coast districts of Peddie and Bathurst, and from these it gradually spread to Albany, Alexandria, Fort

Beaufort, Victoria East, and Bedford. It is brought to a farm by affected calves, and once established, it remains, and annually appears during the summer months. It is a **contagious** disease, contracted very much like typhoid fever. The contamination of the homestead, of the water dam or drinking pool, and even of the veld itself, seems to be due to the excrement dropped by sick calves. **The symptoms** are "high temperature, great prostration, and an offensive, greenish-yellow, clay-coloured discharge from the bowels." The liver is congested, enlarged, and of a saffron-yellow colour in the early stages. If the calf lingers for some time, atrophy, with fatty degeneration of the liver, occurs. The mortality in the cases of bad outbreaks is alarming, as many as 60 per cent. of the whole calves dying—in fact, very few recover. Otto Henning, one of the Government veterinary staff, conducted a series of **experiments** in 1894-95 **at Koonap Heights**, by which it was ascertained that safety could be secured for a lot of young calves by shutting them up day and night in clean kraals, and allowing them to suck twice daily—forage and grass being given as well. Under this treatment there was only one-tenth of the former mortality, some 6 per cent. dying of liver disease. So long as diseased calves are permitted to resow year by year the germs which are unquestionably the origin and cause of the disease, so long will it remain to be the scourge of the calf-kraal. There is every reason to believe that, with scrupulous cleanliness and care in the management of calves till they are five months old, the disease may, to a large extent at least, disappear.

The short tape-worm, *Tænia denticulata*, about 12 inches in length, and of the thickness of a clay-pipe stem, and also the *T. expansa*, are sometimes troublesome in young calves from three weeks old and upwards. A tablespoonful of turpentine soaked into raw meal, and given in a little cold water, or in a cupful of raw linseed oil, or 30 to 40 grains of bluestone dissolved in a breakfast cupful of warm water, and given after a good fast, are two useful alternative remedies.

In certain seasons a plague of **black lice** attacks the transport cattle, which may be relieved by washing with M'Dougall's sheep dip. The "**jigger**," a South American flea, *Sarcopsylla penetrans* (the female of which bores into the

skin of the human foot and of the feet of various mammalia, and there deposits her eggs), was introduced on the Guinea coast some years ago. It has found its way right across the continent, and is a source of great inconvenience to the native porters carrying loads up-country. When it gets underneath the nails, sores are liable to develop, and the toes to drop off.

Red-water in cattle, as it is understood in Cape Colony, is not the non-contagious derangement known by the name in Great Britain, but is identical with the highly communicable disease called "Texas fever" in the United States of America. It is also believed to exist "along the Danube River, in the Balkan Provinces, and in Queensland, Australia."

Symptoms.—Dr Hutcheon tersely describes it as "a specific infective fever characterised by great nervous prostration, congestion, and loss of function of the digestive organs, and disintegration of the blood, with the rapid escape of some of its constituents by the kidneys—the urine having a colour like sherry, or even dark claret at times." Not much success attends the treatment of the disease after the characteristic symptoms have been developed. A liberal dose of Epsom salts and ginger, along with one drachm of carbolic acid—the latter repeated—is frequently beneficial if given on the first appearance of derangement when the fever is about, and animals are being watched in anticipation of its coming. Red-water belongs to a class of diseases which ought to be prevented, or made amenable to treatment by inoculation.

It is only twelve years since its **first appearance** in the Colony, and its direction of ingress was from the north. The **Zulus** had experience of it before it reached Cape Colony, and there is a belief that it came to them from the swamps of Swaziland. The disease appeared in 1871 at the Tugela River, forming the boundary between Zululand and Natal. It travelled along the coast districts of Natal to Durban, and following the main lines of ox-waggon traffic, it had penetrated as far as Kokstadt in Griqualand East in 1873. **The Pondos** to the east kept it back for a number of years, as they permitted no oxen to go through their country, but supplied healthy cattle for hire to the traders, until in October 1882 the Cape Government sent up a newly formed regiment —the Cape Infantry—and forty waggons of baggage, with

authority to go on to Kokstadt, the transport riders holding a guarantee that all cattle which died of red-water would be paid for out of the public purse. A number of oxen died on the return journey, and several in the Kafrarian districts. By this means the **disease spread rapidly** in the Transkei country, still extending along the coast in a southern direction. It has penetrated much farther now, and it is only a matter of time until it finds its way to Cape Town. The parts in which it is most severe are low-lying grassy districts—those places where ticks are most numerous and most troublesome. While the disease was spreading in the south, it was extending quite as rapidly towards the north-west. In the space of three or four years it had entered the Free State and Transvaal; and about the same time **ticks**, which were unknown in these inland parts, though abundant near the coast, were introduced, and it would seem from their increase in numbers that they are likely to remain. It must not be believed that ticks are the originators of red-water, as they merely form a medium by which it spreads. Ticks were as numerous on the coast districts before red-water appeared as they are now, and ticks are spreading up-country where as yet there is no red-water.

Red water is a specific fever of a contagious nature, but in one respect it is different from the most of contagious diseases. A diseased animal does not communicate the disease direct to a healthy animal. There seems to be some intermediate link wanting; and in America the opinion, not only of the cattlemen, who recognised it first, but also of the veterinary authorities at Washington, is that the numerous ticks present in the country in which the fever prevails have to do with it.

Rather an interesting coincidence was recognised in the neighbourhood of Pretoria in support of the belief that the tick is intimately associated with the spread of red-water in South Africa, as well as in the Southern States of the American Union—below the thirty-seventh parallel of latitude. It is the practice to burn the grass on the veld in September, so that the ticks which have not then procured shelter in the ground may be destroyed. If from any cause the burning is not accomplished at this time, and is delayed till January, red-water almost invariably appears. It is asserted by the farmers that when burning takes place in the latter month, some plant

grows which produces it, but the tick theory is the more likely explanation of the difficulty.

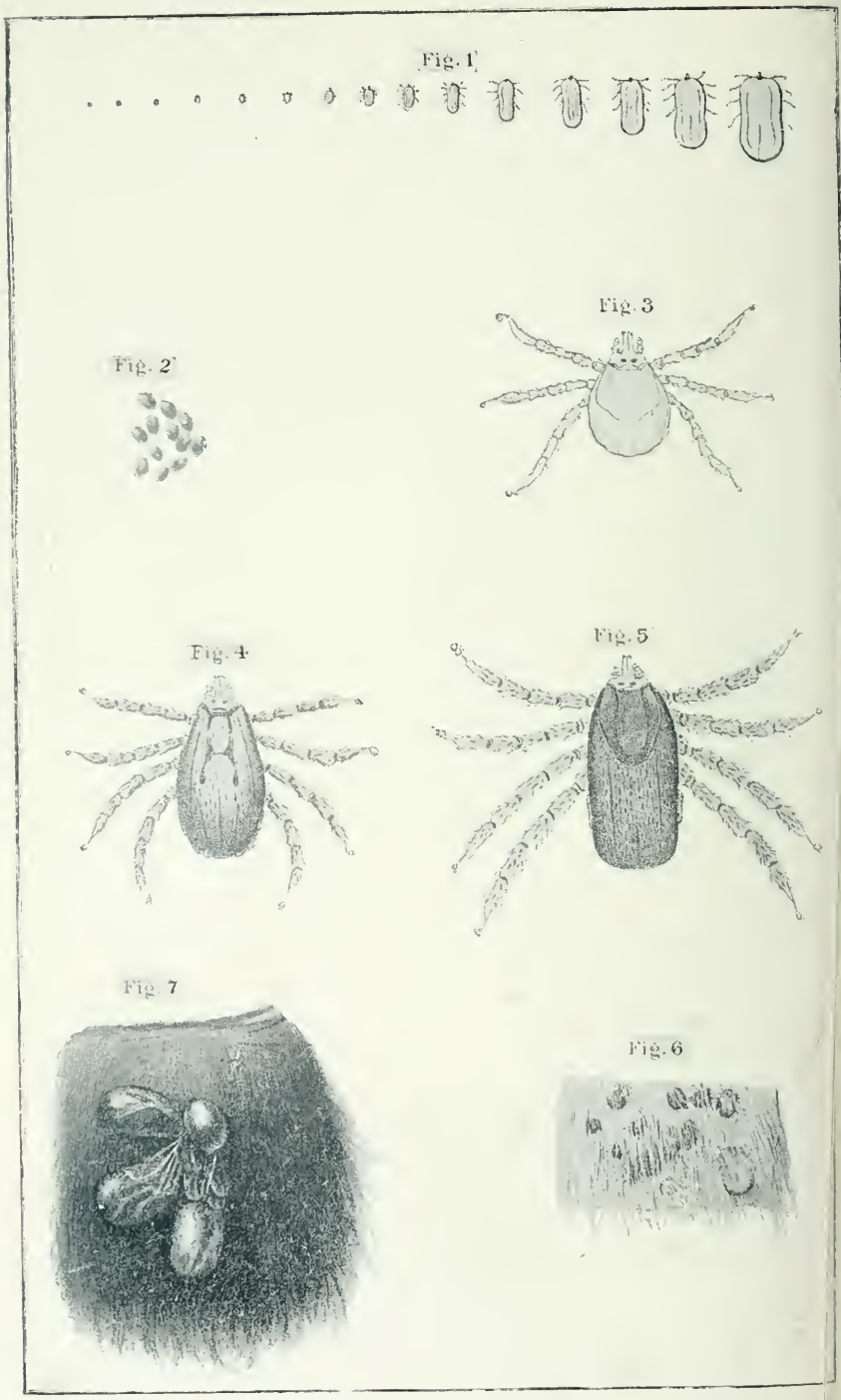
The feasible theory about red-water is that the fever is caused by a specific micro-organism which has been detected in the blood of cattle suffering from Texas fever; that this organism possesses more than one stage in its life-history, and that one of these stages is spent in the body of the tick as an intermedial host. Before healthy cattle can suffer after contact with diseased animals this intermediate stage must pass; but the respite is not for long, as cattle driven into a district subject to the disease will take it if brought in contact with animals that look perfectly well; and a very large proportion of grown-up cattle die, especially if they are in good condition.

Young calves introduced into a red-water country take the disease, but usually recover. Cattle born and reared in such a country do not seem to suffer from the disease, at least in a visible or dangerous form; and while they remain in their own locality they are said to be "salted" and possess immunity from the well-known acute form which it takes, but if they be removed for six to nine months to a part not subject to the disease, and are then brought back, they are as liable to contract it as if they had never been in an affected district. Absolute immunity is consequently not obtainable. On the high veld the intermediate link becomes a missing link in very cold weather. The organism seems to get destroyed, so that the cattle are in practically the same position as those last mentioned. They do not secure the possible measure of conditional immunity from the disease which those in warmer districts possess. We gather from all this that there is some hope for farmers in the coast districts when all the farms are thoroughly infected with red-water disease, or rather with the intermediate link. As long as the cattle are kept at home or in their own district, they will not die of red-water.

From a study of the nature of the disease, it is easily gathered that **quarantine regulations** or restrictions of any kind are worthless unless a permanent line be fixed, and no cattle permitted to pass from the affected area. In 1883, when red-water first appeared in the Colony, an effort was made to stop it by quarantining individual districts, until these became too numerous. Then a large area was thrown together to the

north-east of Buffalo River, embracing East London, Stutterheim, King William's Town, Komgha—the Kafrarian districts. This was maintained till 1884, but that being a dry season, little red-water appeared, and Government, at the urgent request of the farmers, removed the quarantine. In 1885, a very moist season, it reappeared with great virulence, and rapidly spread to the southward, some cases occurring near to Port Elizabeth. An urgent request that the quarantine be again established led to the new south-western boundary being fixed along the line of the Koonap and Great Fish rivers. This was maintained till 1893, when all boundaries were done away with, it being found that the disease had been established in numerous centres in the districts of Bedford, Albany, and Bathurst, to the south-west of the quarantine line. The restrictions are now confined to the individual farms on which the disease breaks out. Quarantine as a means of stopping the disease was hopeless from the first. Any possible success could only do more harm than good, by delaying the time when the whole country should be overrun, so that animals would become salted while young, and the death-rate decrease. The last chance of keeping it out of the Colony was lost when the Government neglected to secure by purchase or other means the control of the two places on which it first appeared, viz., Peeltown mission station, and Leary's farm, near Maclean Town. Had these been fenced, and no cattle permitted to go on to the land, the disease might have been stamped out. The slow rate at which Government machinery moves, and the want of sufficient knowledge and interest on the part of the farmers, made the adoption of any such safeguard impossible.

The **nature of Texas fever** (*alias* Cape red-water), and the relationship of the tick to the disease, has since 1888 been undergoing investigation by the United States Bureau of Animal Industry, and important and interesting results were published in an exhaustive report in 1893. These experiments have clearly established as a fact the belief long held by Southern States cattlemen, that the eight-legged ticks, which, as in South Africa, are present in large numbers on animals within the fever-infected area, are the direct and at present the only means by which the disease is known to be



Face page 297.

PLATE 53.—THE CATTLE TICK, THE CARRIER OF TEXAS FEVER OR SOUTH AFRICAN RED-WATER

communicated naturally to cattle reared without the area referred to. The disease can be artificially produced by subcutaneous and intravenous injection of blood from cattle suffering from Texas fever. An elevation of temperature occurs within a few days of the inoculation, and visible signs of illness manifest themselves not later than the sixth day. This marks the limit of the true period of incubation, although the disease did not appear, in some instances, for ninety days after healthy cattle had been put on tick-infected ground. Clearly the poison, from one of several possible causes, had not found its way into the systems of the animals. **Two types** of the disease were discovered—the one acute and fatal, occurring in the hot summer months; and the other mild, prolonged, and usually non-fatal, occurring during the colder weather of autumn. In the **acute form** the **temperature rises** progressively from day to day, as high, in some fatal cases, as 108° F. It falls rapidly when convalescence begins, and at times also, as in horse-sickness, immediately before death. The next important symptom—the **discoloration of the urine**, which may be a "very light claret colour, or so deeply tinted as to be opaque and blackish—is not due to a discharge of blood from the kidneys, and subsequent breaking up of the red

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THE CATTLE TICK, THE CARRIER OF TEXAS FEVER. Figs., Plate 53.

(Figs. 1, 3, 4, and 5 were drawn under the direction of Dr Curtice. Nos. 4 and 5 were slightly modified before insertion.)

Fig. 1. A series of ticks from the smallest, just hatched from the egg, to the matured female ready to lay eggs.

Fig. 2. Eggs magnified 5 diameters.

Fig. 3. The young tick just hatched (× 40).

Fig. 4. Sexually mature male after the last moult. Dorsal view (× 10).

Fig. 5. The sexually mature female after the last moult. Dorsal view (× 10).

Fig. 6. A portion of the skin of the udder of a two-year-old heifer on which ticks artificially hatched were put when small.

Fig. 7. A portion of the ear of the same animal, showing adults ready to drop off and lay their eggs.

From "Investigations into the Nature, Causation, and Prevention of Texas or Southern Cattle Fever," by Theobald Smith, Ph.B., M.D., and F. L. Kilborne, B.Agr., B.V.S. Washington, 1893.

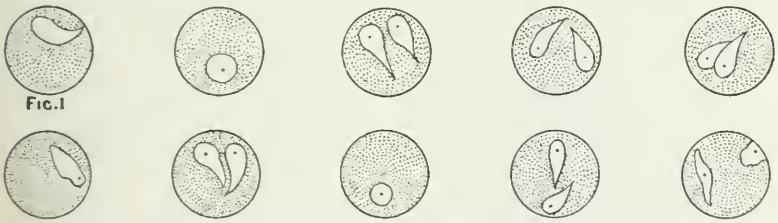
corpuscles, but to filtration of the colouring matter of broken-down red corpuscles (hæmoglobin) already in solution in the circulation into the urine in the excretory structures of the kidneys," a fact demonstrated by Stiles in 1868.

Thinness of the blood, which becomes pale and watery, is the most constant and most valuable of all the symptoms of this disease, and it results from the disappearance of red corpuscles. The **minor symptoms** and appearances are a "dry hot skin (readily perceptible to the touch), high rate of pulse and rise in temperature, loss of appetite, cessation of rumination and of milk secretion, constipation, hyperæmia, followed by bloodlessness of the skin and mucous membranes." The liver and spleen are also much enlarged, congested, and diseased. In the cases which do not prove fatal in America, the "high temperature rarely lasts more than eight or ten days." In Cape Colony the duration of the acute stage is four or five days. Great debility follows, owing to the poverty of blood and the weakened functions of the various vital organs, and sometimes to relapses. Some animals never fully recover, and others take weeks and months to do so. The **mild form** of the disease is so mild that it was unknown until the examination of the blood showed the presence of the micro-parasite. The fever temperature is low, rarely rising above 105° F. in the evening, the period of highest temperatures.

Texas fever is essentially **a blood disease,** although many of the important organs of the body become functionally deranged, and everything points to it being due to the multiplication of a micro-organism, *Pyrosoma bigeminum*, *n. sp.*, which lives in and devours the red corpuscles of the blood. It has been proved that it is always present when Texas fever develops, and that where it exists Texas fever is also present. It may be argued hypothetically that the organism may not be the cause, but only an associate of the real cause, which may be an invisible poison, but that does not detract from the importance of the experiments which have led to our knowledge of the organism.

Blood newly drawn from an animal suffering from the **acute form** of the disease shows under a high-power microscope (500 to 1,000 diameters, Zeiss apochróm., 2 mm., oculars 4 and 8) that some red corpuscles contain two pale **pear-shaped**

bodies, with the tapering ends directed towards each other, and usually in juxtaposition. The rounded thick ends may or may not be close together. The size varies somewhat, but the two bodies in the same corpuscle are generally similar in size. When well developed, each possesses a minute spherical body, which appears like a dark speck near to the thick-rounded end, and shows in marked contrast to the homogeneous material composing the enclosing pyriform body. "In the largest of these pear-shaped bodies there was seen in the centre of the enlarged end a somewhat larger, round, or oval body, which seems to take the place of the smaller body, or else to associate with it. At a low position of the objective, the parasite appeared dark, with a light round spot in the enlarged end.



The parasitic micro-organism found in the corpuscles of the blood of an animal which died of Texas fever. Fig. 1 shows an intra-globular parasite in subcutaneous blood taken a few hours before death—one of a group of organisms which show very marked changes of outline. The remaining sketches of magnified blood-corpuscles contain individually a nuclear (?) body, the lower row being taken from fresh cutaneous blood shortly after death.

From the U.S.A. Report on Texas Fever, 1893.

At a higher position of the objective, the inner body appeared dark, enclosed in the lighter pyriform outline. One or both of these bodies were observed in some of those forms undergoing amœboid changes." The larger pear-shaped bodies are believed to be the mature form of the organism, the smaller bodies and others of irregular appearance and changing form to belong to younger stages of its development. Only a limited number of infected corpuscles circulate in the blood during high fever, probably from ½ to 1 per cent. Within a few hours of death there may be 5 to 10 per cent. of the corpuscles with the pear-shaped parasite present. Large numbers of parasites are found within corpuscles in the capillary blood of congested areas of the internal organs, and it is probably there, and not in the circulating fluid, that the enor-

mous loss of blood-corpuscles takes place during the acute stage of the fever.

In the **mild type** of Texas fever the appearance of the parasite is rounded, and quite different from that just described, and from 5 to 50 per cent. of the red corpuscles of the circulating blood are infected for a period of from one to five weeks. In size it is smaller, and it is believed to belong to an immature stage or stages of the parasite. It appears like a single rounded coccus-like body, resting usually within the corpuscle on its border. The subdivision of the coccus-like body into two has been distinctly observed. This rounded form of the parasite has been identified in fever occurring late in the season in animals which have suffered from a relapse, and also in cases which appear before the usual time. Instances have been recorded in which the mild form has developed into the acute and fatal form. The theory which now holds the field is that the organism present in the mild form is in a state of retarded development, the period of which may vary considerably, according to surrounding conditions. Though much preliminary work has been carried through, and a direct connection established between the organism and the disease, the amount of ground which yet remains to be covered may be realised from the fact that "no distinctly reproductive phase has been seen during four years of observation of a great variety of cases." With regard to the connection of the tick with the disease, it was shown "that the disease can be produced by ticks hatched artificially in the laboratory without the intervention of southern cattle or the infected ground on which these had been placed." The eggs were kept in a warm place, in a little soil, and hatched out in from three to four weeks. The tick in its first or larval stage had only three pairs of legs. When put on a calf for a week it moulted, and two more legs appeared; after another week a second moulting took place, and the sexual parts were developed.

The form in which the parasitic organism is conveyed from the tick to the ox is yet to be determined. That it is the tick and not the south country cattle that convey the disease was demonstrated by mixing North Carólina cattle with susceptible animals after the ticks had been carefully removed,

and no disease appeared; and also by keeping susceptible cattle with those suffering from the disease, but with no ticks on them. That the tick must bite before the poison can be communicated was demonstrated by the failure to produce the disease by experiments in which ticks were ground up and fed to animals, and also when hypodermic injections were given, containing juices from the tick's body.

The coast districts of the Colony are infested with the true eight-legged tick to such an extent that calves die in large numbers, and older animals are prevented from thriving by the irritation produced by the lancet suckers driven deeply into the skin. Keeping calves in the house for the first season tides them over the dangerous period.

GREAT CATTLE TICK, AMBLYOMMA HEBRÆUM.
Male, life-size, and magnified; outline figure showing size of inflated female.

The accompanying illustration of the Great Cattle Tick, *Amblyomma hebræum*, Koch, is taken from Miss Ormerod's "South African Insects," where a full description is given. It would appear that the male, which does not swell by gorging with blood, has been mistaken for another species, and is known in the Port Elizabeth district as the "Shell Tick."

Ostriches are not so much troubled with ticks as the more common stock of the farm, and do well in the tick-infested districts if the climate be not too wet. Ticks swarm in vast numbers in the bush and on the tall grass, and as the animals brush past they take hold and finally fix themselves to the skin, usually in some protected place where they are not liable to be rubbed off. They often appear while very

minute in large numbers on the tender hairless parts of the body, and subsequently spread to suitable places, where they remain permanently, and do not move about like lice and various other skin parasites. The **female** gorges herself with blood, and after the posterior has swelled to large dimensions, and assumed the size and colour of a sloe, probably in twenty-one to twenty-three days, she falls off. The hatching of the eggs she produces takes place among the grass or near the surface of the ground, and the early life of the creatures, during which they receive no food, is spent away from the bovine host. How long the eggs may remain fertile, in a state of nature, during conditions adverse to hatching, and how long the young ticks can live without food, are points which still call for settlement. A female tick continues to lay from twelve to sixteen days, and produces over 2,000 eggs, which appear as "dark-brownish red masses of oval bodies." In warm weather the eggs hatch out in fifteen days, while with a lower temperature six or seven weeks may be required; and if the weather be very cold, no development takes place probably until the warm weather of spring arrives. Young ticks have been kept alive for four and a half months after hatching. The mature male is much smaller than the corresponding female, but he does his share in producing irritation. One misfortune is that ticks, with all the immediate inconvenience of the loss of blood and consequent weakness, of the irritation produced, and of the secondary injurious influences, are **spreading** to parts in which they were unknown a few years ago. They have been carried by transport cattle from their natural habitat near the coast into the Free State and the Transvaal, and they are steadily extending farther up-country.

The connection between **red-water** and the tick has been fully established in America, as has already been explained, although much remains to be done in the Colony to determine what species of ticks are injurious and what are only troublesome. Apart from the evil influence of inducing red-water, the bites of various **ticks affect animals** in different ways. The "bont poot" or "bont pooten" (to use the classical Dutch equivalent), the speckled foot tick, by biting causes a piece of the skin and even of the flesh beneath to slough and

fall out. One small species adhering to lambs or young sheep induces **paralysis.** If a careful and successful search be made, and the offender, which may be only one, discovered, probably about the root of the ear, the inner part of the fore-leg, or even between the digits of the foot, and removed, a lamb which was helpless in the morning will regain its feet by the evening, and be all right again the next day.

Principal Williams, of the New Veterinary College, Edinburgh, has traced the paralysis present in the disease known as "trembling" or "louping-ill" in Scotland to the presence of an organism which, when the disease occurs, exists in the bodies of the ticks living on, and also in the fluid surrounding the spinal column of, affected sheep. This is of the nature of a parasite within a parasite, and it remains to be seen to what extent ticks are liable to contain this and other parasites, and whether some are not free from them altogether. The writer has also described in his **Australian work** the injury done by ticks on the east coast of Australia, living under conditions not very dissimilar to those in Cape Colony, where ticks are most numerous. There horses, dogs, all the common farm animals, and even children, are at times paralysed by a limited number of ticks adhering to some susceptible part, and if they are not found and removed, death will supervene within a few days. The fact has been noticed and repeatedly confirmed by reliable scientific experiments, but the actual cause in the Australian instances has not yet been determined. In South Africa, Dr Hutcheon believes it possible that the cause may be traced to **nerve irritation** produced by the tick bite. We incline to the belief that in Australia, and probably at the Cape, the cause may yet be shown to be similar to that associated with "louping-ill" in Scotland—viz., the **poison in the system** produced by the development within the fluids of the animal body of some organism or organisms introduced through the bite of the tick. The same high authority has also traced in some instances the **white spots**, so numerous on the backs and loins of African horses, to sudden falls of sleet or hail when the skin is in a susceptible condition. The vast majority of the spotted backs in the Colony are undoubtedly due to the biting of ticks, which often hang in little clusters, and leave raw places on the skin when the animals are young.

As these heal, and hair springs, it grows white, owing to defective nutrition, resulting from the injury sustained by its roots.

The irritation caused must be intense, and to some extent at least animals must become accustomed to it before they are full grown, else they would fret so that they could not thrive. If horses are liberally supplied with **sulphur** internally, it has a marvellous power of protection against the attacks of ticks. In the coast districts cattle do not care much for salt, the usual medium in which sulphur is given, but it can be mixed with bone-flour and consumed therewith. Animals in small numbers may be protected to a considerable extent by smearing a strip of three inches broad down the back with sulphur and grease. The sulphur, owing to its searching nature, finds its way to different parts of the animal's body. The tick known in South America as the "garrapata" has been dislodged by sprinkling the skin with a dressing containing carbolic acid. Up-country, near Kimberley, for example, one variety, known as the "**tampan-tick**," takes shelter under the larger mimosa trees in the open veld, so that travellers are forced to deny themselves the benefit of shade from the sun rather than encounter the army of ticks that would assail them. Others again spread over the grass of the veld, and the only means of keeping them in check is to **burn off the grass** at a time when a large proportion of the ticks is resting in it. In the neighbourhood of Pretoria (where it chanced this question was most minutely investigated), experience shows that the right time to burn is in September, just before rains usually come. If a portion of the land be burnt too early in the season, ticks find their way on to it from the unburnt land, and probably come up from their shelter in the ground as the weather becomes hot, and the cattle are subjected to an undue amount of irritation and annoyance. Owing to the way the veld has to be annually burnt as a protection against ticks, it has become less valuable for cattle grazing, and not only are the numbers of cattle less, but their quality is inferior, as compared with what it was before the ticks got into the country. In the Kafrarian districts large tracts of grass land have to be annually burnt, as a means by which to minimise the injury done by ticks.

The **rinderpest**, which has during the present year done so much mischief among the cattle of Mashonaland and Matabeleland, has existed from remote periods in **Central Asia**, but has spread repeatedly through all European countries between which traffic in live cattle existed. Towards the end of last century it is believed to have destroyed **two hundred millions** of cattle in Europe. As recently as 1870-71 France lost by it 100,000 oxen, and it was only in 1872 that the last outbreak of the disease was stamped out in Great Britain through the slaughter of all diseased and in-contact cattle. It is one of the most infectious and at the same time one of the most virulent of bovine disorders, especially on its first appearance among healthy cattle, as many as 95 per cent. succumbing to it. In **Russia**, where it is enzootic, many recover, and it is not so deadly when it appears among goats and sheep. It is transmissible to many **wild animals**—deer, antelope, buffalo, and wild pigs. In the indiscriminating nature of its attack and its deadly consequences it strongly resembles the **cattle disease in Masailand** mentioned but imperfectly described by Thomson, and it may yet be proved to be identical. If so, it seems to be spreading like a great and destructive prairie fire in a southern direction over the centre of the African continent, and Cape Colony ought to make preparations to resist it. It is a **blood disorder** in which three very different **micro-organisms** have been identified, viz., a *Streptococcus*, a *Leptothrix*, and a *Bacillus;* but although undoubtedly due to germs, the parts these play have not yet been determined.

The infection very probably occurs by inhalation, **the contagion** being subsequently transmitted to other parts of the body by the blood circulation. The contagion exists not only in the animal's breath but in the solids and fluids of its body, its excreta and discharges generally, and may therefore not only be communicated by contact, but be carried by men, dogs, and other animals, insects, &c. The **virus** is easily destroyed by the common disinfectants and by exposure to dry air, but moist animal discharges remain virulent for months.

After infection there is a **period of incubation** of a few days. The **initial symptoms** are dulness and a rise of

temperature—106° to 107° F. being commonly registered—trembling, weakness, and a staring coat. The appetite, rumination, and milk are gone or diminished. The more pronounced symptoms which soon appear are intermittent rigors, accelerated respiration, red spots on the visible mucous membrane, vesicles in the mouth like those present in foot-and-mouth disease, excrement dry or absent, pain, salivation, a drooping head and hanging ears, mucous discharges from eyes, nose, and vagina. These symptoms are followed by a bloody diarrhœa, great straining, colic, and rapid emaciation and staggering. At times the animal becomes excited and seems mad, at other times it suffers from shortness of breath and a cough as if it had inflammation of the lungs. The hæmorrhagic spots on the visible mucous membrane slough and leave ulcers, the thickened epithelium being shed in a form resembling bran.

In the British outbreaks *Emphysema* or gases collected underneath the skin, and eruptions often occurred. The animal lies continuously at full stretch, trembles, and grinds its teeth, and the anus and vulva remain open allowing of the involuntary escape of fetid fluids.

Death supervenes in four to seven days, usually in about a week.

Until a *post-mortem* is made, the disease may readily be mistaken for anthrax or pleuro-pneumonia, especially if the time of its duration be unknown. Nearly all the important internal organs are abnormal in colour and in a diseased condition. The blood is dark and tarry, and does not coagulate properly on cooling.

Inoculation has been practised with the fluid from the nose, caught by placing a sponge in the nostril, a single drop being injected under the skin of the neck. The operation in this direct form is attended with so much fatality that it has been abandoned even in Russia, where establishments for the purpose used to exist; but the attenuation of the virus, and the successful vaccination of animals against the malignant form of the disease will no doubt be an achievement of the future. It is one of those matters of such vast importance to Cape Colony that it is well worthy of the immediate attention of the Bacteriological Institute.

The **prophylaxis,** viz., to kill all affected animals, and all those which have been in contact with them, is of the most simple kind, but far reaching and serious in its consequences, as has recently been demonstrated when applied to the cattle of natives, who do not understand or appreciate European methods of dealing with outbreaks of deadly epizootic diseases.

HEAD OF THE TRUE OR MOUNTAIN ZEBRA, EQUUS ZEBRA.
Photographed by the Author on board ship on his return voyage

CHAPTER XV.

HORSES AND MULES.

Not Indigenous to South Africa—The Zebra—Horses Imported by Dutch East India Company—Other Early Importations—English Thoroughbreds brought by Lord Charles Somerset—South African Turf Club—Horses Shipped to India—Weedy Thoroughbreds Imported—The Jockey Club of South Africa—Hackneys sent by Hutcheon and Southey from England—Barber's, Southey's, and Mellish's Studs—Hackneys—Cleveland Bays—Suffolk Punches—Typical Stallion—Basuto Ponies—De Beers Company Horse-Breeding Farm—Horse-Sickness Beneficial—Number of Horses in the Colony—Mules and Asses—The Poitou Mule and Jackass—The Maltese Ass—Horse-Sickness.

The horse is not indigenous to South Africa, the natives having no knowledge of the existence of such an animal at the time the Cape was discovered by Europeans. The natural order Equidæ, to which the horse belongs, was nevertheless well represented by three species of zebra — the "wilde paard" of the Dutch, the common **zebra**, *Equus zebra;* the dauw or Burchell's zebra, *E. burchelli;* and the quagga, *E. chapmani.* The absence of the true horse was most probably due to the destroying power of horse-sickness, because it is hardly conceivable that, unless some excluding influence had existed, the horse would not have found his way from the northern portion of the continent, where he has existed from the earliest historical times. Big game occupied the intervening country in vast herds in which horses migrating to the south could have taken shelter. Another significant fact is that the zebra, being almost immune from the ravages of horse-sickness, maintained its position in the Colony in large numbers.

The date at which the first **horses were imported** into Cape Colony is not precisely known, but they were brought soon after 1650 by the Dutch East India Company from Java,

PLATE 54.—A BURCHELL'S ZEBRA JACK

Face page 308.

Belonging to Professor COSSAR EWART'S Experimental Stud, where crossing with mares is being tried with the object of securing immunity in the progeny from the poison of the Tse-tse Fly.

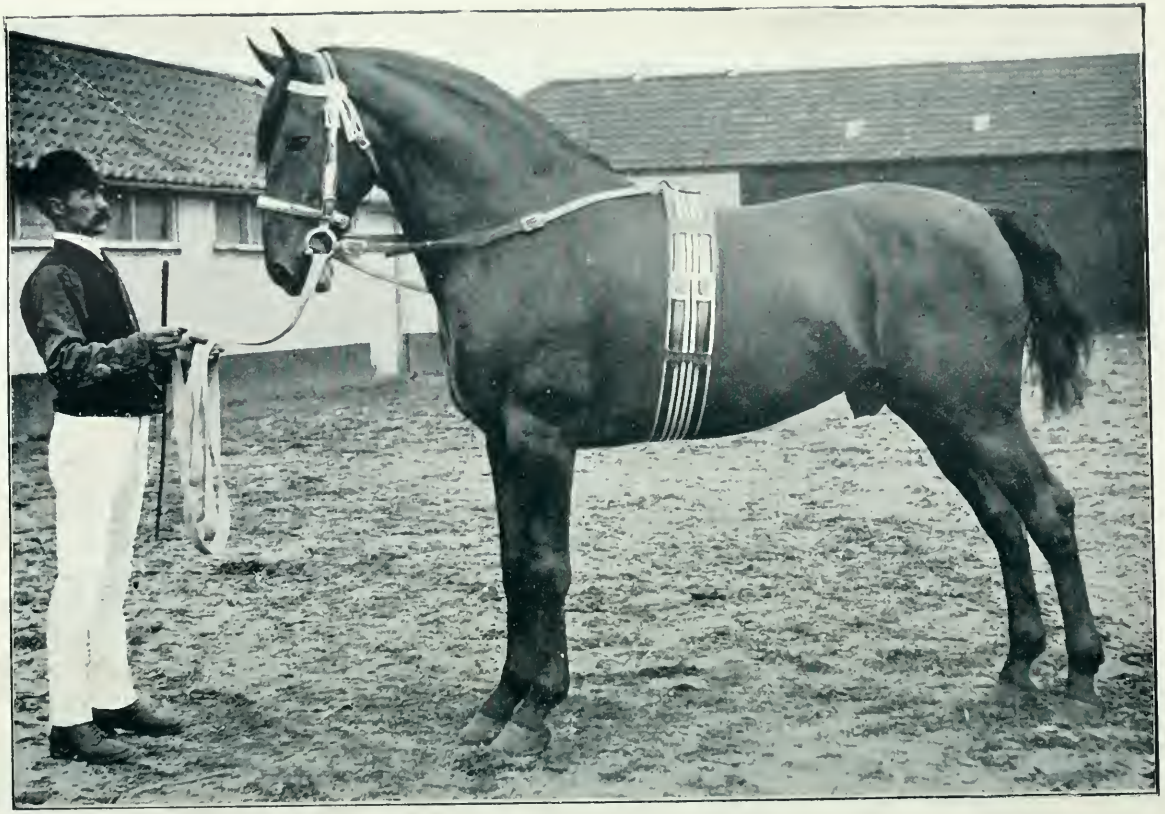
and belonged to the Barb or North African breed, and the variety of the Arab known as the Gulf Arab. The first specimens had evidently not been of very good quality, and the numbers were so limited that in-and-in-breeding was followed with unsatisfactory results in both character and appearance until a number of Persian Arabs were introduced by the Company about 1688. This was followed by the importation of eight stud horses from England in 1792. They were neither heavy draught horses nor thoroughbreds, but probably roadsters. Boston at the same time contributed five stud horses, and the New England States of America a number of horses and mares of Spanish extraction. The blue and red roans, which are in high favour in the Colony for their power of endurance, are said to be descended from a shipment of Spanish breeding horses that were captured in 1807 on board two French ships bound for Buenos Ayres. These various animals may be said to have formed the **foundation stock** from which the South African horse of the present day has been bred, and if the unique mixture of blood be considered for a moment, it need not be wondered at that the progeny were conspicuously deficient in symmetry and defective in size and substance. They were, however, strong and hardy, and possessed of great powers of endurance.

The **next great step** in the history of the breed was the introduction by Lord Charles Somerset, soon after his appointment as Governor in 1813, of a large number of **English thoroughbreds** of first-class quality. Other importers followed his example, and for thirty years the good work begun in this direction was carried on, until the Cape possessed a creditable blood stock which was kept for racing purposes, and the ordinary Cape horse had been immensely improved in appearance and in general character by the use of thoroughbred stallions on the common mares.

The **South African Turf Club,** formed in 1840, is credited with exercising a powerful beneficial influence on horse-breeding, and the period 1840 to 1860, but particularly the latter half of it, may be regarded as the one in which the Cape horse gained the **highest point** of his career. During this time ninety thoroughbred stud horses were imported into the Western Province. Limited numbers of Cape horses were

from time to time **shipped to India** after the improvements introduced by the English thoroughbred were recognised, but the most numerous shipments were selected by Colonel Apperly, a special commissioner of the Indian Government, on the outbreak of the Indian Mutiny, 1857. During this time 5,482 horses and 108 mules were sent to Bombay and Calcutta, and the Colony was enriched by the sum of £215,645. There were constant complaints against the appearance of the animals and their being undersized, but the universal consensus of opinion expressed by Indian officers was that the Cape horse was surpassed by none for endurance under trying climatic circumstances. Cape horses gave an equally good account of themselves in the Crimean War, when several regiments were sent from India a short time before the Mutiny.

A period of indifference in the matter of horse-breeding succeeded the period of progression. Merino sheep and Angora goat farming, and subsequently ostrich farming, absorbed attention, and were more remunerative than horse-breeding. At the same time a **depraved taste** for flashy weeds seems to have sprung up among those who did continue to breed horses. Strength of bone and substance were lost sight of, and unscrupulous speculators were able to introduce what have been described as the "sweepings of Tattersall's," which they picked up at a few pounds and sold for hundreds. It has been estimated that of 500 English thoroughbreds imported into South Africa, one-half at least would do infinitely more harm than good to the colonial breed. While every one appreciates the influence for good that a powerful, big-boned, thoroughbred possesses when put to under-bred mares, it is as freely admitted that there is no way animals of the latter description can be more quickly or effectually degraded than by the use of weedy thoroughbred stallions. To attempt to counteract the weedy tendency a number of Dutch stallions were brought in, but the result has been far from satisfactory. For about twenty years the industry of horse-breeding passed through an epoch of neglect and depression. The **Jockey Club of South Africa**, established in 1882, along with the prosperity of the gold and diamond diggers up-country, has increased the interest in racing and horse-breeding, and con-



A suitable Type for the Improvement of the Colonial Mares.

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sequently led to the general improvement of colonial horses. It is the universal belief that the **Cape horse**, though possessed of many admirable qualities, is too small—wanting both in bone and substance. Common horses are also particularly defective in the fore-legs and shoulders, as well as restricted in their movements, and the practice of **knee haltering** or hobbling them, by tying down the head close to the knee, so that they can feed but cannot travel far, does not tend to minimise the defects. But this method of fastening is so simple and so effective and well adapted to colonial conditions, that there is little chance of any alternative means being adopted. The Cape Government, in view of the defects mentioned, commissioned Dr Hutcheon to go to England in 1889 to send out strong-boned **hackney stallions**, which, when used on colonial mares, would throw fillies likely to breed by strong-boned thoroughbreds the kind of animals wanted. Twenty-eight entire horses were sent out,* all over 15 : 2 hands, and possessed of the requisite strong bone and substance. In 1893 Charles Southey went on a similar mission, and thirteen hackneys were shipped to the Colony. The average price paid for each in the two lots was about £240, and nearly all were sold by auction at Port Elizabeth. The first consignment made an average profit of £20 to the Government, but the second lot came at a time when the demand had slackened, and a loss of £125 each was experienced. The arrival of new blood gave an impetus to horse-breeding, and the results have been so far satisfactory. Where the mares showed good quality, not far removed from blood stock, the results have been best. The stallions were bought by men living widely apart, and are now dotted all over the Colony. The fee at which they usually stand is £2 per mare—not an exorbitant charge for the use of an animal worth £250. Several other importers have introduced useful hackneys with satisfactory results, and the influence for good ought to begin to show itself on the breeding stock of the country in the immediate future. No elementary experiments by way of testing the principles of breeding need to be tried. For example, uni-

* Beatus, a thoroughbred by Ethus out of Gladness, was the only horse which was not a hackney.

form results need not be expected if the foals by the hackney stallion and common country mares are kept and used as entire horses.

It is as good as a holiday treat to visit and examine such **studs of thoroughbreds** as those of Hilton Barber, at Halesowen, Cradock, and of Charles Southey, at Culmstock, in the Middelburg district; but establishments of this kind, which could compare favourably with similar establishments in Great Britain, are not for the ordinary farmer, except in so far as he may now and then go to such a fountain-head for blood for the improvement of the breed of his own work-a-day horses.

More interesting from the farmer's point of view would be a visit to **E. H. F. Mellish's** mixed **stud** of hackney, Cleveland, and Suffolk punch horses, good typical specimens of the three breeds, and all suitable, when properly mated with colonial horses, for raising the size of colonial breeding mares. The breeds are here mentioned in order of merit, so far as the general purpose horse is concerned. The high action of the **hackney** is objected to by some owing to the periodical hard dry condition of colonial roads, but the action of the colonial horse errs in the other direction, and the use of the blood stallion on the cross-bred hackney mares will still further modify the high movement. Though possessed of good bone and substance, the **Cleveland bay** horse, mainly on account of the lowness of his action, but also because he is not so nearly related to the thoroughbred, is to our thinking not quite equal to the hackney for the purpose. Nevertheless the success which has attended the use of Cleveland bay stallions in Australia, with a similar object in view, is sufficient reason for giving them a trial in the Cape. In the production of heavy **draught horses,** for work in towns, the **Suffolk punch** will no doubt be useful, not only in breeding pure stock, but also in crossing with large-framed native mares. To secure the best results in fast work something more solid and compact in structure is necessary than the bone of a work or draught horse of any breed.

The type to be sought for is a good-sized, compact, symmetrical horse, carrying his height well in the depth-measurement of his body; with good free action, which implies a well

Photo. by Glassberg, Paarl.

PLATE 56.—IMPORTED SUFFOLK PUNCH STALLION.
The Property of E. H. F. MELLISH, Cape Town.

Face page 312.

Photo. by Glassberg, Paarl. PLATE 57.—IMPORTED CLEVELAND BAY STALLION. *Face page 313.*

formed but muscular and substantial shoulder; with tight, well shaped legs, with plenty of hard flinty bone, adorned with large joints, but without other enlargements. In disposition he must be free from vice and from nervousness, both being defects which are likely to be transmitted to the progeny, and to cause inconvenience and anxiety, if not positive danger. And last but not least in importance, all imported stallions at least should have a **pedigree** which will warrant a belief that they will breed true to type. Individual horses possess greater potency than others in this respect, but this requires to be demonstrated by results. No reliance can be placed upon a mongrel, although it is possible for certain animals of the kind to "get" excellent stock when they chance to inherit strongly the prepotent influence of some well-bred ancestor.

Basuto ponies stand about 14 to 14½ hands at the withers, and are extremely hardy, active, and sure-footed. They are reared in a hilly rugged country which gives them every opportunity of freely using their feet and limbs from the first. The small size is partially due to the starvation they suffer at the end of winter—the latter end of August and September—when the grass becomes dried up and gets blown away. Adverse circumstances, if they are not too severe, develop hardiness in constitution in those which survive, and weed out the weaklings. How far nature and the care of the Basuto people combined had succeeded in producing a pony war-horse capable of great physical endurance and marvellous feats of activity, the British troops well knew during the last Basuto War. These excellent ponies are **descended from** horses brought from Batavia by the Dutch, in the last century, and stolen by the Basutos from the Boer farmers. Fresh blood has been taken into the country from time to time by the same means. About fifty years ago there was a chief called Sikonyella, who was famous for his feats of horse-lifting. Recently the breed has been improved by crossing with **Arab stallions.** Young things ready to go to work are brought into the Colony, and can be bought for about £4 each. When trained and proved, a pony of substantial build and good looks is worth about £12. In their natural state they live much with the people, and are extremely gentle, docile, and easily handled, and being accustomed to native

blankets flopping, are trained ladies' ponies from the first. The particular upbringing to which they are subjected makes them more at home in foraging for themselves during the course of a campaign than horses reared in an ordinary way, and every now and then an animal performs some actions which induce one to think that the exceptional reasoning powers of the Basuto pony are no myth but a reality. If a breed of 16 to 17 hand horses of the same quality as a Basuto pony could be produced, they would be worth well nigh their weight in gold.

On the **De Beers Company stock farm**, near Kimberley, which may be regarded as a good typical example of what a horse-breeding farm ought to be, a stud of 500 brood mares has recently been selected by the purchase of suitable animals from various parts of the Colony. Eight thoroughbred stallions and a Jack donkey are kept. Forty of the mares are cross-bred hackneys, and the others, with a few exceptions, are high grade cross-breds by well-bred stallions. A good number of the most suitable specimens for the purpose of breeding **Indian remounts**—the object which the Company has in view—stand 15 : 3 and 16 hands, and many have strong serviceable bone. Those which are under size for the special purpose in view are put to the Jack to breed **mules**. The brood mares begin to drop their **foals** in September, and every precaution is taken to prevent the loss of condition, either from exposure to cold winds or from deficiency of food during winter. The natural grass, mostly of the strong-growing species known as "rooi-gras," *Anthistiria ciliata*, Retz. (which grows so freely on the red sand of the district that it is not well adapted for sheep), is cut for **hay**, and as much as 30 acres of veld are allowed for grazing each animal throughout the year. The land is being fenced off into camps large enough to accommodate eighty mares, the number allotted to each stallion. Pure **water** is being supplied from wells which are made 50 to 60 feet deep, at an initial outlay of 15s. per foot for sinking and facing with stone. Much natural **shelter** is to be found in the thick bush, but in those parts of the Colony which lie exposed and are void of trees, artificial shelters in the form of inexpensive iron-roofed open sheds, stone or "mist" walls (see page 482), and hedges of American aloe must be provided.

PLATE 58.—DE BEERS HORSE-BREEDING FARM NEAR KIMBERLEY.

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The precaution of fumigating all the animals twice each month is taken during the horse-sickness period, by burning fires of horse dung in a small kraal, and throwing tar and sulphur on as it smoulders. This is directed not only against the disease, but also against skin parasites. For the latter purpose, no doubt, the practice is a good one, but when an epizootic attack of **horse-sickness** appears it will be necessary to confine the animals under cover of a close house, or to adopt the arsenic treatment, or, let us hope, the anti-toxine method of prevention, shortly to be issued from the Bacteriological Institute.

In the dry spring, for two months, from the latter part of August till into October, each horse camp has a heap, consisting of 10 bags **salt**, 10 bags wood ashes from the kitchen, and 10 lbs. of sulphur, with water thrown over to induce a crusty condition, made for the horses to **lick**. This serves the double purpose of preventing disease and of encouraging the development of a glossy condition of coat.

When the De Beers stud is got into good working order, as will probably be accomplished within a year or two, the class of animal bred should be too good to dispose of to the Indian Government, including expenses of delivery, at £40 each for four-year-olds. De Beers Company ought to hold an **annual sale** of colts rising two years old. Many should be fit to use as stallions on common stock, and would no doubt average at least £30, and thus pay better than keeping them till they are twice the age for an additional £10. This would enable the Company to keep a larger number of mares, and to confer a considerable benefit on the Colony by distributing annually a number of well-bred animals. The ultimate aim would of course be the Indian trade, but the first claim upon enterprising breeders is the improvement by every possible means of the breeding stock of the Colony.

There are so many inferior and worthless animals about that it has been claimed for **horse-sickness** that it is **a blessing** in disguise for the purpose of clearing them off. Another benefit accredited to this disease is the destruction of Kaffir horses, which have become so numerous in some parts that the idle Kaffirs cantering about on horseback have become a public nuisance. The last available **returns of**

the numbers of horses in the Colony show that the loss sustained by the last great outbreak of horse-sickness in 1891-92 has not yet been made up, and that the Colony is now about 100,000 horses short of the numbers that were recorded during the census in 1891.

Year.	Horses.	Mules.	Asses.
1891 Census . .	354,133	50,634	45,267
1892-93, Estimated .	267,738	49,915	39,642
1893-94, Do. .	252,508	52,598	42,175
1894-95, Do. .	254,198	53,508	48,235

Mules and asses are used to a considerable extent for transport purposes in the drier parts of the Colony—the Western Karoo country—and much of the **ploughing** and farm work in the Western Province is done by mules in place of oxen. In some of the free-working soils it is not an uncommon sight to see, attended by two Cape boys, four stout active mules, worth £15 each, clothed in the common white "brayed" leather harness of the country, at work in one of Ransome's wooden - beamed wheel ploughs, and turning over about two acres a day, in a rough and ready but on the whole a serviceable fashion. In the "Ruggens," again, eight or ten horses or mules may be found yoked together, and not going deeper than three or four inches, or turning over much more than half the above amount. Mules are much used up-country for **coaching work**, on account of their staying power and their ability to accomplish better results on inferior food than horses, but they require a lot of driving, and they are obstinate and tricky at outspanning. Probably the latter defect arises from a want of care in breaking, as neither mules nor asses get at that time, as a rule, as much attention as horses. The mule is more delicate when quite young than the pure-bred offspring of either the horse or the ass, and it takes longer to come to maturity. It is, however, healthy and less liable to equine disorders after it grows up. It unfortunately suffers

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quite as readily as the horse from horse-sickness, and is credited with succumbing even more rapidly than the horse after the active stage of the malady is reached. Condition powders, containing a good proportion of sulphur, given twice a week, have been known or believed to prevent the disease. Donkeys are generally thought to possess immunity from its attack, but probably, like the zebra, it is only less liable to the most serious consequences of the disease than the other members of the family group. A young three-year-old mule of good substance and 13 hands high will readily sell for £20 in most parts of the Colony, and animals a shade larger often run up to £30 each. One method of improvement in mule breeding would be the importation of large Spanish or United States **Jack donkeys**, animals about 13 : 3, and costing say £120 in America. The De Beers jackass was nearly this height and of a favourite colour, viz., dark hair over the body, light-grey about the mouth and belly, tan round the eyes, above the muzzle, and on the ears. £25 each had been offered for all the "he" progeny of this Jack on selected ass mares.

No imported stock could endure the starvation which native stock do endure, and consequently it should always be borne in mind that even imported donkeys and their descendants will require better food and greater care than the patient, long-suffering **common small donkey**, which strongly corresponds to its Irish prototype. As many as twenty or more of these slow but sure creatures may regularly be seen quietly wending their way with a waggon in the dry Karoo districts. The donkey has been aptly termed "the most economical motor force in the Colony."

A recent case of a **mule** stallion **breeding with a mare** was reported in the Free State on what was declared to be reliable authority, but, although this is admitted as possible by the scientific world, minute inquiry and satisfactory evidence must be adduced before the circumstances can be accepted as beyond a doubt.*

C. L. Sutherland, of Coombe, Surrey, one of the first authorities on mule-breeding in England, fully describes the

* The *Agricultural Journal*, Cape Town, for 1894, vol. vii., page 205, makes reference to various instances of fertility in mules.

Poitou mule, used in France for heavy farm work, in a report submitted to the Richmond Commission on Agriculture. He points out that, being bred from strong-boned farm horses by the large Poitevin jackass, they are often as large as farm horses, 15 to 16:2 hands, big-jointed and short-legged, with plenty of bone below the knee, and large rounded feet, more like those of the horse than the contracted feet of the ass. In most of their prominent features they strongly resemble the paternal parent, the heaviest and strongest, but also the least symmetrical of the various asses. The price of one of the improved kind when quite young ranges from £80 to £120, and if of good size and a proved foal-getter, up to £200 and £320. The **measurements** of a good specimen are given as follows:—"Height, 14:1 hands; forearm, 19½ inches; knee, 15 inches; below knee, 8½ inches; hock, 17½ inches; below hock, 12 inches; greatest girth, 77 inches; girth behind shoulder, 66 inches; length of head, 25 inches; length of ear, 15 inches; ears, tip to tip across, 32 inches." The Poitou breeders do not care for greys, but select black or brown-bay donkey-stallions with white bellies. The tip of the nose is greyish-white, and covered with a fine down. If Cape farmers would go in for breeding from these animals, mating them with the largest in place of the smallest boned mares, they would secure mules worth £50 or £60 each when ready to go to work at three years old. The size would not be so large as the biggest Poitou specimens, but this would be all the better for Cape Colony. Although it is generally admitted that both horses and mules are at present too small, it would be a great mistake in such a climate to attempt to breed the largest animals for general use. What is wanted is an animal with good strength and substance, but in dimensions not too large. For a lighter class of work on the road, in which the pace is quicker, the **Maltese ass** might be used to cross with well-bred mares. This variety has given excellent results in crossing with thoroughbred mares in the East and in the West Indies. A pure Maltese ass has a black body, neck, and legs, and white or light-grey under the belly and inside the legs. His head is light, his ears full of motion, and his eyes and muzzle fringed with tan and white. The height is about 13:2, and the girth 5 feet 3 inches.

PLATE 59.—POITOU JACK DONKEY.
14 hands 2½ in., worth 8,000 francs or £320.

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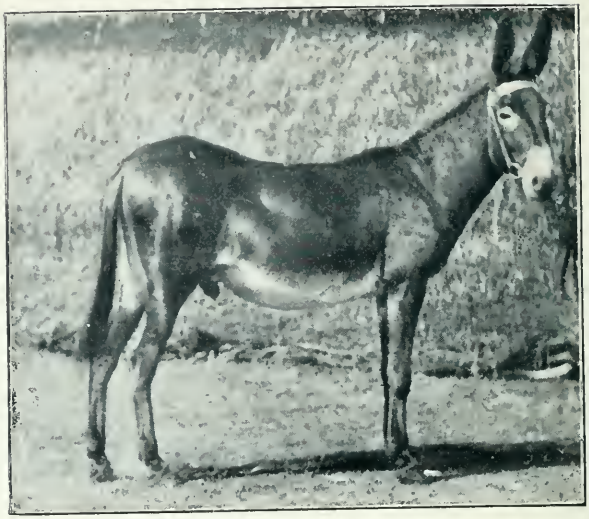

PLATE 60A.—MALTESE JACK DONKEY, 14 Hands, 1 Inch.

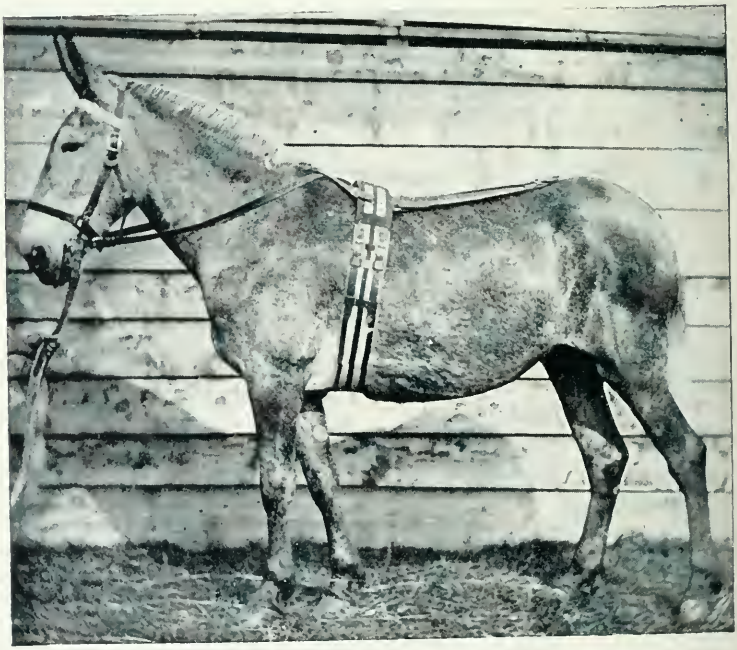

PLATE 60B.—POITOU MULE, 17 Hands.

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There is little doubt but that mule-breeding, as well as horse-breeding, if conducted on scientific principles and managed skilfully, has a great future before it in South Africa, the animals bred being not only for use in the Colony and up-country, but for export to India and to various other parts of the world for army purposes. Should a war break out anywhere, the Cape ought to be ready to meet the demand in all branches of the service, and reap a full share of the abundant harvests which occur at such times.

Horse-sickness or "**paard-ziekte**," *Œdema mycosis*, is a deadly epizootic disease which has been known in Cape Colony since 1719. It is annually in evidence in some places, and every now and then it breaks out extensively and sweeps the Colony. Seven serious epizootic outbreaks have occurred in South Africa—Cape Colony, or the Free State, or Natal—since the first historical one in 1763. On one occasion 70,000 horses and mules, worth £525,000, died. In the last great outbreak, that of 1891-92, the casualties among horses and mules numbered 14,128. The disease is by no means confined to Cape Colony and the adjoining territories, but it extends into the Transvaal, and a considerable amount of evidence is forthcoming to show that it exists in Central Africa, both to the north and to the south of the Equator. **Summer** is the season in which horse-sickness is most prevalent, from January till early May in a great many places, but it sometimes arrives in November or December. It acquires its full force about the beginning of February, and disappears for the season on the advent of frosty weather. Heavy rain has also been known to check it. **Low-lying districts** are most subject to it, but even on high veld, which is generally so free from the disease that horses are sent during the dangerous months from the low country for safety, if a kloof or valley exists, and the animals are permitted to enter it, the disease may appear even thousands of feet above the sea.

A Government inquiry was made in 1854-55 into the nature of the disease. It was then shown not to be contagious; that horses exposed to the night air, especially if a mist rose from the ground, were most subject to it; that horses stabled at sunset and kept in till the dew lifted next morning were comparatively safe, and so were horses shut up at night in

small cattle kraals, with manure several feet deep to act as an artificial warmer, on the principle of the garden hot-bed. It has been reserved to **Dr Edington**, Director of the recently established Bacteriological Institute,* to carry forward on scientific lines the investigation into the nature of the disease. As far back as 1886, in instructions given to a veterinary expert sent by the British Government to study an outbreak in Natal, it is declared that the disease must be due to a micro-organism. This organism has been distinguished and separated from a host of nameless organisms present in horse-sick blood. It is, according to Dr Edington, "one of the filamentous fungi, which, under suitable conditions of heat and moisture, **grows in the veld**, but whether in water, in the soil itself, or as a parasite, must be left for future observation to ascertain." **The vegetative spores** of this fungus are larger than micrococci, and under the microscope appear oval in shape and flattened or slightly concave at the ends—like so many little

MICRO-ORGANISM OF HORSE-SICKNESS.
After Dr Edington.

barrels. When stained, a solid dark nucleus leaves a transparent space at each end and along each side. They are invariably present in the blood during the latter part of the time a horse suffers, and can be readily distinguished under the microscope. The mycelium on which they had grown can also be seen after a careful search, and Dr Edington believes he has found the resting spores, the presence of which accounts for the unique fact that "horse-sick blood kept fluid and mixed with pure carbolic acid to the strength of 3 per cent., has proved to be virulent to healthy horses even after being kept for nine months." The same high authority finishes an interesting chapter on "Post-mortem Examinations," in his Report for 1894, by saying, "The one chief feature of horse-sickness is the remarkable exudation into subcutaneous and subserous tissues."

* See his Report for 1894, to which indebtedness is freely acknowledged by the author.

There are at least **two varieties** of the disease. (1.) **The paard-ziekte,** the common form in which the lungs are most seriously affected, a circumstance which is regarded as an indication that the disease has been contracted through germs inhaled in breathing. (2.) **The dikkop,** in which swelling of the subcutaneous tissue of the head and neck forms the most prominent symptom, the swelling being at times confined to the tongue, and giving rise to the variety known as blue-tongue or "blaauwtong." In both forms the period of incubation, the time elapsing between the reception of the organisms in the system and the first sudden rise of temperature, is about eight days; but while the former usually terminates fatally in about twelve days from the onset of the initial rigor, death in the latter is generally delayed for a few days longer. In the common form of the disease the end comes very rapidly. The animal is suffocated or drowned by an exudation of blood serum into the air passages, these becoming gorged with a dense white froth, which does not collapse on a portion being blown from the mouth and nostrils in the death struggle. **The lungs** appear solid, gorged with the exudation, and the edges are streaked by clear lines.

In all forms of the disease a considerable quantity of **serum is found** in the pericardial sac or envelope which surrounds the heart, in the pleural cavity, and in the subcutaneous tissue of the neck, and at times in the abdominal cavity and other parts of the body which lend themselves to the collection of the serous fluid escaping through the tissues. The action is practically equivalent to that of a filter, and, as one would naturally expect, few, and in some instances no barrel-like vegetative spores can be found, owing to their having been kept back by the tissue which admitted of the escape of the serum. This accounts for the uncertainty attached to inoculation with any other fluid found in the system, except with the blood in which the organisms live and reproduce their kind.

By venous inoculation both forms of the disease, in no way differing from those spontaneously acquired, can be induced in healthy horses. Another form locally situated in the abdomen has been produced by ingestion, and it would

appear from an ingestion experiment on sheep that they may also contract the disease in like manner, but this trial demands repetition and confirmation, as the results are contrary to the generally accepted fact that no animal outside the family *Equidæ* is liable to suffer from the disease. From the Report of the Director of the Colonial Bacteriological Institute for 1894, it appears that his hope of a remedy against the disease lies in the direction of the comparatively recent advances of prophylactic medicine in which an **anti-toxin** is used to combat the toxin, which is a poison in the system developed by the disease germs. Twenty horses salted by this means have recently been sent up to Matabeleland to test the soundness of the theory. Repeated failures to cultivate an anti-toxin by aid of the horse-sickness fungus make it necessary to try as a remedy anti-toxin produced through the attenuation of some other virus, such as that of diphtheria.

Marked success has attended preventive treatment by the daily administration of small doses of **arsenic and sulphur.*** The practice may be carried on during the whole period of danger without injuriously affecting the animal's health. The great drawback to this remedy is the difficulty of getting the operation of administering the dose carried out regularly, so that the action may be steadily maintained in the system. Otherwise satisfactory results cannot be attained. Large doses of **alcohol** (Cape brandy) are reported to have proved beneficial in Natal, and Dr Hutcheon recommends (pending the publication of the expected results from the Bacteriological Institute) the use of common salt, and Glauber or Epsom salts, or even of copious bleeding early in the acute stage of the disease, also carbonate of ammonia and oil of turpentine to replace a portion of the alcoholic stimulant.

Cures are claimed for the treatment of keeping the animal warm, and giving a teaspoonful of tartar-emetic every hour during the critical stage. **A salted horse** is spiritless, and looks unthrifty in the coat, and thick about the neck and head. Although this confers immunity from the disease so far as the district in question is concerned, if a horse be removed to another district he is liable to suffer.

* Four to five grains of arsenic and a teaspoonful of flowers of sulphur.

CHAPTER XVI.

GOATS AND GOAT FARMING.

The Boer Goat—Habits of the Goat—Goat Flesh—The Angora Goat—Difficulties of Goat Farming—Contagious Lung Disease—Trade Position of Mohair—Influence of Fashion on Prices—Prospects of the Mohair Industry.

The Boer goat, which is termed the native goat to distinguish it from the recently imported **Angora,** is a strong, coarse, hardy, energetic animal, strongly resembling the English goat. So tractable is it that it is sometimes yoked into a light garden wheel-hoe and made to work like an ox. A common **colour** of its hair is black and white, but black, brown, and mixtures of these colours, also grey of different shades, and even pure white, are well in evidence. A few are hornless, but as a rule dark-coloured **horns** are well developed, and rise antelope fashion from the crest of the frontal bone. **Goats are herded** in flocks by themselves, or run with sheep to act as leaders, which, in trekking from place to place or even moving over the veld in search of food, they do in an independent and even majestic fashion. In driving a mixed flock into kraal, the native boldness of the goat acts like a charm in overcoming the natural timidity of the sheep. No one can for a moment doubt that the goat is the more intelligent of the two animals, and that the goat will live and even thrive under conditions not favourable to sheep. A natural habit of the goat is to climb, and in mixed grass and bush veld this gives the goat an immense advantage over animals like the sheep, which crop only the growth close to the ground. A goat, by standing on its hind legs and supporting itself by resting its fore-feet on the branches, can immensely extend its food supply, and bring within its reach the leaves of trees, which are of special value in times of drought. **The restless and enterprising habit** of the goat

is liable to lead to injury to the feeding power of the veld. It is generally acknowledged that goats are more destructive than sheep to the best varieties of bushes and other food plants, and that if a full stock of goats is regularly kept, year after year, on a certain area, it will degenerate in feeding capacity. **The changing of varieties of stock** in succeeding years, or the running of mixed stock together, which is discussed in another place, is indispensable in successful goat farming. The excessive **energy** of the goat is liable, under South African conditions, to lead to injury to the veld in yet another direction. Goats not only travel more than sheep, but they more frequently walk one after the other when in search of food. In so doing they trample the surface into tracks, which readily deepen into sluits by the action of the rain-water from heavy thunder-showers. These tend to lower the quality of the vegetation by running off the natural water supply which ought to sink into the ground. Moreover, there is the uneven surface left, and the loss sustained by the washing away of soil.

The flesh of the goat, after cooking, is not readily distinguishable from the thin dark-coloured mutton derived from Merino sheep, and consequently much of it is consumed as mutton. In many districts it forms the chief meat supply for the general purposes of the farm.

The Angora goat was first imported about 1840 from the village of Angora, in Asia Minor, situated in a mountainous district 220 miles east-south-east of Constantinople, by Colonel Henderson, an Indian officer. He put an Angora ram to pure white "blink-haar" Boer goat ewes, and the female progeny were as they came forward crossed by the father ram as long as he lived. At a later date several importers brought in large numbers of pure Angora goats, which, by crossing, established many of the flocks in the Eastern Province, the original centre being Caledon in the west. The last and perhaps the finest of the early imported Turkish Angoras were secured in 1880 by **J. B. Evans** When selecting and purchasing the finest specimens of the breed, he spent about six months travelling through the country on horseback, in company with the British Consul in Angora—a Scotsman, and agent to Thomas Crabtree, the oldest mohair

PLATE 61.—GOATS FEEDING IN THE VELD.

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merchant and importer in Bradford. So highly were the goats prized by the people of the country that they parted with them as reluctantly as if they had been their own children. The goats were sold soon after their arrival at Port Elizabeth at from £100 up to £400 each.

The exportation of Angora goats from Turkey was soon afterwards prohibited for a time, but in the end of 1894 the Prime Minister (the Right Hon. Cecil Rhodes) personally conducted negotiations with the powers at Constantinople, which resulted in a relaxation of the prohibition, and in the appointment by the Cape Government, on his return to the Colony, of two experts to select and purchase a number of very superior animals. Some thoughtful men disapproved of the new departure, mainly owing to the risk of re-importing the deadly lung disease, which had before so nearly wrecked the goat industry of the Colony, and because, they argued, the large number of first-rate animals already in the country made it unnecessary to import fresh blood, and questionable whether new blood would improve the standard of quality. A **shipment** of about 200 goats was accordingly landed early in December 1895, and placed in quarantine until 5th February 1896, when 150 of them, belonging to the Mosenthals, merchants of Port Elizabeth, were sold by auction at prices ranging from £6 up to £330, or an average of £50 each.

It is freely admitted that there is only a limited number of **pure-bred goats** amongst the best Angora flocks of the Colony, though the repeated use of pure-bred bucks has to all intents and purposes established what is practically equivalent to pure blood. Between the finest of these high-grade Angoras and the Boer goat there are **numberless varieties** showing different degrees of impurity, and producing mohair of various grades of quality between the hair of the common goat and the lustrous, silky product of the Angora.* The great desideratum in the matter of eliminating impure blood as much as possible is a strong Angora Goat Society for the whole Colony, with a well-managed flock-book, and progress in this direction is already under way.

Bastard goats are liable to retain the natural tendency to

* See page 353 for table giving numbers of goats in the Colony.

periodically **shed the hair,** which is a characteristic of the Boer goats, so that the excuse for the adoption of the objectionable practice of **shearing twice a year** is the preservation of mohair which would drop off and be lost. The repeated use of good rams in the flock will gradually modify this tendency, and permit of the operation of shearing being carried out at the best season, as a rule June or July. The second shearing is generally accomplished in October or November, when the hair has had only four months to grow. The second clip is consequently short in the staple, and worth little more than half the value of the first clip. It suits a certain branch of the Bradford trade, and it is nearly all used up in that district. To secure the full market prices there should be but one shearing in the year, and not only should the mohair be baled in a clean condition, but the rams, ewes, kids, and "kapaters" or wethers should be shorn separately, and the hair, after being sorted on the spot into at least four **different qualities**, also packed separately. **Goats** in ordinary flocks **clip** 2½ lbs. to 3 lbs. each on an average, but a good stud flock of ewes should yield 5 lbs. to 6 lbs. each, and rams more than double this weight. Certain varieties of goats, like different varieties of Merino sheep, produce more **yolk** than others, giving origin to a classification of **oily and non-oily** goats. A ram of the first class will at a year old sometimes clip 16 lbs. of hair, while the yield from the other may not exceed 8 lbs. to 10 lbs. The oily goat is a larger and more vigorous animal than its rival, but shows less quality, and is liable to become coarse as it grows old, and to lose its hair on the under surfaces of the body.

A well-bred Angora should be closely covered on all parts of its symmetrical, rounded, substantial, and well-balanced body, with single locks or ringlets of long, white, wavy, silky, and lustrous hair. It must be free from kemp, an indication of the Boer goat relationship, and as far as possible of fine quality throughout, although it need not be expected that the hair of the breeches, which naturally tends to coarseness, will be as fine as that growing from the neck and shoulder, or as short and soft as that grown on the belly and between the thighs. In addition to the long valuable hair, there is an inferior undercoat of fine hair, like the second coat of a collie dog, which is

W. Roe, Graaff Reinet. *ace page* 326.

PLATE 62.—ANGORA GOAT, OLD BUCK, "PRINCE." Bred by C. G. LEE, Klipplaat, in the Karoo.

W. Roe, Graaff Reinet. PLATE 63A.—ANGORA GOAT, YOUNG EWE.

PLATE 63B.—ANGORA GOATS, YOUNG RAMS, Property of Dr SMARTT, Britstown. *Face page*

removed as "noils" in the process of manufacture. Mohair* of good growth may naturally vary on the same animal from 9 inches in its longest parts to 6 inches and less. **A fleece** hanging from the side of the animal ready for shearing should fill the hand when grasped, and feel dense but soft and downy to touch; and as the goat stands its coat should appear to touch the ground. Indications of **good breeding** are exhibited in a neat, well-proportioned head, a broad forehead, with prominent eyes, and a narrow and finely cut nose. The ears are broad, thin, flat, and pendent, their outside surface along with the face and legs covered with fine silky white hair. **The flattish horns** should be light in colour, much larger in the case of the ram than in that of the ewe, becoming twisted and spreading outwards with an inclination backwards. Thick, erect, dark horns indicate an excess of Boer goat blood.

In the case of any **marked departure** from the true Angora type, either in colour or in symmetry, it is best not only to remove the kid but also the mother from the stud flock. The Angora is among goats a **delicate** animal, liable to suffer from pulmonary weakness when exposed to cold and wet, and particularly so if kept on low-lying ground. The high and dry altitudes of Cape Colony (exclusive of bleak mountains) seem admirably suited not only to the health requirements of the goat, but to the production of the finer qualities of mohair. So great and so rapid has been the success of the goat industry that it is a question whether, after a little more care has been devoted to breeding from the best stock, Cape Colony will not, as regards quality as well as quantity, become the most important centre of mohair production in the world.

"**Cape mohair** has not yet reached the perfection of Turkish grown mohair, neither being so bright, nor having the spinning property to make it of equal value by 2d. to 3d. per lb." This statement, which is made on the highest British authority already alluded to, ought to be a beacon to guide the South African farmer in the course of his attempt at improvement. Bright lustre and fine silky quality of hair are the main objects to strive after, and this can be ultimately attained

* The name given to the hair of the Angora goat.

in the climate of Cape Colony by breeding from the best rams that can be found in the Colony, and from importations from time to time of the finest blood from Bei Basar—the best district in Turkey for growing the most valuable mohair. Ample **precautions** must, of course, be taken by lengthened quarantine **against** the introduction of **disease,** and it should be made clear to importers that no cross-bred or inferior stock can receive a first-class certificate as breeding animals from the Government inspector. If goats were subject to **inspection,** and liable to be branded first, second, or third class, according to quality, attempts to introduce inferior blood, with the object of making an unfair profit from unsuspecting purchasers, would not occur. It might be argued that such a regulation is unnecessary, because the farmers are quite able to protect their own interests, as was demonstrated in the case of a shipment of Angora bucks brought from California last year. The importer lost heavily, as the animals, not being good enough for breeding purposes, were sold at butchers' prices. This safeguard may be all very well in the case of distinctly inferior specimens, but good-looking goats of impure blood might be introduced which farmers might buy, and most likely seriously injure a good flock by using them. The safeguard of Government inspection would come in usefully in such an instance. The industry is now such an important one that it warrants special attention.

It was not till 1862 that **mohair** was returned separately in the exports, when it weighed 1,036 lbs.

In 1878	it weighed	1,300,585 lbs.,	value	£105,313.
„ 1885	„	5,251,301 lbs.,	„	£204,018.
„ 1895	„	11,090,449 lbs.,	„	£710,867.

Though the **returns from goats** are good, and particularly so after the smart rise of 40 per cent. in the value of mohair which occurred in 1895, the life of the goat farmer is not always a happy one, as goats are altogether more difficult to manage than sheep in a healthy district. There is trouble from **abortion,** which ought, although the immediate cause may have been an accident or injury, to be treated as a catching or contagious disease, affected animals being separated without delay. The tendency to this and to pulmonary weakness, and also the difficulty experienced in getting

female Angoras to recognise and care for their kids when young, may possibly be due to some extent at least to the **in-and-in-breeding** to which they have been subjected.

During the **period of kidding** the practice is to examine the flock carefully every morning before leaving the kraal, and all ewes that show signs of approaching parturition are kept back. This is necessary in order to reduce the number of kids that are dropped on the veld as much as possible, because after a kid has been carried home on the back of the Kaffir herd, the mother very frequently refuses to take it, and may require to be tied up for two or more days before she will permit it to suck. In order further to obviate the difficulties arising from this tendency to desertion, each kid and its mother are marked with a distinguishing mark, so that they may be readily brought together. The kids are not allowed to run with their mothers on the veld, but are kept in the kraal during the day, until they are old enough to feed in the open, when they are herded by themselves near the homestead. Kids begin to appear early in August, and they are castrated when about eight days old, and weaned at the age of six months.

The **scab insect** which infests the Angora goat belongs to the symbiotic group, and differs from the scab insect of the sheep and that of the Boer goat, as may be seen by referring to page 370. Scab or brandziekte of the Angora goat is not nearly so difficult to cure as that of the Boer goat, neither does it spread so rapidly as that of the sheep. The most deadly scourge to which Angoras are liable is a **contagious lung disease,** which happily does not now exist in the Colony. It was introduced in 1880 in one of the last flocks of goats imported, and broke out early in 1881, but was stamped out before gaining a permanent footing by the energetic means employed by Dr Hutcheon, the Colonial Veterinary Surgeon. The disease is as deadly as pleuro-pneumonia in cattle, and is more rapid in its progress. Nodules appear in the parenchyma of the lung, and extend in a spherical manner until the surrounding parts become involved, and the naturally light and cellular lung substance assumes the solid consistency and dark colour of liver. **Inoculation** with the clear lymph which exudes from a diseased

lung was proved by experiment to be satisfactory as a preventive, and 44,000 goats were inoculated within a few months. In October authority was given by Government to supplement inoculation by slaughter where necessary—compensation to the extent of about 10s. each, or two-thirds of the value, being paid to the owners. A number of flocks which had not been inoculated were slaughtered outright, and individual members of inoculated flocks not having secured immunity from the disease were also killed. A second outbreak occurred a few months later, and 20,000 animals were re-inoculated, but eventually the disease was eradicated; and belonging to that class technically termed "specific," the disease cannot reappear unless brought to the country by a goat suffering from it.

Mohair is now **used** in the manufacture of a great variety of articles, the chief being women's dress goods, mantles, &c. It is also employed in producing plush for the furnishing trade; material for the upholstering of railway carriages; braids for military trimmings and for ordinary wear; astrachan cloths for jackets, dresses, caps, and muffs; imitation furs of various sorts; carriage rugs and boot and shoe laces. The cause of the recent great demand and rise in price has been the changing of **fashion** in ladies' dress. Fine dull goods made from soft wool are no longer in fashion, and mohair being the article next to silk in brightness of lustre, and less costly by far, a great demand has resulted. The increased prosperity of the **Angora goat farmer** does not rest on any very stable or reliable basis, as fashion is well known to be as fickle as fortune, but he can do something to encourage its stability by improving the quality of the hair, and thereby offering a more attractive article. Another point in his favour is that female fancy is decidedly more inclined to the bright than to the dull when both experiences are familiar. The chances are, now that mohair has at last gained its due position in ladies' favour, it will continue for a lengthened period not only to maintain but to strengthen and extend that position.

PLATE 64.—FAT-TAILED HAIRY AFRIKANDER SHEEP (RAMS). *Face page* 331.

The wall behind consists of rectangular blocks of sheep dung ("mist") cut from the firmly trodden accumulations on the floor of the Kraal.

CHAPTER XVII.

SHEEP AND SHEEP FARMING.

Fat-tailed Sheep—Beginning of Merino Sheep Farming—Characteristic Points of the Merino—Varieties of the Merino Breed—Unsatisfactory State of Sheep Farming—Kraaling Sheep at Night—Fencing—Predatory Animals—Jackals—Main Features of Sheep Farming—Shearing—Ground Plan of Wool Shed—Dipping—Lambing—Castration—Branding and Marking—Sheep Folds—Old System of Management—Numbers of Sheep and Goats—Turnips Grown for Sheep in New England—Value of Ensilage—Mutton-Producing Sheep—The Cheviot Breed.

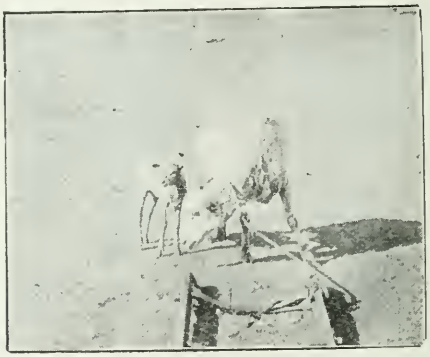
THE sheep which the European discoverers of Cape Colony found in the possession of the natives was the parti-coloured, hairy, lop-eared, **fat-tailed sheep,** which strongly resembles a well-known Persian variety. The broad, flat tail usually weighs from 6 lbs. to 15 lbs.,* and consists mostly of a soft, sweet fat, used in out-of-the-way places and during times of drought as a substitute for butter. Although leggy when alive, and yielding but a light carcase when dressed, the native sheep is in high favour with the butcher, who will buy a mixed flock of Cape sheep (or their crosses, which are still more numerous than pure-breds) and Merinos when he would not look at a flock of the latter by themselves. Hairy sheep are better adapted than Merinos to very light Karoo pasture, where stock have to travel over large areas to obtain sufficient food. Some farmers prefer them on account of their comparative freedom from scab, and in districts in which "steek-grass" is abundant. The spicules which by working into the wool of fleeced sheep produce so much irritation do not readily adhere to the hair.

In laying the foundation of many of the existing flocks of **wool-producing sheep** in the Colony, selected white-haired ewes were crossed about the year 1793 by imported Spanish

* Some tails weigh 20 lbs., and a few as much as 30 lbs. each.

Merino rams, some being from the Royal Flock of George III., and the female progeny again with pure-bred Merinos, until the Merino characteristics became tolerably well fixed. About this time Colonel Gordon, an officer in the Dutch East India Company's service, imported a number of ewes as well as rams—also of Spanish blood—and it was from this flock that twenty-nine sheep were taken in 1797 to establish the fine-woolled Merino of New South Wales.

Curious cases of **atavism**, or reversion **to the Cape sheep** ancestor, occur at times among animals which possess what appear to be pure Merino characteristics. As an example of such a case, a photograph (here reproduced) was taken of



A Lamb of a Merino Ewe, showing marked indications of reversion to a hairy-sheep ancestor.

a lamb a month old, at Spitzkop, Barkly West, which was thought by the natives to have been sired by a steenbok. The form of the body, the slender legs and very small feet, the shape of the head, and particularly the prominence and brightness of the eyes, together with the bare coat of a russet brown colour, were all pointed to as strong evidence in favour of the theory. Besides all these undoubted peculiarities and differences from all other lambs in the flock, it was wild and decidedly more active than they were, and jumped about in the kraal very much like a buck.

Merino sheep farming extended slowly in the Western districts from 1812 to 1830, but it developed rapidly and became general throughout the Colony after the **Boers**, dis-

PLATE 65.—FLOCK OF FAT CROSS-BRED MERINO AND FAT-TAILED SHEEP.
The stone walls of the Kraal are coped with cakes of "mist," or dried sheep manure.

Face page 332.

PLATE 66A.—VERMONT MERINO EWES, BRED IN NEW ZEALAND.

PLATE 66B.—PURE NEGRETTI MERINO RAM BRED IN AUSTRALIA. *Face page* 333.

gusted with British law and British interference, **began to trek** north on the abolition of **slavery** in 1834. The very moderate share of compensation for the loss of their property, amounting to about two-fifths of the appraised value of the slaves, was to be paid in stock after each claim had been proved before commissioners in London. These illiterate people could not comprehend the meaning of this treatment, or estimate the value of the proposal in money, and numerous petty agents coming round relieved them for an old song of their rights to compensation. This and the **decision of the British Government** in the end of 1835, during the sixth Kaffir War, to give back to the natives much of the land fought for and won by the Boers after all the losses in men and means which the Boer population had sustained, practically left the latter no alternative but that of flight from the sphere of British influence at whatever sacrifice. Many sold their farms for a span of bullocks or a pair of "veldschoons" (home-made shoes of untanned leather), and departed. As British farmers came in, chiefly in the Eastern Province, Merino sheep spread and increased rapidly.

The change of fashion in woollen fabrics has from time to time during the last hundred years led to the **introduction of rams** of different strains of Merino blood possessing different degrees of fineness or quality of wool. At one time the large and somewhat coarse Rambouillet or French Merino was the favourite; but the closely-bred and dense-coated Vermont or American sheep, the fine-woolled Saxon or German variety, the hardy and active Negretti, and also the Australian and close-woolled Tasmanian, have each had their share of attention. Probably the last are the best suited to the present requirements of the Colony.

The following description of the **characteristic points** of the Merino breed, and the distinctions noticeable between its well-marked varieties, is extracted from the author's work on "The Agriculture and Rural Economy of Australia and New Zealand." *

The Merino is white in hair, hoof, horn, and wool; the bare portion of the muzzle is of an orange-fleshy colour (white being objectionable); the eyes are light-grey; the horns in the male well developed, spirally

* Published by Sampson Low, Marston, & Co., London.

coiled inwards, and not placed too wide nor yet close enough to touch the cheek. In the case of **ewes** the great majority are without horns: when horns do appear they are comparatively insignificant.

To the touch, the back is thin-fleshed, and slightly elevated at the withers; the back-bone is rather sharp. The skin of some breeds, notably the German and the Vermont, is more or less full and wrinkled, more particularly about the neck, but the great majority of the Cape and Australian Merinos are plain-skinned, with the exception perhaps of a few wrinkles at the neck. The looseness of skin and the folds were objected to by the shearers, who were greatly retarded in their work owing to the care it was necessary to exercise to prevent cutting the skin; but in these days of shearing by machinery, wrinkles do not offer such an impediment or source of danger.

Irrespective of the difficulty of shearing, **wrinkles** are not liked except as an indication of purity of breed. If it were not the case that the Australasian progeny of Vermont and other wrinkled sheep lose the wrinkles, the infusion of fresh blood of this kind would be in less favour. There is a tendency to the production of coarse wool-fibre, especially on the crowns of the wrinkles when these are large and numerous. **Wool** should be abundant on the belly and extend down the legs to the feet and well on to the head and face, so that at shearing-time little but the nose and hoofs is to be seen projecting from a flouncing ball of white wool. The part of the face not clad with wool should be covered with soft silky hair.

In well-bred sheep the wool is close, dense, and fine; though it varies in these characteristics as well as in length and profusion in the different varieties of the breed, and even within these varieties, according to the locality in which they are reared and kept, or, in other words, to the nature of the country, food, and climate.

Sheep generally produce finer wool after they are once shorn. Uniformity in the quality of the wool on the different parts of the body is striven for—the wool of the hindquarter or thigh should not be hairy or strong in staple, but should resemble the wool of the side and forequarter as much as possible. On being parted for inspection, down the side, thigh, shoulder, or back, it should divide freely without any sign of adhesion or matting, as this would stamp it as inferior for the purposes of combing wool. A fine, wavy, bright staple should be presented down the sides of the opening (a condition usually more pronounced near the forequarter than on the thigh), and at the bottom of it a bright flesh-coloured streak of skin.

A real Merino fleece as it grows on the sheep should be firm as a board and packed like a cauliflower—the tips of the wool being even, neither fuzzy nor straight, nor standing up in places. With great length of staple, which is not a natural characteristic of the breed, the density which is of so much importance is lost.

Metis-merinos from France produce long loose wool. They were originally formed by crossing the Merino with the English Cotswold breed, to increase the amount of mutton, and are in consequence not so hardy as pure Merinos for the drier parts of the country.

Saxon Merinos have very fine bright, close, soft wool, forming an ample and fully extended covering to all parts which grow wool. **The Tasmanian Merinos**, which now, as a rule, bring the largest prices at ram sales, belong to this latter breed. The Tasmanian flock-owners have but small flocks, and they bring their animals out to show better than their competitors in the other colonies, but in addition to "tittivations," to housing, feeding, and protection from wet weather, there is no doubt that the soil and climate of Tasmania is peculiarly well suited to the development of the best qualities of the breed. The north and middle of the island produce better sheep than the south. The lambs are much wrinkled in the skin, particularly when they are well fed and fat, but this condition is lost, except on the neck, as they grow up to maturity.

In the case of the **Negretti**, the skin of the imported sheep is much wrinkled all over, and the staples are not free. The wool does not part readily in shedding, which causes loss in combing, and necessitates the transfer of the wool from the "combing" to the "clothing" class, for which there is not so much demand. The climate and soil of Australia have in a few years altered the defective condition and lengthened the staple.

The Spanish Merino is a sheep of large size, producing a superior quality of strong combing wool.

The Rambouillet or French Merino, descended from the Imperial Flock, is larger than the German or Spanish Merino, and produces fine wool, though not quite so fine as that of the Saxon Merino.

The Vermont Merino, from the State of Vermont,* is one of the most perfect as regards good covering and density of fleece. It is one of the most highly bred varieties of Merino, having been kept pure since 1803. Although it is refined in appearance, and grows a very heavy fleece of wool, it is not a universal favourite with breeders. It is thought by some to be soft in constitution, the result of close breeding; and the wool, which is lacking in softness, brightness, and fineness, contains an exceptionally large proportion of yellow yolk which washes away when the fleece is scoured.

Although the numerous **conditions of climate** and varieties of soil represented in that large stretch of country known as Cape Colony have, with insignificant exceptions, been proved admirably suited to the **propagation of Merino sheep** and the production of excellent samples of Merino wool, the sheep and wool industries are far from being in a satisfactory condition. Certain **animal parasites** and diseases —some well known in other parts of the world, and others local in their character — act as obstacles to progress, and will be discussed later, but probably one of the greatest

* One of the five New England States of North America located on the eastern border of the State of New York.

hindrances to advancement has been the system of **herding sheep** closely together during the day and **shutting them up in kraals** or small enclosures over night. It may be admitted that the practice was absolutely necessary for the safety of the sheep in the early days, but until the custom is as completely banished from Cape Colony as it has been years ago from the Australian colonies, the best results need not be expected from the sheep stock of the country. The want of fences, the natural propensity of the Kaffir population to steal, and the large number of predatory animals, such as jackals, wild cats, and also the larger of the feline family, which are steadily disappearing, were excuses for the practice, and in certain districts even now can be brought forward.

Fencing was encouraged, with immense benefit to the country, by the success of ostrich farming, which for a number of years brought very large sums of money into the pockets of those who developed it, and which still forms one of the most profitable pastoral industries of the Colony. By far the **most common fence** in the Colony is made of five to seven wires (the top one generally barbed), supported on wooden standard posts, 15 to 25 feet apart, and the wire bound together by a single, or better, a double wire lacing every 5 or 6 feet. The **cost** per mile may be roughly stated at £45 to £55, depending to some extent upon the initial cost and the outlays on carriage of the posts, as well as upon the strength and numbers of wires used. Wire of German manufacture, owing to its good quality and cheapness, is rapidly gaining ground in the colonial market. In the Eastern Province standard posts cost 2s., and straining posts, put in 240 yards apart, 5s. each. The plain wires are not fastened by staples—the common practice in this country—but passed through holes bored in the posts by an auger after they are fixed in position. Sneezewood is the favourite fencing timber, but there are several colonial trees which provide good hard and lasting posts for the purpose. The power of wood to resist decay and the attacks of insects is increased by placing the newly cut posts for six months in a water dam to dissolve out the sweet and easily degraded sap-residue. The wood becomes harder for the treatment, and less attractive to wood-eating insects. On the Karoo, where wooden straining posts

are expensive, and not easily got, **clay strainers**, 6 feet long by 5 feet high and 2 feet wide, are erected 400 feet apart, at a cost of about 4s. each. The wires are simply laid at the proper heights into the well-puddled clay as it is being built up, and require no further fastening. The total cost of a 7-wire fence, 4 feet 6 inches high, in these parts is about 1s. 11d. per yard. Fences are sometimes made entirely of clay, which is puddled after wetting by mules driven round and round on a pile of it, but they are more expensive than wire fences, costing 2s. to 2s. 6d. per yard, and are seen more as ornamental than as farm fences. Kraal fences are often made of thorny branches, and cost little at first, but require to be frequently added to, and must be regarded as unsatisfactory.

Fences not only confine stock to the owner's land, but make it more difficult to steal sheep without detection. The police regulations are now more perfect than formerly, although the natural instinct of the black to steal from the white man cannot be said to have changed. The **wild animals** are decreasing, although in some parts, especially near thick bush country and other natural shelter, considerable trouble is experienced from jackals. In some districts the Boer population is either careless or indifferent to the use of means for the destruction of jackals, so that a united effort has never been made to destroy the pest wholesale, and breeding centres are thus left, from which redistribution takes place. Government has proved its interest in **jackal destruction** by offering first 5s. and latterly 2s. 6d. for every tail of the animal brought in.* This has not yet led to the desired result, and stories are afloat of tails of jackals as well as those of other animals having been brought from regions north of the Colony, and the reward dishonestly secured. Hunting by terrier dogs and trapping are methods of destruction far preferable to the common and dangerous practice of poisoning, though the wide areas to be hunted over make it impossible to employ dogs with effect in certain parts, and the jackal becomes extremely wary of traps, so that great skill in baiting is essential. Poisoning, usually

* See page 251 for the last issued scale of compensation.

with arsenic or strychnine placed on raw flesh, is not only a danger to dogs and other animals of the farm, but the practice is credited to a large extent with the reduction in recent years of the numbers of **aasvogels** (vultures), the great carrion scavengers of the country.* This has upset the **balance of nature** to some extent by increasing the number of blue-bottle flies, the maggots of which now do the scavenger work. Had the climate been humid, these flies, which also lay their

HEAD OF A BABOON. *Photo. by P. Ashenden, C.E.*

eggs or larvæ on the wool of living sheep when moist, and give rise to the destructive and troublesome pest known as "fly-blowing" or maggots, might have proved disastrous, but as it is this danger is confined mainly to the humid districts of the east coast and to a few centres in the Eastern Province.

The Maanhaar (maned) jackal, or aard-wolf, *Proteles cristatus*, Gray, an animal intermediate in appearance between

* South African Griffon vulture, *Gyps kolbii.*

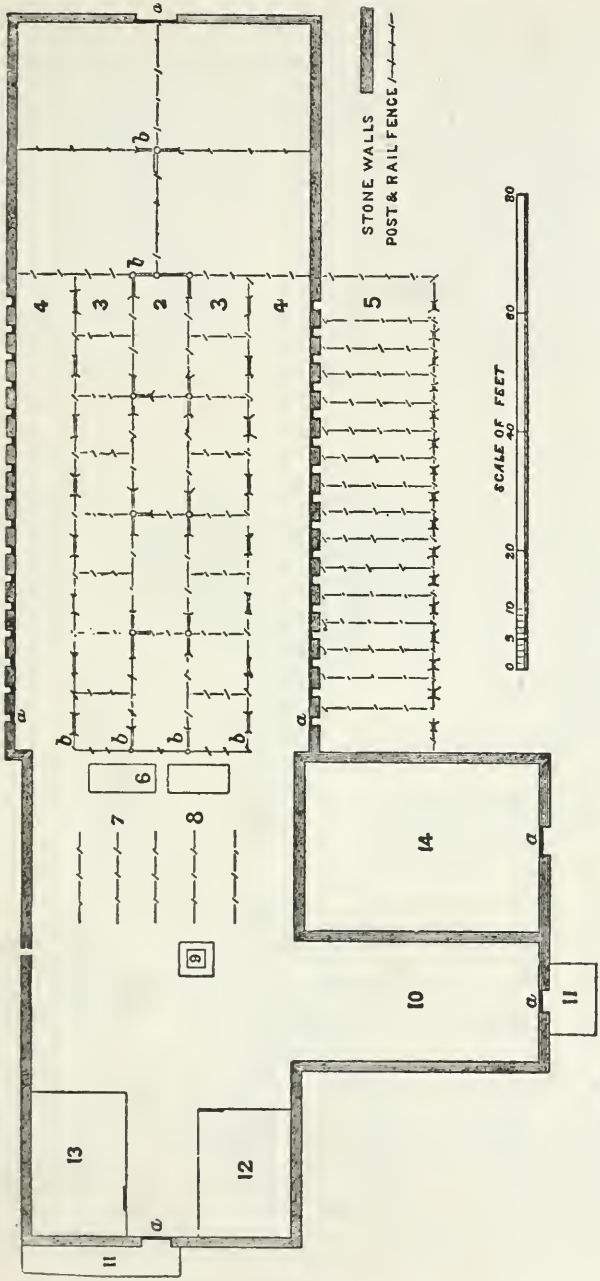
the hyena and the common jackal, has recently been the subject of discussion as to whether it attacked sheep or not. It is generally supposed to live mostly on carrion, and on white ants or termites, locusts, grubs, beetles, &c. Its molar teeth are so small and irregular that the idea of its chewing bones as the common red jackal does may be given up, but there is a strong presumption that in some parts, and some only, it has recently acquired the habit of killing lambs with the same object as have the **baboons,** which are known to destroy lambs in certain localities for the curdled milk found in their stomach, whereas in other districts they are harmless. Baboons are becoming more and more troublesome to the farmers. They attack full-grown goats and sheep, as well as lambs, and tear open the udders of the breeding ewes in search of the milk. They also destroy pumpkins, mealies, and potatoes in the fields. Even the **red jackal** is not always as destructive as it might be, as may be seen from the serious losses sustained at times when one or more jackals acquire the habit of attacking a flock of sheep; nevertheless the mischief worked is so general and so serious that it is a question whether Government should not give liberty to the officers of properly constituted **societies** for the destruction of vermin to go on the lands of any one in the performance of their duty without being regarded as trespassers. Had it been in any other country than Cape Colony, where feeling runs unusually high with regard to interfering with what is claimed as the private right to do as one pleases with his own, there would have been no question as to the expediency of granting such liberty in the interest of the common good; but the further question arises here, Might not such opposition be created that in this as well as in other directions more injury than good would result? Jackals are most destructive among ewes and lambs, but safety can be secured for the breeding flock by enclosing them in a camp protected by **a jackal-proof fence,** viz., an ordinary barbed-wire fence, with a wire net—3 or 4 inch mesh—about 2½ to 3 feet high, and sunk six inches into the ground, substituted for some of the lower wires. The price of 14-strand netting per mile is about £20, but the extra outlay over the cost of a common wire fence would not amount to so much if

the fence had to be erected. Some enterprising farmers have adopted the jackal-proof fence over the whole of their property, but the additional outlay, which is greater when the netting has to be added to an existing fence, is more than the average colonial farmer can afford under existing circumstances.

Without attempting to describe in detail any one of the many systems of management of sheep practised in the Colony, a few of the **main considerations** involved may with advantage be stated. The Egyptian method (ancient and modern) of **shearing** twice in one year is far too prevalent. The only really good excuse for it, viz., that treatment for scab is made more easy and effective, is one of which the Colony ought to be heartily ashamed. No doubt rather more wool may be got from two shearings than from one, but the expense is doubled, and the sheep are injured by an additional unnecessary "handling." Progressive farmers who pay attention to the quality of their wool aim at shearing only once. In the lower and warmer districts shearing begins as early as September, but October and November are the most busy months, while the work is done as late as December in the higher, colder, and more exposed districts. The golden rule in this matter is not to shear in cold or stormy weather. The second operation is done in March or April, and it is argued by some that ewes shorn at that time take better care of their lambs, by finding shelter for them when going into places which afford protection for themselves. This is a hollow excuse, because a ewe giving milk cannot do so to the best advantage when suffering from cold, and spending the time which ought to be devoted to feeding in search of external warmth. The accompanying ground plan of an Australian wool-shed will serve to show the kind of accommodation which is much wanted in the Colony.

Dipping is not an annual custom as in Great Britain, nor is it necessary in the Colony, any more than it is on the plains of Texas, in flocks which are free from scab. Clean flocks which have never passed through a dipping-tank are to be found in both countries. The **sheep louse**, *Trichodectes sphærocephalus*, N., and the **kade**, *Melophagus ovinus*, Linn., have only within the last five or six years been introduced into Cape flocks by imported sheep, and they have not yet

GROUND PLAN OF AN AUSTRALIAN WOOL SHED.



1. Four sweating pens to the right. 2. Race to "yard-up" sheep. 3. Catching pens. 4. Shearing board for sixteen shearers. 5. Sixteen pens for shorn sheep. 6. Wool-sorting tables. 7. Bins of fleeces awaiting pressing. 8. Ditto. 9. Wool press. 10. Wool store. 11. Platform for loading wool. 12. Skirtings and pieces. 13. Lumber. 14. Cart and machine shed. *a*. Door. *b*. Gate.

had time to spread, as they are likely to do within a few years. Goats suffer much more from the attacks of lice than do sheep. The operation of dipping is carried out at from two to four weeks after shearing, when all wounds made by

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THE SHEEP KADE, MELOPHAGUS OVINUS, LINN. Figs. opposite.*

Fig. 1. Female 6-legged sheep-tick or kade; 1*a*, larva case, each natural size.

Fig. 2. Male, dorsal view, ×8: *a*, head; *b*, thorax; *c*, abdomen; *d*, limbs; *e*, oval bristle-covered discs, which correspond to the points of attachment of wings in other flies; *f*, rudimentary halteres or poisers.

Fig. 3. Male, ventral view, ×8: *g*, *h*, and *i*, the three segments of the thorax; *k*, the external genitals.

Fig. 4. Female, dorsal view, ×8.

Fig. 5. Larva case, ×8: *a*, cephalic end; *b*, two rows each of seven shallow indentations.

Fig. 6. Foot: *a*, the two claws between which hangs *b*, the pinniform prehensile organ; *c*, the tarsi, whose last joint *d* supports the prehensile organ; *e*, distal end of the tibia.

Fig. 6*a*. Prehensile organ, ×60: *a*, the segmented muscular portion included within the tarsus; *b*, the flexible grasping portion.

Fig. 7. Front view of head: *a*, the compound eyes; *b*, the antennæ sunk in cuplike cavities; *c*, the labrum which protects the sucking organ.

Fig. 8. The sucking apparatus: *a*, the labrum; *b*, the orifice from which the tube protrudes; *c*, the sucking tube.

Fig. 9. End of the sucking tube, ×120: *a*, teeth by which the tube cuts its way through the skin; *b*, rod upon which the teeth are set; *c*, tube which has lateral orifice in it. Other details not shown.

Fig. 10. External genital apparatus of female: *a*, spine-covered cap which fits over *b*, the genital orifice above; *c*, two clusters of spines which seem to be for clasping; *d*, the terminal of the seven pair of stigmata or breathing pores; *e*, anus.

Fig. 11. External genital apparatus of male: *a*, the two lateral of the three chitinous styles which surround the projecting intromittent organ; *b*, two clusters of spines which seem to be claspers; *c*, stigmata.

Fig. 12. Larva case, ×6: *a*, case with the broken operculum inside; *b*, cephalic end, showing line where the operculum splits off, and the remains of a central orifice through which nourishment was obtained by the embryo from the parent; *c*, caudal end showing the two dots corresponding to the two terminal stigmata.

Fig. 13. Larva case with larva, ×6: *a*, ventral view; *b*, dorsal view.

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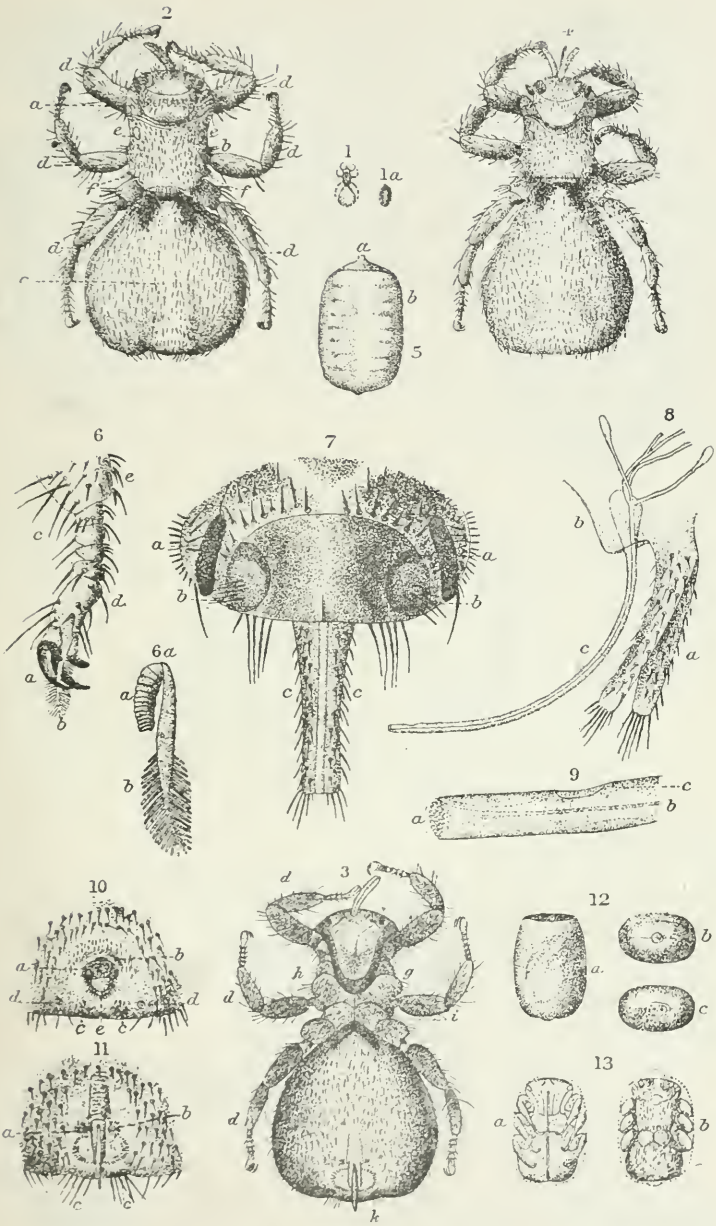
* This and the Figs. on pages 345 and 347 were taken from "Animal Parasites of Sheep," by Cooper Curtice, D.V.S., M.D., Washington, 1890.



THE SHEEP KADE OR LOUSE-FLY, MELOPHAGUS OVINUS.

careless shearing have healed, and when the wool has grown sufficiently to retain enough dip material to complete the process of destruction of the parasites, as the new brood hatches from the eggs, which are not injured by contact with dip.

Lambing begins in September—the spring month which corresponds to March in Great Britain—or in October at high altitudes, among those flocks which depend entirely upon what the veld in its natural state provides, and for which no artificial feeding is supplied. It is a general experience that lambs born earlier or during winter—from the middle of May till the general lambing season in September, with a lull extending from late in June till early in August—are more healthy than lambs dropped in spring or summer—more free from internal parasites, and ready to take full advantage of

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THE SHEEP LOUSE, TRICHODECTES SPHÆROCEPHALUS, N.
Figs. opposite.

On page 345, Figs. 1, 2, 3, 6, and 7, and on page 347, Figs. 1, 2, 3, 5, 11, 12, 13, and 15 are equally enlarged, and present relative differences in size and form. Other parts are also enlarged similarly for the sake of comparison.

Fig. 1. Male, natural length indicated by line.

Fig. 2. Female, natural length indicated by line: *a*, head; *b*, antennæ; *c*, face; *d*, cheeks; *e*, *e*, dorsal sutures; *f*, *f*, *f*, legs; *g*, prothorax; *h*, metathorax; *i*, abdomen; *k*, dark transverse bands; *l*, line of hairs on each segment; *m*, *m*, stigmata or breathing pores; *n* (fig. 1), male genital orifice; *o*, female genital orifice; *p*, female claspers.

Fig. 3. Young specimen just emerged from shell.

Fig. 4. Male antenna.

Fig. 5. Female antenna.

Fig. 6. Egg soon after being laid: *a*, cap with peculiar rod-like structure; *b*, line at which the cap is to cleave off.

Fig. 7. Egg shell which has lost its embryo and cap: *b*, *b*, wool fibres.

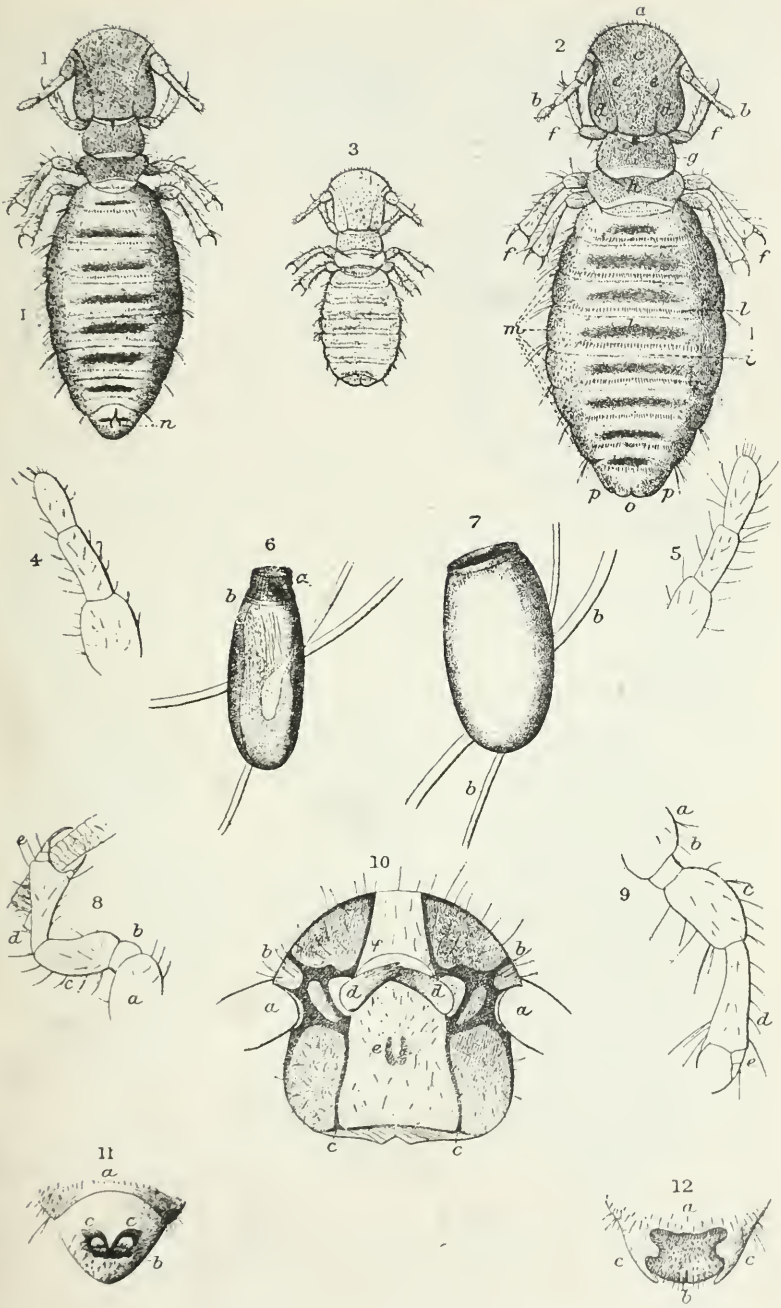
Fig. 8. Anterior leg: *a*, coxa; *b*, trochanter; *c*, femur; *d*, tibia; *e*, tarsi and claws.

Fig. 9. Posterior leg.

Fig. 10. Head, ventral side: *a*, *a*, antennæ; *b*, *b*, ventral continuation of dorsal suture; *c*, *c*, ventral suture; *d*, *d*, mandibles; *e*, maxillæ showing through the chitinous gular plate; *f*, the labrum.

Fig. 11. Tail end of male, dorsal view: *a*, the last segment; *b*, the genital orifice; *c*, chitinous, hook-like appendages of the genital apparatus.

Fig. 12. Tail end of female, ventral view: *a*, the last segment; *b*, the genital and anal orifice; *c*, the claspers.



THE SHEEP LOUSE, TRICHODECTES SPHÆROCEPHALUS.

the first flush of spring grass. Such early lambs require to be supplied with green forage, such as barley, oats, or rye usually grown under a system of irrigation. Autumn lambs in the low country, below the second range of mountains, arrive in April and May. There is a limit to the periods of lambing, as ewes do not usually come in season until about the middle of December.

Double lambs are not numerous on the veld. Ram lambs are not often sold, but "sorted" to make wethers or hamels, and kept till they are four or five years old, although lambs under favourable circumstances are in good condition for killing up till Christmas, when the best of the grass season may be regarded as past.

Male lambs are **castrated** when about a month old, and the tails of both sexes are usually cut quite short at the same time. Death from these operations is of rare occurrence. It is a matter for regret that the **branding act** of the Colony is optional, and consequently of little or no value. Sheep farmers, although indifferent and inactive, are in favour of a compulsory system of marking, but those who deal, in cattle more particularly, object, and there the matter rests.

Marking sheep with paint on the wool—a practice more or less injurious to its market value, according to the nature

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LOUSE OF THE ANGORA GOAT, TRICHODECTES LIMBATUS, GERVAIS.
Figs. opposite.

Fig. 1. Male, natural length indicated by line.

Fig. 2. Female, natural length indicated by line: *a*, head; *b*, antennæ; *c*, clypeus; *d*, cheeks; *e*, *e*, dorsal sutures; *f*, *f*, *f*, legs; *g*, prothorax; *h*, metathorax; *i*, abdomen; *k*, *k*, dark transverse bands; *l*, *l*, lines of hairs; *m*, *m*, breathing pores; *n*, male genital orifice; *o*, female genital orifice; *p*, female claspers; *q*, male genital hooks.

Fig. 3. Head, ventral view: *a*, antennæ; *b*, mandibles.

Fig. 4. Posterior end of female, ventral view: *a*, genital and anal orifice *b*, claspers.

Fig. 5. Egg: *a*, the cap; *b*, the line where it splits off.

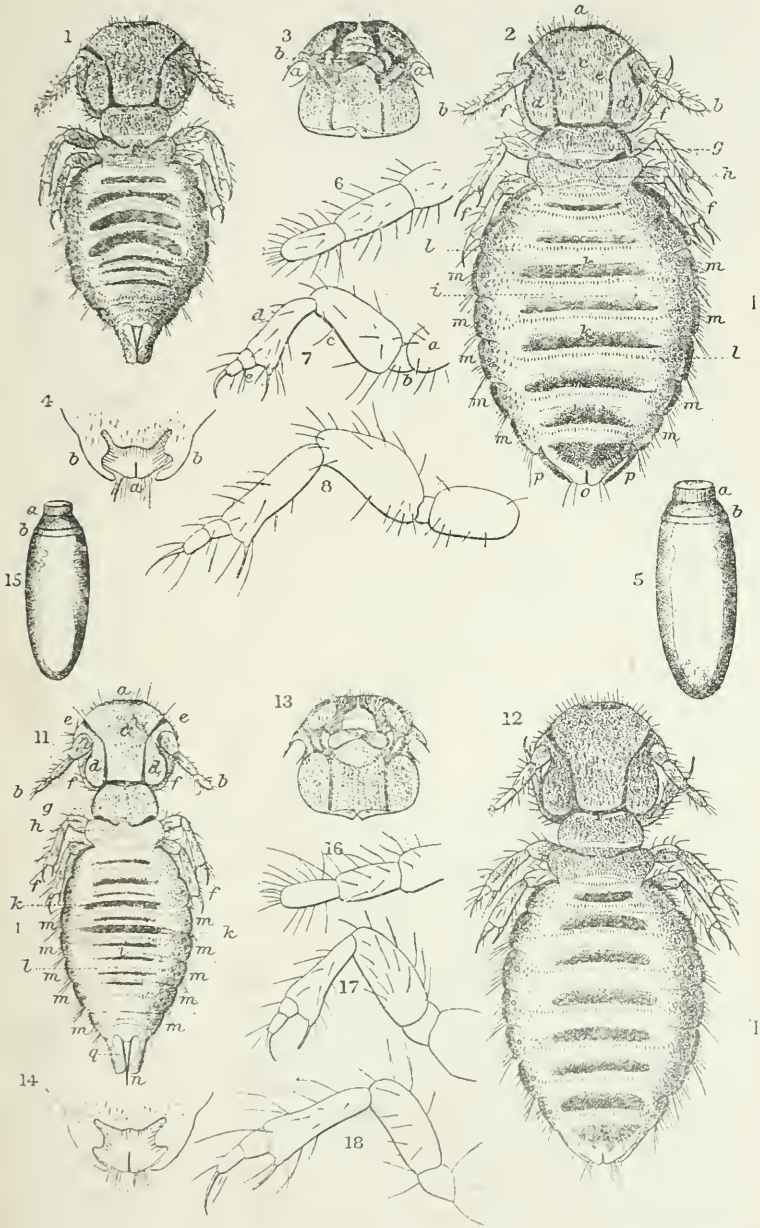
Fig. 6. Antenna of female.

Fig. 7. Anterior leg: *a*, coxa; *b*, trochanter; *c*, femur; *d*, tibia; *e*, tarsi and claws.

Fig. 8. Posterior leg.

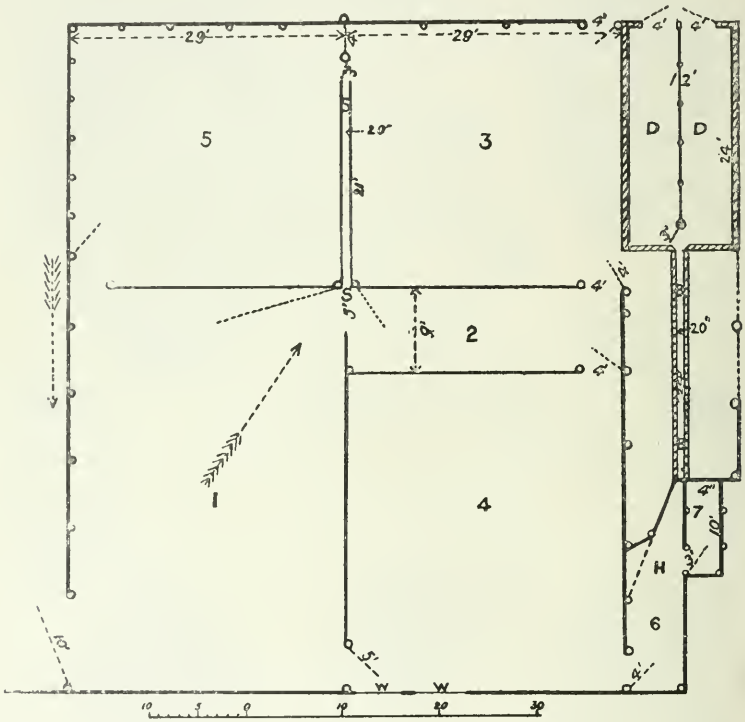
LOUSE OF THE COMMON GOAT, TRICHODECTES CLIMAX, N.

Figs. 11-18. Numbered and lettered for the same parts as Figs. 1-8.



ANGORA GOAT LOUSE, TRICHODECTES LIMBATUS, GERVAIS; AND COMMON GOAT LOUSE, TRICHODECTES CLIMAX N.

of the material used and to the method of execution—has to a large extent been discontinued in the Eastern Province since the introduction of fencing.



Ground Plan of a Sheep Fold, Shedder, and Swimming Bath.
Scale, 1 inch to 20 feet.

Stone and Brick Walls, Double Lines. Post and Rail Fences, Black Lines. Swinging Gates, Dotted Lines.

The length of the **bath** (B, B) is 24 feet, and of the **dripper** (D, D) 24 feet. The **dripper** (D, D) has a concrete floor, with small channels, 4 inches wide, on each side of the central partition. It has a fall of 3 inches from each side towards the centre, and of 6 inches from the exit end to the bath. The **bath** (B, B) is 18 inches wide, and when filled it contains at the deep end $4\frac{1}{2}$ feet of dipping material. The side walls at this end are perpendicular rather than converging as they go down, as although more dipping solution is required than when the sides contract, less splashing and loss in that direction occur when the sheep take the plunge suddenly. The sides towards the exit end converge near the bottom, which springs from a point 6 feet distant from the plunge end,

Perhaps the most glaring deficiency in the sheep farming of South Africa is the want of properly constructed **sheep-folds,** fitted with the Australian sheep-shedder and other available conveniences, to permit of a flock being handled without receiving widespread and severe injury. No animal on the farm is more easily injured physically and constitutionally than the sheep, and the present method of driving a flock into a confined kraal, where Kaffirs are directed to rush at the animals to be removed while standing in a mob together, cannot fail to lead to far-reaching and serious consequences, not only to the animals but to their owner's pocket. Sheep when gently treated can be trained to run in properly constructed folds, so that they can be separated into different lots without ever being caught, and nearly all the minor operations of the fold can be accomplished without seizing or lifting the sheep off their feet. The saving in the matter of death-rate, together with that resulting from the improved condition of sheep, which become poor through the injuries received from rough handling, would amount to a considerable sum annually, and would speedily compensate a farmer for his outlay in constructing folds.

The accompanying ground plans, drawn to scale, of sheep-folds will supply data by which any sheep farmer who takes a proper interest in his business should be able to construct a fold suitable to his requirements.

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and ascends at a uniform angle till the level of the dripping floor is reached. The sheep are driven along the roadway in the direction of the arrows, a 10′ gate opening across the roadway and closing it. The sheep are penned in No. 1, passed into No. 2, and hand sorted into 3 and 4, or they may be passed through the shedder (S, S) into 3 and 5. For dipping, the sheep pass into No. 6, and are then driven up passage H. A shepherd standing on the left of the passage, and leaning over the boarding, pushes each sheep into the bath B. No. 7 is a decoy pen, in which four or five sheep may be placed to induce the flock to go forward more freely. The swinging gate at H is of service in pressing the sheep into the passage. The same applies to the gate at the entrance to the shedder. Four men can dip 200 sheep per hour, giving each sheep a minute in the solution. One of the men with a crutch attends to the sheep in the bath, and puts any down that have not gone properly under with head and back. He also prevents the sheep passing too quickly, and attends to the gates at the entrance and the exits of the dripper.—*Scottish Farmer.*

Wire being unsuitable, the best **fences for sheep-folds** in most districts of Cape Colony would be walls built of cakes of "mist," cut from the bottoms of old sheep kraals, shown in Plate 64. The proper **site for a fold** is a level piece of dry hard land free from natural obstructions which would prevent the approach of a flock of sheep from any direction. Should there be a slight inclination of the surface, which is admissible and even advantageous in a climate where rain falls in sufficient amount to make the ground muddy if surface drainage be not provided, the fold should be so placed that the sheep run uphill until the "sorting" fold is reached. The dimensions and forms of the most of the minor folds may be varied indefinitely according to the number of sheep to be accommodated, and the locality of the fold as a whole. The **"hand-sorting"** or **"catching" fold** should never be more than 9 feet wide, the floor must be level and paved with cobble stones, or formed of some hard, dry material. Its natural position is in the centre, so that numerous folds to hold different classes of sheep connect with it. Posts and rails form the best fence for a hand-sorting fold in a hot country, as **fresh air** is freely admitted, a matter of importance when sheep are packed so closely together, as they intentionally are to keep them from rushing about and injuring themselves when being caught in this fold. If built of "mist," **ventilation spaces** should be left at the bases of the walls to permit a current of air to pass under the bellies of the sheep.

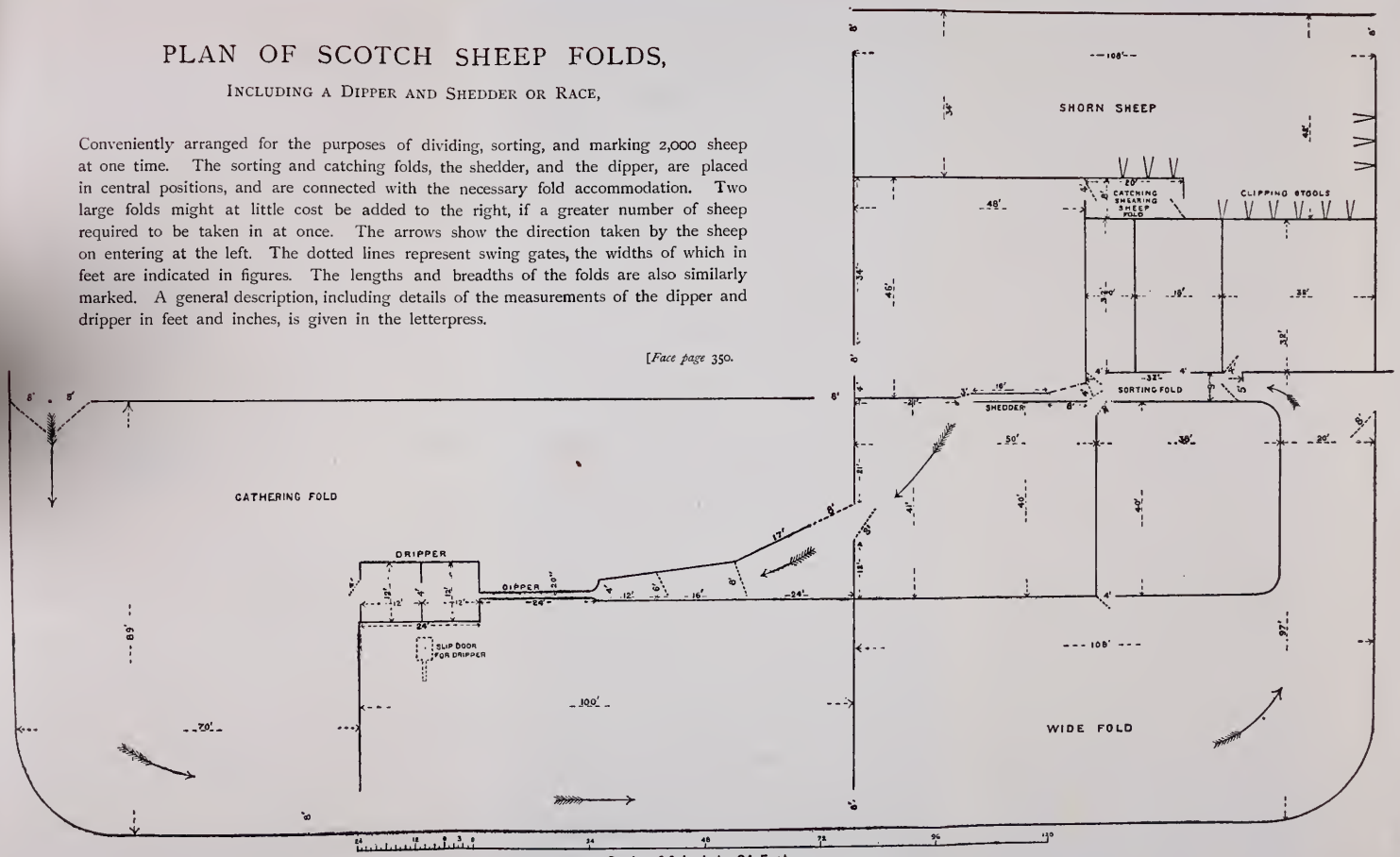
If the separation can be done without handling, the sheep in that case pass to the **shedder**, where they can be separated into two or more lots without being seized. The shedder, which is 18 to 24 feet long, consists of two boarded walls about 3 feet 6 inches high placed parallel to each other, 12 inches wide at the bottom and 20 inches at the top, to provide sufficient space and no more to admit one sheep to pass at a time. A **swing door,** 3 feet beyond the exit end, is hinged to a post put in line with the centre of the shedder, so that the door commands the entrance to two folds—one on each side. This door is used by the man in charge to close the entrance of one of the folds while a sheep passes into the other, and thus a combined flock, say of hairy and of wool-producing sheep, can be separated

PLAN OF SCOTCH SHEEP FOLDS,

Including a Dipper and Shedder or Race,

Conveniently arranged for the purposes of dividing, sorting, and marking 2,000 sheep at one time. The sorting and catching folds, the shedder, and the dipper, are placed in central positions, and are connected with the necessary fold accommodation. Two large folds might at little cost be added to the right, if a greater number of sheep required to be taken in at once. The arrows show the direction taken by the sheep on entering at the left. The dotted lines represent swing gates, the widths of which in feet are indicated in figures. The lengths and breadths of the folds are also similarly marked. A general description, including details of the measurements of the dipper and dripper in feet and inches, is given in the letterpress.

[*Face page* 350.



Scale of 1 Inch to 24 Feet.

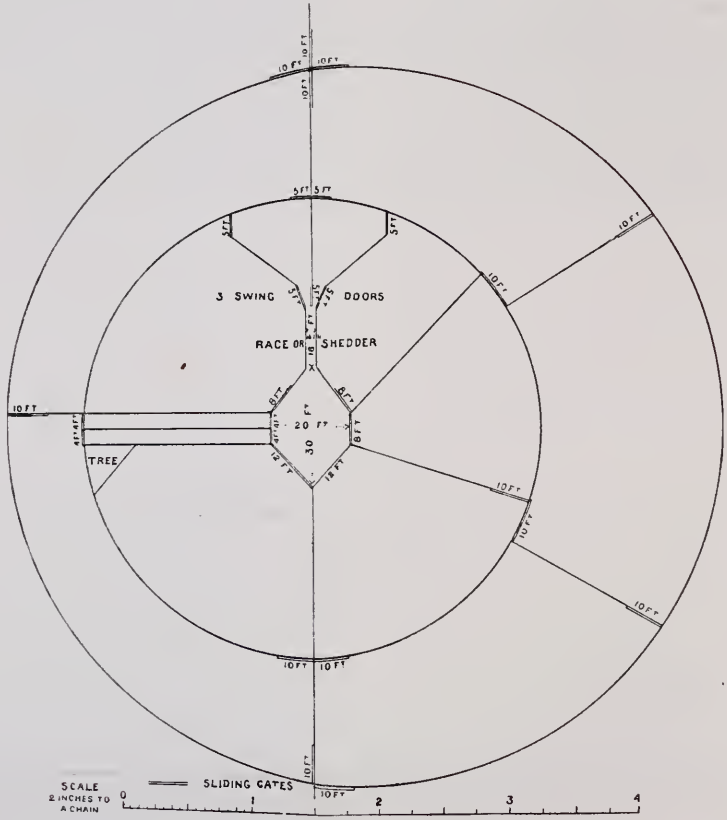
PLAN OF A NEW ZEALAND SHEEP YARD

On Whakaki, the Property of John Hunter Brown, near Napier, in the North Island.

Planned and Constructed by Farquhar M'Rae, the late Manager.

Explanatory Note.

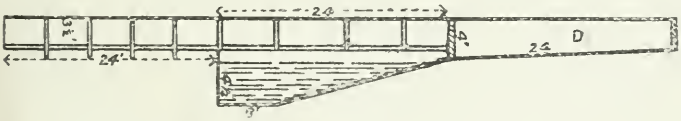
The **Whakaki sheep yards** are large enough to accommodate 4,000 sheep at a time, and **three men** are sufficient to handle that number. Here the use of the **race** or **shedder** has been brought to the greatest state of perfection. By the employment of three swing gates or doors marked on the plan one man can separate a flock, while passing once through the race, into four divisions. He uses the third or central door to divide the two smallest lots of sheep, so that it is not necessary for him to move his hands very frequently. The two alleyways, 4 feet wide, beside the tree to the left of the plan, are employed when handling fat sheep, when mouthing, or branding requires to be done, but in all other cases the sheep pass through the yards without being caught or touched by hand. All the **gates** (marked with a double line on the plan) open, with the exception of the three swing doors, by sliding to one side, so that they can be opened without crushing the sheep, and are in most cases, whether open or shut, well out of the way, being in line with the abutting fences.



[*Face page* 351.

into different flocks without a single animal being touched or injured. For the separation of three different classes of sheep a second swing door can be introduced midway in one side of the shedder, which should then be the maximum length, and an additional fence requires to be erected to make two divisions in the fold on the side referred to. A similar arrangement may be carried out on the other side of the shedder if it be necessary to divide a flock into four classes at one operation. One smart man can work the doors in the sides of the shedder and shed out two classes of sheep, leaving to the man in charge of the door at the end the easier work of separating into two divisions those permitted to pass the side doors. Sheep are a little shy at first, but with goats as leaders the initial difficulty would be easily overcome. After they have been through a few times they run freely and even anxiously.

Apart from the saving of labour, the benefit to the sheep is so immense that no one who gains experience of a shedder ever goes back to the old practice of separation by handling.



Sectional Side View of a Dipping Tank and Dripper.

The **dipping tank** or bath ought to be long to give the sheep a good swim to let them get thoroughly wetted. The tank should also be narrow so that sheep have not room to turn, and that there be no unnecessary space which would require a large amount of dipping material to fill it. The length should not be less than 24 to 30 feet, and the width 18 to 20 inches. The water in the well or deep end, into which the sheep are plunged, should be 4 feet 6 inches deep for a distance of 6 to 10 feet, and the bottom of the exit end might shelve out from this point to the surface.

The **dripper** (with a concrete floor falling 3 inches from each side to the centre, and 6 inches from the exit end to the tank, so that the dip material which runs off the sheep must drain back into the tank) may be divided in two equal parts, either up the long axes by a permanent fence or across the

narrow way by means of a fence and slip door. One-half being filled with sheep direct from the bath, it is closed, and the sheep stand to drip until the second half is similarly filled; then they are allowed to escape. See page 376 for further details.

Something of the **older system** of management, which was at one time general in the Colony before the introduction of fences, may still be seen in the **Caledon district,** a part of the country which has long had a reputation as a sheep country, although it barely maintains its old position. Taking one of the largest flocks, numbering 10,000 to 12,000 Merinos, the following **conditions** may be expected to exist. The ordinary flock receives no artificial food, but when a stud flock is kept it requires liberal treatment. The soil of the district being very deficient in lime, and internal parasites being numerous, there is a great craving by the animals for **bone and salt.** Both ought to be supplied in liberal quantities mixed together, the bone being ground into fine flour. As flocks are closely shepherded and put into kraals at night, there is no difficulty in bringing the sheep daily within reach of the mixture. **Ewes culled** by the teeth, the culling beginning at four years of age, are kept, if the teeth be good enough, till they are six to eight years old. On Karoo veld the teeth wear down rapidly, and on sour veld, where the grass is wiry, they wear on the sides and become open, but on the sweet veld, where the vegetation is of finer quality, the teeth wear better and last longer. Old ewes—as many as 600 or 700 yearly—are largely consumed by the Kaffirs living on the farm. Hamels, weighing from about 40 lbs. to 50 lbs., are sold at five years old for 10s. to 12s. each.

The average **fleece** weighs about 3 lbs. of wool, washed about a week before shearing, which is done by hand, in October. Two **rams** are set aside for every 100 ewes, and they are let into the flock 145 to 150 days before the lambing season is expected. It is as essential here as in other parts of the Colony that the rams be not shorn immediately before they go to the ewes. If put out newly shorn, they suffer from cold and neglect their duty. Angora goat bucks act in the same way. **Lambs** begin to come with June, and when weaned they are separated and kept in flocks of similar age.

One man takes charge of 500 or 600 sheep, and he receives as **wages** from 10s. to 20s. and food—five pecks of meal and two sheep—per month.

Owing to Cape Colony being what may be termed a monsoon country, with alternating seasons of heavy rains and **drought,** which make the natural food supply very irregular, the condition of stock is periodically lowered, and progress retarded. When the drought is unduly prolonged, as it frequently is in one district or another, stock suffer seriously and die in large numbers. Although the Colony is rich in the elements of means for preventing this serious and steady drain of its capital resources, it is only recently that farmers have begun to wake up to the importance of self-help in the matter. The reward offered by Nature is tempting, because not only can a farmer prevent loss, but he can at the same time increase his profit by utilising much of the valuable natural food, which at present goes to waste, to be found during the abundant season. The Colony is face to face with the facts that, with a growing demand for mutton for Johannesburg and other great mining centres to the north, the numbers of **sheep are decreasing** in place of increasing, and that the **price of wool** has reached a ruinously low point, in a great measure justified by the inferior condition, due to scab and other causes which affect market values.

Comparative Numbers of Goats and Sheep in the Colony Proper since Statistics have been taken.

Year.	Sheep.	Angora Goats.	Other Goats.	Wool, lbs.	Mohair, lbs.
Initial census, 1891	15,194,636	3,092,639	2,880,348	51,407,914	6,638,422
Estimate, 1892-93	15,164,943	2,732,724	2,317,605	47,272,102	6,435,600
Do., 1893-94	13,354,748	2,532,842	1,807,293	41,440,932	7,425,443
Do., 1894-95	13,726,841†	2,533,634	1,780,703	65,632,613	11,090,449

Something had to be done to get out of antiquated grooves, and to meet the exigencies of times that rapidly change.

* Includes lambs reared each season.

† Of these 1,761,383 are hairy Cape sheep.

One of the most **interesting developments** was met with in the New England district, in the neighbourhood of Barkly East, where for the last two years **turnips** had been successfully grown and fed to sheep during the annual season of scarcity. Few varieties had been tried, but of these the common white turnip probably did best, although in some cases swedes gave marvellous results.* As swedes when not thriving well are liable to suffer from fungoid attacks near the crown of the bulb, and as something possessing better feeding qualities than a white turnip is wanted, it is probable that yellow turnips, or some of the well-known hybrids—the Fosterton, for example—would prove satisfactory. It was found that thirty acres of roots sown broadcast—swedes put in early in January, and whites following as late as 15th February—were sufficient to supply a flock of 2,000 sheep with the additional food required to tide them over the barren season, one acre being sufficient to provide for 500 sheep during one week. **The method adopted** was as follows:—A turnip flock is made up by drawing out from time to time the thinnest and most needy members of the total flock from some time in June on till 25th July, when the final selection is made. These eat turnips daily for an hour in the morning, and again for an hour in the afternoon, the Kaffir boys herding the sheep to one side of the turnip field to prevent the waste which would result if the turnips were all broken at one time. It is so planned that the turnips are grown in a corner of each camp for the sheep belonging to it, and after the morning feed they are turned out to the veld to pick up as much of their natural food as possible. In this way the animals are stimulated to exertion, and not permitted to become too dependent upon the artificial supply. For the first few days after going on the turnips the sheep tuck up in the bellies as they neglect the grass, but they soon fall into the way of resting a while and then spreading over the veld to feed. The cost of growing the turnip could be reckoned at little more than the outlay on seed (at 2s. per lb.), and the extra fencing required, as no additional Kaffirs were engaged, and the ploughing of the

* Three selected purple-top swedes grown on Holbrook, G. G. Wallace's farm, weighed collectively 75 lbs.

land was thrown in with the work done by "bij-woners" working on the share principle.

It is found that when the **condition** of the sheep is maintained throughout the year they do not so readily fall a prey to parasites, and the death-rate is consequently lessened, and only slightly exceeds 1 per cent. per annum. The tendency to weakness or breaks in the wool is also overcome. But perhaps the two most **important benefits** to be derived from the new departure are—(1) The increase in the number of sheep that may be kept—in many instances at least 50 per cent. more than under the old system; and (2) the additional power to adapt one's management to the requirements of the market for the time being—the production of fat lamb or the breeding for either mutton or wool, as may be found expedient.

New England is favourably situated, in comparison with certain other parts of the Colony at lower elevations, owing to the abundance of **summer rains.** In such a district as Cathcart, for example, turnips grow very well in certain seasons, but rains are at times so long delayed at seed-time that turnips could not be depended upon as the sole additional support of the sheep stocks. The **system of ensilaging** green food during summer when growth is luxuriant might be employed as a stand-by when turnips fail. There is an immense amount of valuable grass, particularly in the coast districts of the Colony, allowed to go to waste annually. If cut when still growing and succulent, and before running to seed, it would make excellent silage, which would keep for years if not required, and form a substantial insurance against the evil results of drought.

Merino sheep do not produce **mutton** to suit the English taste, but it must be admitted that, when killed on its native pasture and not injured by driving or railroad travelling, the mutton possesses an excellent flavour, resembling that of some of our finest British mountain breeds, while the thin condition is rather an advantage than a drawback to its keeping qualities during the hot weather. Nevertheless, where **early maturity** is an important object, it will be necessary to obtain rams from one or other of the well-known short-woolled Downs or the long-woolled breeds. As little is yet known in the Colony of the respective merits of many of

the most prominent **British breeds**, mistakes are sure to be made for a time.*

Various important points have to be taken into consideration in selecting **the breed to use.** With the comparatively small Merino ewe a ram of a breed with a large head would lead to difficulties, and entail a considerable loss in both ewes and offspring at lambing time. Again, for a high, cold, and exposed district a ram which will "get" a lamb with a rough coat of wool at birth is decidedly preferable. This is a distinct and regrettable drawback to the best of the so-called black-faced or **Down breeds** of England as compared with the rival **longwools**. Their **wool** is short at birth, and, although it grows rapidly, it is deficient at the time of all others when it is most wanted. For **crossing purposes,** in breeding fat lambs for the butcher, it will probably be difficult to find the equal of the Shropshire Down or the Suffolk Down ram for a warm or sheltered district; and the combination of essential qualities in a ram suitable for the colder uplands will be found in the Border Leicester—hardiness, activity, early maturity, and an abundance of the woolly covering at any age. For a number of years crosses between the Suffolk Down ram and Merino ewe have been successfully bred on the borders of the Free State and Griqualand West. It is found that the **lambs** at six months old, worth 10s. each, pay better than hamels sold at 20s. at three or four years old. By disposing of them at an early age a loss by death of 10 to 15 per cent. is prevented. The wool is of finer quality than that of the longwool cross, and the lambs are not too fat for the South African taste.

In departing from the original custom of breeding Merino sheep chiefly for the wool, and attempting the **production of mutton** as well, mistakes are sure to be made and money lost

* The author found on one occasion an excellent flock of Hampshire Down sheep which had been sent out as Southdowns, and rams had been sold for years, and at good prices, as Southdowns. No one need regret the mistake, as the Hampshire is unquestionably a better general purpose sheep for the Colony than the Southdown would have been. For details of the different breeds the reader is referred to "The Farm Live Stock of Great Britain," published at 12s. 6d. by Crosby Lockwood & Son, 7 Stationers' Hall Court, London.

PLATE 67A.—A CHEVIOT RAM.
From the Mountains on the Scottish and English Border.

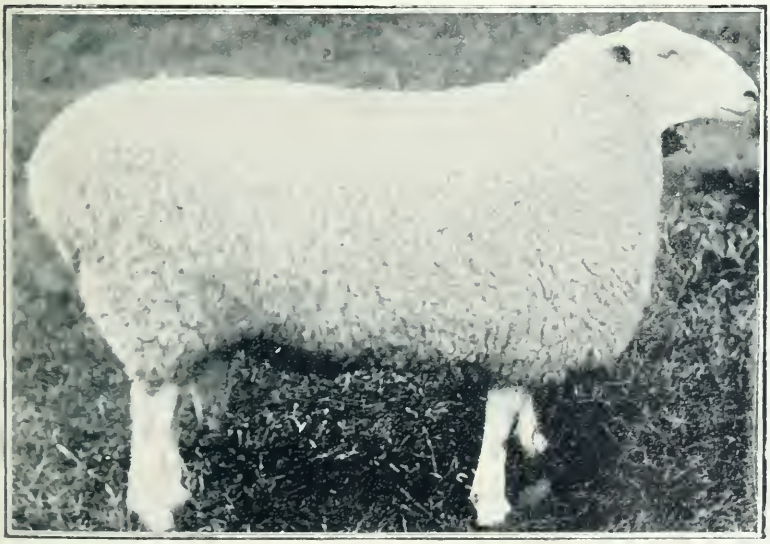


PLATE 67B.—BORDER LEICESTER RAM.

Face page 356.

by those who rush deeply into new ventures of which they have no experience. It should never be lost sight of that even the hardiest native cattle and Merino sheep get very lean during winter, owing to the withered state of the food, the sudden changes of temperature, and the great extremes of heat and cold. It may be taken for granted that the natural condition of colonial **pastures is not good enough** during winter to support any of the early-maturity British breeds, or their crosses, without liberal artificial feeding, and that in the most exposed or poorer districts no reasonable amount of food would supply the deficiency. This being admitted, disposes at once of the idea of keeping as ordinary breeding ewe stock either pure-bred English longwools, black-faced Down sheep, or crosses of the same. Whatever may be done in the way of introducing rams of early-maturity breeds the ewes must be Merinos,* which are known to thrive under existing climatic and other surroundings, and farmers ought to aim at maintaining both **the old and the new system** on the same holding by breeding a pure Merino stock of good quality from their young ewes, and utilising only the older ewes to breed cross lambs for the butcher by the imported early-maturity rams. There are many **advantages** in such a practice which do not appear at first sight. By replacing hamels by breeding ewes the expansive power of the flocks of the country is greatly increased. An old ewe gives birth with less difficulty than a young ewe to a lamb sired by a ram of a larger breed of sheep, and when the offspring, which requires a more liberal supply of milk than a Merino, does arrive, she has it to give. Again, the ewe flock is bred on the ground, an advantage as compared with having to buy sheep reared under circumstances which may not have formed a suitable preparation for them in their new quarters. To breed at home becomes all the more important owing to the prevalence of scab in the Colony, and the liability of importing with new stock such an insidious disease as heart-water.

The spring pastures in the best sheep districts are good enough to make well-nursed **lambs ready for the butcher** at

* Certain British mountain breeds—the Cheviot, for example—may be regarded as exceptional in this connection.

six or eight months old, and a demand for mutton of this description is that most likely to develop in the ever increasing mining centres. If ever a frozen meat trade were established with Europe, or let us say with the United States of America —quite possible eventualities, although the time may be far off—it would be undoubtedly in young cross-bred mutton or lamb.

The Cheviot breed, which derives its name from the Cheviot Hills, forming the border country between England and Scotland, has proved its cosmopolitan character by successes achieved in the North-West Territory of Canada and in New Zealand. It would probably do remarkably well in high districts like New England. The wethers at two or three years old make the finest of butchers' sheep, and the ewes would suit admirably when necessary to cross with long-wool rams. The yield of wool is good, and it belongs to the class of lustre wools which always remain in fashion.

CHAPTER XVIII.

WOOL AND HAIR.

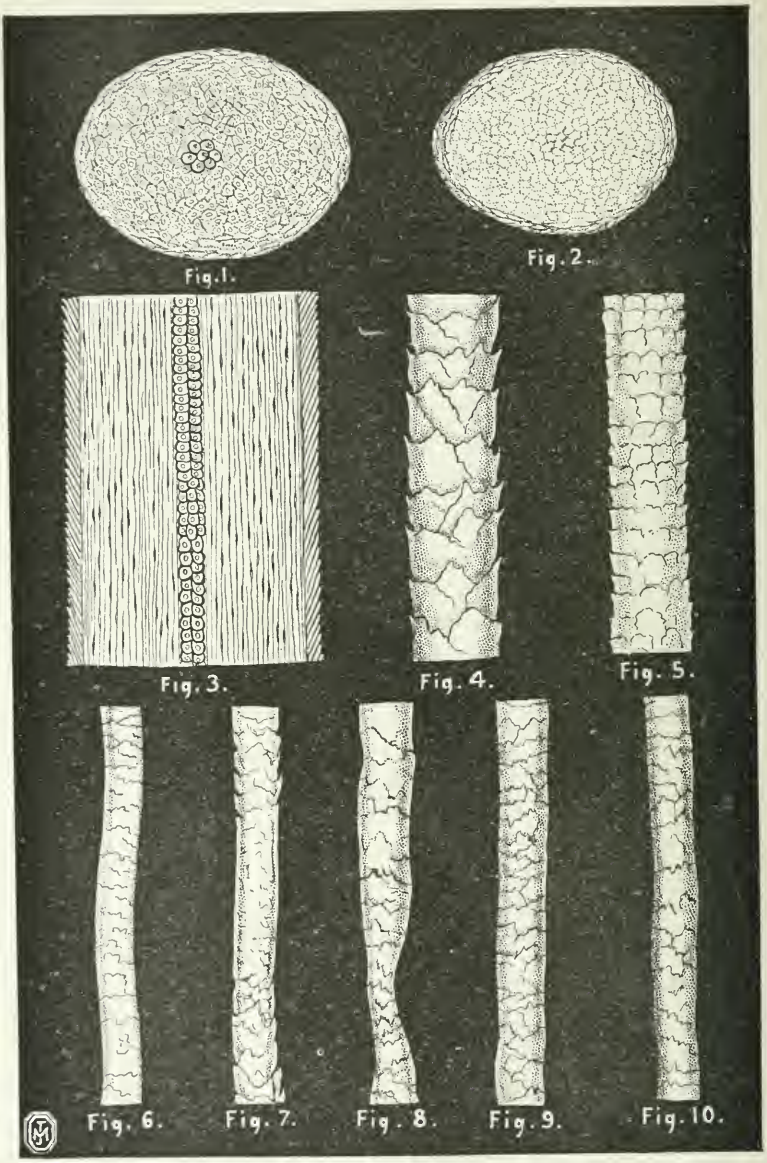
Bowman on the Structure of Hair and Wool—Lustre-Wool Fibre—Good and Bad Soaps—Hard Spring Waters unsuitable for Washing Wool—Rules for Washing Wool—Varieties of Wool Fibres—Mohair resembles Wool—Amount of South African Wool Exported—Position of Cape Wool in the British Market.

VALUABLE and original information, the result of much careful scientific research, is to be found on the subject of the **structure and character of wool and hair**, in a book by Dr F. H. Bowman.* The **illustrations** on page 360, copied from this work, showing the structure of hair, wool, and mohair, render elaborate letterpress description unnecessary.

Hair is **composed of fibrous bundles** made up of elongated cells. **Fig. 1** shows in cross section the three different forms of cells represented:—(1) The rounded nucleated cells forming the central medulla, frequently containing air and little rounded globules of fat; (2) the angular cells forming the cortical substance, on which the firmness, elasticity, and colour of the hair depend; and (3) elongated cells and laminated plates forming the cuticle. **Fig. 3** is a longitudinal section of a similar structure, showing, in addition to the cells enumerated, the serrated edges of the flattened scale-like cells forming the outer sheath, which Bowman describes as "a firmly adherent, thin membranous layer, consisting of flat, imbricated, epithelial scales." He says also that these "flattened inspissated cells are very similar in character to those which form the outer cuticle of the epidermis of the skin, and have with them a common origin."

The cells are all very densely packed together when a hair

* "The Structure of the Wool Fibre, and its Relation to the Use of Wool for Technical Purposes," by F. H. Bowman, D.Sc., F.R.S.E., F.L.S., &c. (Simpkin, Marshall, & Co., London, 1895), to which the author is much indebted.

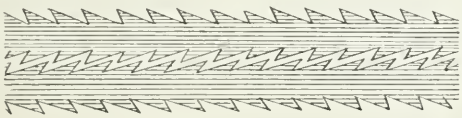


WOOL, HAIR, AND MOHAIR.

FIG. 1, Cross section of Hair. Fig. 2, Do. of Wool. Fig. 3, Longitudinal section of Hair. Fig. 4, Typical Wool Fibre treated with Caustic Soda. Fig. 5, Hair similarly treated. Fig. 6, Kemp or Dead Hair. Fig. 7, Kemp and Wool in one Fibre. Fig. 8, Wool Fibre with a weak part. Fig. 9, Coarse Mohair Fibre. Fig. 10, Fine Mohair Fibre. All greatly magnified.

is examined in its natural state. The fibres are as a rule straight and the surface smooth, so that only transverse lines, not individual cells, are distinguishable. By **treatment with an alkali** the edges forming the serrations above mentioned stand out distinctly, overlap each other like the scales on a fir-cone, and point invariably towards the unattached end of the hair. The parts may be still further separated into fibrous bundles, and into their constituent cells, by treatment with a strong acid such as sulphuric acid.

The great **distinction between wool and hair**, which is more a matter of degree than of kind, is the extent to which the serrations project. In wool the scaly outer covering is much looser than that of hair, a characteristic which enables wool fibres to adhere to one another, *i.e.*, to felt or mat when the fibres do not lie all in one direction, apart altogether from the adhesive power given by twisting. The reason why wool does not mat on the back of a healthy sheep is because the



Diagrammatic Illustration showing how Wool Felts.

serrations, like those of hair, point all in the same direction. **Fig. 4** represents a typical wool fibre greatly magnified, and shows "the pointed and serrated edges of the epidermal scales when treated with caustic soda." **Fig. 5** shows hair which has undergone similar treatment.

Although some hair, like that of the woolly-headed negro, is curly, hair is generally straight; but in the case of wool there is a strong tendency in the fibres, especially in the finer sorts, to become curly or wavy, characteristics which add to the holding power when spun into yarn or made into fabrics. The following figures indicate the relative **diameters and twisting tendencies** of wools from different well-known breeds of sheep:—

	Curves per Inch.	Diameter of Fibre.
(1.) English Merino . .	24 to 30	$\frac{1}{1562}$ of an inch.
(2.) Southdown . . .	13 to 18	$\frac{1}{1272}$,,
(3.) Lincoln	3 to 5	$\frac{1}{650}$,,

It must be remembered that on the same sheep very

different qualities of wool grow on different parts of the body, and that hair and wool may be seen on the same animal. **Kemp** in the wool of a sheep is a familiar illustration, and the **downy covering** at the root of the hair of the collie dog is merely an example of a condition of things which is not uncommon in the animal kingdom.

Fig. 6 represents **kemp** or dead hair found in some fleeces, shown by reflected light; and **Fig 7** one fibre consisting partly of kemp and partly of wool.

Fig. 2 shows a transverse section of wool fibre (Lincoln hogg), illustrating the arrangement of the "closely packed transparent cells, smaller and less marked than in the hair section, with outer sheath of epidermal scales. The free serrated margins of the scales slide over each other and secure the greatest amount of liberty to the surface of the fibre without any rupture of the covering which would undoubtedly be caused by any more rigid arrangement of the epidermal part." Wool fibre possesses greater softness and pliability than hair, and consequently the more prominent margins are not so easily injured as they might have been had they belonged to a more rigid structure.

A fine **lustre-wool fibre** examined as an opaque object under the microscope presents a beautiful appearance, "like a laminated surface of silver," when the surface has been cleaned and the light is properly thrown upon it. "The **scales** have an almost transparent look, and a smooth, lustrous brightness, which well accounts for their excellent reflecting properties." Too much washing, washing with water at a high temperature or with hot alkali, injures the lustre of wool.

The surface scales when covered with the natural oily secretion from the sheep's skin adhere pretty closely to the shaft of the fibre. "The action of **soap** and **hot water** upon the surface of these fine scales destroys the continuity of the reflecting surfaces, and causes it like any rough surface to disperse the light instead of reflecting it in solid sheets." Dispersion of light also occurs to a greater degree in the case of coarse than in that of fine wools, the larger surfaces of the scales being associated with increased roughness in their texture. Scales differ much also in thickness and tranparency. The scales of some wools are dense and like ivory, others

resemble opal glass, and reflect light both from the upper and the under surface, and some which are very thin and transparent assume the appearance of mother-of-pearl.

The **lustrous character** is also due to some extent to the "structure of the cortical part of the wool" and to pigment cells contained in it. These generally aid in reflecting light, and thereby increase the brilliancy of the wool.

"Borax **soaps** of good quality, and as neutral as possible, carbonate of ammonia and caustic ammonia, and stale urine, which contains carbonate of ammonia, are the substances which act upon the wool fibre the least, and can therefore be best used as detergents; but both soda and potash, especially the latter, can also be used without injury if the quantities and temperature are properly regulated.

"**Di-sulphide of carbon** dissolves the **suint** and fat of wool very easily and completely, without injuring the fibre. The di-sulphide may then, when removed from the wool, be driven off at a steam heat, leaving the unchanged fats behind as a residue." The difficulties associated with the carrying out of the process have not yet been fully surmounted.

Inferior soaps containing an excess of alkali or such impurities as resin, silicate of soda, china-clay, &c., are to be avoided.

Hard spring water containing carbonate and sulphate of lime is unsuitable for washing purposes, as chemical action takes place, and results in the formation of an insoluble lime soap, which adheres to the fibre and interferes with the action of the dye stuffs employed in colouring the yarn.

The **Rules** recommended **by Bowman** to be followed in washing wool are—

1. Never permit the temperature of the washing liquor to exceed 100° F.

The practice of turning steam directly into the vessels which contain the wool is most reprehensible, because when the steam, in the act of condensation, comes into contact with the fibres of the wool they may be subjected to a much higher temperature than they can stand without injury, since the mass of wool in the water prevents the free formation of currents, and one part of the liquid remains at a higher temperature than another. The best way is to have the water heated in a separate tank or cistern, and draw the water into the washing machines from this cistern where the temperature can be kept comparatively constant.

2. Nothing but perfectly neutral soaps should be used, at any rate when the wool is in any degree clean, and potash in preference to soda as

the base of the soap. When the wool is very dirty and the grease hard and stiff, it may sometimes be necessary to use a slightly **alkaline soap**, and thus remove the adhering grease more rapidly, but the greatest care should be exercised to prevent the surface of the fibre from being injured. The **suint** or yolk—the natural grease of the wool—is composed largely of sudorate of potash, which being soluble assists in the washing of the wool without deteriorating it. The higher lustred fibres, such as alpaca and mohair, are even more sensitive to temperature and free alkali than wool, and hence in washing all fibres where lustre is important, the lowest temperature above 60° F. and the perfect neutrality of the soaps are most important.

3. The less agitation and mechanical action in the form of squeezing or pressing which can be used, the better. When wool fibres are exposed to the action of hot water, they are more liable to felt than when in a dry state; and especially when the wool is intended for worsted rather than woollen spinning, ought the greatest care to be exercised in the manipulation of the wool so as to cause the least felting action.

4. The greatest care should be exercised in the drying of wool after washing, so as to prevent too high a temperature, which should not exceed 100° F. at the most, but the lower the better.

If the wool is too much dried it becomes desiccated, and loses its natural kindness and suppleness, and tends to become brittle. When unduly dry, the wool fibre becomes electrified, and the fibres then are mutually repellent, so that they resist the natural order in which they should be placed by the action of the machinery, and the yarn becomes uneven and rough.

The **operation of wool washing**, as carried out at Uitenhage, the great centre of the industry in the Eastern Province, was witnessed at the Union Works, under the guidance of J. Every, the manager. About 50 bales of 100 lbs. each can there be washed daily, and in good weather this amount can be finished each day. The operation is extremely simple. The wool goes first through a duster placed on the first floor, which teases it, and blows much of the sand and dust out of it. Some Karoo wool is very greasy, and large quantities of dust settle in and adhere to it. For this reason close-coated sheep are best suited to the Karoo districts. A common defect in the wool of the very dry country is that it grows with a break or weak part in the staple, save in exceptionally favourable seasons.

The wool leaving the duster drops through a shoot into the first of two warm-water baths placed on the ground floor, in which it is washed with soap manufactured on the premises. It floats from the receiving end of the bath to the delivery

end, being stirred up and passed on by sets of tines revolving in the water. It next passes between a pair of flat rollers or squeezers into the second hot bath, which is simply a duplicate of the first. From this it goes into a cold-water box with revolving arms or stirrers, and then through a cold-water rinser. When removed it is placed in a centrifugal "whizzer" constructed on the same principle as the centrifugal butter-drier, and the bulk of the moisture is mechanically ejected by the centrifugal action of the machine before the wool is spread out on the gravel floors to dry. The cost of the complete operation is 5s. per 100 lbs., weighed in the grease; and the average loss of weight by the washing of the wool brought to this centre is about 60 per cent.

There is **great variety** in the characters of wool fibres occurring (1) on different parts of the same animal at the same time; (2) in the growth of different years and of different ages of the animals; (3) under different conditions of climate and nourishment; (4) in different breeds of sheep belonging to different countries; as well as (5) in different members of the same breed, of similar ages, and kept in the same flock. Certain countries and certain districts are famous for wool production; and good management, which implies healthy surroundings and excludes the supplying of either too little or too much food, encourages the development of wool of good quality, whereas an unhealthy habit of life and bad management reduce the normal quantity and lower the normal quality of wool.

Fig. 8, page 360, shows a fibre with a weak part, which may be the result of one of a number of causes, viz., a period of disease, of scarcity of food, or the presence of scab insects. The fibre becomes brittle and easily broken, and the yarn and woven material made from it inferior in quality and deficient in wearing properties.

Mohair from the Angora goat much more closely resembles wool than hair, as may be seen from a reference to **Fig. 9**, representing a coarse fibre with large irregular scales; and **Fig. 10**, fibre taken from the finest part of the fleece of a pure-bred buck.

The following information was courteously supplied by Buxton, Ronald, & Co., 24 Basinghall Street, London, E.C.:—

The yearly export of wool (mostly Merino) from Cape Town and Mossel Bay, in the Western Province; Port Elizabeth, in the Eastern Districts; East London, in Kafraria; and Durban, in Natal, consists of about 256,900 bales:—

From Eastern Provinces . .	173,166 bales.
,, Western ,, . .	28,085 ,,
,, Port Natal . . .	55,652 ,,

There is very great variety in quality and characteristics of wools grown in these different districts, the results partly of climate and partly of the presence or the absence of enterprise on the part of the growers. The most important difference in South African wools, and one which divides them into two distinct classes, is the custom still prevalent of shearing twice in the year. At one time the whole African clip was shorn twice in the year, but during the past twenty years the more progressive farmers have recognised the greater commercial value of wool of twelve months' growth, and only about three-eighths of the total production now consists of that of six months' growth. Of the latter, about equal proportions are used by English and German mills in the manufacture of many descriptions of clothing fabrics. The Cape exports a little wool of six months' growth to America, but it is worthy of note that American manufacturers pay more attention to the longer wools than they formerly did. A considerable share of the longer-stapled wools is absorbed by German manufacturers; but by far the largest consumers are the Yorkshire mills, where about one-fifth of all the Cape clip is converted into "top," the semi-manufactured article between the raw material and the spun yarn, and which forms the leading medium of buying and selling. About 122,000 bales were dealt with in the London public auctions of colonial wools during 1895, and the prices ruling at these sales determine the basis of values for the trade at large. The coarse mixture of hair and wool derived from first crosses of Merino with the fat-tailed sheep, forms only an insignificant part of the South African clip; but while of limited proportions and small value, it is nevertheless in favour for the manufacture of "homespun tweeds" and soldiers' uniforms, and the pelt makes excellent leather for Cape tan gloves. Even more valuable are the pelts of the pure fat-tailed sheep, as the hair is carefully removed by a chemical process, and there are none of those cuts which are so often made in the skins of sheep while wool is being shorn. The fat-tailed sheep only produces hair, which is of so little value that it is never shorn. When the sheep are killed the hair is left on the pelts and shipped to this country. When removed from the skin it is only fit to mix with lime used for wall plaster.

CHAPTER XIX.

SCAB OR BRAND-ZIEKTE IN SHEEP.

Scab Detrimental to Progress—Estimate of Loss to the Colony—Boer Farmers' Objections to Scab Act—Injury done by Scab—Symptoms of Scab—Administration of the Scab Act—Benefits of Central Control — Simultaneous Dipping — Dipping not Understood — Different Species of Scab Insects—Propagation of Sheep Scab—Popular Dipping Materials—Sulphur and Lime—Hot *versus* Cold Dipping—Value of Tobacco—Dipping Tanks—Poisoning by Dip—Winter Dipping—Cooper's Proposal to Eradicate Scab.

THE greatest deterrent to the progress of the stock industry of the Colony is the prevalence among sheep more particularly, but also among Angora and Boer goats, of the "disease" commonly known as **scab** — the result of an abnormal and unhealthy condition of the skin due to irritation created by myriads of microscopic mite-like insects or acari. During the time of the author's visit no farming question attracted so much public attention as the subject of scab and the Scab Act. And marvellous to relate, although it is estimated that the annual **loss** to the Colony from scab alone amounts to **a million** pounds sterling, the energy displayed was not expended in trying to find the simplest, most expeditious, and most effective cure, but in opposing the legislative means directed against scab infestation.

The **Boer population** of the old type entertain very strong and even obstinate objections to Government interfering in any way with the management of their farms, and consequently to the periodical visits of the scab inspectors. Some, with faith which would have done credit to a Scottish Covenanter, believe that an outbreak of scab is as much a **judgment of God** as the seven plagues of Egypt were, and being sent for some gracious object, it would be wicked to appear to strive against the Almighty by attempting to destroy it—forgetful that the Author of all good may some-

times permit evil so that His creatures may be ennobled by overcoming the same. Another, and perhaps a larger school, made it a political question, and although it was impossible to imagine that many of them could have sympathy with the divine interposition theory, they used the dissatisfaction which prevailed to weld together a somewhat disunited party for the attainment of other **political ends.** Probably much of the opposition which has been experienced would have been obviated had Government organised in different districts a proper system of instruction and explanation before attempting to introduce compulsory regulations.

Dissatisfaction was not confined to those who for one reason or another sympathised with the existence of scab, or rather the cessation of efforts for its destruction, but many who were sincerely anxious to see the country cleared of the scourge became disheartened and despondent at the imperfect character of the Scab Act, and at the vacillating and dilatory policy of the Government in the administration of it. It is impossible for an impartial observer who has studied the nature of scab not to sympathise with the last-mentioned malcontents. It has been abundantly demonstrated that **scab is due to** certain well-known insects which cannot develop spontaneously, but like any of the animals of the farm must descend from parents. The possibility of **spontaneous generation** in even the lower forms of animal life is not in these latter days entertained by men of science.

It is well known that **scab prevents a flock thriving**; increases the death-rate; lowers the quality and value of wool through developing weak places in the fibre; leads to the objectionable practice of shearing twice annually, and increases the anxiety of management while it lessens the return for invested capital and expended energy. Further, it has been shown that by united and strenuous effort not only a country, but a continent—Australia for example *—can be absolutely **cleared of the pest**, and that by the use of simple means the insect can be prevented from reappearing.

Of the easily distinguished **symptoms of scab** the first to

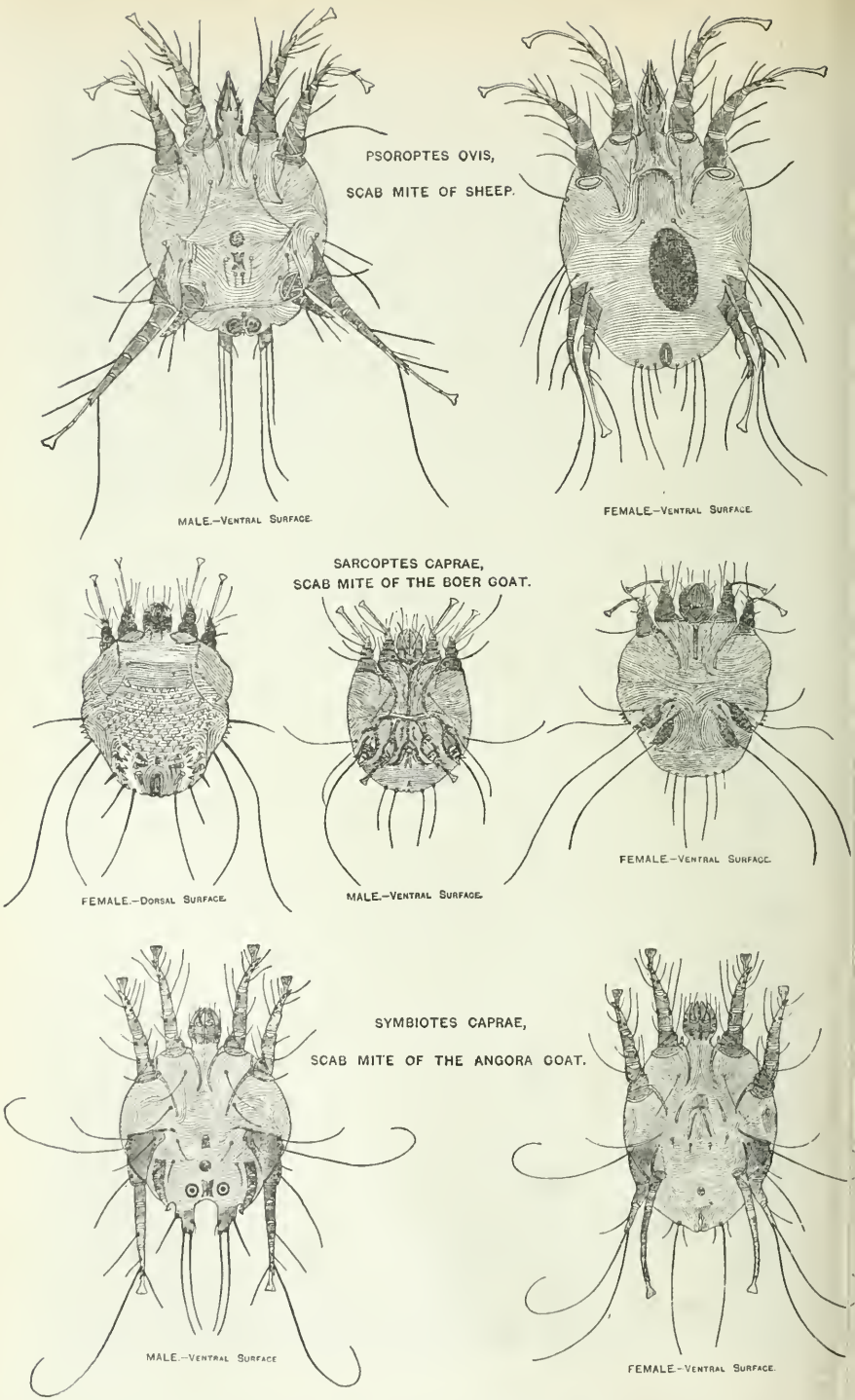
* A few places in Western Australia must be mentioned as exceptions, but this does not affect the argument, which holds good in the case of all the other Australian colonies.

appear is itchiness—the animal biting, scratching, and rubbing itself. Stains are made on the wool by the hind feet used in scratching, and small tufts of wool, detached by the action of biting at the irritated parts, adhere to the surface of the fleece. The skin of the affected parts if pinched is thick and hard to grip, and on shedding the wool purplish-yellow pustules may be seen on the skin discharging serous matter; or at a later stage hard crusts or scabs may be felt at the base of the wool.

Animals which are in poor condition from any cause afford the most favourable conditions for the rapid increase of the insect. This interesting fact has been proved conversely through the difficulty which has been experienced in establishing artificially colonies of insects on sheep in high condition with abundance of yolk in the wool.

A Scab Act, to do any really permanent good, must of necessity lead to **inconvenience** among stock-owners, and those possessed of a proper sense of duty to their neighbours as well as to themselves, are prepared to submit and to encourage others to follow their example; but it would be contrary to human nature to expect such men to endure without murmuring practically all the inconveniences necessary to do the work thoroughly, while aware of the fact that their efforts would be in vain, and that failure must be the inevitable result.

The whole community has suffered for a number of years from the injurious consequences of repeated **defective efforts** to cope with the disease, and although some good has been done in certain localities, the Colony seems no nearer a final solution of the question. The last report of the Superintendents of Scab Inspectors is full of complaints of gross neglect of duty on the part of a large number of their subordinates. While the Chief Scab Inspector is nominally in control of the working of the Scab Act, each locality is entrusted with the election of its own Sub-Inspector, with the result that the districts which require the most efficient officer is often very badly provided for, and the work neglected or carelessly executed. Desultory and disjointed action under local and frequently uninterested or inexperienced control, can only be vexatious and ineffective. The overpowering benefits of paramount **central control** in coping with disease have been recently demonstrated beyond all question of doubt by



SCAB-MITES OF SHEEP AND GOATS.
Sheep Mites; Boer Goat Mites; Angora Goat Mites. All greatly magnified.
Drawn from Nature by Mrs D. Hutcheon.

the successful action of the British Board of Agriculture in stamping out pleuro-pneumonia in cattle; and, let there be no shirking the fact, not without much strenuous opposition and healthy criticism during the process.

It is to be feared that if individuals exist who seriously believe in the possible efficacy of the present Scab Act, they are doomed to disappointment. It will be a hard, if not an impossible, task to find any effective measure short of those recommended by the Colonial Veterinary Surgeon, viz., repeated **simultaneous dippings**, associated with the destruction of the old infected kraals. To accomplish the work inexpensively and systematically the country would require to be divided into **four areas**, each of which would be operated upon in turn. All the sheep in the earliest district would be first dipped, and while the others remained undipped all importation of sheep into the dipped area would be prohibited. There would be no objection, however, to sheep from the dipped area going freely into the undipped districts. The first area having been completed, the second would be undertaken as expeditiously as possible, and on the sheep there being dipped it would in the matter of export and import of sheep be put on the same footing as the first area, and so on until all four divisions had been undertaken—the universal rule being that dipped sheep may go anywhere, but undipped sheep must not enter the dipped area until they also have been operated upon. The area in which restriction on movements existed would thus rapidly decrease, as dipping went on, and finally disappear. The work should be done by a staff of trained experts who would pass on from division to division, and be a guarantee that the dipping was properly executed. Dipping has been so **little practised** that many farmers do not understand the method of preparing the dip-material, or how to put the sheep into the bath when ready—quite a natural consequence in a country where dipping is little known and rarely required except when scab appears. This is a sufficient explanation of the oft-told tale that farmers have dipped, or more correctly gone through the form of dipping, and obtained no beneficial results.

A study of the accompanying figure will show that the sheep, the Angora goat, and the common Boer goat have each a **species of Acarus** peculiar to itself. *Psoroptes ovis* is the

common scab-mite of sheep; *Symbiotes capræ* that of the Angora goat; and *Sarcoptes capræ* of the Boer goat. Though one genus is more common to each animal named than others, yet some animals become infected with three distinct genera of Acarus. The symbiotes (the mite which congregates in families) infesting the Angora goat, breeds freely on the Boer goat; while the sarcoptic **Boer goat scab-mite** (which burrows deeper, and pierces the epidermis, the others only irritating its surface) will also affect horses and cattle—more particularly while they are young. It is not easily distinguished from the itch insect, *Acarus scabies*, and it has been known to establish itself on the legs of human beings whose clothes had been brought into close contact with infected animals, though probably it could not breed there. Repeated washing with carbolic soap for a week proved an effective remedy. While this is so, there exists no direct proof that the common **sheep scab** can be communicated to any other of the domestic animals. There is no solid foundation to the objection of farmers to clean their sheep while **wild animals (antelopes)** remain scabby, as the mites in these cases belong to the sarcoptic groups, found only on animals covered with short hair.

Flocks of sheep have been known to take scab through being shut in a **kraal**, into which no sheep had been admitted for a period of years. Even twenty years have been mentioned in this connection; but caution is necessary in accepting reports from people who are not accustomed to observe such matters with scientific accuracy. An illustration may be found in a report that living scab insects had been found in kraal manure at the depth of from one to two feet from the surface in a place from which sheep had been excluded for years. It is admitted that the acarus **eggs** will, under favourable circumstances, remain in the manure for a considerable period of time, extending to years, and hatch, in the event of sheep lying down on them, or their being blown into the wool along with the fine dust from the surface of the kraal floor. But it has not been scientifically demonstrated that the scab insect can live more than three weeks, under the most favourable circumstances, away from the skin of the sheep, and no credence whatever is given to the implication

that it can propagate its species for generations in any other than its natural habitat—the skin. As the **life-history** of the scab insect extends over a comparatively short period, to be estimated in days or weeks, it follows that if living insects are found in sheep's dung years after the time when the sheep were removed from the spot, the insects must not only have lived and bred, but they must have bred through many generations. If this were possible, it would raise a very serious question as to the difficulty, or even the impossibility, of eradicating scab.

The **mystery** of the so-called "scab insects" existing in large numbers, and breeding in the stale manure of sheep kraals, was satisfactorily explained by Dr Hutcheon towards the end of 1895, when it was shown that a mistake had been made in identification by the farmers who found the manure or kraal insects, and that these were mites which live exclusively upon decaying organic matter and not upon a living animal. The accompanying figures, drawn by Mrs D. Hutcheon, showing No. 1 the male and No. 2 the female of one species, and No. 3 an immature form and sexually undeveloped representative of another species, were submitted by the author to **Albert D. Michael.***

After explaining that it is impossible with any certainty to identify species or even genera from outline drawings owing to the want of structural detail, he says :—

Figs. 1 and 2 are of one of the common so-called cheese-mites (*Tyroglyphidæ*). If the drawing be correct they should belong to the genus *Rhizoglyphus*, but probably they are really a *Tyroglyphus*, present on the sheep-manure to eat the minute fungi which grow there, or else to eat the decaying vegetable or animal matter. No. 3 is one of the *Gamasidæ*, probably of the *genus Lælaps;* if the drawing be at all correct it is immature, and consequently impossible to identify ; it seems a very ordinary form. It is a predatory form which probably preys upon Nos. 1 and 2. Neither of the three would be parasitic ; they might be found in plenty of other places besides the manure.

One of the most prominent differences, to the ordinary observer, between the manure-mite and the scab-mite may be fully appreciated by comparing the hooked terminations of the limbs of the insects, represented in the three figures, with

* The authority on mites in this country, and author of "British Oribatiæ," Ray Society, London.

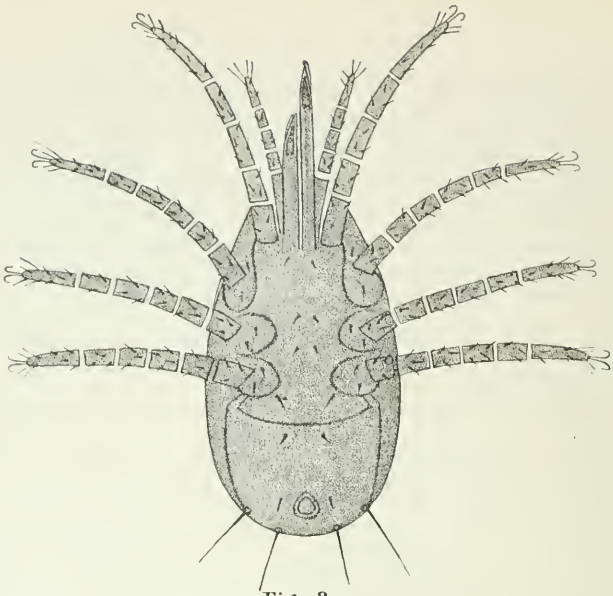


Fig. 3.

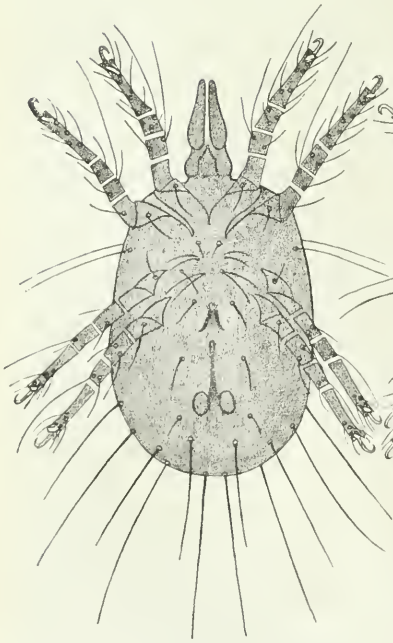


Fig. 1.

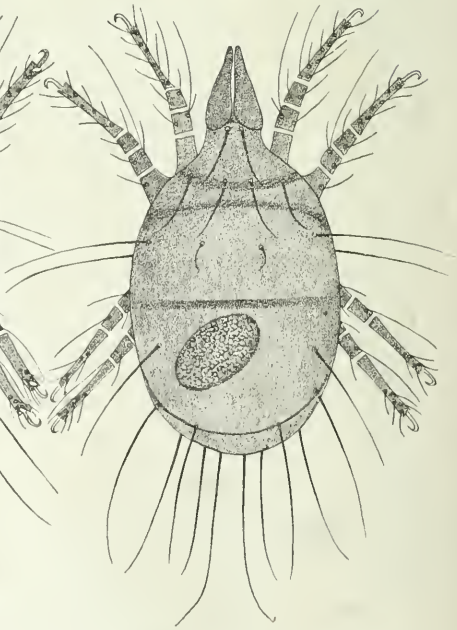
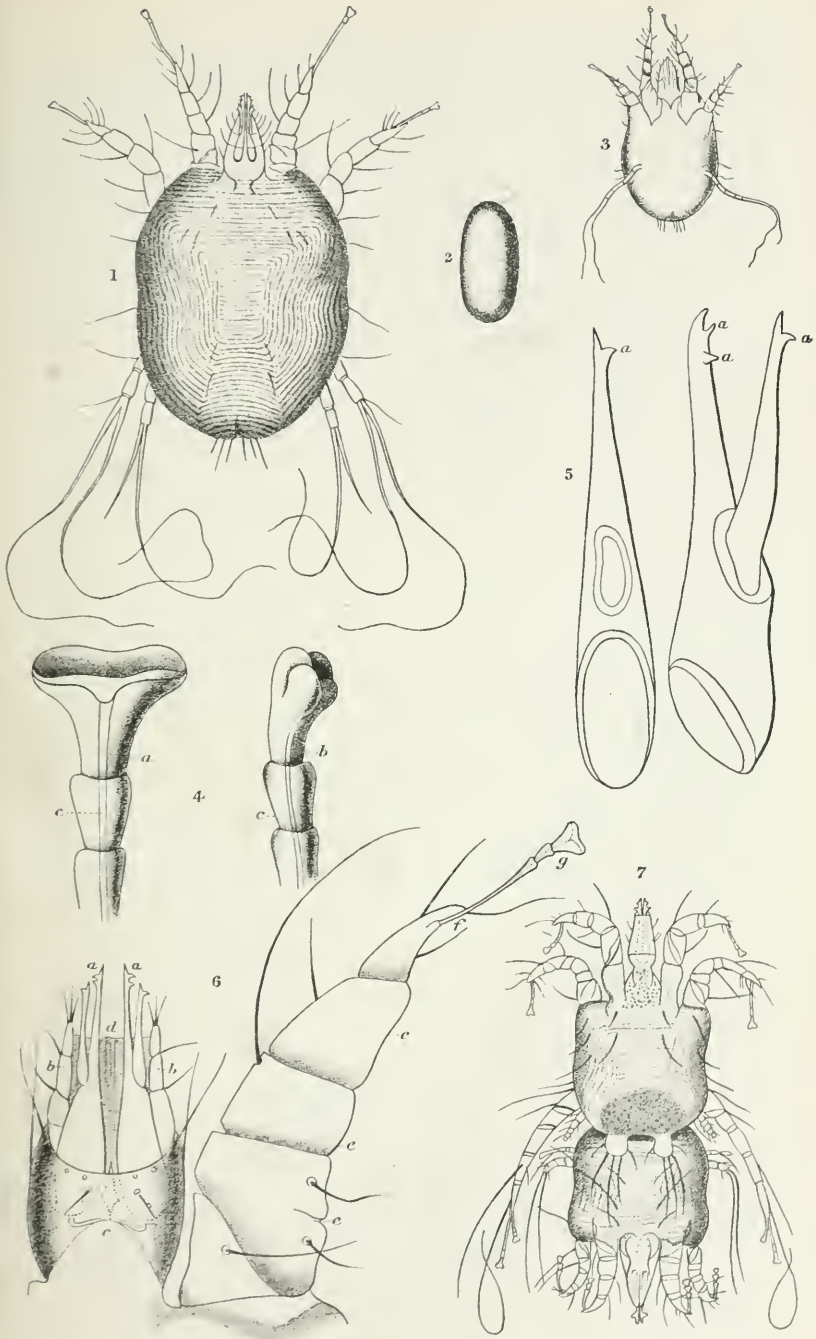


Fig. 2.

Mites (Magnified) found in the Manure of Sheep Kraals and mistaken for Scab Insects.
Drawn by Mrs D. Hutcheon.



COMMON SCAB-MITES. PSOROPTES COMMUNIS, *var.* OVIS AND EQUI.

Key on page 376. *U.S.A. Report Animal Parasites of Sheep, 1899.*

the sucker terminations of the true scab-mite shown in detail in the figures on page 375.

Apart from what has just been explained, it should not be forgotten that kraals become temporarily infested with scab insects, and for a much longer period by their eggs, ready to establish themselves on sheep that are brought within their reach. The veld also becomes unclean; and it is a matter of first importance, when a flock of scabbed sheep has been dipped, that the pasture should be changed at the same time, and all the kraals on the original run burned.

There are about twenty **varieties of dip** used in the Colony, and when skilfully applied, it is probable that all are capable of destroying the scab insect, although an insect will retain life for an hour after being immersed in a solution of almost any one of them. But in addition to the crop of mature insects, there are myriads of eggs to cope with, which will hatch out in a few days. It is the recognised practice to dip a second time ten days after the first operation; but in addition to this, it is necessary to use material which, by adhering to the wool, will remain for a time, and destroy the young insects as they escape from the eggs. **Sulphur,** owing to its extraordinarily searching nature, and to its being so inimical to the lower forms of vegetable and animal life, is the most valuable ingredient to accomplish this end. Applied externally, or taken internally, it is equally deadly. It is not to be wondered at that the common lime and sulphur dip should be

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THE COMMON SCAB-MITE—PSOROPTES COMMUNIS, FÜRST., *var.* OVIS. Key to the figs. on page 375.

Fig. 1. Young female before moulting for the last time.

Fig. 2. Egg drawn from a specimen which was inside an adult female.

Fig. 3. Young six-footed larva.

Fig. 4. *a* open, and *b* closed sucker of Psoroptes from ears of rabbit; *c*, the rod which connects the membrane on the end with the muscles which close the sucker.

Fig. 5. Two views of the mandibles. The lateral spurs, *a*, *a*, point outward (Megnin).

Fig. 6. Head and anterior limb enlarged ventral view: *a*, mandibles; *b*, antennæ; *c*, maxillæ; *d*, membrane joining the antennæ; *e*, *e*, *e*, joints of the limb; *f*, the claw; *g*, the ambulacrum or sucker.

Fig. 7. Male and female of *Psoroptes communis*, var. *equis*, Megnin.

most extensively used, and that Cooper's dip, which is largely composed of sulphide of arsenic, should come next. The following table, taken from the Report of the Superintendent of Scab Inspectors located at Bedford, and relating to his district, will show the relative merits as judged by the test of experience of eight of the **most popular dips**:—

Name of Dip.	Number of Sheep Dipped.	Number of Owners.
Sulphur and lime . .	2,057,246	2,980
Cooper's	1,395,377	5,593
Little's	595,981	2,070
Austrian arrow tobacco .	511,347	708
Hayward's	416,025	337
Tobacco extract . . .	290,597	518
Quibell's	176,072	80
M'Dougall's . . .	76,334	146

Sulphur-lime dip, which has been proved so effective against scab, not only in Cape Colony, but in Great Britain, America, and Victoria, is naturally condemned by patent dip agents, whose business would be injuriously affected if the true merits of the sulphur and lime dip were more widely understood. It is said to injure the wool, unless used immediately after shearing; but though injury may at times result, it is not the fault of the material, but the want of experience in those who use it. Sulphur and lime, when properly united by boiling together for a considerable time, until the hyposulphide of lime is formed, can be used to dip sheep in full wool without observable injury. The proper proportion of **ingredients** is 25 lbs. of sulphur and 18 lbs. of slaked lime, made into a thick cream, and boiled for twenty minutes in 20 gallons of water; then the solution assumes an orange colour, and unites to form sulphide and hyposulphide of calcium. When put into the tank, the quantity is made up to 100 gallons. The dip is all the more effective if it be kept up to a temperature of 100° F., so that it may more easily penetrate the hard **scabs** under which the mites find shelter and protection. The scabs are formed by the serous effusion from the skin (resulting from irritation produced by the sharp-pointed mandibles of the scab insect) drying round the base of the wool fibres. In the case of Boer

goats, with the sarcoptic insect, which gets under the epidermis, **hot dipping** up to even 110° F. is absolutely necessary. Goats should remain one and a half minute in the dip, and sheep at least one minute. The great advantage patent dips have over lime and sulphur is, that they can be all mixed with cold water, which is a saving of trouble. On the other hand, the lime and sulphur dip costs considerably less, even when the boiling of the water is reckoned. The Komgha district was the first district cleared of scab, and this was accomplished purely through the use of lime and sulphur.

Apart from the possible variation in quality of dipping material, and the different amounts of energy displayed in getting rid of scab, some districts yield to treatment more readily than others; for example, scab is more easily overcome in the Karoo than on the moist, grassy lands near the coast.

Tobacco has long been associated with the most effective dressings used in outbreaks of scab, and being a colonial product, its value, especially when used in conjunction with sulphur, or one of its compounds, should not be forgotten. As boiling weakens its power to kill, it is prepared like tea, by infusing 4 or 5 oz. in a gallon of warm water for two hours. A successful Australian dip consisted of—Tobacco, 25 lbs.; flowers of sulphur, 15 lbs.; water, 100 gallons.

The round **dipping tank** employed in the Colony is only to be excused in the case of small flocks. The long bath, 24 to 30 feet in length, and merely wide enough to admit of the passage of one sheep at a time, should be in universal use when large numbers are to be dealt with. The proper practice with such a convenience is to plunge the sheep in one at a time, nose first, and over the head. Sheep then see what is going to happen, and close their mouths, so that cases of **poisoning,** so frequent with arsenic dips, when sheep are put in back downwards, are quite unknown. When a sheep is swimming slowly through the tank, as it ought to do, it may with perfect safety be repeatedly pushed down over the head. When an arsenic dip is used, the sheep should be thoroughly dripped or drained before being turned out on the veld, else arsenic poisoning will occur among the animals grazing over the part on which the dip has been permitted to drop. Cases

of poisoning by arsenical dips have been several times reported, in some of which the result has been brought about by sheer ignorance of the nature of the materials. "The solubility of arsenious acid, coloured by orpiment* to give it a distinctive and precautionary yellow colour, is but small and slow when cold water is used. It has happened that the operators, unmindful of this fact, have filled their tank with water and then emptied the tin of arsenical dip upon its surface. The arsenic holds a superficial film of air very tenaciously, and in virtue of it floats like a scum. Even persistent beating of the liquor with rods does not bring about the solution and disappearance of the floating poison until after a considerable time has elapsed. The proper method is to mix up the calculated quantity of dip-powder with *boiling* water in a tub until it is perfectly wetted into a smooth creamy paste, and presents no lumps. So prepared, the material will rapidly and uniformly mix with the water-content of the tank, and there will be no floating arsenical scum on the surface to give a mouthful of deadly poison to the first half-dozen sheep if put carelessly through. It is obvious also that, even if no fatal accident arises from the sheep swallowing such arsenical floating scum, they cannot fail to carry it away adhering to their fleece, and by this means render the proportion of material in the fluid considerably lower than is intended. Any person can satisfy himself of the reality of the above reported conditions by shaking up a pinch of dry arsenic with cold water in a phial. It will be quite impossible, even by violent agitation, to wet the whole of it at once and prevent a superficial scum."

Winter dipping has been objected to, more particularly by those who took up the Anti-Scab Act agitation, but there can be no valid objection raised if it be practised in mild sunny weather, and not after mid-day, so that the sheep may get their skins dried to some extent before the cold of night settles down. Winter dipping is practised with success in Scotland, where climatic conditions are much more trying than in South Africa, and in Cape Colony also it has been shown that it is not necessarily injurious. Government has also limited the possible loss to the owner by becoming liable to pay for all

* King's yellow, or yellow sulphuret of arsenic.

deaths over 2 per cent. resulting from compulsory dipping under the Scab Act.

A businesslike **proposal** was made to the Cape Government in April 1893 by **William Cooper & Nephews,** the well-known sheep-dip manufacturers, to "completely eradicate from the Colony the scab disease in sheep and goats" within a period of three years, for a maximum sum of £735,000. The proposed conditions rightly and naturally embraced compulsory power to dip in such a manner as would secure success, and also to destroy old kraals from which the sheep might have been reinfected. The cost of dipping was to be borne by Government, and this disarmed the opposition which would certainly have come from those who oppose all legislation leading to direct expenditure by themselves. The proposal was said to be favoured by many who are at present acting in opposition to the Scab Act. They had probably not realised that the destruction of old kraals implied an outlay in making new ones. The danger of entering into a contract necessitating such strict compulsory regulations was too great for the Government to undertake, and the proposal was declined. Seeing the alternative efforts have proved so unsuccessful, it is matter for regret that the Coopers' proposal was not accepted, as the Colony continues to lose annually from the evil influences of scab more than the sum asked for its complete eradication. Of course, it may be argued that this is not a colonial question, that it is a purely farmers' question. No doubt it is a farmers' question in the first instance, but one ruinously affecting such an important industry that it becomes in its direct as well as in its secondary bearings a colonial question of the first importance. About three-fourths of the export trade of Cape Colony, exclusive of diamonds, are the products of sheep and goats. Such a loss as we refer to is bad enough in good times, but when we consider that it comes in addition to reductions in profits through the influences of bad times, and that it in many cases transforms a possible moderate profit into a serious loss, the far-reaching nature of its influences begins to be realised. Large numbers of those employed in the chief industry of the Colony cannot get into debt and become bankrupt without the general interests of the Colony being made to suffer.

CHAPTER XX.

DISEASES OF SHEEP AND SWINE.

Heart-water in Sheep—Autumn Fever in Sheep—Liver Fluke in Sheep—Wire-Worm—Tape-Worm—Doses of Arsenic—The Wild Pig—The Wart Hog—The Common Country Pig—The Tamworth Breed—Tape-Worm—Measly Pork—Pig-Breeding—Importance of the Pig—Numbers of Pigs in the Colony.

Heart-water in sheep is another obscure disease of a specific character, which seems to be unknown in other sheep countries. No systematic investigation has ever been made into its true nature, but from general observation of its course it seems to be due to the presence of an organism in the blood, —a fact which associates it with such diseases as red-water, anthrax, liver-sickness in calves, horse-sickness, and many febrile diseases of the same class. It is **characterised by** high fever, great depression, and an abundant pale-yellow serous-albuminous fluid, which rapidly effuses into the thoracic cavity and pericardium. It is this latter appearance which gave origin to the name—a designation badly chosen if it were intended to convey any description of the nature of the disease. Some sheep die in twenty-four hours after they have become visibly affected, while some linger a week and even longer. Very few recover. It appears to have a period of incubation of from fourteen to sixteen days.

Heart-water was **unknown** till about **thirty years ago**, when it first appeared on the coast in Peddie and Bathurst. It travelled gradually inward from farm to farm, taking some farms and missing others that in all respects look similar to those that were involved. In this way it spread through the districts of Alexandria, Albany, Fort Beaufort, Victoria East, East London, and the lower parts of King William's Town and Komgha. And in this area to this day there are large tracts of country which to all appearance look admirably

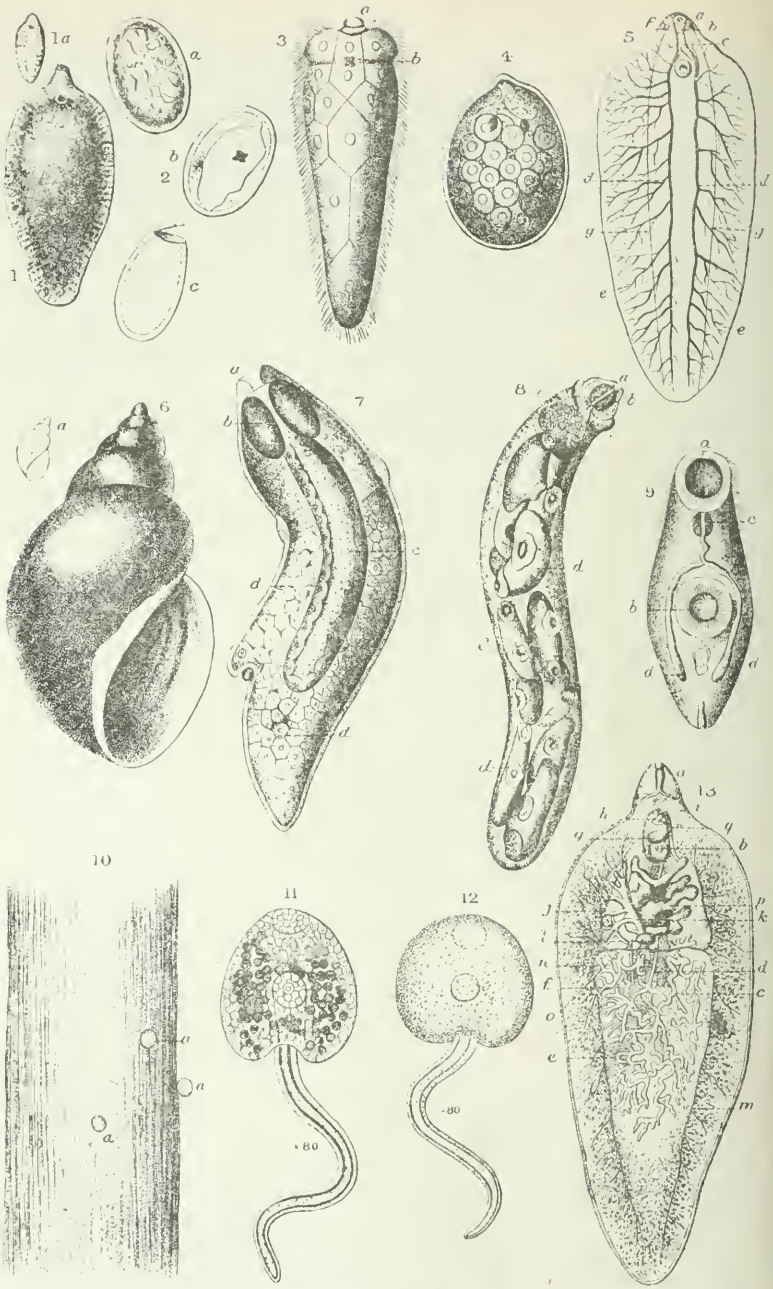
adapted for sheep, but upon which they cannot live, although they did remarkably well at one time. No evidence exists to support the theory that it was due to **overstocking**; and, in short, for the present the cause remains a mystery. This is one of the diseases which will have to be studied in the Bacteriological Institute. A knowledge of its nature, and of some possible means for its prevention or control, may yet be of special interest to the Colony. It is not at all certain but that the disease will spread to other districts not yet invaded by it, or that, as red-water is likely to do, it will not extend to the whole Colony. The rate at which it travels is much slower than in the case of red-water, but it is a significant fact that the affected area is still expanding. A **mixture** of turpentine, raw linseed oil, sulphate of iron, and sulphur, given in full doses, at short intervals, has proved very successful as a preventive of heart-water, and **arsenic** given in small doses every second day has been tried with apparent benefit; but unless the object can be accomplished by the administration of a limited number of doses, the injury done to sheep by bringing them together, and by the constant handling required in giving medicine, makes it impossible to regard this as a satisfactory practice for general adoption. The farmer must exercise patience until scientific research has shown the true nature of the disease, and has discovered some preventive or remedial treatment.

Since the foregoing was penned Dr Hutcheon writes that "experiments conducted by Soga towards the end of 1895 show that the best preventive yet tried is a mixture of one part of lime to three parts of common salt, finely powdered and sifted—a teaspoonful is the dose repeated every eight days. It is seldom that more than three doses are required to arrest the further spread of the disease. Among curative remedies, the best results have been obtained by giving two drachms of oil of turpentine in half-an-ounce of raw linseed oil, three times a day. Quinine administered in large doses lowers the temperature, but it does not appear to arrest the effusion of fluid into the chest, nor aid in its absorption afterwards, both of which the turpentine appears to accomplish."

Autumn fever, or "**blaauw-tong**," in sheep is a form of influenza which is thought to be nearly allied to horse-sickness,

if not identical with that local form of it which affects the head and the tongue more particularly. It occurs about the same period of the year, generally from mid-summer throughout the autumn, and it gives every indication of the sheep having during the night inhaled or swallowed, probably both, some form of malarial poison from mists or exhalations from low-lying or damp ground. Like horse-sickness it may be prevented by keeping the sheep under cover, or kraaling them at night on an elevated place. The walls of the kraal keep back the mists, and the temperature inside is raised by the sheep themselves and by the heat produced by the fermentation of the manure, often many feet thick, covering the bottom of the kraal. When a sheep is affected the feet become inflamed and tender, the lips become swollen, and the nostrils sore and raw. In bad cases the tongue becomes purple and much enlarged. In some seasons 50 per cent. of a flock will take the disease if precautions are not instituted, and 10 to 15 or even a greater percentage may die.

Rot or liver-fluke or "slak" in sheep is not a widespread disease in the Colony. It is due to the presence of flat, fluke-like worms, *Fasciola hepatica*, in the biliary ducts. It is confined chiefly to low, marshy land, and to the higher areas of the country, where the rainfall is greater than at lower levels, where salt is deficient, and where vleis have been allowed to become flooded, or filled, like a sponge, with moisture. It has recently been ascertained that the minute shell snail, *Limnæus truncatulus*, in which the parasite spends a considerable portion of the cycle of its existence, is to be found all the way from Cape Colony to Egypt. Wherever land becomes wet, the probability is that sheep grazing on it will contract the disease, and a few infected spots in a camp might, in a comparatively short space of time, lead to the infestation of the greater number of a flock. **The remedy** is a most simple one—viz., to drain the land if it be too wet. This can easily be done by drawing a plough furrow through the part in question. By washing, this furrow speedily deepens into an effective drain. Salt given to the flock to lick is also beneficial as a preventive of the most serious consequences, though not alone a sufficient remedy; and a little sulphate of iron powder acts as a stomachic, and stimulates the digestion; but no actual remedy can be



The Liver-Fluke, Distoma hepaticum (Fasciola hepatica).

said to be a success after an animal exhibits the anæmic condition which marks the development of the disease. Sheep with only a few flukes may live for the usual period of their existence, and never show any symptoms of disease; and if such sheep lived long enough, they would ultimately get quit of all the flukes if they were kept on sound land, and away from renewed infestation, as in course of time the flukes die, and are ejected. They cannot multiply within the sheep, for at least two stages of the cycle of their existence are passed in another host.

Wire-worm or red-worm, *Strongylus contortus*, in sheep

LIVER-FLUKE, DISTOMA HEPATICUM, LINN. Figs. page opposite.*

Fig. 1. Adult fluke, natural size: 1*a*, young fluke, natural size. (Raillet.)

Fig. 2. Eggs: *a*, egg with developing embryo; *b*, egg with embryo; *c*, egg-shell. (Raillet.)

Fig. 3. Ciliated and free embryo: *a*, perforating apparatus; *b*, ocular spot. (Leuckart.)

Fig. 4. Encysted embryo found in snails. (A. P. Thomas.)

Fig. 5. Diagram of digestive apparatus and nervous system: *a*, mouth sucker; *b*, pharynx; *c*, œsophagus; *d*, branches of intestine; *e*, their branchlets; *f*, nerve ganglia; *g*, ventral nerve. (Raillet.)

Fig. 6. *Limnæus truncatulus*, the principal snail which is the larval host of the fluke in Europe: *a*, natural size. (Raillet.)

Fig. 7. Redia of *Distoma hepaticum*: *a*, mouth; *b*, pharynx; *c*, digestive tube; *d*, the so-called germinative cells destined to produce cercariæ. (Leuckart.)

Fig. 8. Redia containing cercariæ: *a*, mouth; *b*, pharynx; *c*, digestive tube; *d*, *d*, cercariæ. (Leuckart.)

Fig. 9. Cercaria dissected from its cyst: *a*, anterior sucker; *b*, ventral sucker; *c*, pharynx; *d*, *d*, branches of the intestine terminating in cæca. (Leuckart.)

Fig. 10. Grass stalk with three encysted young flukes, *a*, *a*, *a*. (A. P. Thomas.)

Fig. 11. Free-swimming cercaria just before it is about to encyst. (A. P. Thomas.)

Fig. 12. A slightly older stage than Fig. 11. (A. P. Thomas.)

Fig. 13. Genital apparatus of the liver-fluke: *a*, digestive tube; *b*, ventral sucker; *c*, anterior testicle; *d*, its deferent canal; *e*, posterior testicle; *f*, its deferent canal; *g*, seminal vesicle; *h*, genital sinus; *i*, cirrhus pouch; *j*, ovary; *k*, oviduct; *l*, shell-gland; *m*, yolk glands; *n*, longitudinal, and *o*, transverse yolk-gland canals; *p*, uterus; *q*, vagina. (Raillet.)

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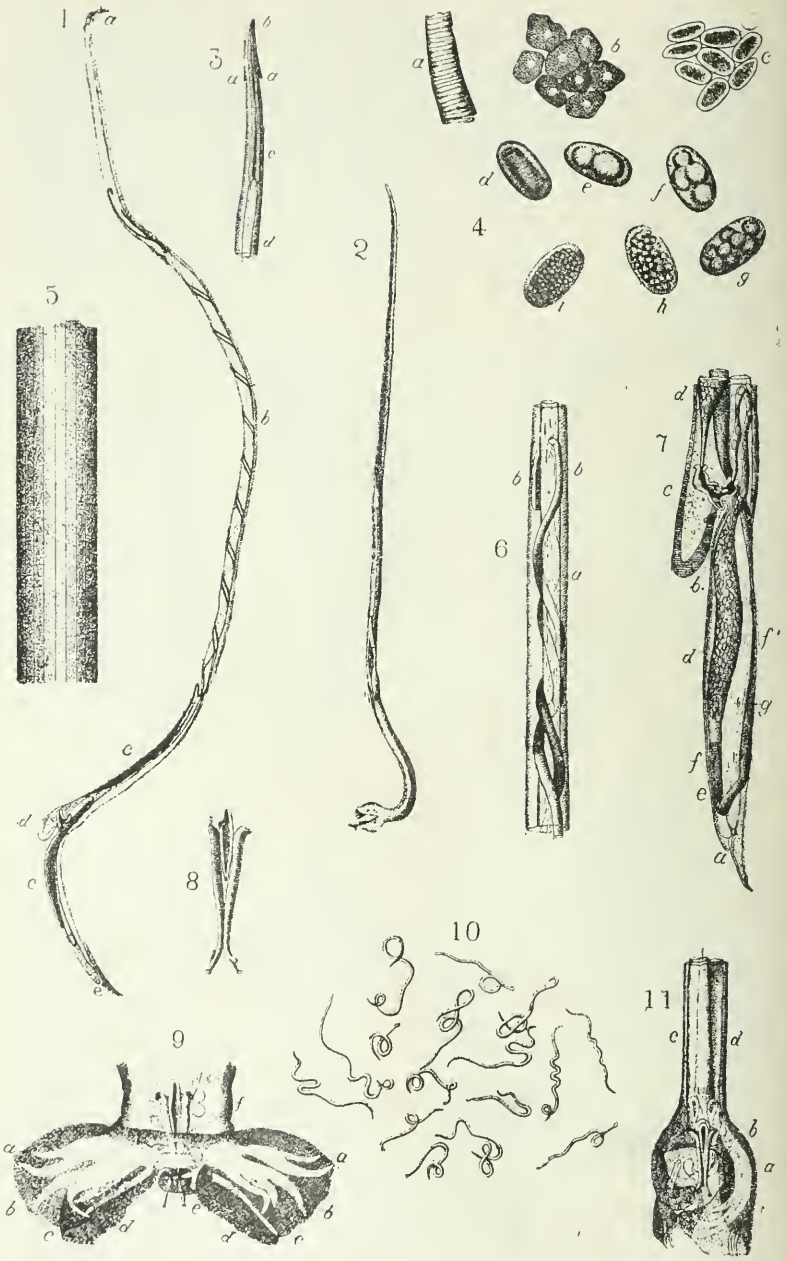
* These figures, and those on pages 386 and 389, were taken from "Animal Parasites of Sheep," by Cooper Curtice, D.V.S., M.D., Washington, 1890.



Wire-worm, Strongylus contortus—The Twisted Stomach Worm.

is one of the most insidious and widespread causes of loss of stock to the Colony, and is found usually located in considerable numbers in the fourth stomach. Like some other parasitic affections, it tends to increase more particularly where sheep are the only stock kept from year to year on the land, or when from any cause they get into poor condition. Even in such a healthy district for sheep as the Stormberg, it is well in evidence. The wire-worm is most prevalent in or after seasons of excessive rainfall, when the grass is badly rusted. This is merely another way of saying that the nutritive qualities of the grass are inferior. Animals affected with wire-worm suffer from a depraved appetite, and take to eating earth. The most **effective remedy** which has yet been found in the Colony is a solution of sulphate of copper or bluestone given after the sheep have fasted for at least twenty hours—1 lb. of bluestone dissolved in 8 gallons, or say 50 quart (beer) bottles, of water, 4 oz. being a full dose for an old sheep, down to 1 oz. for a three months old lamb. On occasions when the solution has been given stronger than this—42 quart bottles to the 1 lb. of bluestone—inflammation of the stomach and intestines has occurred, and large numbers of sheep thus treated have died

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WIRE-WORM, STRONGYLUS CONTORTUS, RUD. Figs. page opposite.

Fig. 1. Adult female, ×6: *a*, head; *b*, ovaries wound around the intestines; *c*, *c*, uteri; *d*, a large papilla, just in front off and covering the vulva; *e*, anus.

Fig. 2. Adult male, ×6.

Fig. 3. Head: *a*, two barb-like papillæ; *b*, mouth; *c*, œsophagus; *d*, intestine.

Fig. 4. Eggs, highly magnified: *a*, eggs before they have left the ovaries; *b*, eggs showing nuclei; *c*, eggs after they have passed through the oviduct; *d*, egg with one cell; *e*, with two; *f*, with four; *g*, with eight; *h*, with many; *i*, egg as it is laid.

Fig. 5. Skin, showing nine of the eighteen longitudinal lines.

Fig. 6. Portion of female: *a*, the intestine; *b*, *b*, the ends of the ovaries.

Fig. 7. Caudal end of female: *a*, the anus; *b*, the vulva; *c*, vagina; *d*, *d*, uteri filled with eggs; *e*, oviduct; *f*, *f*, ovary; *g*, intestine.

Fig. 8. Spicula, enlarged.

Fig. 9. Bursa, expanded to show costæ: *a*, ventral; *b*, ventro-lateral; *c*, lateral; *d*, dorso-lateral; *e*, dorsal; *f*, spicula.

Fig. 10. Group of adult males and females, natural size.

Fig. 11. Caudal end of male: *a*, bursa; *b*, spicula; *c*, seminal reservoir; *d*, intestine.

in consequence. Goats are not so easily affected in this way, but in any case it is better to err on the safe side. It has been demonstrated that it is the strength of the solution, and not the total amount given, that proves dangerous. If one dose does not destroy the worms completely, a second may be administered at the end of a fortnight. Sheep, particularly when young, frequently die from weakness after the remedy has been applied, from want of nourishing food to sustain them in their exhausted condition. A change of veld, and to better and more abundant food, is a very important part of the treatment.

The tape-worm, *Tænia expansa*, Rud., is another parasite which, like the wire-worm, is becoming increasingly troublesome among small stock. Both can be picked up from any part of the veld on which sheep or goats have within a few months been grazing. In this they differ from fluke, which is more localised. The tape-worm does not cause so much irritation in the mucous lining of the bowels as the wire-worm does in the stomach, but by drawing nourishment from the food as the ingesta passes through the bowel, it exhausts the strength, especially of a **young animal,** whose tissues are more tender, and whose constitution is softer, and less able than a matured animal to cope with either internal or external parasites, or other difficulties. Liberal allowances

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BROAD TAPE-WORM, TÆNIA EXPANSA, RUD. Figs. page opposite.

Figs. 1 and 2. Young tape-worms, natural size.

Fig. 3. Head end of tape-worm, drawn to show vermicular contractions when living.

Fig. 4. Head, top view: *a*, *a*, the suckers or cups, by which the worm attaches itself to the intestinal walls.

Fig. 5. Head, side view: *a*, *a*, suckers; *b*, *b*, folds in the neck; *c*, *c*, the first segments.

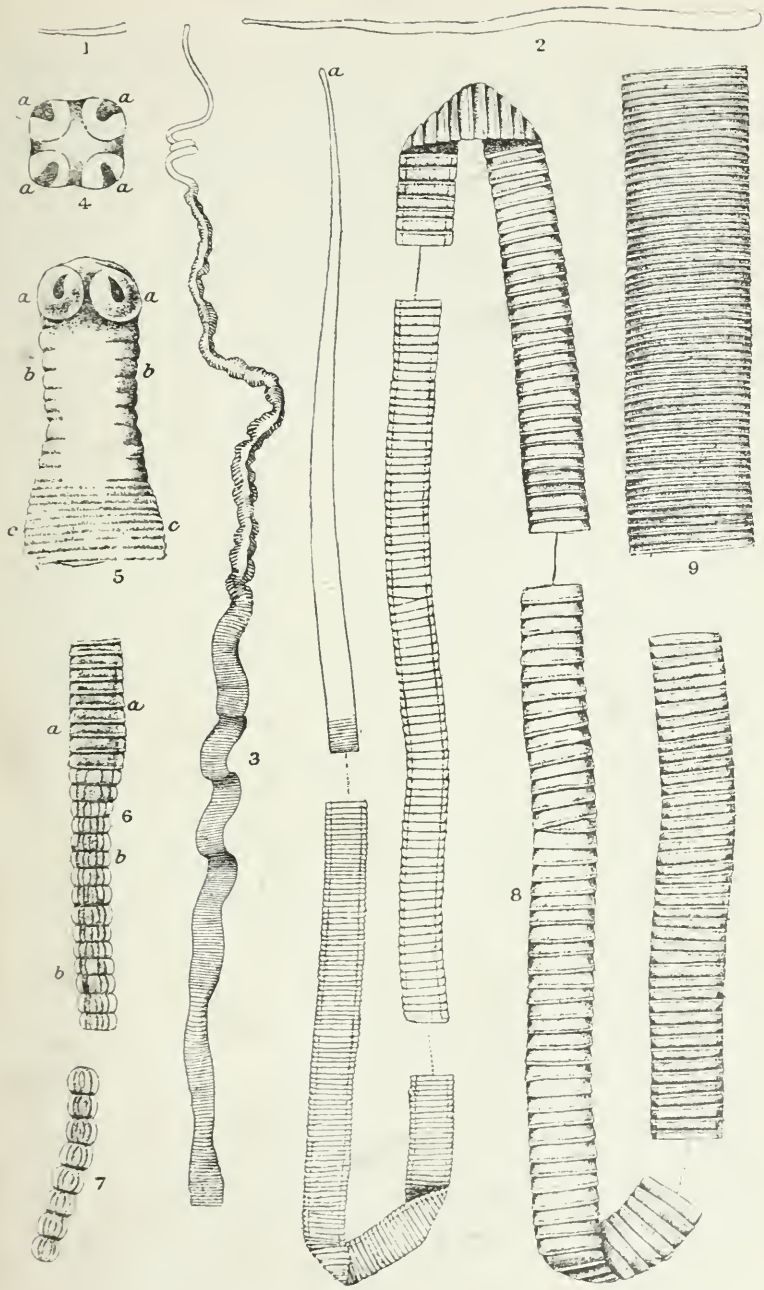
Fig. 6. The large end of a young tape-worm: *a*, *a*, segments which are not mature enough to drop off; *b*, *b*, segments ready to pass away from the worm.

Fig. 7. Segments, or proglottides, found separate from the worm.

Fig. 8. An adult tape-worm, drawn in sections at regular intervals apart: *a*, head.

Fig. 9. A fragment of another worm, which is not only slightly larger, but whose segments are shorter and broader.

The specimen shown in Fig. 8 could have assumed very much the same form when alive as is seen in Fig. 9.



The Broad Tape-worm, Tænia expansa.

of salt and lime (1 of lime to 5 or 6 of salt) are no doubt actively detrimental to the establishment of worm parasites in the digestive system. Change of pasture in alternate years (as grazing sheep one year on land which carried cattle the year before, and *vice versâ*) is an excellent preventive. In Great Britain, it is a well-known fact, that to run lambs on a pasture soon after old sheep have been grazing on it, is a most objectionable practice, and one likely to lead to parasitic attacks. The parasites are not always of the same species as those now under discussion, as the "hoose" worm, *Strongylus filaria*, is much more liable to appear than either tape-worm or wire-worm. South Africa seems to be highly favoured in the matter of the attacks of strongylus as compared with certain parts of the **Australian colonies**, where it is impossible to keep sheep without periodically fumigating them for lung-worms or using the intra-tracheal injection syringe as an alternative remedy. In certain parts of Australia, too, human beings as well as animals suffer from the formation of **hydatids** (in which the embryo tape-worm of the sheep, *Tænia expansa*,* is found) in many of the internal organs, which frequently cause death. These are taken into the system in impure drinking water, and the lesson for Cape Colony to learn is, that if tape-worms are permitted greatly to increase on the veld, the chances of their immature forms being found in drinking water will also increase, and the hydatids appear in the vitals of the unfortunates who drink it. If the annual winter starvation, and the famine during periods of drought, did not occur, parasites would have greater difficulty in establishing themselves. The vital functions of a healthy well-nourished body often prevent their development, or so reduce their numbers that the injury done is inappreciable.

The **study** of the **life-history of** internal and external **parasites**, and the best means for their destruction, is well worthy of the attention of every stock-farmer in the Colony, as it is estimated upon the best authority that they are responsible for the death of as many farm animals as all the different forms of disease put together. A little consideration will show that the **preventive method** of treatment is infinitely superior

* See Tape-worm discussed under Pigs at the end of this chapter.

to remedial measures, however useful the latter may be when practised on a small scale and when the evil has become well established. Nevertheless, the farmer ought to learn everything that can be known relative to remedial treatment, so that he may be able to employ it when occasion demands.

In giving medicine for the destruction of parasites, the animal should be **fasted** for twenty hours before it is administered, so that the alimentary canal may be partially emptied, and thus allow the medicine, which acts as a poison to the worms, to have full force. After the worms are dislodged, they may be cleared out by an aperient dose, or they may remain and break up under the action of the digestive process. Should an overdose be given to a fasted animal, it is then much more liable to produce injury by poisoning than when the paunch is full. For that reason, when **arsenic is given** as a preventive of such diseases as horse-sickness or fever, it is not expedient to fast the animal, as would be done in the effort to destroy worms, and it is much more effective when given in small doses of three or four grains daily, than in large and somewhat dangerous doses at long intervals. The following quotation from one of Dr Hutcheon's reports determines the quantities of arsenic to be given in the most handy and, at the same time, good and useful form, **Cooper's sheep dipping powder**, which is practically within the reach of every one :—

The weight of Cooper's powder contained in an average teaspoonful is 135 grains, of which about 24 grains are arsenious oxide, and about 5 grains arsenious sulphide, or very nearly 29 grains of white arsenic—arsenious oxide. A teaspoonful of Cooper's powder contains the dose generally given to ten sheep—which is practically 3 grains of arsenic each. A tablespoonful would contain four teaspoonfuls, or roughly, 120 grains, and enough for forty sheep. Two tablespoonfuls would contain 240 grains of arsenic, enough for eighty sheep ; and if that amount is dissolved in one gallon of water, which is 160 ounces, that would make each dose for a sheep two fluid ounces or a wineglassful, while three wineglassfuls would be a sufficient dose for a horse. Cooper's powder is usually given mixed with salt or sulphur, but it may be given dry on the tongue, unmixed with the salt, without any loss—as it is soft and adhesive. A broad blunt-pointed knife is generally used. The dose is placed on the point of the knife ; the boy opens the sheep's mouth, when the knife containing the dose is introduced, turned over, and the powder left on the back of the tongue ; for lambs and kids, after fasting for twenty, or more hours, that is much the simplest plan, and they should go direct to their mothers to wash it down by sucking and swallowing milk.

The **fasting** of sucking lambs for two days is also sometimes tried alone, with the object of inducing a scour in the lamb through the milk which has collected in the mother's udder not digesting properly. And again, sheep scour if put suddenly on the fresh **young shoots of grass** that come up after land has been burnt. Though this is said to clear off wire-worm, it is if anything more likely to be beneficial in the case of tape-worm. No definite line can be drawn between the treatment for the one and for the other, as both parasites are frequently present in the same animal. In short, quite a number of species may make their attack at one and the same time.

The wild pig of South Africa, the "bosch vark," *Potamochœrus africanus,* is a dark-grey animal, about 2 feet 6 inches high, with a large callous protuberance on each side of the face, half-way between the nose and eyes, and long sharp-pointed, tufted ears, which bend over at the tips. It is gregarious in habit, and lives mostly on vegetable food.

The **wart hog**, "valke vark," *Phacochœrus æthiopicus,* is also a native of the southern portions of Africa, being found in places from Abyssinia to Kafraria. It closely resembles the true wild hog, except in **dentition**, and in the number of its young being limited to four in each litter. It has altogether only four very large molar teeth, and its tusks are enormous. The head is large, and the muzzle broad. The common name is derived from two conspicuous excrescences or warts underneath the eyes. It lives mostly on roots, which it digs up with its powerful tusks. It is furnished with a mane, the hair or bristles of which are sometimes 10 inches long, extending from between its widely set ears along the back. Excellent sport is had by hunting either the wart hog or the bush hog above mentioned with dogs. Selous says that "in the opinion of most hunters there are few things more palatable than the flesh of a fat wild pig."

Domesticated pigs, which are kept in considerable numbers in Cape Colony, though frequently far from pure, are descended from European breeds. The **common country pig** is a thick-set, well-bodied animal, on short legs, and frequently grey in colour like the bosch vark. Where there is abundance of shelter, so that they may escape from the direct rays of the sun, white pigs do very well; but

where they are at all exposed, the black varieties have great advantages. The **Tamworth breed,** with its long nose, active disposition, and hardy constitution, should be admirably adapted to colonial conditions.

Although healthy on the whole, the pig too has its ailments. A stage of the **tape-worm** of man, *Tænia solium*, which affects pigs by producing **measly pork,** is the one which is of most interest to the general public, as, if the flesh is eaten without being properly cooked, it will infest the alimentary canal of the human consumer with tape-worms. The head attaches itself to the mucous membrane of the bowels, and the worm continues to grow within the intestines of its unwilling host, absorbing by its outside surfaces the juices it requires for its nourishment, and development goes on at a rapid rate. It is extremely difficult at times to dislodge the head from the human being, although fragments of the segmented worm pass frequently. Its presence is not uncommon among the Kaffir population, and the pig contracts the infestation while running at large about the Kaffir quarters, and picking up all sorts of garbage, among which the segments of the tape-worm dropped by man are swallowed. The eggs escape the process of digestion and get into the circulatory system of the pig, and are from this distributed in the muscular flesh throughout the different parts of the body, there to become encysted and to produce the diseased condition known as measly pork, *Cysticercus cellulosus*, and continue as embryo worms for a few weeks, on the chance of the pork being eaten. Then the parasite passes into the mature stage, which is the tape-worm in the intestines of the human consumer. If the pig be kept shut up and fed on clean food for a few months before it is killed, the embryo worms die, and become absorbed, or remain as nodules, usually associated with a little calcareous deposit. The pork may then be eaten with safety.

In a country where oaks grow so rapidly as in Cape Colony, and mature so many acorns, **pig-breeding** and rearing, which involves little expense or trouble when a proper system of management is adopted, ought to be much more extensively practised than at present; and where such variety of green food can be grown by irrigation, and where

mealies or maize is so abundant, the cost of producing pork should be moderate. It is not generally understood that as a source of human food the **pig** is, so far as the whole world concerned, by far the **most important of all** our farm is animals. No doubt beef and mutton occupy a more prominent place on the tables of the rich and the well-to-do classes in Great Britain, but pork occupies no inferior position even in these high places. It has been often asked, what would an English breakfast be like if bacon and ham were entirely excluded from the table? We only begin to realise its true position, however, when we take into consideration the prominent place which the flesh of the pig occupies in Germany, in China, among the lower classes in India and the millions of the black population of the Southern States of America, in which latter locality hardly any other flesh is consumed. The quality which the Colony is capable of producing would occupy the first rank. With abundance of exercise during the period of growth, the lean and fat become mixed in a way that is unknown in house-fed pork or bacon, and the animals being more healthy the carcases produced are altogether more mature, more finished, and better flavoured. It is to be regretted that the **numbers of pigs** in the Colony are far below what they were in the census of 1891. Then they numbered 208,299. In the succeeding years the estimated numbers have been 154,103 in 1892-93; 156,570 in 1893-94; and 169,205* in 1894-95.

* This is exclusive of 83,748 which are returned for the Transkeian Territories and Walfish Bay, making a grand total of 252,953.

CHAPTER XXI.

POPULATION, LABOUR, AND WAGES.

Early Inhabitants of South Africa: Bushmen, Hottentots, and Bantus—The Census Returns—Malays—Fingos—Mixed and Other Races—The European Population—The Boers and their Characteristics—Cape-boys—Wages—Quality of Native Labour—Wine as Part Payment—Surplus Labour—Wages at Kimberley and Johannesburg—Market Gardeners—Poor Whites.

Theal's History of South Africa, in describing the **Bushmen**, who were the aboriginal inhabitants, and savages of a very low type, says: "They were pigmies in size, yellowish-brown in colour, hollow-backed, and with skins so loose that in times of famine their bodies were covered with wrinkles and flaps. On their heads were rows of little tufts of wiry hair hardly larger than peppercorns, and leaving the greater portion of the surface bald. Their faces were broad in a line with the eyes, their cheeks were hollow, and they had flat noses, thick lips, and receding chins. They anointed their bodies with grease when any was obtainable, and then painted themselves with soot or coloured clay. The clothing of the males was the skin of an animal hung loosely over the shoulders, and often cast aside; that of the females was little more than a small leathern apron. To the eye of the European no people in any part of the world were more unattractive. They had no domestic animal but the dog, and they made no effort to cultivate the soil. They lived by the chase, and upon wild plants, honey, locusts, and carrion. Their weapon of offence was a feeble bow, but the arrow-head was coated with poison, so deadly that the slightest wound was mortal." They built no houses, but sheltered in caves and among rocks. They were treacherous to their neighbours, and formed a constant menace to the early settlers. It is to be feared that to secure safety they were hunted in their mountain fastnesses

and desert wastes and shot down more like wild beasts than human beings. The race is now almost extinct in the Colony, only a few being scattered in the arid country of the Northern Border.

In addition to the Bushmen, who at the time of the arrival of Europeans occupied the greater part of the interior of Cape Colony, there were two other bodies of people who had much greater brain development, and were decidedly higher in the scale of civilisation—(1) **The Hottentots,** who occupied a considerable range of country skirting the south and west coasts of the Colony, and extending along the banks of the Orange and Vaal rivers; and (2) **representatives of** "the great **Bantu family,** which occupies the whole of Central Africa from the Atlantic to the Indian Ocean," who were encroaching from the north-east upon their weaker neighbours, and had found their way along the coast as far as the mouth of the great Kei River.

The **Hottentots** were never very numerous, and they remained in a perpetual state of war with the Bushmen, who were both physically and intellectually their inferiors. The resemblance in some respects between the two peoples is so great that it is generally believed that the Hottentots are descended from Bushman women, and men of a superior race of people who at some very remote period probably came from a distance, and after killing or driving off the Bushmen, settled down upon the best of their country.

Their gaunt and bony **cattle** and hairy fat-tailed **sheep** have already been described. The **dog** was the only other domestic animal which they possessed. They were a pastoral, not an agricultural people, living on milk and flesh, and on such roots and bulbs as nature supplied during periods of scarcity. The huts in which they slept were of a very temporary character, but marked an advance in civilisation on the Bushman's cave. Both Bushmen and Hottentots have peculiar **clicks** in their languages which preface many of their words, and both have rapidly **diminished in numbers**, like the aborigines of Australia under, for them, the exterminating influences of civilisation.

The **Bantu race** of dark-skinned Negroids is of a very different type and character. Its **prolific tendencies** are so

great as to threaten, now that war is almost at an end, to be the imminent cause of one of the greatest social difficulties of the future of South Africa, viz., that of overcrowded population.

The name of **Kaffir,** signifying infidel, was given by the Mohammedans to the dark-skinned African races generally, but it has been restricted in South Africa to representatives of the Bantu race, whose designation was "**Ama-Khosa,**" or sons of Xosa, their greatest historical chief. Tribal groups are also locally distinguished as Zulus, Makalakas, Basutos, Pondos, Bechuanas, and Damaras.

Kaffirs are greatly superior to the Hottentots in both physical and mental characteristics. They have been described as "fine, powerful, able-bodied men, reserved and self-possessed in manner, but courteous and polite, and sensible of kindness and consideration." The race probably gains something of its superior vigour from having been formed of mixed blood—a fact which is supported by the appearance from time to time of very different types, both physically and intellectually. Like the Hottentots, Bantus are now believed to have sprung from males of a superior race, probably highly refined and civilised, who mated themselves with females no doubt captured from a tribe much lower in the scale of civilisation. The Kaffirs in Cape Colony now **number** over 600,000, and the great majority of them belong to the country lying between the great Kei River and Natal, or occupy locations on what were the Eastern Border districts lying to the west of that area. At **the last census** taken in 1891 the population of Cape Colony was returned as follows:—

Races.	Persons.	Males.	Females.
European or White . . .	376,987	195,956	181,031
Malay	13,907	6,713	7,194
Hottentot	50,388	26,248	24,140
Fingo	229,680	108,566	121,114
Kaffir and Bechuanas . .	608,456	306,635	301,821
Mixed and others . . .	247,806	123,209	124,597
Total . . .	1,527,224	767,327	759,897

The figures show that only **one-fourth** of the total population belong to the **white** or European race. The returns taken at the **previous census** in 1875, when compared

with the above results, indicate that the **rate of increase** of Cape-born whites in the sixteen years has been 42.94, and of coloured people 35.20 per cent. **Two influences** are at work which are liable to alter the relative positions of corresponding figures belonging to the next census, viz., the cessation of wars in which natives were killed in greater proportions than Europeans, and the decrease of the less prolific section of the coloured population.

Nearly one-half of the total population, viz., 672,458, were returned as "engaged in agricultural and pastoral pursuits."

Only 22.26 per cent. of all races and ages were able to read and write, but of Europeans about 68 in every 100 can do so. Next to them come the Malays, but with only 18 per cent. of literates.

The **Malays** in Cape Town are coachmen, masons, carpenters, and fishermen. In the suburbs they are generally woodcutters, but they are not widely distributed.

The **Fingos** are Bantus descended from the dispersed Zulu tribes who were in "servitude to the Ama-Khosa Kaffirs, and were received under the protection of the Colonial Government in 1835, when they only numbered 16,800."

"The **mixed and other races** include the descendants of the former Negro slaves, partly sprung from the intercourse of these and of white men with the aborigines, and they are partly foreigners, including Indian, Malagasy, Arabs, Chinese, Turks, Creoles, and others."

Of the **European population,** the descendants of the early foreign—mainly Dutch and French—settlers are greatly in the majority, although with a very much larger emigration from Great Britain and Ireland than from all other European countries, the proportionate British increase is now the greater of the two.

The **word** "**Boer**" is the Dutch for a tiller of the ground, but its meaning in South Africa has been extended to cattle-breeders as well as to cultivators, and "it is frequently used in the plural form to signify the whole rural population of European blood speaking the Dutch language." Somewhat crude ideas have been formed and expressed regarding the **Boer population** of South Africa by those who have imperfectly grasped the bearings of the case. Some people seem

to imagine that the Boers are possessed of personal characteristics which separate them from other Europeans who have chosen Africa as their adopted country, that they are incapable of modern civilisation, and that they are inherently the natural enemies of progress. The differences, whatever they be, are not due to race but to environment, and what are regarded as peculiarities and idiosyncrasies are natural results of causes which have been at work for generations, and are still existent in part. The early settlers, widely scattered over a vast country, were deprived of the means for and the benefits of **school education**, although all were taught to read the Bible, and naturally their spheres of knowledge and of interest became contracted beyond anything in the experience of educated people. But while losing in this direction they developed qualities some of which are unfortunately becoming all too rare among so-called educated communities. They acquired settled habits and self-reliance, which is a commendable form of independence, and cultivated a wholesome desire for merely simple fare and simple creature-comforts. Their limited means, the difficulties of their isolated position, and the dangers from the chronic state of war with the native population whose lands they had appropriated, developed in a marked degree the instinct of **self-preservation**, which, so far as the rejection of many recently suggested European innovations are concerned, has been mistaken for indifference or even for dogged opposition to modern ways. It is easy to realise that in dealing with a people accustomed to wait for developments rather than to work for them, and whose whole inner life differs so much from that with which the would-be improvers are familiar, mistakes are most likely to occur in judging of what would be advantageous, and what would be detrimental to their position. Much of the Boer reluctance to change, even when the change is undoubtedly for the better, is due to the spirit of opposition fostered by the resistance offered to or the failure of injudicious changes attempted in times past.

The educated and **progressive Boers** are as much alive to the advantages of real progress as the descendants of British parents, and even the **isolated country Boers**, who vastly outnumber the other class, are open to be convinced, although

they frequently assume the manner which clearly implies a disbelief in the existence of the man capable of bringing conviction to their minds. The country Boers possess many of the homely qualities and ways of the **small farmer class in Scotland** of a few generations back, who could not be fairly described without the prominent use of the word "canny." It is more than a suspicion that many of the Boer ways and ideas were derived directly from the Scotch through the Scottish **parsons** who have been conspicuous personalities in the early Dutch Reformed Church since the Cape became British. The Presbyterian parson has at all times exercised a powerful influence over the Boer population, which in respect for devotion to **religious beliefs** and practices bears a strong resemblance to the Scottish peasantry described by Burns in the "Cottar's Saturday Night." It is to be regretted that the full influence of the parson has not in every case been used to instil into the people the overwhelming importance of a good general education as a means for both spiritual and temporal elevation and advancement. As a rule the Boer population is strictly **moral**, and free from the mock modesty and the restraint from innocent social intercourse between the sexes, which a disordered moral condition engenders and renders necessary. This is not due to any inherent quality in the race, but to the circumstances of their surroundings, their strict religious teaching, and the custom of early marriage. Where their morals are subjected to contaminating outside influences, they are not specially conspicuous for assuming the role of the saints. Probably the **chief difficulty** to overcome in the future of the uneducated Boer population is the erroneous and absurd idea universal among poor people, even of the lowest classes, that one man is as good as another. Jack is not only as good as his master, but no one is good enough to be master to the other, and they would live in a state of semi-starvation rather than go to service. A **young man** works for his parents for a living till he is twenty-one years of age. Then he wants to marry and set up a separate establishment, and he does so on money borrowed on a section of the farm handed over to him; and with the existing tendency to lower prices generally, the payments necessary on the bond keep him in poverty for the remainder of his natural existence. The position is not

Photo. by Wilson, Aberdeen, N.B. *Face page* 401.

PLATE 68.—BOERS RESTING AT AN OUTSPAN.

improved by the natural **disinclination to work** of white men who have inherited the traditions of their slave-owning ancestors, and by the possibility of existing in a South African climate, although only in a very primitive fashion, at an almost incredibly small cost.

Easy-going habits of living were introduced by the early settlers, who—excellent pioneers as they were—with dogged patience and perseverance, trekked into new country with a waggon and established themselves where for years nothing would be heard of government interference, and little of social intercourse with neighbours experienced. After getting coffee, a settler, dressed in a flannel shirt and trousers, would start off in the morning with his rifle, and come back in the evening with the products of his day's sport. His **food** consisted largely of flesh and milk, and his other wants were few. A limited number of cattle, goats, and sheep, to fall back upon when hunting failed, supplied nearly all his actual needs. Such a one had practically no ready money, and small means, from which to pay taxes. He naturally acquired a habit of thought which excluded the idea of the necessity for the existence of government, and when by any chance brought within its sphere, he doggedly resented the interference of the law. Restraint of any kind, even under conditions which have materially changed, is irksome to such people, and a prevailing belief exists that because a farm may be said to be a man's property, he has a perfect right to do with it as he pleases. But unfortunately that very simple principle does not agree with modern ideas of community government, and a man may not "do what he likes with his own" if his action will at the same time injure his neighbour. Accordingly, the **Boer must adapt himself** to altered circumstances, and, although his training may have unsuited him for accomplishing the end willingly and readily, the object is none the less necessary of fulfilment, and none the less likely to be attained in the long run. If the general interests of the community of which he forms a part make it necessary for him to give up some of the privileges he has treasured in the past, the same influence with which he will come into closer relation will confer upon him countervailing privileges, so that in the end he may participate in the full measure of happiness

naturally provided for him, which after all is the universal desideratum.

The "**Cape-boys**" form a mixed so-called "bastard" class, descended from a variety of races, including Bushmen, Hottentots, Mozambiques (with short woolly hair), and Malabaries (with long smooth hair), the latter having been brought to the country as slaves in the early days. As is usually the case with prosperous cross-bred populations, they are energetic and active; and under supervision they make excellent workmen. The best of them find employment on the railways, where the labour is hard but well remunerated.

The **rate of wages**, and the forms in which they are paid, differ considerably in the different districts of the Colony. The most common custom in paying the wages of native farm labourers is to supply food, and give a money wage in addition, generally amounting to 10s., but in some districts to 20s. and even 25s. per month. The food mostly consists of mealies (partly as meal), 100 lbs. being regarded as an allowance for one man. If he has a wife and children, he is given an extra quantity, or a few acres of land to cultivate. It is acknowledged to be best to supply what is actually required for the family, otherwise the people simply help themselves. On grazing farms where Kaffirs are steadily employed tending stock, they are often allowed, as an additional perquisite, to run a few cattle, sheep, or goats with those of their master. The practice in the matter of supplying flesh as part of the food is very various. A single man may get as much as 1 lb., and a man with a family 2 lbs. per day. In some places it is only given once a week. The supply depends to a large extent upon the available number of goats, old ewes, or oxen on the farm, and upon whether or not there is an abundance of milk. A **Kaffir** is generally contented with meal and milk, and an occasional gorge of flesh, when a meat-hunger comes upon him. **Hottentots**, on the other hand, expect a regular supply of meat.

In the neighbourhood of **Port Elizabeth** wages are paid at the rate of £2. 5s. to £2. 10s. per month, half being distributed in cash and half in rations. It is a custom with large farmers to keep a general store to supply their work-people with common necessities, thus rendering it unnecessary for

them to go shopping at a distance, and probably drinking, and preventing outsiders charging them exorbitant prices for commodities which are to be had at cost prices at their doors —meal, for example, at 11s. per 100 lbs. The modern requirements of a workman per week may be stated as 20 lbs. meal, 5 lbs. meat, ½ lb. coffee, 5 lbs. sugar, ¼ lb. South African roll tobacco, and milk when it is to spare.

Some do not **drink brandy**, although many are addicted to it. If a Kaffir takes to drink, it becomes a mania with him, and he cannot be cured of the evil habit. Upon the whole, drinking is not so common in the East as in the Western Province, where vineyards flourish, and where, in consequence, wine and Cape brandy are more easily and cheaply obtained.

Native labour is not at all bad when **supervised** by Europeans, and when a proper system of working is introduced. When work requires to be done, the day is not restricted to eight hours, and there are no holidays except Christmas and New Year's Day and the weekly Sunday rest. The practice of letting **work by the piece** is coming in, and, as is usual everywhere, it works satisfactorily. **Kaffir women** do not work in the fields where the men are employed under European masters, which is a misfortune, as it would keep them out of mischief. This is all the more to be wondered at, as in the original condition of a Kaffir community the women did practically all the work, and the men devoted themselves to fighting and to tending the cattle. Hottentot and "bastard" women work in the fields throughout the western districts of the Colony; and in towns and villages everywhere, native women are employed as domestic servants.

The "**Cape-boys**" in the Western Province are considered the best workmen in the Colony. They handle the spade with the dexterity of an Irishman, being trained in the use of it as soon as they are able to work. In ploughing they get over an amazing amount of ground, but in a very rough fashion. The great difficulty is that they want to work only four days a week, and to spend the rest of the time in drinking and frivolity, which would thoroughly unsettle them for doing satisfactory work during the period set apart for it. This is largely due to the pernicious custom of giving a **daily allowance of wine**, a custom similar to that of supplying beer to the

labourer in the South of England, which has been a potent factor in preventing his rising to the level of the workman of the North of England and Scotland, where alcoholic stimulants are only partaken of at rare intervals. **Wages** in the west are on the higher end of the scale applicable to the Colony—2s. per day without food, or 9d. to 1s. with food, a cottage, and an allowance of one to one and a half, and sometimes even two bottles (beer-quart size) of wine daily, except Sunday. The wine is generally of very inferior quality, not worth 3d. per bottle, and water is frequently added. Nevertheless, many men look with greater interest upon the wine than on any other portion of their earnings. A few masters have discontinued the supply of wine, and given an additional 3d. to 6d. of money wages per day. This custom will no doubt become popular and more general, and result in the work being better done, and in the labourers becoming more contented and more sober. Such at least has been the English experience where beer money has been substituted for beer. It would be a blessing to the labourer and a boon to the country, if it were made illegal to supply intoxicating liquors of any kind as a portion of a man's wages.

Cottage accommodation is often very poor, and confined to one compartment. In some cases 1s. per week is deducted from the wages, but as a rule a cottage is a perquisite. A few progressive farmers, in their own interests, as well as in those of their people, wisely provide two compartments in each cottage, and supply a small area of land for cultivation in addition to the customary allowances.

The ordinary wages are sometimes increased by 6d. to 1s. per day during busy seasons, such as shearing and harvest times, especially in those parts where the farm has to compete with other sources of demand for labour.

Surplus labour from the mission stations is not so plentiful as it was a few years ago, as men now go off to Cape Town. Some are far-seeing enough to remain in the country districts for a couple of months during the busiest season, and go into the towns when the period of high wages comes to an end. Good workers about Cape Town easily command 3s. per day, and at times even 4s.

On the **railway** active, able-bodied men earn 3s. to 5s. 6d.

PLATE 69.—NATIVE QUARTERS.

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per day as platelayers, &c., and this tends to draw away the most active and energetic, and to leave on the farms the lazy and inferior hands, while with less efficient work the wages tend to rise. The gold and diamond **mines** have also proved powerful centres of competition with the agricultural interests in the labour market, and as the rates of wages are extremely high when considered in connection with the cost of living, the state of things tends to reduce the available supply of labour, by rendering the workmen too quickly independent, and as a natural consequence, lazy. In the De Beers diamond mines at **Kimberley**, where 8,000 natives are employed at day work, the wages are from 3s. to 6s. per day. In the **Rand** gold mines at **Johannesburg** the black boys (who numbered 70,000 in 1895) receive 2s. 6d. per day or £3 per month and their "scoff" (food), which consists of mealie meal and "vamma" or flesh-meat, the latter limited to 2 lbs. per week.

There the work is in reality paid for by the piece, although by European contractors who take it from the companies, the rate is reckoned by the day. Boring the solid rock with a chisel and hammer in preparation for blasting with dynamite is the chief operation. When a man finishes a hole 3½ feet deep, he completes his day's work, and is entitled to ascend; but the natives work to each other's hands, and the stronger and more experienced of them help the younger ones, so that a section of a shift is able to leave in a body.

One of the most prosperous communities in a humble way in the Cape District is that of the **market gardeners**—the descendants of early British and German immigrants of the poorer classes. Some ultimately became overseers on large farms, and some landowners. One recently died at Alphen, at the age of seventy, who had remained in the employment of the Cloete family for thirty-five years. A number took to the occupation of market-gardening, and their descendants, many of whom have a distinct mark of the tar-brush, occupy 2-morgen (4-acre) garden lots, which they rent, with unpretentious though neatly kept cottages, at about £1 per month. The soil being rich, and the cultivation practised excellent, they grow in abundance for the Cape Town market all the commoner vegetables, which they deliver by means of one-horse carts, each grower taking his produce to

town two or three times a week, and bringing back a load of horse manure. These market gardeners work hard, but they do not neglect the education of their children, though they also teach them to work with their hands. A small but at the same time a most prosperous and useful section of the community is thus being reared, which stands out in marked contrast to the class of people next referred to.

The so-called "**poor whites**" are chiefly the descendants of French Protestant refugees, and, in some districts, of early Dutch settlers. The initial cause at work in reducing them to poverty, was the excessive subdivision of the land among the members of a family—one of the chief hindrances to successful colonisation by Frenchmen living under French law in any part of the world. During the latter part of the seventies the law was altered, and freedom of testamentary disposition introduced into the Colony, but the old law still remains in force in the Transvaal and Orange Free State. The practice of borrowing money, as the difficulties resulting from bad seasons and the limited amount of land increased, still further degraded them. The very general impression that a white man, however poor, was **not born to work** in a black man's country, was not only a contributing cause to the existing position, but it remains one of the chief difficulties in the way of the introduction of means for the improvement of the poor white population. A foolish and meaningless **pride** of a hereditary nature—for certainly no quality now remains to justify the development of it in the present generation—prevents the female portion of the community from entering **service** of any kind. Although many of the men do not work on account of laziness, this is not the case with the majority of the women, who, after they are married, slave at every sort of household or home drudgery.

The **daughters of the poor German settlers** possessed till recently the same sort of mistaken independence of service, but during recent years, since home difficulties, including repeated visitations of locusts, have become more acute, a number of girls have entered the employment of prosperous farmers and residents in towns as domestic servants. The difference in creature-comforts must show such a contrast in

favour of the new development that the practice cannot fail to become general and popular.

It is to be hoped that the poor white community is not yet so completely degraded that improvement is impossible, although the difficulties are great, owing to the resistance offered by the people themselves, and to the fact that the position of poor whites has, unfortunately, been made a **political question** in a manner which tends more to pauperise, than to elevate them. At one time men were as independent of service as women. Now, married men engage freely as shepherds or labourers, and will undertake any menial work. Some of the young men go out as shepherds, but they are more independent. Few can read or write, and even these cannot do so any better than a British child of seven years of age, while they look upon compulsory **education** as a grievance of first importance. The pinch of adversity during recent bad times may have forced a few to find relief in honest labour, but it has driven many from the country districts to take **shelter in villages** and towns without any visible means of subsistence, there to maintain a precarious existence and to swell the list of cases of **petty theft** of such property as linen and poultry, which in small village communities in other parts of the world is usually safe.

Young women who refuse to work are there, by poverty and the increase of opportunity, as well as a desire for fine clothes, driven to the streets. The step is frequently not a downward one, as the standard of morality of many of the class is too often of a low type, incestuous intercourse in families living indecently huddled together in insufficient house accommodation being not uncommon. Forty years ago the poor white communities, which are **scattered** pretty **widely** through the older settled portions of the Colony, were conspicuous for **sobriety**, but many have lately fallen victims to the brandy demon, which the Government of Cape Colony has been in the habit of fostering in its bosom like a cold-benumbed viper.

The poor whites of Cape Colony are no exception to the general rule, that when the **white man** becomes **demoralised** and degraded in a mixed black and white community, he is capable of descending to greater depths of degradation than

the man with the black skin. The position of the poor whites now so nearly approaches desperation that the usual governmental means, which cannot be dissociated from pauperising influences, are insufficient. A South African **Lady Dufferin** is wanted to organise a **society of female workers** who would be willing to take the task of reclamation in hand. There are **many gentlewomen** with Florence Nightingale instincts and determination, both in Cape Colony and in Great Britain, whose upbringing has admirably qualified them for such work, who would be delighted to engage in it if they were made aware of the necessity for it, and shown means by which it could be accomplished. The difficulties are no doubt great, owing to the wide distribution of this unfortunate class, but the prospect from the humanitarian standpoint is also great, and the work could not fail to be interesting—all the more interesting that it would lie to a large extent among the young and rising generation, who would in their turn influence more effectively their parents and elders than any outside society of enthusiastic workers in well-doing.

Any Work, Baas?

CHAPTER XXII.

IRRIGATION.

General Principles of Irrigation mainly deduced from Experiences in British India and America—The Steynsburg Scheme—The Slagtersnek Scheme—The Oudtshoorn Scheme—Previous Government Experience—Irrigation Dam, Beaufort West—Irrigation, Van Wyk's Vlei—Object-Lessons from previous Experience—Prominent Defects in the System of Irrigation—The Egyptian Method of Washing Salt Land—The Californian Check and Levee System—Conclusions relating to Finance—Irrigation Law in Cape Colony.

IRRIGATION is one of the oldest of agricultural practices, and has been continued and handed down to us from a period prior to any written history. We may infer this from the fact that some of the richest land under cultivation, where the most ancient peoples dwelt, cannot be made to produce anything without the artificial application of water. Irrigation is, on account of the variety of objects for which it is practised, the diversity of conditions under which it is employed, and the complicated nature of the scientific principles involved, one of the most varied of all the numerous branches of agriculture which now call for investigation. Although in some instances the practice of irrigation has been carried to great perfection, yet there has been upon the whole a distinct lack of scientific investigation and explanation of the reasons of success and the causes of failure.

The application of water to land seems to the uninitiated to be a most simple operation, and the rapidity of growth after a warm and refreshing shower of rain blinds the casual observer to the fact that water applied in an artificial way is associated with disadvantages and difficulties to the cultivator which are frequently more or less permanent, and also at times accumulative No doubt a vast amount of useful practical knowledge is possessed by those who have

been engaged in irrigation as a life occupation, and who at the same time have benefited by the instruction of those who have preceded them in former generations, but there is a want of a collation of scientific facts, and of explanation of systems and principles. The literature is meagre, new, and unsifted, and the subject not sufficiently studied. The great opportunity which Great Britain has had in India of performing her part in this connection has been lost. Although the engineering works of the great irrigation systems of the country have been executed and maintained with admirable skill, yet the distribution of the water provided by those works has never been under any responsible expert authority. The consequence is that in many places irrigation proved more of a curse than a blessing, and no reliable record of the facts of interest which have occurred has been made.

The **improved methods of irrigation** now being extended in the fruit-growing regions of Western America may be said to be merely in their infancy. Crops have no doubt been successfully grown for years, and, on the application of water, this may be called the first result, but there are after-effects upon the land which are accumulative, and which have not yet been fully investigated Experience has reached far enough to show that it will not do to jump to the conclusion that, if fruit grows well for the few years after water is first applied, it will continue to do so. This being settled, it is then necessary to determine what waters are unsuitable, and how to apply good waters, so that they may do the minimum amount of injury to the soil. These are questions that are now of special interest in the Irrigation States of America. They are questions which will be foremost in the development of irrigation in the colonies. The new and improved methods of American irrigation are clearly more suitable than those of any other country to Cape Colony, in so far at least as the conditions of the two countries are similar. The climate is one point in which the regions requiring irrigation in Cape Colony and the arid Western States of America are in a great measure alike, and naturally the crops to be grown will be practically the same. In connection with the cultivation of small areas under investigation, fruit of various kinds may be held as ranking high in importance; not because fruit is better suited

to irrigation than some of the forage crops, but because it returns a more valuable yield per acre.

According to present information, it will not pay in America to grow grain crops on land under a great irrigation system. At the current prices for grain, and with the millions of acres of land in the various wheat-growing regions of the world that will produce grain at a *minimum* cost, irrigated land cannot compete with the land mentioned, unless in such an exceptional country as Egypt, where two and three crops a year can be secured, and where corn-land is worth a rental of £5 per acre.

It must not be imagined that the application of **water alone without manure** will keep up the fertility of soil, and guarantee greatly increased annual returns. Virgin land of good quality when first broken in, with or without irrigation, will yield heavy crops; but if cultivation be continued without manuring, in a very few years the yield is greatly and quite naturally reduced, whether water be applied or not. Where there are facilities for employing the American system of gravitation to advantage (and this is so in many places in Cape Colony), the cost may be considerably less than where pumping is necessary. So different were the experiences of Western America, with her gravitation system of application, as compared with those to be encountered in Australia, when by the irrigation scheme of Mildura and Renmark, the greater part of the supply was proposed to be got by pumping from the river Murray, that it was at first felt by many that the venture was in a great measure a new and untried experiment. The recent financial difficulties of Chaffey Brothers Lim. have entirely justified the doubts and fears expressed at the time, and ought to be a salutary warning to over-confident irrigation enthusiasts in Cape Colony.

It may be of interest to those who are connected with irrigation works in the colonies, or who, like the author, look upon irrigation as an important factor in the development of the arid regions of South Africa, to know what have been the **experiences in Western America**, and to hear of the difficulties that have been met with, as well as of the rich rewards that have fallen to those who have been successful.

The most experienced irrigators under the new methods

are still only learners. It is therefore not to be wondered at that the details of the systems employed in various parts not particularly dissimilar in character, are yet widely different, and, moreover, that the full effects of the injuries sustained by those who have most seriously erred are not yet fully realised. It seems that one of the most natural mistakes to commit is to apply too much water. It is led up to by a very simple process of reasoning to the effect that, if a little water is good, more water ought to be better. Some favoured spots do for years escape serious or in fact any appreciable injury from the application of infinitely more water than the amount required; but in other places the injury is immediate and easily perceived. Common-sense ought to teach the observant that owing to the irregular distribution of rainfall, which comes in season and out of season, much of the moisture the earth actually receives is of no value to the annual crop, if indeed it does not injure it. It may readily be inferred that, if applied at the proper time when the crop stands in need of it, a greatly reduced allowance per acre would suffice. This is the first striking advantage which a complete system of irrigation has over the natural rainfall method of water supply—it can be turned on or off as circumstances require.

There are various **methods of measuring** and estimating the amount of water applied to land. In the Irrigation Department at Washington the "**acre-foot**" (*e.g.*, the amount of water which, if permitted to cover an acre, would measure 1 foot in depth) is the standard measurement adopted. The oldest, simplest, and the best standard unit for water measurement is the flow of a cubic foot per second; but the unit in almost universal use in the Western States is the **miners' inch**, a relic of the early California gold-mining days. It may be defined as the amount of water passing through an opening an inch square, under a pressure of a specified number of inches of water measured from the surface of the body of water to the centre of the exit opening. In Colorado the legal pressure is 6 inches of water, and in California that in common use is 4 inches. Under the latter circumstances 50 miners' inches are equivalent to about 1 cubic foot; or the value of the miners' inch may be stated as follows:—

1 miners' inch .	0.02	cubic ft.	= 0.1496 gals. per sec.
" " .	1.2	"	= 8.976 (or 9) gals. per min.
" " .	72.0	"	= 538.56 gals. per hour.
" " .	1728.0	"	= 12,925.44 (or 13,000) gals. per twenty-four hours.

The amount of water allowed in terms of the miners' inch measurement varies considerably. A continuous flow of a 1-inch stream on the 4-inch pressure is considered sufficient for 10 acres at Ontario, and for 3 acres at Riverside. No doubt the unit of a cubic foot per second, being altogether more satisfactory and more simple, will ultimately be adopted both in Cape Colony and America.

The **surface flooding of land** is followed by the compacting of the particles of the soil, and the hardening and solidifying of its surface. One and all of these effects are against the perfect growth of crop plants, and the injury resulting is accumulative in soil of a given density, usually in proportion to the amount of water supplied. Soils that contain a fair amount of clay also **crack** or open up deeply on drying, and thereby compress and injure the roots of growing plants, besides exposing a greater surface from which excess of evaporation takes place, and loss of moisture proceeds. To obviate these tendencies in land growing fruit-trees or crops sown in rows, **frequent cultivation** is necessary to keep the surface in a finely divided, powdery condition. There is no practical method by which evaporation can be so effectually reduced to a minimum, as by a layer of finely divided soil closely covering the surface.* The moisture is held fast, and the baking of the soil containing the roots into a brick-like condition is prevented. Land growing lucerne, which cannot be cultivated while the crop is on the ground, has to be ploughed up now and then to loosen the surface, and to let the water get into it, so hard does it become by repeated watering.

* George Christison, the great authority in London on the practices of Indian tea growing, stated in a lecture delivered at the Society of Arts May 1895 that, "In all countries subject to droughts—especially in the tropics and sub-tropics—a thorough cultivation and pulverisation of the soil, especially at the surface during autumn and the dry season, is by far the best means for preserving the moisture and obtaining healthy crop growth."

The operation can be performed with impunity, as it does not destroy the roots of this crop, which subsequently grow with increased vigour. The induration of the surface soil is not the only serious damage done to soils by excessive supplies of irrigation water.

The **water-table**, or the surface of subsoil water, is frequently injuriously raised, so that the area becomes water-logged, and the crops actually drowned out. In some irrigation districts of California, where excessive quantities of water have been used for a number of years, the interstices of the subsoil particles of the basin into which it has been poured have gradually been filling from below, so that the water-table has been forced up from a depth of 40 feet to a few feet from the surface, and in some instances up to the surface itself. The remedy in the latter instance has been to stop the excessive use of water, and to dig round a field so affected a drain 7 feet deep to carry off the surplus water as it rises. If permitted to come up into the surface layer occupied by fruit-trees or crop plants, the deep roots rot off, and the area of the feeding ground, as well as the feeding power of the plants or trees, is thereby diminished. The raising of the water-table is no doubt an advantage if it does not approach too near the surface. In some places where the proper conditions in this respect have been secured, the subsoil moisture has been sufficient to grow crops without irrigation.

Perhaps the most baneful result of an excessive use of water in a hot climate is the accumulation of **alkali efflorescences** which destroy vegetation and render the soil barren. The soluble salts of the soil are dissolved by the abundance of water soaking through it, and are carried in solution by capillary action to the surface, where they are left as a crystallised crust or powder, when the water goes off by evaporation. An excess of soluble salts in a soil is harmful to vegetation, although the salts be such as are beneficial to plants when present in moderate quantities, but this is not a usual cause of difficulty. The effects are as a rule only hurtful when by means of evaporation the surface becomes charged to redundancy. Eliminate the action of evaporation and nothing of an unusual or injurious nature could be detected in either the soil or soil-waters of many badly affected

districts. If the young and tender plant be poisoned soon after germination it dies immediately, or if the hurtful condition of soil be induced during the growth of the plant, the bases of the stems rot as the crop advances to maturity, before it can form and perfect its seed. It is evident that whatever will tend to maintain the soluble salts in the body of the soil, and prevent their appearance on the surface, ought to have consideration as a remedy against the evil. To this end under-drainage to prevent so much water rising, and frequent and deep cultivation of the surface soil to mix and powder it, have proved simple and efficacious mechanical means.

The **salt or alkali soils** of California correspond in a number of important particulars to the "**brak**" soils of South Africa, and the "**reh**" or "**usar**" soils of Northern India. We are indebted to Professor E. W. Hilgard, of the University of California, at Berkeley, the "soil-wizard" of the West, for much valuable information regarding the causes and prevention of injury by alkali accumulations. This authority divides the **substances which form alkali deposits** into three classes: (*a.*) Neutral alkaline salts, such as common salt, Glauber's salt (sulphate of sodium), sulphate of potassium, &c. These are injurious only when present in large quantities, and relief can then only be obtained by washing them out of the soil by means of under-draining and flooding the land. (*b.*) Soluble earthy and metallic sulphates and chlorides, such as the bitter sulphate of magnesia (Epsom salt), chloride of calcium, alum, copperas, &c. The cheap and efficient antidote to most of these substances is lime or marl. (*c.*) Alkaline carbonates and borates. These, especially the former, are injurious in the smallest amount, rendering the soil-water caustic and corrosive, and in clayey soils almost impossible to obtain good tilth on account of their peculiar action upon clay. The antidote to these (the true alkali salts) is gypsum or land plaster. The **carbonate of soda** is by far the most injurious of all the "alkali" salts enumerated under the three headings. This is due to its corrosive power, and also to the peculiar action (shared with the carbonate of potash), which makes it almost impossible in their presence to produce a tilthy condition in true clays. They are maintained in the most "impalpably divided condition, that of well-worked pottery clay,"

in place of the flocculent though tilthy state assumed in a cultivated soil; and they bring about the dissolution of the vegetable matter or humus, the effect of which action is made apparent by the dark appearance of the alkali spots or "**black alkali**" in some localities.

The accumulations of surface salts vary materially in different parts of Cape Colony. In certain Karoo districts, the most important of which are indicated on Map 3, **nitrate of potash** has been found in considerable quantities, and the belief has become pretty general that the origin of the valuable ingredients in the deposits was the urine of the "dassie" or **rock-rabbit**, with short ears, which on occasions becomes numerous There seemed to be no foundation for the supposition, or any evidence to show that the deposits were of animal rather than of vegetable origin; and it was in 1895 still an unsettled question whether the deposits were in quantity sufficient to pay for the working of them as a source of saltpetre, although companies were being formed with the object of exploiting them. Where nitrate of potash is present in considerable quantity, the areas are limited as compared with the total surface upon which salts accumulate; and if the salt which gave the following **analysis**,* scraped from the surface of a **brak soil** at Culmstock, in the Middelburg district, can be accepted as a representative sample, potassium and magnesium are only present in limited quantities, and **sodium salts** form the great bulk of the material:—

Water	3.0	per cent.
Sand and other mineral matter (magnesic carbonate) insoluble in water	11.0	,,
Chlorine	7.8	,,
Carbonic dioxide	6.2	,,
Sulphuric oxide	33.8	,,

This would nearly correspond to the following, calculating all the alkali present as sodium:—

Water	3.0	per cent.
Sand	9.8	,,
Sodic chloride	12.9	,,
Sodic sulphate	60 0	,,
Sodic carbonate	11.0	,,
Magnesic carbonate	2.5	,,

* Specially made, at the request of the author, in the Laboratory of the Agricultural Department, Cape Town.

Although the final result of the presence of "reh" in British India is barrenness, as in the cases of the brak soils of South Africa and the alkali soils of California, the conditions in the various countries when compared differ somewhat in detail. The neutral sulphate of soda or Glauber's salt, at one time largely used as a drench for cattle, is the most prominent ingredient in the South African and Indian alkalies, common salt, or chloride of sodium, coming next. In California, although each of the salts named forms a large percentage of the total amount present, yet in a considerable number of cases sodium carbonate is most abundant, and in others, if not most largely represented, it is almost invariably present in such quantities that its presence, owing to its noxious effect, is productive of the greatest share of the resulting injury. Clay soils in California are reported to suffer more severely than light or sandy soils, while in India certain light, sandy, or silty soils are as badly affected as any. In India, in addition to the primary causes, which are present in the case of the rise of efflorescences in any country, viz., heat sufficient to produce rapid evaporation, and a sufficient abundance of water to be evaporated, there seems often to be some mechanical defect in the salt-retaining power of the soil. There is little doubt that the peculiar influence which the carbonate of soda has upon clay, has also a good deal to do with the fact that heavy soils in California suffer to a greater degree than light soils in the same neighbourhood, or than the heaviest class of soils in India. The chemical reaction of a fertile soil is slightly acid. The presence of the mild and useful agent, carbonic acid, is a sufficient explanation of this fact. Neutral salts, although soluble, do not readily exercise any injurious influence unless when present in large quantities. It is the caustic nature of the carbonate of soda which gives an alkaline reaction that is mainly responsible for the injury resulting from the presence of this salt in even very small proportions. The object aimed at in applying gypsum as a chemical antidote to soils poisoned by salts of the alkalies, is to induce a neutral condition. Deep drainage, together with frequent and deep cultivation, is necessary in the presence of alkalies of whatever kind.

The saline impurities in irrigation water is another matter for consideration, of equal importance with the existence and

character of the soluble salts in the soil. Much of the "sweet" water in Australia, and the brak water in South Africa, is in no way hurtful to stock when they become accustomed to it, but is not to be used for irrigation purposes. The determination of soluble matters in soil or in water can be accomplished with certainty by the analytical chemist, and when the results are presented, useful deductions can be drawn from them. But in this instance the materials are sought for in the condition in which they naturally exist, and have not to be changed in form, nor has a conjecture to be made as to the possible nature of them, as in the case of a so-called "complete" soil analysis.

It should be remembered that the **solid contents in solution** in clear river water usually vary from 5 to 12 grains per gallon. The waters from brak springs in Cape Colony, and sweet waters from artesian wells in Australia, are unfit for irrigation purposes, as the percentage of saline matter is immensely greater. It is interesting and instructive to estimate the **amount of saline material left** in the surface layer of soil by a system of irrigation where river water is used; and where the whole is ultimately evaporated, there being no escape into drains or into a porous substratum. It should also be understood that the power of the soil to incorporate a certain amount of soluble matter, has been fully satisfied. Ten inches in depth of water is a convenient amount to select as a basis for the calculation, and it is at the same time a usual annual amount actually applied in irrigation practice. Seven grains to the gallon, and a period of ten years in which to carry out the work, would give the following results:—One gallon of water will cover about $1\frac{1}{2}$ square feet 1 inch deep; or two-thirds of a gallon 1 square foot, 1 inch deep; or $6\frac{2}{3}$ gallons per square foot is equal to 10 inches in depth of water. In ten years there would be a deposit of $466\frac{2}{3}$ grains, or about 1 ounce of alkali upon each square foot. If this consisted of salts which entered into the composition of plants, or were not hurtful to them on account of being distributed through the whole body of the soil occupied by their roots, the addition would act as a manure rather than as a cause of injury. Much, therefore, depends upon the character of the salts thus accumulating. If free from carbonate of soda, little

fear may be entertained of river water producing serious consequences unless when it is applied to an area where there is no means of escape for subsoil water. Land on river banks is not likely to be thus affected, as it is found that surplus irrigation water usually finds its way back into the river at a lower point. A case in which danger in the application of river water may be predicted is when a canal, carrying river water, is led into a land-locked depression with only evaporation as a means of escape for moisture. Under such conditions in a hot climate few river waters could be used for irrigation without the ultimate result being injurious. The substratum gradually fills up the basin, and, as the water rises, soluble salts are carried with it from considerable depths.

So important is the matter of the existence of the means of escape for surplus water, that the **irrigation laws** of any community should provide for a **drainage system** where no adequate natural means of drainage exists. It might not at first be necessary to drain for a few years, but if the water-table in the lower levels were ultimately found after regular inspection to rise near the surface, the community in question should be bound to construct drains, so that the owners of land at the lower levels should not suffer by their property becoming water-logged through soakage of water from the higher levels. Near Fresno, in the great California valley, the water-table has risen from a depth of over 40 feet till within 3 to 5 feet of the surface, and in a few places to the surface. In the Salt River valley in Arizona the subsoil water has come up 30 feet nearer the surface since it was settled and irrigated. Irrigation on a considerable scale in Cape Colony is comparatively new, yet many of the dangers and difficulties detailed and discussed have already begun to appear, so that precautionary measures are all the more urgent. The results referred to are the accumulated results of irrigation carried on under conditions that are very similar to the conditions which prevail in the Colonies. They have been found equally true in vast areas in India and America, and it may be taken as purely a matter of cause and effect that the ultimate result in South Africa will be similar under similar conditions. The same natural laws govern the work of irrigation in the countries named, and in fact in all parts of the

world similarly situated. South Africa need, therefore, look for no special dispensation to secure immunity from numerous evils which spring from misguided practice. Her only chance of escape is to employ the means which the results of previous experience have placed at her disposal.

The system of **surface irrigation** is most generally adopted because it is most simple and least costly to establish; but of the **three common methods**—(*a*) surface, (*b*) side, (*c*) sub-irrigation—it is the one attended by most injurious consequences to the land and to the crop. **Side irrigation** may be shortly defined as the supply of water to land by soakage from the sides of open ditches, so that the surface is never injured by flooding. A simple and effective modification of the side or soakage system is in general use in the orchards of the Western States, where the water is guided into three temporary furrows or channels opened on each side of a line of trees and then allowed to percolate through the body of the porous soil lying to the right and left. After the water has been turned off and sufficient time has been left for the surplus moisture, not firmly held by the soil forming the channels, to sink, the surface is cultivated and the channels obliterated to prevent their becoming hard and opening in cracks. **Sub-irrigation** is the system which is held to be the most perfect of all the various methods of applying water where the soil conditions are suitable, because by leading the water on the land in subterranean channels, which are laid like ordinary tile or pipe drains, the least possible supply of water is made to serve the purpose with the greatest benefit to the land and at least cost of maintenance. The channels, if properly constructed, also act as drains when not required for the supply of water. The one drawback is the vastly greater original capital involved in this system than in any other in laying down the underground distributing channels. The cost of tile-draining a field in Britain is estimated at from £6 to £8 per acre, according to the nature of the land and the consequent depth of the drains and width between them. The average cost would be still greater in a new country where wages are high and materials expensive.

The total cost, including head works and distributing channels, of bringing water on land in the territory of Arizona,

one of the most successful and most perfect irrigation centres that are to be found in America, is only £2 to £2. 10s. per acre. No explanation is necessary to show that, under ordinary circumstances where capital is dear, the additional expense of £6 to £8 per acre must make the cost prohibitive. Moreover, in the case of land with a porous subsoil, a portion of the irrigation supply might sink and escape from the soil without benefit to the crop.

A good deal can be done to prevent the appearance of alkali, and also to ameliorate the condition of soil suffering from it, by the selection of deep-rooted and vigorous growing crops that cover and shade the surface, and absorb the water they require by deep and fleshy roots well down in the soil or subsoil. In both ways such crops lessen the upward current of water by capillary action, and consequently lessen the accumulation of soluble salts near the surface. It was thus that the author explained in his work on Indian Agriculture the success of the growth of the rain-tree, *Pithecolobium dulce*, Bth., on "usar" soils. By the decay of deep fleshy roots in the soil, the power to retain soluble salts in its substance is increased, and the total amount left free to circulate in the water of the soil is proportionally diminished. The crop of all others which, from a scientific as well as from a practical and useful point of view, has given the best results under irrigation is lucerne, *Medicago sativa.**

Three of the numerous **irrigation schemes** which are under the consideration of Government were specially inquired into and the proposed sites examined, viz., those at Steynsburg, Slagtersnek, and Oudtshoorn.

The **Steynsburg scheme** is specially favoured by the natural advantages of the locality. A capacious dam can safely be constructed at a moderate cost, and the water distributed over an ample area of good land conveniently situated for economical canalisation. The proposed **barrage** to be built between two abutting kopjes, and constructed of stone

* The greater part of the foregoing pages on the principles of irrigation were written after the author had seen the systems of irrigation in India and Australia, and had paid a special visit of investigation to the Western Irrigation States of America, and first appeared in his work on "The Agriculture and Rural Economy of Australia and New Zealand."

to be found close at hand, would in the centre be 580 feet high and 90 feet wide at the base, and would cost, according to the engineer's estimate, £113,000. The drainage **catchment area** is 80 square miles, and the area of the large reservoir would be 1,000 acres, and its capacity 1,200,000,000 cubic feet, providing a flow of 60 cubic feet per second, or an equivalent of 2.3 feet deep of an annual supply of water over the 26,000 acres which it is proposed to irrigate. Of this, 6,000 acres are Government property. The present estimation **value of the land** commanded by the proposed scheme is 20s. per acre, and its prospective value, with water supplied at an annual charge of £1 per annum, £7. 10s. The **elevation** of the area is about 4,000 feet above the sea, and that of the dam 700 feet higher.

The **rainfall** of the district is 22 to 24 inches, and it is abundantly evident that the amount of water proposed to be supplied will be capable of irrigating, under a proper system of management, more than double the area calculated on—1 "acre-foot," or water to the depth of 12 inches, in addition to the rainfall, being quite sufficient when under control to meet the demand of the crops for moisture.

That the soil is well suited to irrigation has been demonstrated by a settler, **Andries Duplessis**, who has for over twenty years successfully irrigated a portion of it lying to the Thebis Station side of the so-called Springbuck or Thebis Flats. This cultivator takes advantage of the proximity of the railway to send his produce to market in Kimberley. He has secured twenty-two to twenty-five and even thirty fold in his grain crops, when not attacked by rust. The **soil** on these flats is of a browny-red colour, varying in depth from 4 to 20 feet, and it does not become so hard when irrigated as the soil in many parts of the Colony. Similar level areas, to which surplus water could be led, exist farther down the river, which is used as a main canal to carry the water as it comes from the reservoir. The **climate** is temperate, and suitable for the growth of European fruits, including oranges.

This is perhaps the **most promising** of all the large irrigation schemes, because of the moderate amount of money required and the ample prospects of success from the agricultural as well as from the engineering standpoint. The great

question to settle is whether it ought to be a Government undertaking, or a company venture encouraged and supported by a Government subsidy. It would, no doubt, be a success either way. The author, with a wholesome horror of the expensive nature of works conducted as Government concerns, particularly in a country where labour troubles are chronic, inclines to favour the proposal that a **limited liability company** should be permitted to take it in hand, in the hope that the success achieved would lead to the formation of similar companies in other parts of the Colony. There need be no fear of the work not going on if Government offered a subsidy of £10,000 and a free grant of the 6,000 acres of land; the benefits to be gained by Government in return would be the extension of an important colonial industry and the concomitant increase of wealth and prosperity.

The **Slagtersnek scheme** would be a much smaller undertaking, and from the engineering point of view associated with no serious difficulties. A tunnel of 1,100 yards, and deep cuttings of 300 yards more, are proposed to be made from a rocky bend of the Fish River, through the flank of an adjoining hill, the water to be carried to a stretch of fairly level land lying to the south-west of Cookhouse, for a distance of seven miles, by a main canal which would feed five storage dams. From these the distribution over 20,000 morgen of land would take place.

The **weir** in the river would not require to be more than 15 to 20 feet deep, and the total **cost** for main works is estimated not to exceed £50,000. The **misfortune** connected with the scheme, which up to this point looks so exceptionally promising, is that the **land** is not only generally **poor**, but otherwise unsuitable for irrigation. Very little of it could be described as of good quality, much of it being thin and overlying a green shale, and some on an intractable light-coloured "till" or dense clay.

The **Oudtshoorn scheme** was explained to the author on the ground by Percy Ashenden, the engineer in charge of the survey, and found to be one involving greater difficulties, and demanding greater engineering skill than either of the others. The district has been made in the agricultural sense by the success of irrigation, and the fact implies **two sets of circum-**

stances of importance in the development of any future scheme of irrigation. First, that the water-rights of those in possession require to be maintained or compensated for; and second, that the benefits of irrigation having been demonstrated, it will be more easy to calculate from the estimated costs the possible return from a new venture, and more easy also to make it a success with a willing population possessed of technical skill.

It is proposed to construct **two large dams** or reservoirs in the mountains, the **first** to hold 1,700,000,000 gallons with a head of 100 feet, by means of a masonry wall 125 feet high built across a narrow gorge on the Grobelaars River. This would involve the submersion of De Vos's farm, and three or four others situated in the valley pictured in the accompanying plate. The **second** proposed dam would be on the Le Roux River, a tributary of the Grobelaars River, which enters at a lower level than the site of the first dam. It would be formed by a wall 125 feet high, also situated in a narrow gorge between the precipitous banks of the river. It possesses an estimated capacity of 1,500,000,000 gallons. An alternative proposal involves the erection of a wall nearly 200 feet high to hold 2,000,000,000 gallons. The **catchment area** for the two dams would be 100 square miles, possessing a rainfall of 24 inches. The water would be carried down the river beds and collected in a **distributing dam** situated in the Cango Valley. It is proposed to leave undisturbed the **existing proprietary rights**, which number about twenty-five, and are hedged about with many difficulties and complications, and to carry the additional supply of water saved by the dams past the present irrigated land to the new area to be watered by **three main canals**—a high- and a low-level canal on the west bank, and a high-level canal on the east bank of the river. The high-level canals would each be twenty miles long, and the one on the low level somewhat less. This proposal involves considerable **engineering difficulties**, which will materially add to the initial as well as to the annual expenditure, and forms what seems to be the only weak point in an excellent scheme. The **fall** from the highest reservoir is about 1,000 feet to the irrigable land, and the **west bank high-level canal** must, to maintain sufficient fall, wind in a

Photo. by Percy Ashenden, A.M.I.C.E. *Face page 424.*

PLATE 70.—SITE OF A PROPOSED IRRIGATION DAM FOR OUDTSHOORN

most tortuous fashion round the spurs of the foot-hills along which it will pass. To prevent "seepage," involving loss of water and damage to adjoining property, a concrete channel which would necessitate infinite care in its maintenance would be required all the way. The **land** proposed **to be irrigated** extends to 25,000 acres, and is of excellent quality and character for irrigation purposes, although in some places greater depth would have been advantageous. There is not, as at Steynsburg, a practically unlimited amount of land under control upon which surplus water might be used. The **estimated outlay** in the original scheme, which involved the construction of only one reservoir in the mountains, was £15,000; but the more ambitious project, with two additional dams, may involve a capital expenditure not far short of double this amount. The **crux** of the position rests **in the finances.** It can no doubt be made a success from the engineering and agricultural points of view, but it remains for those who take a special interest in the scheme to show that it will pay.

The **Government** is not without **experience in irrigation** and water works carried out under the direction of John G. Gamble, the **Hydraulic Engineer**, who held office for a number of years, and presented voluminous reports on irrigation schemes in various districts of the Colony. The method of **advancing** the necessary **money** to local bodies to build irrigation works has also been tried, but, it is feared, without any very distinct encouragement to continue to do so. A case in point is to be found in the irrigation **dam at Beaufort West**, which was built by the municipality, at a cost of £12,000, with money borrowed from Government at 6 per cent. A successful irrigation community of morgen-lot (2-acre) holders, some of them paying as much as £21 of annual rent, provides the money to pay the interest, but there is no sinking fund, unless one is provided for by the rate of interest charged on the outlaid capital, and the dam is rapidly filling with soil washed from the Karoo-bush veld, from which the water supply is drawn, and which is furrowed and loosened on the surface, and made more easily denuded by the trampling of animals coming and going to and from the dam to drink. In a comparatively short space of time the dam will be filled,

and the Government will probably be expected to write off as a bad debt the sum of £12,000 originally lent to construct the dam.

The **Van Wyk's Vlei Irrigation Reservoir** in Carnarvon divisional district has also proved a white elephant to the Colony. The engineering works were executed in 1882-83 under the advice of the Hydraulic Engineer at a cost of a little under £18,000. The inducement from the engineering point of view was the immense water-holding capacity which could be secured at a relatively small cost.

The original scheme, published in the Hydraulic Engineer's Report for 1880, estimated that a bank about 300 yards long and 35 feet at the highest point would form a reservoir with a capacity of 35,000,000,000 gallons. But the **weak points** of the position, which, had they been ascertained and duly considered, ought to have outweighed all arguments in its favour, were—(1.) The extent of the **water surface** of the dam when full would be 19 square miles, and the average depth only 10 feet. (2.) The **rainfall** for three years 1893-95 was only 4½ inches, and the most sanguine estimated average never exceeded 6 inches; while it was known that it would take an annual rainfall of 10 inches draining from the estimated catchment area of 240 square miles to fill the dam. (3.) The **annual evaporation** from the dam when full would be 7 feet 2 inches, or more than the actual amount of water likely to find its way into it during the year. (4.) There was a decided tendency to the formation of **salt** on the surface soil of certain lands in the district, although the reports of the quality of the soil from the chemical point of view were excellent. No notice was taken of the fact that any soil, whatever its chemical composition may be, will in time become salt on the surface, if natural water be applied to it in quantity, and the evaporation be so great as to exclude the possibility of water escaping by drainage.

When it was realised that the rainfall was altogether insufficient to maintain a head of water in a shallow dam of the capacity in question, the **Carnarvon River was diverted** in 1888 at an initial cost of £900, and made to throw its water into the dam. A small irrigation colony is now maintained on a portion of the land, for which the Government paid £3,300

as compensation for cancelling the remainders of the leases of the farms exappropriated in 1883.

The **report of the bailiff** on the Van Wyk's Vlei estate, published in 1895, shows a total revenue of £1,230, and an expenditure of £490, figures which form a sufficient guarantee of the unimportant nature of the place.

The failure of the Van Wyk's Vlei irrigation scheme ought in future to be a **valuable object-lesson** to the Irrigation Department of Government. The results have been perfectly natural, and need not be regarded as in any way discouraging, if the elementary principles in the management of irrigation water be duly attended to. However salt a soil may become during a period of years of neglect or bad management, there need be no insurmountable difficulty experienced in restoring it to a sweet and wholesome condition for the growth of crops, with an abundant supply of water at command. The **free drainage** of surplus water is the great means for the **prevention of brak**; and **washing**, which also implies thorough drainage, is the infallible and only real and sufficient means for overcoming the braky condition.

There are **two systems** of washing. The **first** involves the running of water over the surface without making any preparation for it, to encourage sinking into the soil—a system which is wasteful of water, and possesses neither efficiency nor any other redeeming feature; and the **second** is the system in which water is imprisoned on the surface of the soil, and made to soak through it into drains, which carry it off along with the salt which it dissolves during its passage. The following is a description of the latter system (fully investigated by the author during a visit to Lower Egypt in 1891), which is successfully carried out on an extensive scale in the salt areas of the Nile Delta,* and is as applicable to the brak soils of South Africa as to the salt soils of Egypt in the north of the continent:—

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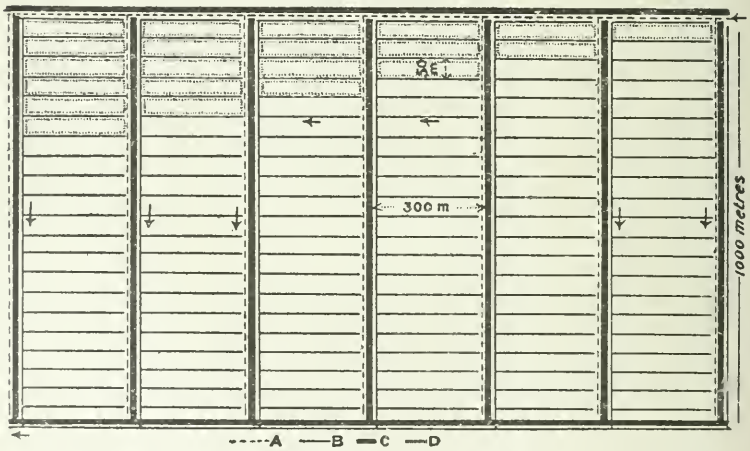
* The facts were communicated, and the original of the accompanying figure plan drawn, by A. C. Welch, Bachelor of Science in the Department of Agriculture, Edinburgh University, Manager, Aboukir Land Reclamation Company, and a former student of the author.

The accompanying figure or ground plan shows the **canalising** of an ideal farm or "hod" of 420 feddans * (or 436 Imperial acres). It is laid out by two parallel main drains (B) 1 kilometre (5 furlongs) apart, only one of which is shown at the foot of the plan. These have a surface width of 4 to 6 metres (1 metre = 39.371 inches), and the earth thrown out of them forms an elevated road (C) at each side if required, of 6 metres wide. Along the upper side runs the farm canal (A), with a width of 2 metres, and depth $\frac{3}{4}$ metre. The land is subdivided by main drains into fields or "hoshays" 300 metres wide and 1 kilo. long, containing 70 feddans each. These "hoshay" drains have a surface width of 2 to $2\frac{1}{2}$ metres. Two-thirds of the earth thrown from them forms a road (C) along one side, and one-third of it laid to the other side forms

PLAN SHOWING THE EGYPTIAN WAY IN WHICH BARREN SALT LAND is laid out to be washed to make it fertile and capable of growing crops.



A, *Canals bringing fresh water.* B, *Drains carrying off salt water.* C, *Roads—elevated.* D, *Banks of earth 6 to 10 inches high.*

merely a retaining bank (D). The road is made 4 metres wide. On the other side of the road runs the subsidiary field canal (A), with a surface width of $1\frac{1}{2}$ metres, and depth $\frac{1}{2}$ metre. These 70-feddan fields are further subdivided by drains (B) into twenty plots, each containing $3\frac{1}{2}$ feddans, and measuring 50 by 300 metres.

The smallest drains are cut $\frac{3}{4}$ to 1 metre deep according to the land level. On low-lying land there is never 1 metre of drainage, but $\frac{3}{4}$ metre ($2\frac{1}{2}$ feet) is found to be sufficient. They are never made deeper than 1 metre, as they fill in so readily on the salt soil. If 1 metre deep, they are made $1\frac{1}{4}$ metres wide; if 0.75 metre deep, only 1 metre wide on the surface. The earth is thrown out to each side, forming banks, (D), only shown

* 1 feddan = 1.038 acre.

on the upper portion of the plan, about 1 metre wide, and, when consolidated, 6 to 10 inches high. A small "berm," or narrow strip of land between the ditch and the bank, 10 inches broad, is cleared and left on each side. On the larger drains the slope of the sides is kept as nearly as possible at 1 : 1, *i.e.*, an angle of 45°. The land requires to be gone over carefully with the levelling instrument first to make sure that the canal is being placed on the upper side of the field, and the escape drain on the lower.

The cutting of the drains is usually done in the months May to August, when the water is scarce, and drainage consequently low. In September the Nile flood comes, and the land is filled as full as the banks will hold. Aided by the pressure of the head of water, water by degrees filters through the body of the soil into the drains, carrying the salt with it. One man (pay £1 per month) attends to each 70 feddans regulating the water admitted, so that the land may neither stand bare, nor the banks burst under the pressure of an excessive supply. The land is thus kept full of water till March, when it is dried off and ploughed. In April water is filled on again and "dineba" is sown. This is a kind of grass which appears in large quantity as a weed in the rice-fields, and is the first crop the land will carry. Owing to the limited supply of summer water, only one-third of the land can be sown with dineba in April, the remainder being sown when the flood comes in September. By the way in which the dineba springs, the extent to which the land has been freed from salt can be gauged. If it grows well, berseem (Egyptian clover) may be sown the following October, and the success of this crop is an indication that reclamation has been accomplished, and cotton can follow. If the berseem does not grow well, the land may be washed in the following winter, or barley, which will grow where berseem will not, tried as a winter crop, and dineba again sown the next summer as a reclaiming crop. It grows like rice in water kept 6 inches deep.

The readiness with which sweetening takes place depends directly on the extent to which percolation proceeds when washing. Land consisting of stiff black clay a metre deep is very difficult to wash. Light sandy land, with only 5 or 6 inches of black alluvial clay on the surface, washes very readily. The former washes better when ploughed and subsoil-stirred.

If, during the first winter's washing, reeds and grasses appear, this land may, with some hope of success, be sown with rice in summer, but as rice requires a large amount of water, the area of its growth must necessarily be restricted.

Cost per Feddan,

The cutting of drains being done at 1½d. per cubic yard—

If small drains, ¾ metre deep, 10s. per feddan;

If 1 metre deep, 14s. per feddan.

Average cost of cutting . .	£0	12	0
Washing, six months at £1 per month per 70 feddans (in round figures) . . .	0	1	9

Ploughing, 4s. per feddan . . .	£0	4	0
Dineba seed	0	1	8
Levelling, sowing, and watering for three months	0	2	0
	£1	1	5

If the dineba grows well it may realise 4s. per feddan, but this is not to be relied on.

Second Year—

Berseem seed	£0	9	0
Sowing and watering, &c. . . .	0	1	0
	£0	10	0

Total cost, £1. 11s. 5d.

To allow for land which does not grow berseem the first year, and therefore incurs further expense, the total reclamation cost may be estimated at £2. Further expense must be put down to cultivation, which ought to give an immediate return. Thus, the first ploughing is done by contract by natives for 4s., but after berseem, or even before, bullocks must be bought to put in the cotton.

There is a great difference between simply washing and reclaiming, the latter embracing much more than the former. The salt land is bare of vegetation, and therefore very poor in organic matter. Anything which will encourage weeds to grow is of advantage; hence the benefit of dineba, as it fills the land with roots. The salt soil is also too consolidated, and after washing, it requires to be broken up with regular ploughings, to allow of the oxidation of other deleterious substances which exist. Roasting in the hot Egyptian sun, and flooding with the rich red Nile water, are stages of the after-treatment which follow one another regularly.

Land is sometimes salt in the vicinity of **brak springs**, owing to the seepage of the salt water from the overflow. Deep **drainage** would at once check the supply of salt to the soil, and render the process of sweetening simple.

The **most prominent defects** in the common system of irrigation practised in Cape Colony are (1) the too frequent and too abundant use of water, and (2) the leading of water too much over the surface of portions of the land intended to grow crops. It is no unusual thing to hear of a man who leads water on the same land once a week during summer, and once a month during winter, when probably two or three waterings annually are all that would be actually necessary under a proper system of management. And again, it is too com-

monly the practice to let the water go at the upper end of a long ridge or bed to find its way over the surface to the lower end of the land to be watered. Such treatment leaves the upper portion of the field washed and water-worn, and in a condition not unlike the bed of a stream. The water, in the case of land growing grain crops, is sometimes kept within bounds in the line of its course by **low earth-banks**, or walls made by a **wall-block**, a triangular wooden implement, 9 feet wide, resembling a snow-plough, which is dragged over the surface after the seed has been harrowed in.

In Chapters X. and XXIV. it has been partially explained how the **injury** from excessive, and from surface watering, **might be minimised**. Much harm could be prevented by **leading the water** on to broad ridges **by means of supply drains**, one running parallel with and between each pair of ridges (or more correctly, nearly level beds), and elevated by building their sides above the surface to be watered, so that the water would flow from them on to the land. The beds could then be thrown into little squares by the formation of earth-banks a few inches high, at right angles to the supply drains. One side of each square being contiguous to a drain, a supply of water would be available within a few feet of any spot to be irrigated, and the surface washing would be thereby avoided. Such a system implies **full control** of the water supply, as any given area of a few feet in a field can be watered, or can be kept dry, without regard to what is being done in other parts of it. Greater **skill and care** are no doubt necessary, and these in one sense entail greater cost for labour, but not greater in proportion to the results obtained under the improved system as compared with those derived from the old and imperfect one.

In many cases, especially where land is being laid down, say to lucerne, for a period of years, a durable adaptation of the system described (known in California as the "**check and levee system**") might advantageously be adopted.

The land is first deeply ploughed, and, by the use of **scrapers**, well known in the Colony in connection with the making of earth-banks for water-dams, the soil forming the knolls is lowered into the hollows, and the surface made as level as possible. The levees (banks), along the crowns of which the

distributing ditches pass, are thrown up by the scrapers skimming off the surface when the ground is originally level, or when uneven by removing the elevations close to the levee, advantage, if possible, being taken, in the interests of the general work, of natural ridges when they occur. The **levees** stand 12 to 18 inches high at the crown, and gradually slope off on each side to ground level, where the base is 6 to 10 feet wide, so that harvesting machinery can pass over them without difficulty. The **checks** or enclosed spaces are by the formation of cross levees made of various areas and shapes, dependent upon the natural formation of the ground, and whether the surface be level or sloping, as well as upon the amount of money to be spent. The **water-supply ditches** run along the crowns of levees, which lie in the direction of the fall or hang of the surface, and from these the water is let out where and when desired. A little **practical experience** and judgment soon indicate the position in which the levees ought to be raised for the even and most economical distribution of water, the ideal direction being, when local circumstances permit, at right angles to each other on account of the greater facility with which machinery then passes over them. The land generally presents the **appearance** of an **uneven chessboard** of squares, irregular four-sided figures, triangles, &c., of different sizes.

The permanent "**head ditch**" runs along the higher end of the field. After the first crop has been removed, and the land has again been ploughed, the **distributing ditches**, which get obliterated, are again struck out where required along the levee crowns.

It is best to begin work each year after harvest on the stubble, and to do as much as possible before next seed-time, as it takes several years to thoroughly level and smooth the surface, the water indicating the position of the depressions which require to be filled up. When **irrigation begins**, the water passes into one check until it has received enough, then the inlet is closed, and the water is led on to the next, and so on, until the whole is completed. In addition to the natural rainfall of California (10 to 25 inches annually), one **thorough soaking** of the land before sowing, and one irrigation at night-time when the crop is about 9 inches high, on

sandy loam, will secure a crop. In many localities where the soil has greater power of retaining moisture, one good soaking before sowing is sufficient.

Harrowing fills in the distributing ditches, so that the reaper easily passes over them, but in spring a man is sent round as an extra safeguard to smooth off any irregularities.*

There is no doubt a **great future** for **irrigation** in **Cape Colony**, under skilled guidance and management. The want of water is great in the widest areas, but not to such an extent as is generally supposed. There are unique **advantages in the natural formation** of the surface, which are furnished by chains of mountains in which water can be easily stored in dams to be constructed at moderate cost.

One great question remains to be settled, viz., in what way can Government best lend its aid to the numerous irrigation schemes, which will sooner or later be brought forward. The **author** is strongly **of opinion**, in the light of the experiences of Victoria, and the Irrigation States of Western America—that the initiative should be taken, and the great burden of the responsibility be borne, by the people who take an interest in the development of any given scheme, and who are to be the greatest beneficiaries by its success, the duty of Government being to give all possible reasonable encouragement, and even, under well-conceived regulations, to provide material assistance. Only by such means will it be possible to draw the line between injudicious schemes, such as that at Van Wyk's Vlei, which ought never to have been undertaken, and those which are worthy of consideration and encouragement.

The subjoined **Memorandum**, which was courteously prepared for the author by the Honourable The Chief-Justice of the Cape of Good Hope, Sir J. Henry de Villiers, will show **how the law stands** in relation to many of the more important questions which are likely to arise in connection with irrigation water-rights.

The only legislation in the Colony relating to water-rights is to be found in Act No. 36 of 1882. That Act, however, does not define water-

* The author is indebted to E. M. Arnold, B.Sc., also a former pupil, for refreshing his memory with regard to the foregoing details of the Californian system of laying out land for irrigation.

rights, nor does it specify the modes in which such rights may be acquired, but merely provides facilities to persons having a right to water to convey such water across the lands of other persons. In order, therefore, to ascertain the rights to which riparian proprietors are entitled, it becomes necessary to fall back on the common law which, in the Cape Colony and the other South African Colonies and States, is the Roman Dutch law. This task is by no means a difficult one, seeing that the Supreme Court of the Cape Colony has, by a series of decisions, settled all the questions which have already arisen, and has laid down certain general principles for the decision of questions which may still arise between riparian proprietors. The leading case is that of *Hough* v. *Van der Merwe*, decided in 1874, where it was held that the owner of land by or through which a public stream flows is entitled to divert a portion of the water for the purposes of irrigation, provided, firstly, that he does not thereby deprive the lower proprietors of sufficient water for their cattle and domestic purposes; secondly, that he uses no more than a just and reasonable proportion of the water consistently with similar rights of irrigation in the lower proprietors; and thirdly, that he returns the water to the public stream with no other loss than that which irrigation has caused. What constitutes a just and reasonable use was held to be entirely a question of degree, which depends upon the circumstances of each particular case. That decision has been followed by the other South African Courts, and the chief difficulty which has arisen in its application has been to discover in each case whether the stream is a public or a private one. Of navigable rivers there has been no question, because there are none in the Colony. Until 1876 it had been generally supposed that a person on whose land water rises was the owner of the water, and could treat it as a private stream; but in that year it was laid down, in *Vermaak* v. *Palmer*, that if for thirty years or upwards the stream had flowed down to the lower proprietors in a known and defined channel, they were entitled to treat it as a public stream. In the same case it was decided that a stream which occasionally ceases to flow during the heat of the day in very dry seasons, but which never dries up at its source, is to be treated as a perennial, and therefore a public stream, and that an upper proprietor has no right to the exclusive enjoyment of the water. In 1879 it was decided, in *Jordaan* v. *Winkelman*, that lower proprietors do not by the exclusive use of the water for any period, however long, acquire the right to prevent the upper proprietor from claiming his reasonable share at any time. The court there appointed a competent person to report to it, after due examination, what would be a fair distribution of the water among the different riparian proprietors, taking into account the nature of the soil over which the stream flows, the extent of land belonging to each proprietor, the comparative extent of land capable of cultivation, and the distance of the different cultivated lands from the main stream. But although, in the last case, the lower proprietors acquired no exclusive right by using nearly all the water when it reached them, it has frequently been held that if a lower proprietor leads water out of a public stream above the upper proprietor's land, and has for thirty years or upwards used this water peaceably, openly, and

as of right, he may thus acquire a right to the water to the exclusion of the upper proprietor. In the same way, if an upper proprietor has for thirty years diverted all the water for his own purposes, the lower proprietor cannot claim his share even of a public stream.

In 1880 the Court of Appeal reaffirmed the views that a stream may sometimes become dry in the heat of summer without forfeiting the character of a perennial, and therefore of a public river, and that a person's right to deal as he chooses with water rising on his own land is subject to the limitation that the water thus rising is not the source or the main source of a public stream.

It sometimes happened that the course of a stream was altered by means of an artificial water-course, and the question then arose whether, if the stream has flowed down to lower proprietors in the new channel for thirty years or upwards, they are entitled to use that water for purposes of irrigation. In 1882 it was decided, in *Myburgh* v. *Van der Byl*, that the riparian proprietors of such artificial water-course may thus acquire all the water-rights which they would have had if it had been a natural stream. In the subsequent case of *Municipality of French-Hoek* v. *Hugo*, decided in 1883, it appeared that the Court of Landdrost en Heemraden had in 1810 authorised Hugo's predecessors in title to divert a stream, which would naturally flow down one side of the mountain, down the other side. The Courts of Landdrost en Heemraden were district courts, established during the Dutch occupation, which, among other duties, settled water disputes. These courts have long since been abolished, but their decisions still regulate the distribution of water between hundreds of riparian proprietors in this Colony. In the case just mentioned, the Court held that Hugo, having used all the water in the new channel for the period of prescription to the exclusion of the municipality below, could not be interdicted from such further exclusive use. This judgment was affirmed, on appeal, by the Privy Council.

In the case of *Struben* v. *Waterworks Company*, decided in 1892, the question arose whether the owner of land who, in digging the land, abstracts underground water, which would otherwise find its way into a public stream, is liable to the lower proprietor, and the following rules were laid down. The owner of land is entitled to the water which rises thereon, except in so far as such water has for thirty years or upwards been a source of a public stream, in which case his right in respect of the accustomed flow is limited by the rights of the public, so far as they are capable of being exercised, and by the riparian rights of the lower proprietors. The lower proprietors have a right to a share of the accustomed flow only, and therefore if the upper proprietor, by operations upon his own land, acquires an additional supply, he is not bound to allow such additional supply to flow down, but may treat it as his own. A person who, by digging a well in his own land, for the *bona fide* purpose of improving the value of such land, abstracts underground water finding its way in undefined, and to him unknown channels, is entitled to all such water, although the abstraction may cause a diminution in the supply of other wells, or even of a public stream. The cases in the

Colonial Courts are generally those in which a lower proprietor complains that the water required for his needs has been diverted by the upper proprietor, but it occasionally happens that the upper proprietor complains that the lower proprietor has obstructed the free flow of the water, and has thus thrown back the water. In the case of *Ludolph* v. *Wagner*, decided in 1888, the Supreme Court held that where a person has the right to discharge water on to his neighbour's land by means of a natural channel, or by means of an artificial channel, which has existed for thirty years or more, he may increase the ordinary flow to the prejudice of the lower proprietor, if such increase be occasioned in the ordinary course of draining, ploughing, or irrigating the upper land, and be not greater than is reasonable under the circumstances. If the channel becomes choked through neglect, he may compel the lower proprietor either to clean it himself or allow him to do so.

The above rules, of course, only apply where the proprietors have not made any agreement among themselves for the distribution of flowing water. Such agreements are extremely common in those districts where cultivation can only be carried on by means of irrigation. In some cases the different owners have the simultaneous use of the stream, and the distribution takes place from a reservoir by means of pipes of different dimensions, according to the quantity allotted to each. In other cases the proprietors irrigate by turns, each being entitled to the whole stream for a certain number of hours a day, or a certain number of days a week or month. Agreements of either kind are often made when a farm is partitioned among several owners, and they are generally based upon the award of arbitrators chosen to effect a distribution. The agreements are registered with the title-deeds in the Registry of Deeds Office, and thus become binding upon all future owners of the land, whether they had previous notice of such agreements or not. Where the courts are applied to for relief, on the ground that some of the proprietors are deprived of their reasonable share of the water, it is not unusual for the court to appoint some expert in the district to report to the court as to the most suitable mode of distributing the water, having regard to all the circumstances of the case. The report is generally adopted, but it frequently happens that the court makes the adjustment upon the evidence submitted to it without the assistance of an expert. In former years disputed cases of water-rights were of frequent occurrence, but since the farmers have come to understand the principles which regulate their rights such cases have been rare, and when they do arise, are oftener than not amicably settled without the intervention of the court.

CHAPTER XXIII.

AGRICULTURAL IMPLEMENTS AND MACHINES.

Transport Work on Colonial Roads—The Transport Waggon—"Braying" Green Hides to make Ox "Rims"—Ploughs used in Cape Colony—Harrows—Cultivators—Rollers—Self-binding Reapers—The Australian Stripper—The Prices of Implements.

THE **transport waggon**, drawn usually by sixteen oxen,* was at one time the sole means for the conveyance of travellers and commodities between the coast and the interior of South Africa. Coaches and railways have superseded them in certain parts, but locally and in the undeveloped interior the bullock waggon is still the great means of communication. Progression by this mode is slow but it is sure, and, above all, it is comparatively inexpensive. Few people, accustomed only to the splendour of the trappings and the general appearance of the British **dray horse** in the lorries of the railway companies and those of the great brewers or other merchant princes, realise how worthless these would be in a new country without roads, and where food has to be picked up anywhere or anyhow; and how admirably suited is **the ox**, the embodiment of power, endurance, and patience, to trying surroundings.

The **first roads** of a country are merely waggon tracks, which wear in places into sandy ruts in dry weather and into muddy holes when rain falls. No repair is ever attempted. When one part becomes wheel-worn or water-worn and too difficult to pass over, a new way is taken alongside on the veld. As an instance of the ultimate result, the author counted at one place as many as thirty-two parallel tracks lying close to each other forming the old main waggon road from Port Elizabeth to Cape Town.

The transport **waggon for up-country traffic**, to carry

* See Plates 10, 13, 50, 51, and 68.

from 3 to 5 tons Imperial, **costs** about £100. The **weight** is 30 to 32 cwts., and the **length**, gauged by the bed-plank or floor, is about 17 or 18 feet, experience having shown that 20-feet waggons are too large and cumbrous. The **floor**, 4 feet 1 inch wide, is usually laid with Baltic deal 9 inches by 1½ inches. The top **side-beams**, 17 to 18 feet long, are made either of stinkwood or pitch pine 9 inches by 3 inches; the side-rails of the same materials 3 inches by 2 inches. The **understell** consists of two scammels, two axle-beds, and one drie-board, all of black ironwood. The ironwood **beam underneath**, which rests on the axle beds and connects the fore and hind axle, is 11 feet 6 inches long. The **diameter** of the back **wheels** is 5 feet, and of the fore wheels 4 feet 7 to 8 inches. The **naves**, made of yellow-wood, or better, of flat-crown, a native wood of Natal, are 14½ inches long, the fore pair being 11½ inches and the hind pair 12½ inches in diameter. The best **spokes**, 3 inches by 1¾ inches, are made of assegai wood, which is extremely strong, hard, and durable. The **felloes** consist of the wood of white pear or bitter almond, 4½ to 5 inches in depth and 3 inches thick. The **axles**, imported in halves which are welded after they arrive, are 3 inches in diameter at the thickest of the round part, and cost about £3 each. The **brake** is made of 1¼ inch diameter imported iron. The four iron **wheel shods**, which weigh 3½ cwts., are 3 inches broad by ⅞ inch thick. The black ironwood **disselboom** or draught-**pole** measures 11 feet 6 inches in length, and the round **yoke** (see Plate 13) 5 feet 3 inches, with a diameter of 3½ inches, pierced by four slots to receive the **yoke-keys**. Eight stinkwood yokes weigh 1 cwt. The **oxen**, usually sixteen coupled together in pairs—the front pair led by a man or boy by means of a halter tied to the horns—are yoked to one long **draught rope** (usually of "brayed" leather thongs) which passes up the middle of the two lines of cattle when they are in position. The animals are stimulated to exertion by the driver walking alongside and using freely a long leather-thonged bamboo-handled **whip**.

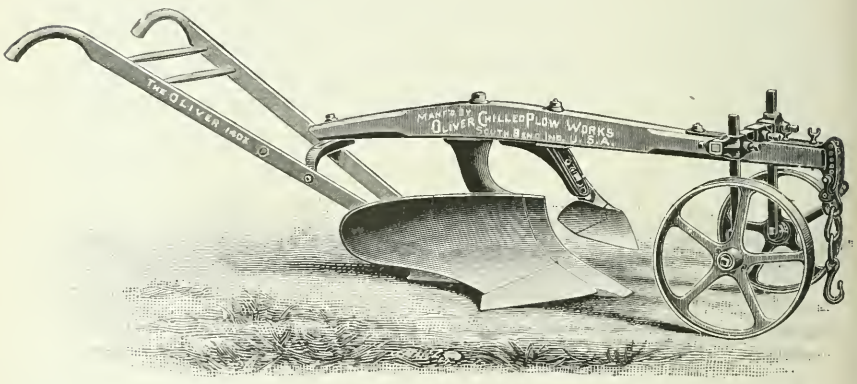
Braying is the simple and largely mechanical process by which raw hides are prepared for the making of the rough white leather-harness in use in the country districts of the

Colony, and of the "rims" or powerful leather ropes just alluded to. A green bullock's skin is wetted and buried in the dung of a kraal (sometimes within a bag) for two days, more or less, according to the season and the condition of the manure. The heating due to fermentation which takes place removes the hair, but the action is not permitted to go on long enough to injure the skin. Gathered together from the sides, it is then hung up by one end, probably to a tree, with a weight, frequently a waggon wheel, suspended from the lower extremity. It is kept moist, and twisted to the right and then to the left until it begins to become white; then, to soften it, the hide is greased with sheep's fat mixed with fish oil or lard. Twisting and greasing at intervals are continued until the hide becomes pliable and white throughout. Between the times, which may be two, three, or more, the hide is hung up to twist, it is stretched laterally and horizontally on poles, and the inner surface hacked with a blunt hoe to expand it, and to remove any flesh which may have been left if the operation of skinning has been badly executed. The preparation takes at least the labour of an industrious man a week. Good skins, which would sell green at from 12s. to 18s. each, are worth, when prepared, from £2 to £3. Rims are usually cut out of the green hide in a long strip of an inch or more broad, beginning at the edge and going round and round, as in this form they are more easily handled than the uncut hide while braying. Under the treatment the leather becomes very soft and pliable, and extremely strong. Thongs, called "rimpies," made from the fine soft skins of bucks, are extensively employed by people living on the veld for pointing whip lashes, mending harness, and for the common purposes for which twine is generally employed in more densely populated places.

Recent years have seen an immense increase of the numbers of ploughs in Cape Colony. At one time the old "75," a strong, but badly constructed heavy single-furrow plough, was to be seen almost everywhere. It has to a great extent been replaced by lighter and better formed implements, though it is still used for breaking in land from the veld. When doing rough work on stony land, it is a usual practice to

attach the "rims" of the draught oxen to a piece of **No. 9 wire** fastened to the head of the plough, so that with any excessive strain, which is expected to occur at times, the wire and not the plough, or the gearing of the cattle, gives way. This plough's most conspicuous redeeming quality is inexpensiveness, as it costs only 23s. at port. One of the greatest drawbacks to the new forms of plough is the **cost**. The "Flying Dutchman," a favourite two-furrow American implement (by the Moline Plow Co., Ill.) costs £15 before it can be delivered up-country.

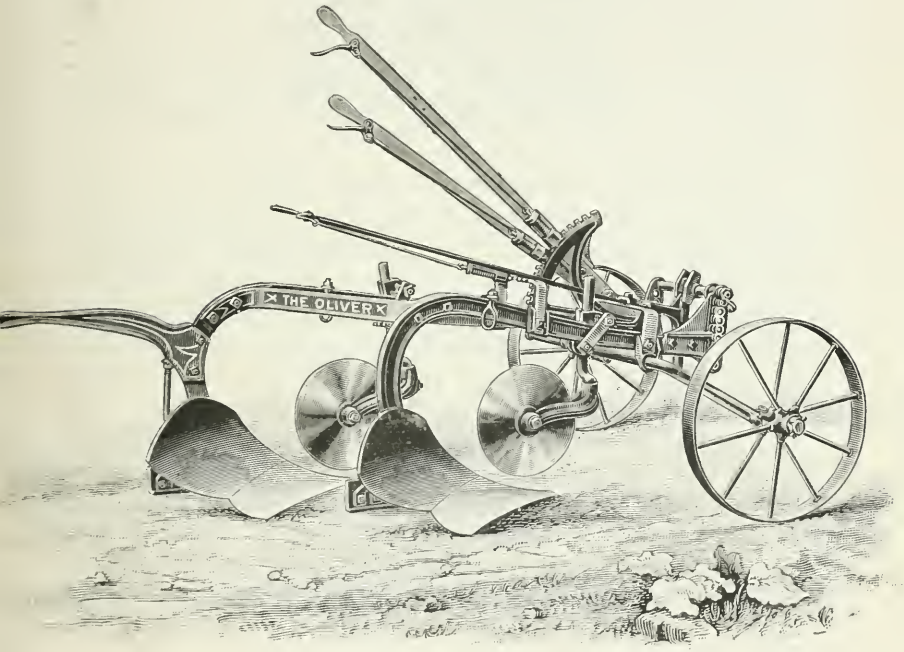
Single-furrow ploughs, like that of Ransome, the Swedish, the Oliver (No. 140 X), and the Steel Swift, for breaking and for first ploughing, which ought to be done to a good depth, **two- or**



Oliver's No. 140 X Chilled, Double-Wheel, Walking Plow.

three-furrow ploughs like the one already mentioned, and those bearing the names of Howard, Eckerst, German Zas, Ransome, and Oliver, are increasing in favour for ploughing in seed and for preparing a seed bed, the work being less expensive than when a single mould-board plough is used for such purposes. Where cattle are used, twelve **oxen** will draw a three-furrow plough, covering 27 inches in breadth, while six **mules** in the Western Province will draw a two-furrow plough, turning over 18 inches at a time. To close and open irregularly shaped lands a single-furrow plough and two strong mules should be used, to avoid the trampling of the surface already ploughed by the numerous mules drawing a two- or three-furrow implement. Two wheels, when fitted to a plough, are more satisfactory than one.

The **digging action** of ploughs, with a pulverising wing for breaking down the furrow slices, as is done by the **J** of Howard, Farror, & Company (a plough with a long beam which does deep and thorough work), is appreciated in some districts. **One-way ploughs** are also employed on hill-sides and when garden and orchard cultivation has to be done. The Ames Plow Company, New York, and the Oliver Chilled Plow Works, South Bend, Indiana, both contribute useful implements of this description. (See Appendix G.)



Oliver's N.D. Steel-Bottom, Two-Furrow, Gang Plow.

The **quick grass** already mentioned as a widely distributed weed in South Africa, gives a great deal of trouble while the work of ploughing progresses, if the implement be not of a shape which will overcome it. The **share** should be pointed, not broad, and the **standard** or main perpendicular support of the body requires to be placed 4 or 5 inches behind the forward edge of the mould-board doing the perpendicular cut, and about 3 inches nearer the furrow side than

is usual in a plough constructed for work on clean land, so that the **roots**, which incline to form in a tangle round the standard, slip off to the left, and drop into the furrow. A **skim-coulter** with a pointing share cuts the roots near the surface of the ground, and should invariably be used in weedy ground. The skim should be set to cut not more than 2½ inches deep, and the same width, or slightly wider than that of the furrow slice. This prevents any increase of draught from double cutting, such as occurs when the skim-coulter is set to cut narrower than the furrow slice.

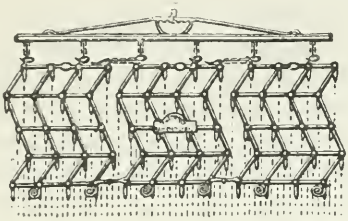
In **ploughs of defective construction**, with narrow shares cutting 6 or 7 inches, joined to mould-boards able to turn a 14-inch furrow slice, or with broad shares and narrow set mould-boards, the draught is greatly increased, and little more than half the surface soil is turned over.

The **Oliver single-furrow chilled plow** is one of the most scientifically constructed ploughs of the day, and it has within recent years become widely used and appreciated in Scotland. For the preference of farmers for this American plough over the original forms of Scotch plough there are **two good** and significant **reasons**—(1) Three pairs of horses working in the Oliver plow will do as much work as four pairs in the old plough; and (2) owing to additional working parts being supplied when worn, these can be replaced by the ploughman without entailing the loss of time and the expense which were formerly necessary in taking the "irons" to be relaid at the smithy.

Oliver's is a **centre-draught plow.** The beam rests on a pivot at the top of the standard, so that its direction can be changed under varying circumstances, and the draught maintained in the centre of the beam.

Another great improvement in the construction of recent forms of the Oliver plow is the **slanting check plate** on the land side. When ploughing soft land, the soil does not tend so much as formerly to fall back into the furrow, and the horses have a clear furrow to walk in. Moreover, in ploughing lea or hard ground, the furrow slice is shaped so that it turns over much more easily under the pressure of the mould-board than the rectangular furrow slice, the edge of which tends to support it in a perpendicular position.

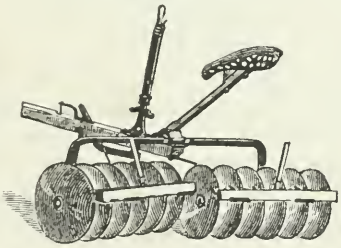
The **great advantage** of the modern improved plough, especially where soils are gritty, owing to the presence of volcanic *débris* or water-worn shingle, so that the cutting points and edges wear rapidly, is that all easily worn **parts** are **detachable and replaceable** at a moderate cost. A saving is also effected in the substitution of hard full **chilled iron** for



Common Zig-zag Harrow.

tempered steel, and the adoption of **reversible points** and share wings, so that when the plough-point becomes rounded below, by turning it is made to present an effective cutting edge.

The great inducement for Kaffir cultivators or for small farmers to plough shallow, probably only 4 inches deep, so that



Disc Harrow or Pulveriser.

a full crop cannot be got, is the fear of breaking their old and rickety ploughs by going deeper.

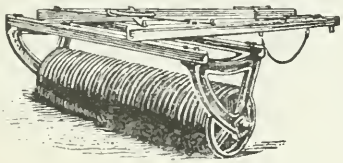
The old **triangular Dutch harrow**, with sides 9 feet in length, and wooden tines driven through them, is still to be seen at work; but of tined implements, the iron **zig-zag harrow**, drawn by six to eight oxen or four to six mules, is the one generally adopted by progressive cultivators. The **disc harrow**, under the name of **the pulveriser**, has quite

recently been coming much into favour. It is chiefly **used for** breaking down the furrow slices after ploughing, killing annual weeds, and covering seed grain after sowing. On soil in good condition for the purpose it will sink 4 inches by its own gravity, and can be made to work deeper by placing weights on the frame. On clean land in South Africa no other implement would better suit the conditions, but used on **land growing couch** no means could be found better calculated to establish it and encourage its growth. The **method** employed **in India** for the cultivation of couch (dúb) on lawns when it becomes thin is to grub it up, so that the fibrous roots and underground stems get divided into numerous pieces. Each piece becomes a centre of growth in the future. The disc harrow at work in a field growing couch cannot fail to cut the plant up, and to bury portions of it sufficiently deep to be safe from the destructive influence of the sun. As a pulveriser pure and simple, the **Acme harrow** would do the work of the disc harrow without planting couch, but unfortunately it is not as a pulveriser that the disc harrow is most appreciated or most wanted. The present price (£17), delivered in the country, is prohibitive to a great many struggling cultivators.

The benefits in orchard work of the use of **cultivators** drawn by mules have been fully demonstrated in Cape Colony, and the larger field cultivator or grubber is becoming more widely used than formerly. It will when better understood be more and more appreciated under South African conditions. The objection to the disc harrow does not in any way apply to the cultivator.

The **Massey-Harris** steel-tined **cultivator** was found doing excellent work under varying circumstances in different districts. (See Appendix F.) The tines, made of steel, tempered to suit the work to be done, are stronger than they appear to be; and a sufficient degree of flexibility prevents a tine breaking when it comes in contact with a boulder or other rigid obstacle. This new form of implement is lighter in draught and more thorough in work, as well as more rapid in motion, than the original forms of heavy grubbers which are familiar in British farm practice. The cultivator is equally valuable on **light land,** where it can be

made to do a large proportion of the work of stirring the soil, and on **heavy land,** where it can be employed to break the furrow slices immediately after ploughing, to prevent them baking into hard and impenetrable brick-like masses. In this as in the former case its usefulness is enhanced by associating it with the Cambridge or **ring roller.** This **combination of work** brings about a **fineness of division** of the soil particles, and at the same time a sufficient degree of **compactness** of the surface to **prevent** the excessive **escape of soil moisture** by evaporation. The cultivator also does excellent service when employed to **stir wheat stubbles**, to encourage the germination of weeds and shaken grain, so that they may supply food for stock for a period, and be easily killed before the succeeding crop requires to be planted. The single exception to this statement is in the case of the wild oat, *Avena fatua*, which grows more freely after the plough than after the cultivator.



CAMBRIDGE OR RING ROLLER.

The **Cambridge roller,** which is also a clod-crusher and pulveriser, is peculiarly well suited to South African conditions of soil and climate. Where **soils** are so light that they are liable to be **blown by** the **wind**, the use of a **flat roller** is sure to aggravate rather than to check the injury, but the influence of the fluted-edged rings of the Cambridge roller is beneficial. When the ring roller is used, the surface does not cake after heavy rain as it does when the plain cylindrical implement has been employed; and the passage of the ring roller over a surface thus affected improves its condition.

The **self-binding reaper** is now extensively used in harvesting ripe crops in the chief grain-growing districts of the Colony. The **scythe** is mostly employed in cutting oats for hay, as it is thought to form a better sheaf for marketing. In the Koeberg district the writer found the M'Cormack and the

Massey-Harris string binders high in favour. (See Appendix II.) The **price**, viz., £45, in districts near the coast, or £55 inland, makes it impossible for a cultivator on a small scale to invest in a reaper on his own account.

The Australian stripper has been used by a few cultivators in the Colony. It ought to be specially serviceable on the occasions when locusts come near harvest time, as they gnaw the straw and weaken it a little below the ears, and increase the loss through heads falling off when the crop is reaped in the ordinary way.

With the **expansion of the demand** for improved forms of implements, and a concurrent **greater competition** for public favour by an increasing number of implement makers, the prices naturally decline, as was well illustrated when the "Iron Age" cultivator was brought into competition with its rival the "Planet Junior," which was earlier in the field. South Africa, owing to the nature of its climate, and to present and impending labour difficulties, is undoubtedly a **splendid field** for the display of the advantages of good farm machinery, but unremunerative **prices of farm produce** sadly deter even the most enterprising farmers from investing money in new appliances.

CHAPTER XXIV.

FIELD CROPS, ROTATIONS, AND MANURES.

Summary of Crops Harvested—Wheat—Improved Method of Irrigating Wheat Land—Wheat-Growing Districts—Rust in Wheat—Steeping or Pickling the Seed of Grain Crops before Sowing—Cross-Fertilisation as a Means for the Prevention of Rust in Wheat—The Gartons' Newton-le-Willow Experiments—The Mealie or Maize Crop—Kaffir Corn—Sunflower—Rotation of Crops—Oats—Barley—Threshing by Travelling Mill and by Trampling Out—The Potato Crop, its Diseases and Means of Prevention—The Tobacco Crop—Luffa—Manure and Manuring—Locusts.

THE subjoined comparative general **Summary of the Returns** of Farm Crops Harvested in 1894-95 * will indicate what are the chief crops grown, and the relative proportions they bear to each other. It also shows how **small the crop** of last year was as compared with the crops of the two previous years, a circumstance largely accounted for by the exceptional extent of the injury done by locusts, drought, and other causes, as the total amount of seed put in the ground did not materially differ from that sown during the two preceding years. Crop yields are almost invariably estimated in South Africa as **so many fold** of the seed used, a practice which does not convey much information to the mind of one accustomed to calculations of so many bushels to the acre. It is essentially an indefinite method of stating returns, as on rich land less seed is required, and the yield is much greater per unit than on poor land.

Wheat, the staple food of the white population, is naturally by far the **most important cereal** crop of Cape Colony, 83,697 muids (3 bushels each) being planted in 1894-95, against 49,681 muids of mealies, the next most extensively cultivated crop.

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* See also page 113.

Comparative General Summary—Return of Corn Crops Harvested.

Particulars.			Amount in Muids*—Colony Proper.	Transkei and Walfish Bay.	Total Whole Colony.
1894-5	Wheat . .	Muids	804,384	17,180	821,564
1893-4	,, . .	,,	999,514	33,029	1,032,543
1892-3	,, . .	,,	1,265,788	31,178	1,296,966
1894-5	Barley . .	,,	219,444	2,234	221,678
1893-4	,, . .	,,	256,962	3,032	259,994
1892-3	,, . .	,,	334,795	6,233	341,028
1894-5	Oats . .	,,	318,902	6,880	325,782
1893-4	,, . .	,,	457,515	5,973	463,488
1892-3	,, . .	,,	534,930	10,776	545,706
1894-5	Oat Hay . .	Bundles	34,518,416	2,948,383	37,466,799
1893-4	,, . .	,,	37,895,078	3,233,083	41,128,161
1892-3	,, . .	,,	39,331,724	3,793,299	43,125,023
1894-5	Rye . .	Muids	143,854½	722	144,576½
1893-4	,, . .	,,	186,798	252	187,050
1892-3	,, . .	,,	182,208	154	182,362
1894-5	Mealies . .	,,	449,263	344,037	793,300
1893-4	,, . .	,,	536,519	383,850	920,369
1892-3	,, . .	,,	528,901	382,352	911,253
1894 5	Kaffir Corn .	,,	90,270	188,913	279,183
1893-4	,, .	,,	188,433	290,915	479,348
1892-3	,, .	,,	123,757	248,904	372,661
1894-5	Potatoes . .	,,	253,071	14,003	267,074
1893-4	,, . .	,,	302,708	11,480	314,188
1892-3	,, . .	,,	Not taken.	...	...
1894-5	Tobacco . .	lbs.	4,720,903	241,628	4,962,531
1893-4	,, . .	,,	4,699,465	379,679	5,079,144
1892-3	,, . .	,,	4,313,980	173,670	4,487,650

The crop returns for 1895 show for the whole Colony a **yield of 11 fold** harvested, exclusive of crops to the extent of over 6 fold that were destroyed, results which are a few bushels below the average of former years. This is estimated to be about 18 fold. In Caledon 12 to 15 fold are got, but there wheat is grown without irrigation, and without any proper

* 1 muid = 3 bushels.

system of crop-rotation, and on soil which is naturally shallow. Dry land at a considerable elevation on the way up from Aliwal North into the New England district was seen undergoing a single ploughing, and was not expected to return more than 8 to 10 fold. In the same district when water is applied, a preliminary ploughing done during summer, and a second ploughing before sowing in April on the advent of rain, 20 to 30 fold are got from land in situations favourable for irrigation, and in consequence generally of better quality.

On the excellent **holm land near Lady Grey**, where wheat grows remarkably well after mealies planted on land newly broken in from the condition of veld, a yield of 30 to 40 fold can readily be reaped. The practice there is to grow wheat three years, then oats or barley for two years before wheat is again sown. If wheat be grown four years in succession, the last crop is very poor. **Dry land wheat** is naturally not so plump as that grown by irrigation, but it is not necessarily inferior for milling purposes if it has matured properly.

In **Oudtshoorn district** wheat is planted in the end of April, in May, and in the beginning of June—the latter being the best time. Early planting does not in that part of the country prevent rust. The yield of wheat is not so great in the district as the high state of fertility of the soil might lead one to infer. There is a tendency in the crop to grow too much foliage; and following a well-known condition in other parts of the world, to wheat grown on land which is rich in combined nitrogen, as the Oudtshoorn land is, owing to the success of lucerne cultivation, rust is very destructive, and is becoming increasingly so as fertility increases. There it is found that the grain grows best in the case of crops that are **watered early**—an operation which no doubt checks the luxuriance of the growth by hardening the soil about the roots of the plants.

In certain districts of the Colony, where **black soil** occurs in the hollows and **red soil** on the elevated portions of the same field, although the crop grown on the red soil is much smaller than the other, it is sounder, makes much better bread, and is not so liable to rust as wheat grown on the richer black soil. The excellent practice on rich soil of eating off by sheep wheat and other cereal crops when they show indications

of suffering from premature luxuriance, is not properly understood by many Cape farmers, but it is a useful means when properly carried out of increasing the yield and improving the quality of the grain. It requires, however, to be adopted with caution if the land has been worked rather wet and left in small lumps, as the wheat plants are then less firmly rooted, and are liable to be pulled up by the sheep.

In Koeberg district **rust** usually comes in November. It is worst in seasons when the rains stop in September, and not so bad when it is wet into October. To escape the rust the early beardless "du Toit" wheat is grown by some in Koeberg and Malmesbury districts, although late bearded wheat is preferable on account of growing more vigorously, and not being so easily shaken by the wind as the beardless variety. The experiences in different parts of the country with regard to rust are somewhat divergent, but this need not be wondered at when distances are so great and conditions so various. In Sterkstrom district rust usually appears in its worst form after fogs, associated with sudden changes of temperature (even 40° and 45° F. in one day), in November or early in December, when the wheat is going into flower. It is found that it is not very badly affected if the crop be sown in March and April. The crops of slovenly farmers who get behind in their work, or those who practise the running of cattle over the arable land late in the season, and delay planting in consequence, are those who suffer worst when a malignant attack comes.

In the district of **Aliwal North**, March and April is also a favourite time for sowing grain crops. Wheat planted at that season always yields a crop, although at times it may not be bountiful. Soft wheat grows well without rusting, and is preferred by millers to hard wheat. **Barley** and **oats** sown in this district before Christmas suffer badly from rust.

In **Grahamstown** district opinion as to the best period to sow is divided—some preferring to plant wheat in March and April, when sufficient rain has come to make ploughing possible, and others, adopting the Kaffirs' method of delaying till the four dry months have passed, sow in September and even later. Wheat sown earlier in the middle of July is cut about Christmas, and can be followed immediately by

either beans or potatoes. Kaalkop wheat, a beardless variety well liked by millers, has in times past been considered one of the best rust-resisting varieties in the Eastern Province, but it is losing its constitutional vigour, as plants naturally tend to do when grown for a long period of time in the same district.

A number of **important questions** relative to the planting and management of the wheat crop are like that just referred to, **unsettled**, and the author is firmly of the belief that much more satisfactory results than the present ones will ultimately be attained when the management of **irrigation water** is better understood. Much of the land which is now thought to be incapable of growing wheat without repeated waterings during the period of its growth, will probably be found to grow steady profitable yields of sound grain of excellent quality without watering after planting if a liberal supply of moisture be present in the subsoil when the seed is sown.* This might conveniently be arranged by thoroughly soaking the soil before the first ploughing. It might then be safely ploughed somewhat deeper than it would be judicious to do for a seed-bed, and a proper degree of solidity and fineness might be secured by the use of the disc harrow and Cambridge or ring roller. A little before sowing, a **second** liberal **watering** would sink well into the soil, and the effects of the surface washing which would occur during the process could be effaced by **ploughing in the seed** with a furrow slice of about 4 inches deep, when the soil had become sufficiently dry on the surface not to bake into a hard condition when exposed to the sun. The plant would thus begin its growth with roots not too near the surface, and with abundance of moisture beneath them. The main consideration in the after-treatment would be the **preservation of moisture** by keeping the surface layer of soil loose, and in a finely pulverulent condition. This, with grain crops which are not drilled, can safely and inexpensively be accomplished according to circumstances by the use of the common **harrow** and **ring roller**—one or other or both. If the land be loose from being lumpy, a consequence of work-

* For example, a stretch of 10,000 acres of deep alluvial soil, excellent for wheat growing, which could be watered in the way suggested from a dam proposed to be constructed at Tygerpoort, near Britstown.

ing when it is too wet, the roller is necessary at first. If the sowing has been done under favourable circumstances, the harrow put right through the crop, when the blade is about 6 inches above ground, will loosen the surface, and will not pull the plants out of root, but give them a fresh impulse to grow. If on commencing operations too soon it is found that the wheat is being pulled out of root, harrowing must be delayed till the roots go a little deeper. After the crop is fixed the work may be undertaken, without doing any injury, one or more times until the plants are 12 or even 15 inches high. Harrowing may also be safely done some days after sowing, and after the seed has begun to germinate, if the fibrous roots have not begun to extend themselves. Where the conditions of soil and climate are such that it is absolutely necessary to water the crop while growing, the longer the watering can be delayed without doing injury the better, in the interests of the subsequent condition of the land and the roots of the wheat plant. Even when a thorough soaking of irrigation water has not been given before planting, a double turn of the harrows would in a great many cases be much more beneficial than a first watering to many crops.

The following are the twenty **most important** divisional **wheat-growing districts** of the country, as shown from the amounts, stated in muids, of wheat harvested in 1894-95 :—

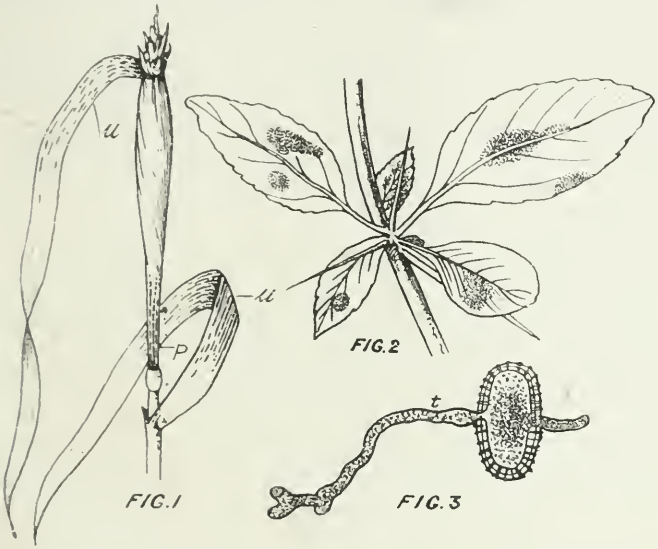
Division.	Wheat—Muids.*	Division.	Wheat—Muids.*
Malmesbury	173,059	Graaff Reinet	16,880
Piquetberg	50,693	Calvinia	16,673
Cape	37,188	Queenstown	16,318
Caledon	35,102	Cradock	16,214
Oudtshoorn	24,793	Aliwal North	16,143
Wodehouse	29,297	Tarka	15,869
Paarl	27,558	Barkly East	14,379
Herschel	22,861	Bredasdorp	12,810
Albert	22,783	Ceres	11,671
Middelburg	18,981	Uniondale	11,326

Malmesbury is by far the most important wheat-growing area, yielding more than three times the amount of Piquetberg, which comes next with a good lead in front of the Cape division, the third in order of merit.

The **coast land** about Alexandria and the adjoining dis-

* 1 muid = 3 bushels.

tricts was at one time a great grain-growing country, but now it is not good for this purpose owing to rust which came to these parts nearly forty years ago. It was in the country before that time, as residents of sixty years' experience in the Colony remember noticing it on their arrival. In the early days oats were free from the attack, although in later years the oat has often been as badly affected as the wheat plant. Up-country rust is not so injurious as in wheat-growing districts as



RUST FUNGUS, PUCCINIA GRAMINIS, ON WHEAT AND BARBERRY LEAVES.

FIG. 1.—Upper portion of a Stalk of Wheat, with Groups of the *Uredo* (*u*, *u*) on the Leaves, and of the *Puccinia* (*p*) on the fast-ripening Leaf-sheath and Straw. FIG. 2.—Portion of a Branch of a Barberry, with a Tuft of Leaves attacked by *Æcidium berberidis*, which forms Yellow Cushions on the Leaf-blades and Stalks. FIG. 3.—Germinating Uredospore (very highly magnified) of *P. graminis*, showing the development of a Germ-tube (*t*).—WARD.

near the coast as Queenstown. Blue-corn, a Rivett wheat with a pith in the straw, is one of the best rust-resisting varieties grown in the Eastern Province.

Rust or mildew of wheat is due to the presence of a **parasitic fungus** known by the name of *Puccinia graminis*, Pers. The **mycelium** of this fungus ramifies through the substance of the leaves and stem of the wheat plant, and lives on its juices. As time goes on, it produces first crowds of single-celled oblong or egg-shaped seeds or **spores**, of a bright

orange colour, one-thousandth of an inch long, which may be observed as masses of innumerable powdery granules on the surfaces of the foliage. This stage is technically termed the *uredo* of the fungus, and is popularly known as "rust," which shrivels or burns up the crop, as its scientific name implies. Three or four weeks later the linear red patches first observed become "purple-brown or almost black in colour," as the spores now produced are of a dark purple-brown, not a yellow hue. The colour changes gradually until no yellow remains. Microscopic examination of the dusty colouring matter shows that then all the **uredospores**, coloured by minute yellow oil drops in their protoplasm, have disappeared, and that they have been replaced by *teleutospores*, also, like the former, borne on stalks connecting them to the mycelium, but consisting of two larger cells more club-like, and of a dark purple-brown hue.

While uredospores readily germinate on being put into water, the teleutospores, being resting spores intended to carry the life of the fungus over a cold or a very dry period, do not readily do so under similar treatment until they have been exposed for months to atmospheric influences. Some will even remain fertile for three years, and germinate when introduced into suitable conditions. Although the spores germinate, and throw out germ-tubes (Fig. 3), ready to penetrate by boring through the cell-walls of a suitable host, it is the accepted belief that neither of the spores described can do so in the case of wheat or other grass plants, and reproduce the fungus in the succeeding year's crop.

The fungus has yet a third, the *æcidium* stage of its existence, which in Europe, so far as it is known, is passed on the leaves of the **barberry**, where, supported by mycelia which ramify through their parenchyma, the masses of *æcidiospores*, which closely resemble those of the uredo stage, produce "waxy cushions," or "bright yellow patches thicker than the rest of the leaf." On being shed and placed on the leaves of susceptible young wheat, æcidiospores produce, first the uredo, and later the puccinia stages of the fungus. **De Bary**, who made known this discovery in 1865, had previously demonstrated that the puccinia of the wheat gave rise to the æcidium of the barberry. Another undiscovered, intermediate host

probably exists in South Africa, as there can be no doubt the fungus, *P. graminis*, is there similarly endowed with the power of *heteræcism*.* All the ordinary means used for the prevention of other fungoid attacks upon grain crops have failed to cope with rust in South Africa, as in other parts of the world.

The well-known fungoid parasites, *Ustilago carbo*, Tul., producing **smut**, and *Tilletia caries*, Tul., **bunt**, are in evidence in the Colony, but they are more spasmodic and not so destructive in their effects as the rust fungus. They only attack a proportion of the grain plants in a field, not the entire crop or the plants in considerable patches of it, as is the case with rust, and injury can be entirely prevented by **steeping** or **pickling** the seed before sowing, to kill the spores which adhere by the aid of a sticky material to the surfaces of the grain. The spores of the rust fungus find their way to the young plant after it is well above ground, and are not necessarily sown with the seed, which is the explanation of the fact that pickling is of no avail as a means for preventing rust.

The **uncertain nature of these fungoid attacks** is well illustrated by the following examples. In the neighbourhood of Sterkstrom undressed Boer oats were half consumed by smut, while hard wheat, which was practically free from that fungus, was seriously injured by rust; and up in the New England district, where rust is said to do little injury, attacks of both smut and bunt are bad.

Steeps of bluestone (sulphate of copper) or of lime solutions of indefinite strength are frequently employed, and the common sulphur-lime and also Little's sheep dipping material of double the prescribed strength for sheep dipping have been successfully used. There is a danger of destroying the seed if the solution of bluestone be made too strong, but in proper proportions, viz., 1 lb. of the blue crystals to 4 bushels of wheat, there is no safer or more effective dressing. It is best prepared by dissolving in a few ounces of hot water, ultimately made up by adding cold water to half a gallon, which is just sufficient to wet the outside of the grain, when well mixed on a smooth

* The foregoing has been written on the lines laid down in Ward's "Diseases of Plants" (Society for the Promotion of Christian Knowledge), from which the figures are borrowed with acknowledgments.

floor. In the case of **oats or barley** the solution ought to be half the strength, as these seeds are more easily injured than wheat.

Although no method of dressing or spraying, either wheat seed or the plant itself, has been of any avail in checking rust, yet the fact that certain robust varieties of wheat have within themselves a greater power of resistance than other wheats, has led to the belief that the best, if not the only really effective way to overcome rust, is to be found in developing the constitutional vigour of the plant. And the solution of this great problem seems to be on the verge of consummation by means of **cross-fertilisation.** Most interesting and useful work in this direction has been carried out since 1880 on a comprehensive scale by **R. & J. Garton**, at **Newton-le-Willows**, Lancashire, England. Fifteen to twenty acres have been utilised, and many thousands of experiments have been carefully and scientifically conducted with a large number of varieties, and even what were formerly regarded as species of wheat, brought from most of the great wheat-growing centres, including Europe, Asiatic Russia, America, India, China, and Japan. Perhaps the **most striking and useful results** have been gained by crossing common wheat, *Triticum sativum*, with a hard-skinned species, *T. spelta*, or spelt wheat.

The **flower of wheat** is furnished with three stamens, bearing anthers, and one pistil, terminated by two feathery branches, and the plant is entirely **self-fertilising,** impregnation occurring before the flower opens and the stamens appear. This persistent in-and-in-breeding having gone on for countless generations, the wheat has followed the general law of nature, and as a result has lost constitutional vigour. The **operation** necessary to bring about cross-fertilisation is performed by removing the anthers with a pair of fine forceps while yet immature. The glumes which surround and protect the sexual parts of the flower are then tied together for a time, and afterwards ripe pollen is poured in, so that one or more grains may rest on the pistil, and do the work of fertilisation The **immediate result** of cross-fertilisation is the production of numerous varieties with very divergent characteristics, including appearance, some being unlike either parent, and unlike any form known in cultivation; but most,

at the same time, possess much greater constitutional vigour. A type originating on a single head, after one or more crosses, may be at first fixed, and be capable of reproduction; but as a rule it has been found necessary through a series of years to make selections of the forms that are desirable for preservation, and in time samples are got which breed true to type like the wheats with which cultivators are generally familiar. In the final selections only what appear to be the best are retained, and the great majority of the infinite variety of what may be regarded as sports discarded.

The **prominent results** which have so far been attained are:—

(1.) Great **increase of constitutional vigour**, showing conspicuously to naked-eye observation in the enhanced yield and the increase of size. The latter may be judged of after perusing the accompanying **plates** of new varieties of wheat, barley, and oats, grown by the **Brothers Garton**, to whom the author is indebted for the plate originals, and for much valuable information connected with the work of cross-fertilisation.

(2.) The **union** in one plant of two or more **valuable qualities** which previously existed in separate varieties of wheat.

(3.) **Early maturity** even greater than that of either parent—a useful quality in a country liable to early frosts, or to rust affecting the wheats which mature late in the season.

(4.) Absolute **freedom from rust** in many cases, and the reduction of it to a matter of indifference in others.

The following is a **brief outline** of the experiments in which the types of wheat represented in Plates 71, 72, 73, and 74 were produced at Newton-le-Willows:—

The Figs. on **Plate 71** illustrate a selection of **six evolved types of wheat**, from an innumerable number of perfectly distinct types, the result of a composite cross. Many of those rejected possessed features entirely different from any of the parent forms. The original varieties employed were:—Triticum Spelta (Black), White Chidham, Mainstay, Pedigree Red, Hardcastle White, Hungarian Red, Hungarian White, and used in the following order:—

A. Hardcastle White on Black Spelta.
B. Hungarian Red on White Chidham.
C. Progeny of A on Pedigree Red.
D. Hungarian White on Mainstay.
E. Progeny of D on Progeny of A.
F. Progeny of B on Progeny of C.
G. Progeny of F on Progeny of E.

The Figs. represent specimens selected from the third year's growth from a single grain.

Descriptions of the parents used :—

Triticum Spelta (Black).—An extremely early variety, with a very tenacious chaff, producing a grain remarkably rich in gluten, but the brittle character of the ear renders it useless for commercial purposes.

Chidham White.—An early beardless variety, with white grain and chaff, short thin ear, straw thin and weak, only moderately fertile; special features, earliness and good quality of grain.

Mainstay.—A late, rough-chaff, very prolific, beardless variety, chaff and grain white, straw strong and of medium length; special features, strength of straw and prolific yield.

Pedigree Red.—A hardy, beardless, white-chaff, vigorous, late variety, grain large and dark amber, straw of moderate length but weak; special features, its hardy vigorous character and size of grain.

Hungarian Red.—A hardy, vigorous, late, beardless, red-chaff variety, with dark amber grain, very short compact heads, and only a moderate length of straw, but very strong; special features, hardiness and strength of straw.

Hungarian White.—An early white-chaffed, bearded variety, grain white and of good quality, but deficient in yield; special feature, earliness.

Hardcastle White.—A beardless, white-chaff variety, grain white and of good quality, straw medium length but weak; special features, quality of grain.

The following are the **principal features of the types evolved** from this combination :—

Plate 71, Fig. 1. In the form of the head of this specimen the influence of three parents is distinctly visible. In the general form of the head it resembles Pedigree Red, but differs from that variety in being slightly heavier set; the chaff is black, showing the influence of Triticum Spelta (Black), whilst the bearded form is transmitted by the Spelt or Hungarian White, both being bearded types. The tenacious nature of the Spelt chaff is also very prominent.

Fig. 2 is abnormally congested, and exhibits features which are not found in any of the parents used; the colour and strength of the chaff shows the slightest trace of Triticum Spelta, and the woolly chaff of Mainstay is very prominent.

Fig. 3 partakes of the form and colour of Hungarian Red, the chaff being dark amber coloured; the beards show the influence of Triticum Spelta and Hungarian White.

Fig. 4. In this the character of Hungarian Red is very prominent, the head being very compact and the chaff dark amber in colour, but much stronger in texture, partaking in this respect of the Spelta parent. In opposition to this very compact form of head, which only measures 2½ inches in length, and possesses eleven breasts, another type evolved from this combination measures 9 inches in length, but possesses only the same number of breasts.

(1) (2) (3) (4) (5) (6)

PLATE 71.—A SELECTION OF SIX EVOLVED TYPES OF WHEAT. *Face page* 458.

Produced at Newton-le-Willows from a Composite Cross, the parents used being Black Spelt, White Chidham, Mainstay, Red Pedigree, White Hardcastle, Red Hungarian, and White Hungarian. Reduced to Half Natural Size.

PLATE 72.—TWO EVOLVED TYPES OF WHEAT. *Face page* 459.

Grown at Newton-le-Willows. Similar to those on Plate 71, with one of the parents (Hardcastle White) in the centre for comparison.

Specimens of three grains from each head are shown below them, the progeny being 50 per cent. larger than the parent. Reduced to Two-thirds Natural Size.

Fig. 5. This shows the same abnormally congested form of head as is seen in Fig. 2, but exhibits more of the character derived from the Spelt and the Hungarian White, being bearded, and having a black tenacious chaff.

Fig. 6. The character of Hungarian Red is very marked in this specimen, the chaff being of a dark amber colour, but the head is longer than that parent, showing the influence of the long-headed varieties.

Other specimens show numerous and distinct features which represent in some degree the influence of the various parents used. Other distinctive features appear in shape and colour of grain, length and strength of straw, periods of maturing, hardiness of constitution, and whether of a sterile or fertile character, details which would alone fill a small volume.

Plate 72 shows two types evolved from the same combined cross, together with one of the parents used in the combination for comparison, the parent illustrated being Hardcastle White, a standard variety. The grain at the foot shows the relative size of the grain produced in each of the progeny, and also in the original parent shown. The form of the ear and the colour of the grain are very similar in each of the progeny, except that the one is bearded, showing the influence of the bearded parent. The grains of the progeny, weighed against the grains of this original parent, show an increase of 50 per cent. in size of grain alone. Although very similar in form of head and grain, they vary in general characteristics, the bearded head being earlier than the unbearded. In this combination one of the parents, Paine's Defiance, is of a very distinct character from the rest of the parents used. In the first cross, this variety was used in conjunction with Hardcastle White, the latter being the female, and the former the male parent. The progeny resulting from this cross were all more or less inclined to sterility of ear, although many of them were remarkably vigorous. This cross also produced a powerful reaction in the progeny, the sportive tendency being very strong. These two varieties produced progeny which proved very sterile in the first cross, but when combined with the progeny of another cross, of a less violent character, the resulting progeny were normally fertile, although many of them exhibited the same amount of vigour as was shown in the previous cross. Many of the types evolved possessed very valuable features, and produced no sterile tendency when used as parents in subsequent crosses. The parents employed were :—Hardcastle White, Squarehead, Paine's Defiance, Victoria de Automne, Pedigree White, and Talavera, which were used as follows :—

A. Paine's Defiance on Hardcastle White.
B. Victoria d'Automne on Talavera.
C. Squarehead on Pedigree White.
D. Progeny of B on Progeny of A.
E. Progeny of C on Progeny of D.

Descriptions of the parents used which have not already been described :—

Squarehead.—A beardless, white-chaff wheat, with a short thickset

head, straw of medium length and very strong, late in ripening, grain dark amber, and of medium quality only; special features, strength of straw, and prolific yield.

Paine's Defiance.—A variety of the Coned or Rivett wheat, *Triticum turgidum*, ear long, well set, and heavily bearded, straw very long and strong, very productive in grain, but inferior in quality, and very late in coming to maturity; special features, length and strength of straw, and prolific ear.

Victoria d'Automne.—A hardy, vigorous, late unbearded variety, white-chaff, grain large dark amber, and straw of moderate length but weak; special features, hardy vigorous character and size of grain.

Pedigree White.—An unbearded, white-chaff variety, with straw of medium length but weak, grain white and of good quality; special feature, quality of grain.

Talavera.—A white-chaff, unbearded wheat, straw weak, grain of good quality and very early; special features, earliness, and quality of grain.

Plate 73.—The most prominent feature of this evolved specimen is the increase shown in the quantity of grains produced in the breasts, each breast counting seven and eight perfectly matured grains, and the individual grains themselves showing a similar increase in size to those in Plate 72. Although this type shows an average of seven grains per breast, still it is eclipsed in yield by either of the two types shown in Plate 72, owing to the smaller number of breasts produced by the ear represented in Plate 73. The average number of grains on the head in Plate 73 are as follows:—14 breasts, averaging 7 grains to each breast, 98 grains to the head. The longest head in Plate 72 counts 24 breasts, averaging 5 grains to each breast, 120 grains per head. Still the wheat figured in Plate 73 is more valuable as a parent, possessing characters which are deficient in the other type. These two types have already been crossed with the object of combining the prolific form of breast in Plate 73 with the greater number of breasts on the head of that in Plate 72, and types will be selected which unite the greatest number of good points represented in the two parents.

Plate 74 shows side views of two specimen heads, A and B, of evolved types of wheat, and one of the parents, C. Type A produced larger grains of much finer quality than B, but the latter was far more prolific. By crossing the two together types were secured which united the prolific tendencies of the one with the superior quality of the other.

The varieties of **Triticum Spelta** were used to fix the grain of the cultivated varieties more firmly in the chaff, and to improve its milling quality. Although the true black character of the Black Spelt is not shown when grown at Newton-le-Willows, still the resulting progeny, although growing under the same conditions, exhibit this property to the fullest degree, many being quite black in the chaff.

At the commencement of the experiments, composite crosses were made before the types were fixed, but now the progeny is not used as parents until it is **fixed in character**, and the results are much more satisfactory.

PLATE 73.—AN EVOLVED WHEAT CROSS *Face page 460.*

Grown at Newton-le-Willows. It has 14 breasts, averaging 7 grains to each breast, or 98 large grains in the one head. Natural Size.

A C B *Face page* 461.

PLATE 74.—SIDE VIEWS OF TWO EVOLVED TYPES OF WHEAT WITH ONE PARENT BETWEEN.

Grown at Newton-le-Willows. One new type produces a moderate yield and very large grain of fine quality, and the other a much larger quantity but of inferior quality.
The best qualities can be secured in certain of the progeny by mating the two varieties together.

It is very seldom that anything is evolved showing any special value subsequent to the third year from the single grain; after this time those which differ from the type are merely deteriorated forms.

In crossing very distinct types of wheat and oats, sterility of head and grain generally results from the first cross; but in barleys, however distinct the types crossed have been, there has never been the slightest trace of sterility in any form, although the most distinct types have been combined.—R. & J. GARTON.

The experiments have long passed the stage when they could be regarded only with interest akin to curiosity, and they have grown on scientific lines into one of the most valuable practical developments in the interest of agriculture of this century. The record comes next to that of Rothamsted in the promise of its usefulness to agriculturists. The work is on a par with the work of that greatest of experimental stations in being solely the result of individual enterprise. The Gartons have recently become associated with Lord Winchilsea, whose heroic efforts on behalf of the union of the three great agricultural classes—landlords, tenants, and labourers—have become a household word; and it is anticipated that some of the benefits which have been so fully experimentally demonstrated at Newton-le-Willows may soon be realised by the farming community.

Cape Colony would do well to share in the advantages to be gained, and might do so with an unusual measure of certainty under terms which would necessitate payment according to results. Under satisfactory guarantees of the safety against illicit distribution of their grains among cultivators the brothers Garton would be ready to introduce choice varieties judged suitable to South African conditions—the remuneration other than actual outlay to be dependent upon the success achieved.

In agreeing to the Parliamentary vote, it would not be unreasonable if the members who are interested in the people having cheap bread insisted upon a promise from the Protectionists that the import duties upon grain would be reduced as soon as it had been demonstrated that the vigorous new varieties of the Newton-le-Willows grains are proof against the evil influences of the rust fungus.

The **mealie**, maize, or Indian corn crop supplies the staple food of the black population of South Africa. It is strong and vigorous, and can, without irrigation, be cultivated where the common European cereals would not grow, if the soil about its roots be well worked, and kept loose on the surface—a requisite of cultivation which the Kaffirs are more alive to than Europeans. It is **planted** on the flat, preferably on alluvial soil, or land being broken into cultivation, the seed being frequently sown in every third furrow as ploughing progresses. In the after-working there is this benefit gained when the earth is hoed up into **ridges** about the foot-stalks of the plants, that the surface remains in a condition so that ploughing in preparation for a second crop can be done almost at any time—a decided advantage when seasonal rains are long delayed. The yield for seed sown, according to the last crop returns, was nearly 22 fold, exclusive of an additional 6 fold which were lost.

The chief **districts** in which **mealies are grown**, with the amounts in muids harvested in 1894-95. are given in the subjoined table :—

Division.	Wheat—Muids.*	Division.	Wheat—Muids.*
King William's Town	84,706	Bedford	13,277
Herschel	32,880	Stockenstrom	11,674
Victoria East	28,260	Oudtshoorn	11,228
Glen Grey	27,860	Humansdorp	9,817
East London	20,480	Peddie	9,704
Queenstown	17,315	Somerset East	8,576
Fort Beaufort	13,722	Graaff Reinet	7,859
Komgha	13,651		

After harvest a Kaffir hangs up his mealie cobs, fully exposing them to the air for two or three months. When thoroughly dry, they are **buried in a pit**, shaped like a short-necked water-bottle, dug 8 to 10 feet deep underneath the cattle kraal, the narrow mouth being covered by a flat stone, and the joints drawn with fresh dung to hermetically seal it. In the South African climate a foot or more of well-trodden cattle manure covering the floor of the kraal effectually protects the store from rain, and even from serious injury from moisture. The aroma inside is fresh and agreeable, being not unlike that of malt or of fresh sweet silage. A

* 1 muid = 3 bushels.

MEALIES OF INDIAN CORN, ZEA MAYS, L.—THE DURA SHAMI OF LOWER EGYPT.

few mealies which become moulded round the edges of the pit are utilised for making Kaffir **beer**, a beverage having the consistency of thin porridge, of which the natives are fond.

Mealies are largely **consumed** during the growing season in a **green** state. When fully ripe, they are often ground into meal, made into thick porridge or "**pap**," and eaten, either alone or with milk, by means of large wooden spoons. When not ground into meal, the mealies have the glazed outer husk or covering of the grain removed by the native process of "**stamping**," usually done by women, as shown in the accompanying plate. The grain is wetted and put into a wooden mortar, in which it is beaten by stamping with a wooden beetle-shaped pestle. The corn that gets thrown out during the operation is usually anxiously waited for and speedily devoured by a few hens, which naturally seem well-to-do. To prevent excessive leakage in this way, the succulent leaves of a dwarf fig-bush, if at hand, are sometimes put in to supply a pulpy material which holds the corn until the work is completed, and which is easily removed by washing.

Kaffir corn or great millet, *Sorghum vulgare*, Pers., the juár of India, is, next to the mealie, the most important native crop. The divisional districts in which it is most extensively cultivated are here mentioned in order of importance—Herschel, King William's Town, Glen Grey, Victoria East, and Peddie, but chiefly the first two. The plant is the largest of the so-called **millets** which form a large proportion of the food of the inhabitants in tropical countries. It is represented by numerous varieties, and is suitable for cultivation on the heavier classes of soils. Although a dry land crop, it grows well under irrigation. In India it is drilled, 3 lbs. of seed being used to the acre as a crop to grow alone, or at times as a mixed crop. The straw from the ripened crop makes useful fodder, and the plant is sometimes grown and cut as green forage. In India it is said to poison cattle when the water supply is not sufficient to maintain its growth in a healthy state. This is no doubt due to the degradation of some of the nitrogenous compounds, brought about by the growth of a fungus which finds a suitable habitat in the

PLATE 75.—KAFFIR WOMEN STAMPING MEALIES. *Face page* 364.
An operation for removing the outer skin before cooking.

KAFFIR CORN OR GREAT MILLET. SORGHUM VULGARE, PERS.
THE DURA BELEDI OF UPPER EGYPT.

tissues of the plant when its vital functions are weak from having received a check to its growth.

The **sunflower**, *Helianthus annuus*, L., which is familiar to most observers as a tall, showy garden annual, would be an admirable crop-plant to cultivate in South Africa on those soil formations in which there is an abundance of lime and of potash. It has long been cultivated in many parts of the tropical and semi-tropical areas of both hemispheres, and it would form a valuable addition to the list of crops commonly cultivated in Cape Colony. The **seed** of the large varieties is consumed like nuts by the Russian peasantry, and it is ground and made into bread in the United States. The smaller kinds are well known and appreciated as food for poultry, and all varieties would be excellent for chick ostriches. From it an oil, with the properties of olive oil, is expressed, the husky residue being made into a useful cake for cattle-feeding. Since the recent growth of dairying in Canada, sunflowers have been grown extensively, and the heads chopped and mixed with green beans and maize in the making of silage, in proportions calculated to contain a suitable albuminoid ratio for a dairy cow.*

The **time to plant** is in early spring. The seed is best drilled 4 to 6 lbs. to the acre, in rows 18 inches apart, and the

* Half a bushel of beans and a third of a bushel of Indian corn are sown to an acre. When the resulting crop has reached a satisfactory stage of its growth—namely, when the corn is at the glazed stage—it is cut and chaffed, mixed with sunflower heads, and then put in silo. The mixed crop will yield some 16 to 18 tons of green fodder per acre, and the sunflower heads weigh about 7½ tons per acre; 2 acres of corn and beans and half an acre of sunflower heads being chaffed together. Round maize or flint corn is used in preference to the dent corn, which generally ripens at a later period of the year. On the Central Experimental Farm, Ottawa, in one of the Government silos, were seen 135 tons of silage made without any weight being put on the top, and the loss was hardly perceptible. It is no exaggeration to say that by the use of silage the stock of a farm can be doubled in numbers, because the silage given in the amount of 40 lbs. to each cow or bullock makes it possible to use straw as fodder, which in ordinary circumstances is regarded as worthless for that purpose.—*From the Author's Special Report on the Agricultural Resources of Canada, published by authority of the Department of the Interior of that Colony in* 1894.

crop thinned out, leaving 30 inches between the plants in the row. A good **average crop** may be estimated at 50 bushels per acre (40 lbs. to the bushel), and from this 50 gallons of **oil** may be extracted, and about 13½ cwts. of oilcake made. A report of a crop grown at Bathurst, in Lower Albany, in 1870, estimates the yield at 68 bushels per acre.

With a plentiful supply of sunlight and heat, the seed crop should be ready to harvest five months after planting; then the heads are cut off, and hung up like tobacco in a curing shed to dry. The seeds are subsequently easily threshed out and made clean by winnowing. If the land be kept clean until the crop is about one foot high, it requires little further attention, as the bulky growth keeps weeds in check. The plant takes up a large percentage of potash, and it is necessary to bury the stalks to manure the land, and to give a dressing of 3 or 4 cwts. of kainite per acre as well.

One of the chief defects of South African cultivation is the want of **systems of rotation of crops** to maintain or restore the fertility of the soil. It is a fact, as the following illustrations show, that the order is varied somewhat, but merely to retard, if possible, the acknowledged system of exhaustion which ultimately leads to the land being left to rest, and to win back to some extent its crop-growing power. In the same way the little artificial **manuring** which is practised—the use of guano more particularly—is too much done to stimulate one crop, regardless of consequences. It is like a whip to a willing horse becoming weaker through overwork. There is a decided want in all but the **Oudtshoorn district**, which is an exception to the general rule, of crops belonging to the natural order *Leguminosæ*. **Leguminous plants** possess the unique power to fix the free nitrogen of atmospheric air by the aid of **minute organisms** living in the wart-like processes on their roots, and then to make use of it in a combined form as an important part of their root food. Much of it is stored up in the masses of roots which occupy the soil in the case of such crops as red-clover and lucerne (Plate 26), and is a valuable ingredient in the root residue as a source of food supply to succeeding crops. On this account, and partly owing to the great depths to which the roots

penetrate to bring up plant food, as well as to find moisture, leguminous crops are capable of giving a heavy yield of produce, and of simultaneously bringing the land into good condition for the growth of cereals.

One important barrier to the introduction of leguminous crops in certain districts of the Colony is the **deficiency of lime** in the soil. The other serious difficulty prevailing in those areas in South Africa where lime is plentiful is the **want of soil moisture,** but with the extension of irrigation this will decrease. In those areas where **the bean and the lentil** can be grown as a field crop, their growth on a wider area would increase the grain-growing capacity of the land.

In **Caledon district** a common practice is to begin with wheat on virgin soil, or with barley if the land has been previously cultivated. Wheat follows wheat for two or three years, then oat crops are grown till the land is exhausted. A good yield of barley under the circumstances is 25 fold, and oats on exhausted land 10 fold, if not cut for hay, which is the general practice. Progressive farmers apply two bags (200 lbs. per bag) of **guano** for each bag of wheat sown. The land after undergoing a course of cropping lies out to rest for four or five years. **Ploughing** of virgin soil or "braaking" is done in September after rain. If rain does not come, breaking is impossible at that season. The ploughing of land previously cropped can be delayed till April, when spring rains fall. The bulk of the **sowing** takes place in May and June, but early oats or barley are best sown in the end of April, although these crops can be sown even in June when rain is late in coming. In a normal season wheat-sowing follows the first sowing of oats and barley at an interval of two or three weeks. In this district lime is in favour for **pickling** the seeds of the common cereals. A heap of grain is mixed with the flour of lime on the floor, wetted and turned over, and next day it is quite dry. The benefit of **harrowing the crop** some time after sowing is not understood in the district, but evidence was forthcoming that the practice of doing so, as explained at page 451, would be attended with satisfactory results.

The system of cropping practised in **Koeberg** and **Malmesbury** grain-growing districts is also a system of

alternate soil exhaustion and resting—the periods devoted to both becoming in recent times shorter than formerly. The cropping period of years is necessarily shorter, owing to the soil giving out more quickly than it did thirty years ago. In Koeberg the areas of farms are too small to permit of a long rest being given to land. At one time six or seven crops could be grown in successive seasons, now it is often found expedient to take only two—wheat followed by oats. The land is ploughed in July, and left in fallow till the succeeding May.

Practices vary in different parts of the Colony, although they are mainly conducted on the exhaustion principle. In some places, two years of fallow are given after eight or ten years of constant cropping, but shorter periods are more usual. In the **Eastern Province**, as compared with other parts of the country, a greater variety of crops is introduced, and there is greater diversity of practice among the progressive farmers of British descent. As an illustration the practice near **Kei Road** may be taken. The most suitable season in which to **work the land** in that district is March. June is the right month for **sowing** wheat; June and July for **oats**. The white Tartarian, or so-called "side-oat," or "side-hanger," does best at this season. The Boer oat suffers so much from smut that it cannot be grown to advantage. The Scotch oat grows during winter, and does well on strong soil. It comes to harvest two months earlier than the side-oat, and may be used as a means for the reduction of **wild oats**, as the crop is removed while the wild oat is still green and not ready to shed its seed. A **barley** crop, intended to ripen its grain, is sown in May: but if for green forage, during the winter, in January. The safest time to plant **mealies** is between 15th October and 15th November. If earlier sown, they are liable to suffer from the attacks of the caterpillars of a white butterfly; and if later, from a grub at the roots, besides other sources of injury. **Potatoes** may be planted at two seasons after mid-winter, and again after mid-summer. In favourable years both **turnips** and **mangels** grow well, sown in spring. If the weather prevents them being planted at the proper season, or if it be favourable to the development of **insect pests**, the entire crop is at times destroyed. The caterpillars of the white butterfly,

the turnip-fly or flea-beetle, and the red ant do, in turns, their share of the destruction. White **turnips** grow well at times, sown broadcast on the New Zealand plan along with grass seeds; but swedes do not agree with this treatment.

In **Aliwal North**, **pumpkins** do better than roots. They are sown in November, and if they fail, roots can then be put in. The period of **sowing** roots differs from that already given. Swedes are best sown in January, and turnips in February. Pumpkins are equally useful as food for man and beast. They are liable to spoil towards the end of the season, however carefully stored in a whole condition, but their keeping powers can be improved by rasping down the succulent fleshy substance, and drying it into a condition similar to that of dried fruit. The labour is much less in the case of pumpkins than in that of roots, as the former crop smothers all weeds when once it has spread over the ground. The following brief quotation indicates the success attending pumpkin cultivation in Victoria, Australia:—

"For milking cows nothing gives better results; while for sows, young pigs, and horses, pumpkins are excellent, and preferable to mangels. Pumpkins are sown in rows 15 feet apart, with a distance of 12 feet between the plants in the rows. The seed is sown by hand, three seeds in each spot, and 2 lbs. of seed per acre will suffice. The yield is from 15 to 20 tons an acre on rich vegetable soil, though the latter quantity is considered an extra crop. Two rows of maize are grown in the space between two rows of pumpkins."

Other illustrations of the diversity of practice may be given. In that adopted on the **Irene Estate**, 10 miles south of Pretoria, the general produce consists of mealies, potatoes,

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PLATE NO. 76.—In this illustration, and also on Plate 77, are shown the heads of two progeny, in which the influence of the naked oat, *Avena nuda*, is very prominent. The **parents used** in the production of this specimen were—Scotch Potato, Thuringer, White Canadian, Rugenscher, Waterloo, White Tartarian, and *Avena nuda* (large).

In form of head the specimen is distinctly intermediate between the White Tartarian and the bell-headed varieties used, the influence of the various parents being very equally balanced, except *Avena nuda*, the influence of which is very predominant, showing the perfect extended panicle, and producing a naked grain, both of which are true characteristics of that variety.

PLATE 76.—AN EVOLVED TYPE OF OATS WITH A BELL-SHAPED HEAD, ONLY SLIGHTLY INCLINING TO ONE SIDE. *Face page* 470.

Produced at Newton-le-Willows by crossing together Scottish Potato Oat, Thuringer, White Canadian, Rugenscher, Waterloo, White Tartarian, and a large variety of Naked Oat, *Avena nuda*, which has prominently stamped its characteristics.
Reduced to Three-eighths Natural Size.

PLATE 77.—AN EVOLVED TYPE OF ONE-SIDED OATS. *Face page* 471.

Produced at Newton-le-Willows by crossing Black Tartarian, White Canadian, Potato Oat, Etampes, and the Naked Oat.

Reduced to Three-fourths Natural Size.

and forage, derived from grain crops. Boer **oats** being liable to rust during summer, are grown in winter under irrigation. The Sidonian oat, which came from Natal, and originally from Australia, does not rust, and grows well in summer. The Boer oats are planted in May, June, and July, and harvested in October, November, and December. Other varieties are planted in December and January, and are ripe in April and May, both seed and forage, the latter being cut only one week earlier than the former.

On **George Paton's farm** of Newlands, north-west of Kimberley, oats are ploughed in, 3 bushels of seed to 10 acres of land, then harrowed, and ridges thrown up by a double mould-board plough to hold water which is subsequently led over the surface. The crop is harvested in December, and mealies planted immediately, so that on a limited area of good land, which can be thoroughly cultivated, and well manured and watered, two crops can be successfully grown within the year. In some parts of Cape Colony, the English winter oat, brought from Natal, is sown in the mealie crop, and eaten off in winter with the mealie stalks, and allowed to come to seed in the following season.

A reference to the crop returns will show that the growth of **oats for fodder** is both general and extensive throughout the Colony. Malmesbury is by far the most important district in which the crop is grown **for grain or seed**, and next to it come Caledon and Piquetberg, but with less than one-fourth of the total yield in each case.

Barley in the Colony occupies quite an inferior position in importance to wheat or oats. The **main centres** of growth mentioned in order of merit are Malmesbury, Swellendam, Robertson, Worcester, Bredasdorp, and Riversdale.

PLATE NO. 77.—In this specimen the parents used were—Black Tartarian, White Canadian, Scotch Potato, Etampes, and *Avena nuda* (large). The selection shows very distinctly the character derived from the Black Tartarian parent, the form of head being identical with that variety, except that the panicles are much more densely crowded on the stem. Although so very powerfully influenced in form of head by this parent, the characteristics of the other parents are also very prominent, the chaff and loose hull are pure white and do not show the slightest trace of the black parents used, while the panicle is extended in form, producing a naked seed showing the powerful influence of *Avena nuda*.—R. & J. GARTON.

Rye holds a still less important place, but for reasons already stated might be grown with advantage to a much greater extent than it is.

The **varieties of barley and oats** grown are not so pre-eminently suited to South African conditions that the vigorous products of **cross-fertilisation** introduced to cultivation by the brothers Garton would not readily find favour among Cape farmers. The plates representing **selected specimens from Newton-le-Willows** show that as striking results have been achieved with these as in the case of wheat.

The travelling **threshing mill** now seen in the Eastern Province has been blamed for spreading the smut and bunt funguses, but if all seed is steeped as it ought to be the objection falls to the ground. The earlier custom still in use in most districts is the treading out of grain on the **tramp floor** or **threshing floor,** the work being done, not by cattle as in

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FIGS., PAGE 473.—This illustration comprises **an evolved type of six-row barley**, together with two of the parents which have been used in the combination shown alongside, the one on the left being a type of bere or six-rowed barley, *Hordeum hexastichum*, called Edel (a German variety), and that on the right, the two-rowed Chevalier, *H. distichum*. The parents used in the production of the progeny illustrated were as follows :—Chevalier, Italian, Manchurian, Golden Melon, Jewel, and Edel.

The **Chevalier** is a medium early two-row variety, with long drooping ear and weak straw, but with grain of good quality, which is its special feature.

The **Italian** is two-rowed, with a compact erect head and long strong straw, which are its special features. The grain is inferior in quality.

The **Manchurian**, a late six-rowed Chinese barley from Manchuria, produces a grain of medium quality but irregular in size. Its special feature is strength of straw.

The **Golden Melon** is a two-rowed type, medium in time of maturity, with weak straw and a good quality of grain, which is its special feature.

The **Jewel** may be described in similar terms, but in addition it drops its awn when ripening.

The **Edel** is a six-row variety, grown in Germany, head long and drooping, grain very small, irregular in size and of a poor quality, very weak in the straw ; special features, earliness and prolific yield of grain.

The characteristics derived from the various parents are very prominent, the length of ear being influenced by Chevalier. The grain partakes in size and quality of the several two-row parents, whilst the six-row form of head shows the characters derived from Manchurian and Edel ; a distinctive feature of Jewel is also inherited, the beards partially dropping off at maturity, as is the case in that variety.—R. & J. GARTON.

An Evolved Six-Rowed Barley between Two Parents. Natural Size.
To the left is "Edel" a German Six-Rowed Barley or Bere, and on the right the Two-Rowed Chevalier.
Grown at Newton-le-Willows.

India, but **by horses** trotting round at a good pace. As in most tropical or semi-tropical countries where trampling is the common method by which grain is threshed, great importance is attached to the simultaneous breaking down of the straw, which is harder and more brittle than straw grown in a climate like that of Britain, and consequently in its natural unbruised state not so palatable to animals. The quick motion of the horse moving round increases the effectiveness of the work, as a lateral rubbing action is given to the feet, by the heels inclining to slip towards the outside of the circle. One thousand sheaves can thus be trampled into chaff by twenty-five horses in four hours. To remove impurities from grain for grinding, it requires to be picked over on a table or clean floor by Kaffir women.

Potatoes are **widely cultivated** throughout the Colony, although not extensively in a good many districts. Robertson, the Cape, and Stellenbosch are the three main centres of production. The crops are grown in some parts under **irrigation**, the water being run as often as six times in the season between the rows or ridges, but in the more humid regions of the Western Provinces, and in many parts of the Eastern Province, near Sterkstrom, for example, on the farm of the **Halse Brothers**, the largest potato growers in the Colony, no water is now applied after the crop is planted, as it is found that irrigation makes the plant more susceptible of disease. What is known as the **potato disease**, *Phytophthora infestans*, finds a congenial home even in the dry climate of South Africa, taking advantage of the period of moisture to attack more particularly the late planted autumn crops and the most exhausted varieties planted. Other blights do much damage in certain seasons.

The fungus, *Macrosporium solani*, which destroys tomatoes under the name of **tomato black spot**, also attacks the leaves of the potato in a similar manner, but not so injuriously as the real potato disease *Phytophthora*. **Red rusty patches** on the leaves also indicate the presence of a fungus, the crop stops growing, and finally the tubers rot. A blight known as **ring disease** and spotted tuber is produced by the fungus micrococci, *amylivorus* and *amylobacter*. A dark-coloured dis-

eased ring and spots appear in the otherwise healthy-looking substance of the tuber, and the market value becomes seriously reduced. The destruction is, however, not wholesale, as in the case of *Phytophthora*. When the potato is boiled the black spots can be picked out and the uncoloured parts not involved eaten; but apart from the disagreeableness of the bad parts, the general quality of the whole is deteriorated.

The following are **remedies** likely to enable growers to cope with diseases which are becoming more extended in their attacks and also more destructive:—

(1.) The importation of **new** and vigorous growing **varieties**.

(2.) Two applications of Bordeaux mixture (see page 214) —the one a little before the usual period when a fungoid attack is expected, and the other three or four weeks later —by the **spraying** machine—one of the numerous knapsack fruit-sprayers for crops on a small scale, or one of Strawson's horse-power machines when the area to dress is extensive.

(3.) Planting only **sound potatoes**; ascertaining the condition by cutting them into sets a few days before planting to allow time for the wound to dry, and to form a sort of false skin.

(4.) The **changing** of potatoes used as sets from one district to another, and from one class of soil to another. Even on the same farm where a rich black loamy soil is found in the hollows, and a red soil on the higher parts, great benefit would be derived from regularly changing the situation of the potato. The larger crops grow naturally on the black land, but the red soil will generally produce a finer tuber for eating, and the best quality of seed-potatoes for the purpose of planting black land.

(5.) The practice of planting potatoes frequently on the same land should be discontinued. This has been done to an excessive degree, cases being recorded where two crops per annum have for fourteen successive years been taken from the same land without it being manured. When disease appears such cultivators not unnaturally lose the entire crop, and, it might be added, deserve to do so.

Under favourable circumstances potatoes sometimes grow to an enormous size—picked specimens weighing 3½ lbs. at

times—but those of the finest quality do not assume large dimensions. Few districts of the Colony produce, under existing systems of cultivation, really first-rate potatoes, which develop when cooked the mealy condition characteristic of a well-grown Irish tuber. Evidence was not wanting, however, to show that with greater care in working much better results could be obtained. The methods of storing are defective for the dry climate. The pits are not as a rule made deep enough, or sufficient earth used to form a covering to preserve a normal quantity of moisture, and growers are consequently induced to leave the crop in the ground, thus rendering it liable to get frosted in districts where frost appears. The American **planting machine** has proved successful with Halse Brothers in saving labour, but the mechanical **digger** has been a failure.

The most **prominent feature** of the potato crop of the Colony seems to be the exhausted condition of many of the old **varieties** of potatoes which produced excellent crops some years ago. The German Blue and the Snowflake, once well known in the Eastern Province, are both worn out. The Early Rose, which has grown for many years in the Colony, is not yet so far gone. The Beauty of Hebron, recently introduced, has proved fairly successful in some districts.

What is wanted to give the potato-growing industry a new start is the introduction of a few of the most recently developed varieties with large robust foliage and a good quality of tuber—such vigorous heavy yielding potatoes as **the Saxon** and **the Dron**, the last introduced into Great Britain by William Beeson, London, or some of Sutton's strongest-growthed varieties. Many varieties have been imported since the relaxation of the original phylloxera law of 1880, but only a limited number of these have been successful, such large-growthed, coarse-haulmed potatoes as the American Eagle and the Champion taking the lead. Exporters ought not to forget that potatoes going from Europe must be accompanied with a schedule containing a declaration of their having been grown in a district free from the phylloxera pest, else they will be delayed at the port of landing.

The Tobacco Crop.—As the cultivation of tobacco was most fully investigated at Seymor and in the Kat River Valley, **Stockenstrom district**, the following remarks will be largely confined to the practices there in vogue. The common plant grown in the country by the name of "**Boer**" or "**Transvaal**" **tobacco** is a coarse bastard variety from Sumatra. A number of **new varieties** have been introduced among the progressive farmers of the district by the Government expert, **H. H. Davison**, the manager of the Government **Tobacco Farm**, Stockenstrom, which was given up in 1895. Of these **White Burley**, which yields 2 lbs. more than other varieties on twenty-five plants, has proved to be the best on the score of heavy yield and good quality; but Sweet Orinoco, Virginia, Persian Rose, Havana, Palatinate, and Blue Pryor have also been successful. The **Boer product**, when well cured, though admirable for smoking on the veld, would not appeal to a European's taste, or be tolerated by non-smokers within the pale of European civilisation. It is very dry, and gives off an offensive odour, or at least one with which Europeans are not familiar, and have no desire to become so, unless when living a South African outdoor life. A great advantage it possesses over European and American cured tobacco for such circumstances is, that it can be smoked all day long without the smoker experiencing the stinging sensation in the tip of his tongue known as "tongue burning.'

In the **Boer method of treatment** the crop is cut before it is ripe, and immediately piled into heaps about 2½ feet deep to sweat and to assume a lighter and more uniform colour. The danger of losing the crop by **hailstorms** at this period is a strong inducement in favour of shortening the risky period by harvesting as soon as possible. Owing to the increasing demand for cigars and tobacco cured on more scientific principles for smoking in the large and increasing urban centres of population, it is necessary to give up the Boer methods of growing and curing, and to adopt those which have been found successful in the great tobacco-growing countries whose products go to the European markets; and to this end Government has employed **expert** assistance, which is slowly but surely introducing improvements which will no doubt sooner or later become general, although the source

may not be acknowledged. A little time will be required in which to learn what of the old methods of working are necessary under the peculiar climatic conditions of Cape Colony. The growers will speedily settle this question when they become familiar with the proposed innovations.

To **make good tobacco** it is held to be necessary to let it ripen before harvesting, and to hang it up immediately in **barns**, which are so constructed that ventilation is completely under control. The walls of colonial barns are often made of reeds, which require to be plastered with mud to make them air-tight. An ordinary barn, 100 feet long and 18 feet wide, may be estimated to cost £70 or £80, unless the building materials are difficult to get and consequently dear.

Tobacco should hang head down for six weeks until it is thoroughly dry, and so hard and brittle that if it were handled in that condition, it would crumble to pieces. Advantage is taken, in getting it down, of damp weather, in which the tobacco by the absorption of moisture from the atmosphere becomes pliable, and capable of being put together without suffering injury.

Tobacco is **sown** in well-cultivated and well-manured **seed beds**, which are covered with bushes or other simple means of shelter and protection, while the young plant, which is very slow of growth, and easily injured, is developing. The earliest of the beds are sown in the middle of June, and more are laid down each month till September, as if plants are too old before they are transplanted they do not develop into good trees. **Planting out** goes on from 1st September till January. The **tops**, including the flowers and the upper leaves, require to be **nipped** off by hand when about 3 or 4 feet high, as the flowers begin to come out. Suckers or side shoots are removed at the same time. If the process of trimming be delayed too long, the yield is reduced. A tree weak in growth should only have a few leaves left, but a strong plant is capable of maturing as many as seventeen leaves. The crop planted in September is cut in February, and the last cuttings should be over before frost comes. As a rule, tobacco should not be grown more frequently than three years in succession. It generally refuses to grow after five or six years, although instances are given in certain favoured spots in the Colony, where tobacco has been

grown for much longer periods (see page 481). Good soil can be brought round by the intervention of one barley crop, although under ordinary circumstances a longer period is desirable. A crop of **green barley** ploughed into the land makes an excellent preparation for tobacco. Tobacco is an exhausting crop, and land devoted to it requires to be well manured in this or in some other way at least once in four years. The **plants**, when 3 or 4 inches high, are best **set in rows** 3 feet apart, with spaces of 3 feet between them in the row. In windy places the latter distance is sometimes reduced to 2 feet, so that the plants may afford more shelter to each other.

The Boer **method of irrigation** is to run the water directly against the footstalks of the plants, so that the soil surrounding their roots becomes water-worn and sodden. As it dries it cracks and hardens, and requires to be frequently wetted, else the development of the plant is immediately checked, and it is liable to suffer from a fungus which gives rise to the condition known as white rust. This first shows itself on the lower leaves, which ought then to be removed without delay. The **climate** is such that after tobacco has been planted out from a seed bed in which it has been carefully watered and tenderly nurtured, it will die if not immediately **soaked with water** at the root; but this could be done to give it a start, and with a little additional labour subsequent waterings could be done midway between the rows, and not directly on the roots of the crop. The earth thrown up in ridges against the footstalks of the tobacco would never get wet on the surface, or be liable to run into a silty condition, and the frequent use of a **horse-hoe** between the ridges would undo the injurious influences of running water over the surface of cultivated land, and keep a finely divided layer of soil as a protection to the roots. The advocates of the present system assert that this would take a greater amount of water, but, on the contrary, less water would be required, as there would be less loss by evaporation. In porous soils water let into every second row would soak through the entire body of the soil, and the difficulties which arise from the application of water could be still further minimised by utilising alternately, as water channels, the rows represented by even and by odd numbers.

Deep ploughing or subsoil stirring are innovations in

working which are necessary in successful tobacco culture, especially in the case of soil which has been under crop for a lengthened period, and the frequent use of the **horse-hoe**, the "Iron Age" or "Planet Junior," greatly reduces the cost of cultivation. After the hoe has done its work, two "boys" can in a day remove the weeds remaining between the plants on an acre of ground.

Under a good system of cultivation an **average yield** of 1,000 lbs. of leaf should be got from 5,000 plants occupying one acre, which at 6d. per lb. would be worth £25, the total outlay being about £12. 10s. The price of first-crop tobacco is frequently below 6d. per lb., viz., 5d., 4d., or even less, if the quality be not first-rate; while second-crop leaf fetches only 1½d. to 2d. per lb. The produce of old stools, or that grown upon exhausted land, is not of much account. It does not keep well, and should not be produced. Much of the tobacco consumed in the Colony is dipped in a lye of "**lucht**," a potash salt got by burning a small Karoo bush with fleshy cylindrical leaves known as "ash bush." The whole plant is pulled up by the natives in January and February, when it is mature or "ripe." If gathered at any other time when the sap is running, it is worthless, as the tobacco treated with it does not keep. After lying three days to wither, it is burnt and sold at from 5s. to 7s. 6d. per bag of 203 lbs., on which a **duty** of 1s. for burning has to be paid. A bucketful of the salt is dissolved in 30 gallons of water, and the dry leaf is soaked in this, and subsequently pressed into large wooden cases, and left for twenty-four hours before it is twisted into **rolls**, which weigh one-third heavier than the original leaf. By these means it is made stronger for native consumption and for chewing. Cut tobacco is merely dipped in pure water, and the usual practice is to dry it on a sailcloth in the open air, except in the **factories**, where the excess of moisture is driven off by artificial heat. In such places treacle and spices, which are unknown in Boer practices, are used in the manufacture of the modern or improved kinds of tobacco. The **great defect** of South African tobacco is the want of burning quality, one authority declaring that not more than 10 per cent. of it will burn without the use of lye.

Tobacco is very inferior in quality in those districts where the water is salt or brackish. Certain parts are favoured above others in the matter of suitability of conditions, as is shown by the official returns of amounts produced. A special instance may be mentioned in the case of land in the vicinity of Oudtshoorn, in which a hard pan called "dorbank," resembling Indian "kunka," forms beneath the soil. Grown on this land tobacco is of superior quality in both aroma and flavour. Vines also do excellently upon it. This limy material, which is often coloured red by iron, is used for road-making. Oudtshoorn is a famous district for the growth of tobacco. On one field of rich soil near the mountains a crop is said to have been grown annually for seventy years; and on another farm a record of thirty years has been made. Catch crops are sometimes thrown in between the annual tobacco crop in this way. The first crop of leaves is taken between the beginning and the end of January, and the second crop in April or May. Barley is then planted in May, and fed off with cattle in August, the land ploughed in the end of August, and planted with tobacco in September. Sometimes only a single crop of leaves is taken; and oats sown in May to be cut as forage in November half-way up the straw, so that a rough stubble is left to plough in as manure. If the old tobacco stumps be left in the ground, and no crop taken, grubs, which accumulate at the roots of the first crop, are liable to destroy the second planting of tobacco.

Virginia Beatall is the new variety which has proved most successful in this district, giving a large yield of good colour and quality. The admitted falling-off of the burning quality of the tobacco in the district is believed to be due to the increase of brak in the soil.

"Bijwoners," who are frequently the hangers-on or poor relatives of some local magnate, grow tobacco and other crops on the share system. If they possess no cattle and receive seed also from the superior, they give half the tobacco crop and one-third of the grain crop. When ostriches are farmed in this way, one-half of the produce is given as rent if the birds do not belong to the farmer. If they are his property, the proportion given is reduced to one-third. The system is not a good one, unless under very exceptional circumstances,

as it discourages individual enterprise through introducing communal interests in property.

Luffa is the Latinised rendering given by Tournefort of the Arabic "lufah," in naming the species of gourd, the fibres of which form a network familiar to many in the shape of a bath sponge. *Luffa egyptiaca* is the best known species, and an attempt has been made to grow it in the Colony. The colonial fibre is not quite so fine as the Egyptian product, and the peach-fly is liable to injure the fruit while it is in the green succulent state, when it resembles a cucumber. A comparatively new use has been found for luffa, in the manufacture of the "vitalite" sock or inner movable sole for boots and shoes. One special advantage it has over all other material for the purpose is, that in addition to being warm and dry, it can be washed when necessary. Probably the coarser Cape fibre may be found to be superior to Egyptian fibre for this special purpose.

Manures and Manuring.

Owing to the prevalence of the custom already discussed of shutting farm animals in kraal during night, large accumulations of dung 15 and 20 feet deep occur in the drier pastoral districts, where manure is not much in demand for fertilising purposes. The heaps get dry, and it is the practice to cut the material, which resembles a light fibrous peat and is known as "**mist**," into slabs 3 to 4 inches thick, and about 16 inches long and 12 broad. In this form it is used for the building of kraal fences (see Plate 64) or as **fuel**. Quite a little revenue is at times secured by the sale of kraal manure, at £1 per 100 cakes, when it is within reach of a market, and when the owners are enterprising enough to undertake the delivery of it. Comparatively little is used as manure, and when this is done it requires to be broken into a fine state of division, or only the dusty portion from the surface of the kraal floor taken, else the results are unsatisfactory. At times the **ashes** are used as manure, but where there is brackishness resulting from the accumulation of **soda salts** on the surface, it tends to aggravate the condition, owing to the amount of sodium chloride being

greater in this than in ordinary accumulations of farmyard manure. In the dry climate the solids of the urine, which contains much common salt, are preserved in the heap. So dry and compact do these mist hills formed in the floors of old sheep and cattle kraals become, that if set on fire they sometimes smoulder for a period of years. Special care in the use of matches has to be taken by those at work in stock kraals. In some parts of the country **crabs** get into the banks of water dams and destroy them ; but when a quantity of mist is mixed with the earth used in constructing the bank, the crabs are unable to establish themselves, owing to the injurious effect on the surface of the crab's body of the ammonia produced in the decomposition of the manure. All these subordinate uses only employ a very limited proportion of the manure collected in the manner described, and the great mass of it which has been accumulated at the expense of the fertility of the land remains slowly rotting in worthless heaps.

The **manurial substance** which is markedly **deficient** in Cape Colony is **phosphate of lime**, an ingredient which is of special importance, owing to the solid substance of bone being largely composed of it. The scarcity of so-called bone-earth is evidenced by the ravenous manner in which graminivorous **animals devour** the **bones** of dead animals picked up by them in the veld, and by the success which has attended the application of **phosphatic manures** in the instances, too few in number, in which it has been used in the Colony. The **lessons** to be learned from these facts are that all **bones** should be carefully collected, and ground into **meal** and flour, to be used either as manure, or fed to animals that require it as an ingredient of their food. A **grinding mill** large enough to do satisfactory work, if driven by a good air-motor, can be secured for £40, and could be utilised for grinding grain and other materials as well.*

Owing to the prevalence of **anthrax** (meltziekte or giftziekte), it would be wise, as a measure of precaution, in a work

* Any of the following **English firms** would supply, on application, illustrated catalogues, and also quote prices for large power machines :—The Hardy Pick Company Limited, Sheffield ; J. Harrison Carter, Dunstaple ; Christy & Norris, Chelmsford ; and the Central Cyclone Company Limited, Fenchurch Avenue, London.

conducted on a large scale, to steam all bones supposed to be contaminated by the germs of disease. When the preparation takes place on a farm where the cause of death in each case could be generally ascertained, all the bones of animals which die of anthrax should be burnt, and suspected bones collected from the veld treated with flower of lime before and after grinding, and then used only as manure.

The concentrated manure most extensively used in the Colony is **guano**, and this is largely due to the fact that Government offers it to the farmers at £7. 12s. per ton, for cash payments, or £3 to £4 below its market value,—a mistaken kindness from every point of view. The stimulation of crop-growth by guano, without the liberal use of bones, or some other form of manure rich in phosphate of lime, is not a practice which comes within the sphere of good husbandry, and ought to be discouraged rather than encouraged by Government, as it most assuredly leads to the ultimate deterioration of the land. The **report** of the Government agent in charge of the **Seal and Guano Islands** for 1893-94 (a good season) shows that the demand is practically confined to the chief grain-growing centres of the Western Province, where it is usually applied to grain-crop land in amounts equivalent to double the weight of grain sown as seed.

The following **amounts in tons** were delivered at the **railway stations** mentioned, and would be used in the districts bearing corresponding names, with the exception of Caledon which would be supplied from Sir Lowry's Pass :—

Malmesbury	835	Cape Division	298	Piquetberg	56
Paarl	559	Stellenbosch	272	Tulbagh	28
Sir Lowry's Pass	366	Hermon	188	Burger's Drift	23

and 182 tons in small amounts to other stations, making a **total** of 2,807.

This was within 50 tons of the year's produce of guano from the nineteen "**islands**, islets, and rocks" placed **under** the **Sea Birds** and Seals **Protection Act**, 1893. All the rocks are not guano-bearing, but are the haunts of the **birds, three species** of which are specially named in the Government Memorandum, 1892, on the working of the Guano Islands, viz., the Penguin, Malagas, and Sea Duiker.

The annual **yield fluctuates** extremely from **two causes** —the washing of rain during wet seasons, and the migration

of the birds, which come and go with the shoals of small fish upon which they feed.

The **produce** of the **season 1894-95** amounted to 3,200 tons, the total receipts for the sale of guano and penguin eggs being £23,110, and the expenditure £10,003. 6s. The Treasury may look upon a balance of this kind as satisfactory, but the **position of the Guano Islands** and the guano supply as a whole cannot be regarded as satisfactory, although it must be admitted that the **quality of the guano** delivered to the farmers, containing about 13 per cent. of ammonia, is now much superior to that supplied by the lessees who had the work in hand before it was taken over by Government, in accordance with a resolution of the House of Assembly, dated 1889.

Apart from the injury done to the farmers, and the loss of revenue by selling the guano 30 per cent. below its value in London, the sum of £10,000 a year, or over 40 per cent. of the gross receipts, is a very large proportion on a business which does not include manufacture, but merely preparation for market and delivery. Such must at all times be the state of matters when **Government undertakes commercial** enterprises which can only be properly conducted on trade principles, when subjected to ordinary trade influences. It is not sufficient to point to the position of a few years ago, and to say, "What a change for the better!" That, after all, is a matter of opinion in which there may be considerable variance, when the evil effects of what are now regarded as improvements are fully realised.

In June 1895, the leases of the **Ichaboe and Penguin Islands** group, lying to the north of the mouth of the Orange River, having fallen in, as the leases of the other groups had been gradually doing since June 1890, a considerable increase of guano at the disposal of Government must have already taken place. It will be a misfortune if any successful effort is made to find a market in Cape Colony for this additional quantity, which has previously been shipped to Great Britain, where for the past three years, guano containing 14.25 per cent. of ammonia has readily commanded £11. 12s. 6d. to £12. 6s. per ton.

To put the **guano industry** on a **sound economic basis**, so that the full measure of advantage might be gained by the

farmers as a class, and by the Colony at large, the guano should be sold at its market price and without favour to any individual or any class of the community. If Government would do this, and devote the proceeds to the **reduction of railway charges** on agricultural products and requirements, it would confer an undoubted advantage upon farmers generally. In his Australian work, the author has fully discussed the duty which devolves upon the Government of a new country to keep down railway charges, as a means not only of aiding struggling agriculturists, but also of increasing the proportion of the rural to the urban population, of fostering industry, and of conferring an important element of general prosperity upon all. The net annual proceeds of the Guano Islands might well be looked upon as a **gift of Nature** or of Neptune which has cost the Colony nothing, and the sum might be devoted to the lowering of railway rates. No measure of direct protection could possess the far-reaching beneficial influences of such a step on the development of trade. Nothing ensures elasticity, which is the very soul of commercial enterprise, like ready means of communication.

To sell the guano at market prices could give rise to no real grievance on the part of the farmer, as those who in their ignorance wished to continue to scourge their land might yet be able to do so at the old cost by applying **nitrate of soda**. The offer of the Government to supply manure at £8 per ton, less 5 per cent. for cash, is liable to induce isolated farmers to believe that £8 is not too much to pay for any mixed special manure offered by manure merchants, especially when the ultimate results are equally good if not better than those got by the use of guano. Such a price gives a **large margin of profit** to be worked upon by dishonest traders, or even by traders who are honest within limits, but are not above taking a 20 per cent. profit for a mixture of two or three substances which, if sold separately, and by name, would only yield them a bare 10 per cent. The colonial farmer need not expect to escape more easily than the thousands of British farmers who confided in middlemen without making themselves masters of the situation. During the years of prosperity which followed the general introduction of mixed special manures in Great Britain, and while it was not a criminal offence to sell any

worthless rubbish to farmers as manure, the agricultural community were robbed to the extent of millions sterling—an expensive whistle to pay for through want of technical skill. As this blackmail was generally deducted from profits which still left a substantial margin, the effects were not felt as they would be felt in Cape Colony with the current rate of prices. The **great safeguard** of the farmer is to discard all mixed special manures unless they come from some trustworthy firm, accompanied by guaranteed analyses, and to purchase only the well-known forms of simple manures which can be easily mixed at home. Special attention should be given to the form in which the nitrogen is present in the manure, as nitrogen from certain sources is of little or no value, and it might even be injurious rather than helpful to plant growth. There are only **three ingredients** in concentrated manures that have any commercial value, viz., combined nitrogen (which is generally in the form of a fixed ammonia salt or a nitrate), phosphoric acid (as phosphate of lime), and a potash salt. The latter not being universally required (on granitic and clay soils, for example), the list of useful substances is made simple to a degree. Still better would it be for farmers to secure their manures through the medium of their own **local associations**, which can command lower prices by dealing on a large scale in the wholesale market. Only by these means can a farmer make himself aware of what he is using as manure, and foreshadow possible results.

Much benefit might be derived from the extension of the **system of green manuring**, viz., the growing of a green crop, preferably a leguminous crop, such as lupine, and ploughing it down to increase the supply of humus in the soil. In vineyards, and still more in orchards, this practice is likely to gain favour when its advantages are better understood.

Locusts.

A number of the chief sources of difficulty and **causes of loss** to the South African cultivator have already been alluded to in connection with droughts, hailstorms, and fungoid attacks, but the **locust plague** forms yet another which is worthy of special consideration.

Sharp * classes the locust as a member of the family *Acridiidæ*, and defines it "as a species of grasshopper that occasionally increases greatly in numbers, and that moves about in swarms to seek fresh food." Some members of the family, which are not true locusts, "multiply locally to a great extent —often for one or two seasons only"—and are then popularly designated locusts. The true migratory locusts are not represented by many species, although their swarms visit many parts of the world. The number of species were at one time thought to be greater than they really were, until it was demonstrated that the *Orthoptera* to which locusts belong change colour during their development, and even after they have reached the imago stage. Much confusion exists regarding the nomenclature and the identification of species. This is not to be wondered at, owing to the spasmodic nature of locust attacks, and to the changes which take place in the instincts as in other characteristics when swarming occurs.

Different **species of locusts** have a curious way of following each other; for example, swarms of *Pachytylus migratorius* (*Tauronotus marocanus*), the North African species, common in Algeria, Tunis, &c., are usually followed by *Schistocerka peregrina* (*Acridium peregrinum*), a large and numerously represented species, which is known to travel very great distances. In Cape Colony *Pachytylus migratorius* is followed by *Acridium purpuriferum*, which is generally regarded as a red-winged variety of *A. peregrinum*. The most abundant and widely distributed species of the migratory *Acridiidæ* (although not the one most frequently seen in South Africa) is *Pachytylus cinerascens*, which is well known in Europe and Asia, and has extended its invasions even to New Zealand. A third *Pachytylus*, viz., *migratorioides*, "inhabits Eastern Africa. A variety of it is the 'Yolala' of Madagascar," and Distant says it is also found in South Africa. The species which has done so much damage in 1895-96 has not been identified, and is said to be new to Cape Colony, or not to have visited it for a lengthened period.

Migratory locusts are productive of much greater injury to crops and vegetation generally than the endemic species.

* In the "Cambridge Natural History," 1895.

METAMORPHOSES OF THE MIGRATORY LOCUST, ACRIDIUM PEREGRINUM.

One mature form flying, and another resting with folded wings on the ground, between two pupal forms at different stages of development.

From Blanchard's "Métamorphoses des Insectes.

The **numbers** in which they travel from place to place are almost incredible to those who have not witnessed their flight. Sharp refers to a writer in *Nature*, who states that "a flight of locusts that passed over the Red Sea in November 1889 was 2,000 square miles in extent, and estimated to weigh 42,850 millions of tons at one-sixteenth of an ounce each locust; and that a second similar, perhaps even larger, flight was seen passing in the same direction the next day." It is little wonder that such clouds of locusts should so **obscure the sun** as to produce the darkness of night at mid-day. The locust is supposed to be carried by the wind, and thereby to cover great distances, but not to possess much power of progression by flight.

Swarms do not as a rule annually alight in the districts which they visit, but do so at **intervals of ten years** more or less. South Africa has recently been exceptional in this respect. During the past five seasons vast **swarms of locusts** have ravaged Cape Colony to an extent not previously experienced, and if their visitations are going to be continuous agriculture will have a poor future before it, unless more effectual means are discovered to cope with the pest. The chances are, however, looking to previous experiences of locusts in other parts of the world, that a period of years may now elapse without any serious injury from this source. **Aggravation of the evil** is found in the facts that the locusts **breed** freely **in Cape Colony**, as many as six or eight broods hatching out at times from the same field in one season, and that **movement** from place to place in search of food is begun before the young insects have acquired their wings. These immature wingless forms, called "voetgangers," or pedestrians, by the Boers, according to Mrs Barber, writing on "Locusts and Locust-Birds in South Africa,"* frequently hop in the direction of the north whence the parent swarms came, and in vast numbers cross rivers and overcome all ordinary obstacles met with in their course.

The development and flight of **large swarms at varying intervals** of time is accounted for by three important facts mentioned by Sharp—(1) That the increase of locusts is kept

* *Tr. S. Afr. Phil. Soc.*, 1880.

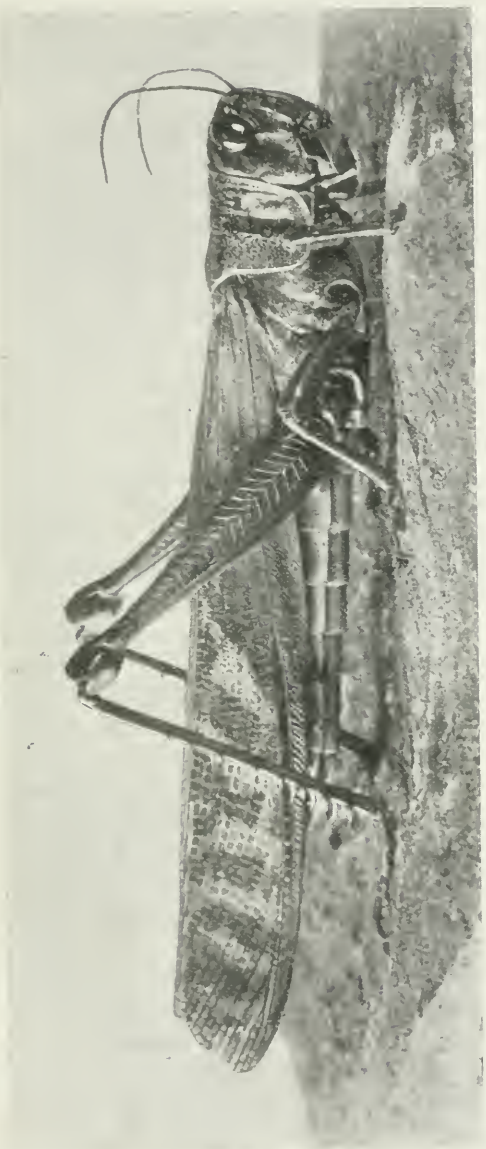


Photo. by W. Roe, Graaff Reinet.

THE POWERFUL-JAWED LOCUST (enlarged to 5 from 3, the natural size).

The new species which visited the Colony during 1895-96, and which preferred to roost in trees rather than in low bushes like the common species.

in check by parasitic insects; (2) that the eggs may remain more than one year in the ground, and hatch out when favourable conditions arise; and (3) that the migratory instinct is only effective when great numbers of superfluous individuals are produced.

An instance of the **power of self-preservation** possessed by the locust was evidenced in the case of the eggs of a swarm which visited Pampoen Poort, in Carnarvon district. The eggs were reported upon reliable evidence to have remained in the ground for eleven years, until seasonal rains came to enable them to hatch.

"It is not known that the parasites have any power of remaining in abeyance as the locust eggs may do; and the bird destroyers of the locusts may greatly diminish in numbers during a year when the insects are not numerous," so that the **balance of nature** may for a time be lost, and result in the production of large numbers of locusts which in virtue of their numbers develop the swarming and migrating instinct more perfectly.

Sharp, following Riley, says: "The female has no elongate ovipositor, but possesses instead some hard gonapophyses suitable for digging purposes; with these she excavates a hole in the ground, and then deposits her eggs, together with a quantity of fluid, in the hole," preferring hard and compact earth to loose soil. The fluid hardens, and forms a capsule-like protection to the eggs.

A Report on the Incursion of Locusts into **Egypt** in 1891, by **Williamson Wallace**, Director of the Egyptian College of Agriculture, is one of the most recent statements of the results of observations on the life-history of the insect. The species was *Acridium migratorium*, and the swarms were supposed to have come from Tripoli The investigations were made in the field and with locusts kept in confinement. Copulation began immediately the swarm arrived in the country, and eggs were not seen for about six days. The **eggs** were oval, about a centimetre long, and of a yellowish-clay colour, 90 to 100 being laid by one female in twenty-four hours, the male and female being locked together during the whole period. In three weeks the pupæ or **young locusts**, then of a pale-grey colour like the eggs, scrambled to the

surface in millions from the holes, not more than 8 centimetres deep, in which they had hatched. They remained for a few hours inactive and helpless, but speedily assumed a darker colour and acquired great activity. The dark-brown or almost black colour with yellow markings of the first three weeks gradually gives place to yellow with black markings, until the full-grown insect at six weeks is almost yellow—the male being "deep yellow, and the female of a pale hue with a brown tinge." The full period of the life-history from eggs to eggs was found to be in this instance about three months.

Although the injury done by locusts is very great, yet their works are not wholly evil. There is no doubt they manure the land. They eat so much that what passes through them is deprived of little of its food- or manurial-value. That their droppings are very considerable in amount may be realised from the constant patter kept up by their falling on the corrugated-iron roofs of houses as a swarm passes overhead. We have in these facts a confirmation of the belief of the old Dutch farmers that stock generally thrives well in seasons which follow locust visitations.* Annual visitations, so disastrous to arable land farmers, confer yet another benefit upon stock farmers to partially recompense for the mischief done. Locusts devour at an immature stage annual weeds which depend exclusively upon their seed for the propagation of their species, and in this way greatly reduce or entirely destroy for the time being "steek-grass" and other injurious or weedy plants.

In 1891-92 one-third of the crops were reported to be destroyed over a large area. At first they spared beans and peas, but now they eat everything, even wild tobacco, which does not agree with them. At times they get on the

* In the great devastation in Bavaria, a few years ago, when the Government lost £100,000 through the ravages of the Nun caterpillars on spruce trees, the sound of the excrement falling on the lower leafage from tens of thousands of feeding caterpillars quite resembled a shower of rain. As a result of this abundant manuring, a most luxuriant growth of grasses and forest weeds sprang up in the following year; and it was remarked that as the indirect result the antlers of the wild deer in the forest were larger than ever before noticed.—R. S. M'DOUGALL, M.A., B.Sc.

rails in such numbers that they stop trains, the wheels becoming slippery, and refusing to grip the metals.

The most simple and **effective method of destruction** practised in **Egypt** was the driving of the young locusts when about three weeks old into long **dry trenches**, 30 to 40 centimetres deep and 25 to 30 wide, by bands of men and children armed with palm branches. The loose earth thrown out in making the trenches was immediately replaced, and the whole trampled firmly, so that escape was impossible. When the locusts had fully developed their jumping powers, they were more difficult to drive, and the trenches required to be made more capacious. Many locusts were also destroyed by **burning** heaps of dry material laid out to supply shelter in open spaces to attract them. In **Cyprus** locusts have been successfully destroyed in large numbers by leading them into **deep traps** by means of extensive screens put up to guide them. The **digging up of eggs** seems a hopeless task, although it has been carried out on an extensive scale in Cyprus. In 1881, 1,300 tons of eggs were thus destroyed without making any appreciable difference to the number of eggs deposited in 1883.

The **flooding of land** in which locust eggs have been deposited only retards the hatching for a few days, and the **working of the surface soil** does little to injure them if they are not left exposed to the direct influence of the sun. The young locust on escaping from the egg can readily find its way to the surface from a depth of 10 centimetres; from a depth of 12 centimetres about half escape, but all perish when buried 15 centimetres deep.

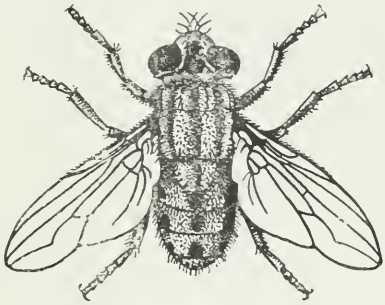
One of the most hopeful **means of combating** a locust attack not yet tried seems to lie in cultivating the **various parasites** that prey upon them, and are capable of destroying them in vast numbers. Beetles belonging to the family *Cantharidæ* lay their eggs in the egg-masses of locusts, and by the young devouring them, secure their wholesale destruction; and ants devour not only the eggs, but many of the young locusts as well. In North America a mite is also most active in their destruction.

A hymenopterous "**sand-wasp**," *Ammophila* (with body and legs black and rufous; face sickly yellow; legs bearing powerful grippers; and body about one inch and a quarter

long, and an inch and a half across from tip to tip of the outstretched wings), seizes locusts and carries them off one at a time to bury them, at the rate of twenty to thirty an hour. The female wasp is armed with a sting with which she paralyses the locust, but does not kill it. By this means the prey is preserved for the use of the wasp grubs when they hatch, and does not decay as it would naturally do if it were dead.

The **brummer fly**, *Cynomyia pictifacies*, Bigot, possesses wonderful power in checking the ravages of locust swarms. It is "similar in appearance to the common house-fly," but about twice its size, and rather lighter in colour, "of an ashen-grey hue, with two white marks down the face." It deposits a living maggot on the thorax of the locust, or an egg which hatches almost immediately. The maggot loses no time in

SAND-WASP (Natural Size).



BRUMMER FLY (Enlarged).

penetrating the tissues under the neck, and after forcing its way inwards, it lives upon the fatty parts intended for the nutrition of the insect during its pupal stage, and finally leads to the death of the host after making good its escape. The periods of development in the cases of the fly and of the locust are identical, and it is supposed that flies accompany locust swarms in their migratory flights. Several **other species** of flies belonging to the family *Sarcophagidæ* are known to be destructive to locusts, but the subject requires working out, and means should be devised for introducing additional species of flies into a swarm of locusts from a stock of flies which might be reared in captivity, and distributed to applicants for them under certain regulations in the same way as young vines or forest trees.

Driving sheep over young swarms tramples them to death, but there is a danger of the sheep becoming lame or taking "klawziekte," owing to irritation set up between the digits.

Brush-harrowing with four to six oxen has been tried with good results, and also burning rags dipped in paraffin oil, but these cannot be considered wholesale remedies.

Much more might be done to check locust ravages in the Colony by the judicious use of **spraying machines**, and the application of the poisonous washes already detailed. Every precaution would have to be employed to prevent the poisoning of farm stock which eat the locusts when food becomes scarce, and which would suffer if permitted to graze on veld sprayed for the special benefit of an approaching swarm of locusts. A limited amount of risk is, however, excusable as an offset to the danger of the animals dying of starvation. Stock might be removed from certain areas to be sprayed with arsenical solutions, and the machines might be freely used upon bushes and trees, including orchard trees, to which the locusts of 1895-96 have paid special attention, gnawing with their powerful jaws, buds and the firmer parts or leaf-bearing sprays as well as foliage. Fenced **potato fields** could also be saved without entailing any danger by spraying with arsenic.

A wash of Little's sheep dip might be substituted in cases where stock could not be entirely excluded, as its effects upon them would not be so deadly as arsenic in the event of its being consumed by them.

It would be interesting to ascertain whether a dressing of **Bordeaux mixture** would not poison the locust without causing serious injury to stock, which could be removed for a time after the application.

ATTACHABLE FIVE-ROW SPRAYER FOR HORSE AND HAND POWER, *Exhibited at the Royal Dublin Society's Spring Show, 1896.*

The pump is fixed to a barrel in the cart, and is worked by a man as the vehicle goes along. The liquid is conducted from the pump to the nozzles by elastic tubes, and controlled by taps. The nozzles and spraying apparatus are arranged along strong iron tubes, which are attached to the hind part of the cart by adjustable screws and bearings. The tubes move on these bearings, and upon holding the lever down the nozzles are simultaneously lifted out of the crop into a horizontal position. The supporting tubes telescope into each other to make the machine small enough for roads and gateways. Prices range from £10. 10s. to £32.

PLATE 78.—STRAWSON'S ATTACHABLE FIVE-ROW SPRAYER FOR HORSE AND HAND POWER, 1896.

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CHAPTER XXV.

EDUCATION IN AGRICULTURE AND AGRICULTURAL SCHOOLS.

The Agricultural Schools at Stellenbosch and Somerset East—Programme of Study at Stellenbosch—Arrangement of Classes at Somerset East—Lack of Interest in the Colleges—Reports of Select Committees to the House of Assembly—Common Fallacies about Agricultural Education—A Farm Unnecessary at an Agricultural School—A Complete System of Agricultural Education under the Education Department—Principles Taught in Rural Schools—Vacation Classes for Schoolmasters—A Text-Book—Agriculture an Optional Subject in the Matriculation Examination of the South African College—Recommendations for the Improvement of the Agricultural Schools—Scholarships.

THERE are two Government agricultural schools in the Colony—one at Stellenbosch, and the other at Somerset East. A third was tried at Grahamstown, in the Eastern Province, but was given up owing to the limited number of pupils who took advantage of it. The work done is mainly theoretical and scientific, although a practical colouring is given to it by association with experimental farm plots, by practical demonstrations in viticulture and dairying, and by a limited number of excursions to farms, agricultural shows, &c. A better idea of the nature of the instruction given may be gathered from the Time Table showing the Programme of Work in connection with the Stellenbosch Agricultural School during the quarter ended 30th June 1895:—

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
8-8.50	Breeding, General Part.	Fruit Culture.	Anatomy and Physiology of Farm Animals.	Viticulture.	Anatomy and Physiology of Farm Animals.
8.55-9.45	Diseases of Plants.	1. Wine-making. 2. Production of Plants, General.	Horse-breeding.	1. Wine-making. 2. Dairying.	1. Wine-making. 2. Cropping, General.
9.50-10.40	Chemistry.	Breeding, General.	Viticulture.	1. Cropping, Special. 2. Diseases of Animals.	Fruit Culture.
10.45-11.35	Chemistry.	Anatomy and Physiology of Farm Animals.	Fruit Culture.	Diseases of Animals.	Horse-breeding.
11.40-12.30	Botany.	Horse-breeding.	Cropping, Special Part.	Diseases of Animals.	Receipt and Issue of Library Books.
1st Hour.	Bookkeeping	Carpentry and Woodwork.	Practical Farm Work & Demonstrations.	Carpentry and Woodwork.	Practical Farm Work & Demonstrations.
2nd Hour.	Elements of Surveying.				

The full course extends over two years, but a number of students come for shorter periods, which ought to be permissible only when they join with the object of studying special subjects. The terms are three in number, and correspond to those of the **Victoria College**, in which the lectures are given. The **school pays** £85 annually to the College for the use of three class-rooms and a reading-room, and with the salaries of three teachers—F. Blersch (Principal), J. W. Crowhurst (veterinary), and C. Mayer (viticulture)—together with that of Dr Marloth (science lecturer), who visits two days a week—the total outlay for instruction amounts to £500, only half of the Principal's salary being estimated against this branch of the expenditure. The total amount put down for the school (including the experimental farm) in the Government **estimates of expenditure** for the current year is £1,505, but in the previous year only £1,300 of the sum estimated were required. The **farm** has an extent of 15 acres, including (1) 8 acres of experimental vineyard, containing 20,000 vines; (2) 5 acres occupied by a nursery of fruit-trees; and (3) 2 acres

of an experimental field, largely devoted to test plots of forage crops. A weak point in the situation, in the matter of securing the confidence of the public, is that Government rents the farm from the Principal of the school. Five **bursaries** of £20 each, to be applied for through the Secretary for Agriculture, are annually available for "promising sons of poor parents," but during the last completed year only three had been applied for. The **fees**—only £2 for agricultural students—are extremely moderate, those of the Victoria College being £12 to £15 per annum. The College has recently made, as a means for expanding the curriculum of study in certain sub-

VICTORIA COLLEGE, STELLENBOSCH.

jects, what appears to be an **excellent proposal**—viz., that for a sum of £500 to be paid by Government, the whole lecture and laboratory work of the school, with the exception of that of the Principal, should be provided by the College. While an arrangement of this kind would cost the Exchequer practically no more than the present system, the course of study in sciences allied to agriculture could be extended, and the waste of energy from the duplication of classes in certain subjects done away with.

The **numbers in attendance** have been decidedly unsatisfactory, in spite of all the facilities offered for acquiring knowledge. The report of the Principal, issued in 1895, showed an attendance roll of 19 pupils, drawn from a wide area, a

great majority being sons of farmers. It was further pointed out, that of 67 students who had left the school since its establishment, 47 are engaged in farming, 7 of these being on their own account, and 9 are otherwise employed in agricultural work; but only 23 completed the full course of instruction, and passed the final examination.

The Agricultural **School at Somerset East** is associated with the **Gill College**, in which the pupils spend the greater part of the morning—nine till two—at general and agricultural chemistry, or at branches of study not included in the agricultural course. One hour each afternoon is devoted to some purely agricultural subject. From time to time **practical courses** in dairy and garden work are undertaken. During summer the practical classes are held between 6.30 and 8 A.M., but at other times they encroach on the time of the College work. **Evening classes** for those who cannot attend in the morning are also held in chemistry. "One extended general excursion and some short ones are taken every year." The staff consists of the Principal, J. H. Overman; an assistant in science (chiefly chemistry), H. Weich; and the Assistant Veterinary Surgeon stationed in the district, J. D. Borthwick. Under the heading **terms of entrance**, the prospectus states that—

"Intending students must be at least fourteen years of age, and will be admitted without examination, provided their previous education is such as to satisfy the Principal. It is desirable that a practical apprenticeship on a well-managed farm should either precede or follow the course of study at this institution. The fee for the School of Agriculture is 10s. per quarter, and the sons of poor parents are, under certain circumstances, even admitted free. Those students who attend other subjects at the Gill College have to pay for these separately. Applicants for admission to any of the College classes must satisfy the respective Professors of their fitness to enter. New courses commence in July, the exact dates being always advertised."

The following return shows the **number of pupils** who have joined the school since its opening till the time of the author's visit—the end of July 1895:—

In 1890 . .	25	In 1892 . .	19	In 1894 . .	13
„ 1891 . .	25	„ 1893 . .	19	„ 1895 . .	11

The numbers are not only small but diminishing; and for the

five available £20 bursaries not a single application had been received during the previous twelve months.

In spite of the facilities offered for acquiring useful knowledge, there was a decided **lack of interest in the colleges** among the farming community. It was abundantly evident that something was radically wrong with the existing system or plan of work, although no fault could be found with the work itself. Many proposals of reorganisation were in the air, but it remains to be seen whether some of the proposals that had received the most favourable attention would, if tried, not make matters worse instead of better.

After taking evidence at considerable length, a **Select Committee on "Agricultural Schools"** (the Report of which was printed by order of the House of Assembly in 1894) recommended the abolition of the existing agricultural schools, and the establishment of two **farms** where agriculture and stock-farming could be taught and carried out on thoroughly scientific and practical principles, and where a large part of the work would be undertaken by the pupils under competent supervision. Another Select Committee on "Technical Education in Agriculture" reported in 1895 on similar lines. These recommendations undoubtedly coincide with the expressed views of many, both at home and abroad, who have no intimate experience of educational matters, but they open up a very large question, which demands ample consideration before action is taken. It has yet to be demonstrated that any proposal of the kind has ever been carried to a successful issue in any part of the world, although the experiment has frequently been tried, and has even been favourably reported upon, by interested persons.

In an article in the *National Review* for April 1888, to which the reader is referred for details which cannot be introduced here, the author enumerates and discusses **four popular fallacies** relating to agricultural education, and to the proper course to follow in learning to farm :—

(1.) That any one, however void of intellect, or the power of using it if he do possess it, can become a successful farmer.

(2.) That the short period of two years devoted to the study of agriculture is sufficient time to fully prepare a man, possessed of no previous knowledge of the subject, to practise it without risk of loss through inexperience.

(3.) That practical work and a scientific training can advantageously proceed at one and the same period of time.

(4.) That manual labour is the practical work of a farmer, and is the most important branch in the training of a youth, on which time and also money should be spent.

The last fallacy is due simply to ignorance, and to the desire of parents of gentle birth to find a royal road for their sons in acquiring the experiences of actual labour. There is no difficulty in the case of the son of a working man acquiring the ability and knowledge of how to work with his hands—in fact, his efforts, by the way, are worth money, are worth his wages in the labour market. The attempt to acquire a knowledge of and facility in labour operations by what might almost be termed the illegitimate means of offering to barter money for that which is really not in the market for sale, can only end in failure. It would be no more ridiculous to try to buy a fish that would live out of water than to try to buy that knowledge of work which can only be acquired in the performance of it. The value of actual labour has, in virtue of what has been stated above, been greatly over-estimated. To the man who lives by field labour, and who of all others thereby profits most by his ability to perform it, this ability is worth from 2s. 6d. to 3s. 6d. per day.

A more serious misapprehension is that of believing that the practical experience required by a farmer in conducting his business is little more than a knowledge of labour and competency to do the work of one of his servants. It is practically equivalent to asserting that an expert workman of the most humble order possesses the qualifications necessary to make a good farmer.

Experience has shown that it is only under exceptional circumstances that the practical work of the farm can be carried out in conjunction with a course of instruction in the sciences bearing on agriculture. **Dookie College**, in Victoria, is a case in point. Much of its early success was due to the unique qualifications of Principal J. L. Thompson, who organised it, and to the fact that, the pupils being mostly drawn from towns and not from the farm, it was possible to accept the total result as successful, although half the time which, in the case of boys brought up to farm life, ought to have been spent in the study of science, had to be sacrificed to enable them to acquire in a manner admittedly imperfect some knowledge of practice. In the cases of youths who have been accustomed to farm work, encouraged from early boyhood to take part in it and to otherwise become familiar with it, no such excuse for the loss of precious time from study can be accepted.

The plain common-sense **view** of the case **taken by farmers** is, that there is no place where a youth can learn practical

agricultural work to greater advantage than on his father's farm and under his father's supervision and direction. Under such circumstances a personal interest in what is going on is developed in the learner in a manner which is impossible where responsibility in the execution of any given object has to be divided among a number of pupils on a school farm. Moreover, when a son works at home, his labour is of considerable value, and often a great convenience to a father, who may very well be excused if he declines to send his son to work on a college farm, entailing not only the loss of the labour at home but the payment of a fee so that the son may be privileged to work for the benefit of some one else. There is also introduced a most important factor which is patent to a practical man, but which the theoretical and amateur educationist is too apt to overlook. With a large number of pupils, such as one would expect to find if an agricultural college became popular, the arrangements for and the methods of work done on a college farm must of necessity become unnatural and differ fundamentally from the work of an ordinary farm. Under a successful scheme at least 100 and probably 200 pupils would be in attendance annually—quite an impossible number to control, supervise, and instruct, unless on a very extensive farm at enormous expense; and even under such circumstances the work would require to be arranged and executed differently from the work of a farm managed in an ordinary way.

A complete system of education in agriculture such as is needed in a country so dependent as Cape Colony upon the success of agriculture, including stock-farming—its most important industry—should not be confined to a few agricultural colleges, which at the best are only available for limited numbers of favoured or fortunate individuals, but should extend to all schools in rural districts, and in time, when work in the lower grades is well advanced, it might also include a branch in the University, which would give instruction on an academic standard, and confer a degree in Science in the Department of Agriculture as an Honours distinction.

On this extended basis, which would involve intimate association with the general education system of the Colony, it would be necessary to transfer the entire control of the educa-

tional work in agriculture from the Agricultural Department of Government to the Education Department, otherwise there would be inevitable division of aims and interests which would hamper progress and render satisfactory development impossible. Room could easily be found for all grades of instruction in agriculture in the excellent system of public education being developed by Dr Muir, the Superintendent-General of Education for Cape Colony.

Agriculture is a subject the principles of which can be satisfactorily taught by a schoolmaster to advanced classes of boys and girls in rural districts, without any necessity for field demonstrations or out-of-door practical work of any kind. It is necessary that the teacher be provided with a suitable text-book, wall diagrams, and hand models, and that he should have the advantage of a course of training under an agricultural expert, who would suggest methods of instruction and emphasise the more important parts of the subject. Something has already been begun in the direction indicated, as agriculture was introduced in 1894 as one of the science subjects taken up in the free vacation courses held for teachers—one in Grahamstown in June and the other in Cape Town in December—but something more extensive than a few lectures in a general course of instruction is necessary to the success of the object in view. Agriculture is a large and an important enough subject when associated with the allied sciences, to absorb the whole available period, which might conveniently extend to four weeks or twenty-four working days of one vacation. A course during the first year of attendance might be advantageously devoted to the principles of agriculture and chemistry—laboratory work as well as lectures on general chemistry—to which three or four hours' work ought to be devoted daily. A similar period in one or more succeeding years could be profitably employed in more advanced stages of agriculture and chemistry, associated with botanical, entomological, and geological work, both theoretical and practical.

Courses of free classes for schoolmasters were begun in Edinburgh in 1888, and during the period which has since elapsed, 459 teachers have attended, and after returning to their respective local centres have given instruction to 14,100

pupils in country districts. In consideration of the importance of the work, and the sacrifice which a hard-working schoolmaster undergoes by giving up a month of his holiday, a **grant** of £1 per man per week, plus the amount of travelling expenses, was at first given by the Board of Agriculture and more recently by County Councils. The **teaching** done, very frequently in the evening, in their respective classes by schoolmasters **is remunerated** on the scale of science subjects under the regulations of the Science and Art Department, South Kensington, or the Scotch Code. It is found to be impossible in districts where the numbers of pupils are small, to form a class every year, but a satisfactory solution of the difficulty is obtained by arranging a **rotation of science classes** extending over a number of years, and including such additional subjects as chemistry, botany, physiography, &c., so that in a sparsely populated district an agriculture class is held once in three or four years, and interest in the subject is not permitted to flag.

Much of the success of the scheme depends upon the **text-book** used. The present want would be fully met if a Cape edition of "Fream's Principles of Agriculture"* were specially prepared, and descriptions of the crops and live stock peculiar to South Africa added.

Another very **important preliminary step** in the direction of putting the teaching of agriculture upon a satisfactory footing, would be to make agriculture an **optional subject** (probably an alternative with Greek or a modern language, or as one of the group of science subjects) in the **matriculation examination** of the University. There is no such thing among boys in Cape Colony, any more than in other parts of the civilised world, as the extensive study of a subject merely for the love of the work. **Some inducement** requires to be held out to encourage the average youth to forego the pleasures of idleness and the lower forms of amusement for the higher pleasures to be extracted, but with greater effort, from learning, and from the healthy exercise of the mental faculties. A boy wants some more immediate encouragement than his ultimate success in life, the real importance of which does

* Issued by the Royal Agricultural Society of England, and published by John Murray, London, at 3s. 6d.

not even dawn upon him until he leaves school. Such encouragement in Cape Colony is found in the matriculation examination, which, necessary though it be, and good up to a certain point, is made too much the be-all and end-all of the pupil's educational existence. So much is this the case, that no scheme of agricultural instruction could have a chance of success unless the work were done as a part of the great educational system of the Colony, which in its lower branches is on the lines necessary to prepare for the matriculation examination.

A useful basis of preliminary work having been laid at school, or in evening extension classes immediately after the school age had been passed, a higher course of study could be undertaken in the Agricultural Colleges with the same object in view—the passing of the matriculation examination, as well as that of securing a leaving certificate or diploma in agriculture and the allied sciences.

Contrary to the prevailing unskilled belief on the subject of agricultural education, the **instruction** given at an **Agricultural College** ought **not** to be **ordinary farm work** (which can only be carried out on a farm managed on commercial principles, and can therefore only be taught where natural conditions prevail), but such as cannot be learned on an ordinary farm—something above and beyond what an ordinary farmer knows—which will give the successful student an advantage over the farmer who has not had the benefits of a scientific training, or the wider knowledge of the subject gained by reading the accounts of the varied experiences of other workers in a similar field. Clearly, then, the basis of a sound and economical practical training for a farmer's son is at home under the supervision of his father, who above every one else has a genuine regard for his success, and where he himself is much more likely to contract a liking for the work in hand than for that done among a number of inexperienced student workers at an agricultural school. Or, as the article above quoted said: "In no way could a young farmer learn the practices of his profession so thoroughly as at home by the old and time-honoured plan, the reciprocal interests of the father and the son having a prominent position in the efforts of both teacher and taught."

The great question to be solved, with regard to the paramount importance of practical work, is, How can the scientific, explanatory, and literary sections be undertaken so as to interfere as little as possible with the practical side of a young man's training? The end could be accomplished by the method which has with most satisfactory results stood the test of many years in the Agriculture Department of the University of Edinburgh, by confining the lecture and laboratory course to the five consecutive months of each year in which least farm work is done, and liberating the students from study during the busy seasons when they really learn most, and when their work and supervision would be of greatest value on the home farm. This division of the two kinds of work not only permits of each being taken up during the months when it can be best performed, but it avoids far-reaching and practically insurmountable difficulties which otherwise can only be overcome at great sacrifice—viz., the difficulty of doing satisfactory mental work after engaging in protracted physical exercise in the open air, and the bodily strain upon a youth doing efficient manual labour when he must spend half the available hours of the working day at a desk, or in a sedentary position. "It is a fact, though perhaps but little known, that it is impossible for a man to labour throughout the day in the fields for such a length of time, and in such a manner, as to get into condition to perform efficient work, and at the same time be fit to undertake serious study, and overcome the natural tendency towards rest and repose during the evening. It may be accepted as a *sine qua non* that a youthful agriculturist in going through a proper course of instruction must, to reap full benefit from it, undertake his scientific education and his practical training as regards manual labour, at different periods. This is an acknowledged principle in engineering, and there is no physiological or other reason why it should not be so in agriculture. To give an illustration, let us ask, How many men who ride hard all day with the hounds can sit down to solid brain work in the evening?" The usual penalty paid when an attempt is made to associate these two incompatibles is loss of time, which is avoided by the adoption of the alternative proposal submitted.

Several farmers in the Colony, whose opinions on the

matter were sounded by the author, **expressed** their ability and willingness to submit to the temporary inconvenience of parting with their sons for a period of five months during the slack season, who would not dream of doing so for the whole year. Five months once granted would almost as a matter of course be succeeded by a similar period in the following season, and by a third period in many instances. The young man would **not** meanwhile **lose touch** with or cease to take an interest in the farm at home, and probably become unsettled for a country life, as one is liable to do if dissociated for two years from local experiences. **Pupils** whose **relatives are not farmers** might be distributed during the seven months' vacation among farmers and managers of farms of different kinds, according to the branch of agriculture or stock-rearing each desires ultimately to follow. There would be no lack of **suitable places** found if a systematic inquiry were made through the Civil Commissioner of each District. For instruction in horse and cattle rearing no doubt the **De Beers farm** near Kimberley, and other similar places, could be made available.

It would be advantageous for the existing schools to cultivate more **intimate relations with** their **associated colleges.** This should not be regarded as an abolition of the agricultural schools, but rather as a means towards their development. **Periodical excursions** to well-managed farms might advantageously be made more frequent, as a means of imparting a wide and varied knowledge of agricultural practice, conducted in a natural and business-like way.

Nothing so extensive as a **farm** associated with such an institution is necessary, but a few **field plots** to enable the teachers to show how experiments ought to be conducted on every farm might be advantageous. It is, however, an accepted fact by those who have had the advantage of experience in the matter, that it would be **unsafe and unwise** to attempt **to conduct experiments** with the object of publishing definite results for general use if students took part in the work, or had free admission to the experimental grounds.

The **scholarships** offered are at present not taken advantage of for two sufficient reasons—(1) They are **too small** to cover the whole expenses of a year's study—a necessity in the

case of the pupils for whom they were intended; and (2) in place of being a mark of distinction, something to be proud of, and to be anxiously acquired, the possession of a scholarship **bears the stigma** of family impecuniosity—"sons of poor parents," or "parents in impoverished circumstances." Agricultural school scholarships of £20 each would probably cover all necessary outlays during a five months' session, as the annual cost of board and lodging at Somerset East is stated in the prospectus of the Agricultural School at from £40 to £48, and at Stellenbosch at from £26 to £40. They should also be offered, without invidious distinctions, purely as a **reward of merit**, determined by the results of examinations held in connection with the agriculture classes to be established in rural districts. Scholarships given on such conditions would induce the most brilliant pupils to continue studies which probably they would otherwise not undertake, and would help to fill the schools with a class of students likely in the future to do credit to the instruction imparted to them. The foregoing views, although in opposition to popular belief, are confidently stated as the mature opinions of one who was reared as a farmer, who has been a Professor of Agriculture for a period of fourteen years, and who has devoted much time to the special study of the question both at home and abroad.

CHAPTER XXVI.

THE AGRICULTURAL DEPARTMENT OF GOVERNMENT.

Creation of and Changes in the Department of Agriculture—Annual Expenditure—The Chief Officials—Qualifications of Officials—The Political Head—The Permanent or Under-Secretary—The Heads of Branch Departments—Qualifications of an Ideal Permanent Secretary—The Bacteriological Institute—Its Commercial and Scientific Work—Developments necessary to make it more useful—Its Possibilities as an Educational Centre—The Cape Government Herbarium—The *Agricultural Journal*—Suggestions for its Improvement.

THE **first Department of Agriculture** for Cape Colony controlled by a Secretary for Agriculture was created in 1887, and associated with the office of the Colonial Secretary. In 1892 a **reconstruction** was effected, and the Agriculture Department became a **Department of Lands, Mines, and Agriculture**, administered under the Colonial Treasurer. The **existing Department**, including the office of Minister of Agriculture, was created in 1893, and provisions made for its administration by Act 14 of that year.

The total **estimated expenditure** under the control of the Minister termed the Secretary for Agriculture for the financial year 1895-96 was £220,800, but this included the following sums under their respective headings, which may be regarded as extra-agricultural :—

Crown Forests and Plantations	£46,195	Guano Islands	£22,000
Geological Exploration, Irrigation and Water Supply	10,826	Mines	3,536
		Surveyor-General	9,620
		Miscellaneous Services	24,900

A substantial **balance** of £103,723 remains for the Department of **Agriculture**, the **expenditure** of which comes under the following heads :—

Salaries and Contingencies	£14,801	Agricultural Schools and Experimental Stations	£3,105
Bacteriological Institute	3,277	Agricultural Societies and Association Grants	12,008
Veterinary	44,920	Botanic Garden Grants	3,675
Viticulture	5,600	Miscellaneous Services	14,600
Tobacco Culture	470		

The **chief officers** associated with the Department under the Minister or Secretary for Agriculture, whose appointment is political, are the Under-Secretary or Permanent Secretary for Agriculture, supported by a chief and a principal clerk; the Colonial Veterinary Surgeon; the Director of the Bacteriological Institute; the Government Botanist and Keeper of the Government Herbarium; the Government Entomologist; a Marine Fishery Expert;* the Conservators of Forests; the Inspector of Mines; and the Surveyor-General.

A good deal of **dissatisfaction** with the work of the Department was expressed by the public, and talk of its total abolition or complete reconstruction was in the air. There was a tendency to go altogether to extremes, and to make changes which would certainly not be improvements. A **measure of reform** was, however, undoubtedly necessary, but it would be invidious, and might even defeat the object in view, to state too directly what changes appeared to be most urgent. It will be convenient and expedient to consider the question in the light of **general principles**, and to leave to those who have a more intimate knowledge and greater experience of the local circumstances involved, to find out the weak points and to apply the remedies.

The **supreme head** of a Department holding a political appointment is at once a source of strength and a source of weakness, but the essential and overshadowing importance of the chief of a Department being within the inner ring, and taking part in the most secret deliberations of those forming the Government of the day, is so great that the disadvantage of an incompetent person being at times appointed for purely political reasons becomes a minor consideration. The danger is also minimised when the political head is supported and instructed by a properly constituted permanent staff of officials. The post of **Permanent or Under Secretary** under the cir-

* The last two offices were first filled in 1895.

cumstances becomes one of paramount importance and responsibility, and the true strength of this official must lie not in the assumption of an air of personal importance, of superior knowledge, and of individual responsibility for all details in every branch of the service with which he is associated, but in utilising to the fullest extent the technical skill of the so-called **heads** of the **different branches** referred to. Each officer occupying the position of head ought to be the highest authority on the subject of his particular work in the Colony, and being so, his final and mature opinion ought to be accepted as such and acted upon without modification or what may be called official alteration. It is impossible for a properly qualified Secretary to be as great a specialist in one and all of the subjects represented in the numerous branch departments as the heads of these departments themselves, and therefore no modification of the proposals of these experts ought to be given effect to without their agreement or concurrence. It may very frequently happen that, owing to financial considerations of which the Secretary would naturally be the dominating authority, original schemes might require to be materially modified, but the skill of the expert is quite as necessary if not even more essential to adjust the details of a modified or reduced scheme as those of an original comprehensive one. While an Agriculture Department ought to appear to the general public to work as one body, the different branches of it should virtually be guided by their respective heads. The **responsibility** would then to a large extent be distributed among them relatively to the advice given, and would not be centred in the Permanent Secretary, who, apart from special subdivisional responsibilities, would have general responsibilities of his own.

The man **best qualified to be Permanent Secretary** for Agriculture, and the previous training he ought to undergo, are considerations which demand ample deliberation. It has been strongly urged that a skilled agriculturist is the man wanted, but this is a popular fallacy born of ignorance of the duties and functions of a Permanent Secretary. There are no objections to the post being filled by such a man, provided he possesses the essential qualifications of a Secretary, but great difficulty would be experienced in finding an individual who

combined the two very different sorts of qualifications. It is absolutely necessary that a Permanent Secretarial Head should have gone through the routine work of a Government Department, else the office work would speedily get into inextricable confusion, and the benefits to be gained from any special agricultural qualifications of the Secretary would not be available.

The **ideal Permanent Secretary** is essentially a strong man, and consequently not afraid of taking and of giving effect to the advice of his specialist subordinates and associates, and at the same time meting out to them all credit where credit is due. He is a man with a large grasp of the subject on the literary and scientific side, an omnivorous reader, with a retentive memory, and orderly literary proclivities — a man who, as an individual and as an official, is respected and esteemed not only by his subordinates but by his Parliamentary superiors, and whose opinions on Departmental questions of policy are sought after and accepted.

It has been suggested that the duties of Permanent Secretary ought to be divided between two colleagues, one a practical agriculturist and the other an experienced office man; but apart from the difficulty of harmoniously associating two men of equal power, all the benefits to be derived might be secured if the Political Head were chosen on account of being distinguished as a practical and progressive agriculturist.

It goes almost without saying that if the most suitable men to fill responsible positions in a Department are to be secured, there ought to be no doubt of the **remuneration offered** being adequate to the circumstances of each case. The practice of offering **insufficient salaries to officials** when first appointed (from which the Government of Cape Colony is not altogether free) is fatal to the success of any service, as important posts are filled by incompetent men who have no chance of promotion except to the pension list, but who after a time claim and frequently receive salaries far beyond their deserts.

The **Bacteriological Institute** at Grahamstown, under the directorate of Alexander Edington, M.B., C.M., of Edinburgh, was established in 1891. It is the only institution of the kind in South Africa, and it has been supported by subventions

from the Colony of Natal, the Orange Free State, and the Transvaal, all participating equally with Cape Colony in the benefits which are derived from it. The **object** for which the Institute was established was the **scientific investigation** of the nature of diseases in farm animals due to specific organisms, such as horse-sickness, red-water in cattle, and heart-water in sheep; but the exigencies of the situation led to the development of a **commercial side**, and it is now a self-supporting institution, and, according to the state of accounts published by the Department of Agriculture in 1895, in receipt of a **revenue** of, in round numbers, £10,300 from the sale of **vaccine** lymph for vaccination against smallpox, and £300 from lung-sick **virus** for inoculation against pleuro-pneumonia in cattle, the former being supplied at 6d. per tube, and the latter at 1s. 3d. per tube, sufficient for five cattle. Diagnosis of cases of **diphtheria** and **rabies** is also undertaken at the Institute, but the **great scientific work** which has absorbed most time and attention during the four years which have elapsed since the laboratories were put into working order, is that done in connection with **horse-sickness**. A considerable and what may be regarded as a satisfactory **measure of success**, in work so tedious and uncertain as bacteriological research, has been attained. Reference has already been made at page 320 to the progress marked and the results achieved, so far as it would be judicious to make them publicly known.

It has also been pointed out from time to time that numerous diseases from which farm animals in South Africa suffer ought to come within the scope of the investigation of the Institute, the establishment of which was one of the most far-seeing movements made by the Cape Government during recent times, thereby calling one of the most recent and most progressive of modern sciences to the aid of the owners of live stock.

To be put on a **satisfactory** and thoroughly scientific **basis**, the Institute ought to be conjointly and amply endowed by all the States and Colonies of South Africa, and the commercial department, though maintained on the plea of usefulness, separated as completely as possible from the research department. The author fully sympathises with the position taken up in this matter by the Colonial Veterinary Surgeon

Plate 79.—Dr Edington at Work in the Laboratory of the Bacteriological Institute, Grahamstown. *Face page* 514.

PLATE 80.—LABORATORY OF THE BACTERIOLOGICAL INSTITUTE, GRAHAMSTOWN.

Face page 515.

while giving evidence before the **Select Committee** of the House of Assembly on the Bacteriological Institute in July 1895. He would even go further than this officer, and assert that a much more **intimate relation** ought to exist between the Veterinary Department of the Colony and its Bacteriological Research Station than there is at present. Admitting the necessity of the internal control of the place resting exclusively with the Director, the great scheme of work to be taken up should be systematically discussed and agreed upon by the Colonial Veterinary Surgeon and the Director of the Institute conjointly, and the special knowledge and wide experience of the chief of the Veterinary Department made available to the fullest possible extent in all preliminary arrangements, which would in many cases require to be made in the field.

So many diseases urgently require investigation—diseases which not only continue to extend but which increase in number, and, it might be added, even in virulence—as witness recent experiences of rinderpest—that important **additions** require to be made **to the staff.** An officer who holds a high position as **a pathologist** is almost as essential in an institution of the kind under review as the bacteriological expert and head; and a larger number of qualified assistants are required to carry on the work of investigating a number of diseases at one and the same time. With such an addition to the staff, time now lost by a limited number of experimenters changing from one class of work to another would be saved.

Effect might also be given to the excellent suggestion of Dr Hutcheon of making the Institute an **educational centre** as well as a research station. Short courses, mainly practical, could with advantage be instituted, in which farmers would have an opportunity of becoming familiar with simple bacteriological and veterinary processes; for example, the proper methods of inoculation, the use of the microscope, the taking of temperatures of animals, the conducting of *post-mortem* examinations, and many other useful operations which could be taught during a residence of two or three weeks.

The **analytical branch** of the Agricultural Department, like the veterinary branch, is too much engaged in doing work for

the public at the cost of the State. This leads to much unnecessary work being undertaken, and is fatal to the prospects of original research, which ought to be the main feature of the analytical department of Government. If a reasonable fee were charged for the determination of all samples sent for examination, the results obtained would be much more highly appreciated than they are at present.

A vast field of research is open to the chemist in South Africa, but it is to be hoped that it will not be restricted to **soil analysis**, the misleading nature of which has been discussed at some length in the author's Australian work.

Only a passing reference can now be made to the **Cape Government Herbarium**,* one of the most valuable collections of plants existing, and to which contributions have been sent from all parts of the world. Constant touch is kept with leading botanists and curators of museums and herbariums in foreign countries, and exchanges with them of botanical literature and of duplicate specimens take place. By this means not only the reputation but the scientific value of the Cape Herbarium is maintained at a high level. Even more of this useful work would have been done but for the total absence till last year of subordinate assistance under the control of the Curator. After being most inadequately housed for years, the cases containing the valuable botanical treasures have recently been removed to fairly suitable quarters in Grave Street, Cape Town, where they may safely rest until provision be made for them in their natural and final resting-place—the South African Museum. From time to time the centuriæ of the *Herbarium Normale Austro-Africanum* are issued to the chief Herbariums in Europe and America, the sixteenth centuria being that for 1894-95.

A valuable **library of botanical literature** is also associated with the Herbarium, but for the present it is unfortunately necessary to accommodate it in a separate building.

One of the grievances urged against the Agricultural Department was the alleged lack of merit in the **fortnightly**

* Under the able supervision of the Government Botanist, Professor P. MacOwan, B.A., F.L.S., &c.

Agricultural Journal, which has been issued to farmers free of charge by the Department since 22nd March 1888, when the first number appeared. Although the general plan of conducting the *Journal* is not the best for gaining the confidence and appreciation of the farming community, the publication is certainly not worthy of wholesale condemnation. In some departments—notably those of botany and veterinary science—it is particularly unassailable. Its **weak point** is to be found in a want of special articles by experts on various subjects, and in the filling of much space with wholesale clippings from foreign agricultural periodicals without that condensation or special trimming which is required to adapt them to local circumstances.

The *Agricultural Journal* is such an **all-important medium** for the communication of information of an interesting and valuable kind to farmers of every degree, that it is worthy of greater consideration and more attention by the Department. Its form and get-up are too much after the style of a newspaper, which, if opened at all, is merely glanced at, discarded, and probably destroyed within a week of its issue; whereas the journal of an Agricultural Department of Government ought to be a **reliable compendium** of interesting information worthy of preservation, and useful not merely for the moment, but for reference in succeeding years. To this end the *Journal* of the future, following many excellent examples set in England, Australia, and America, ought to take the form of **an octavo volume**, to be issued in parts at longer intervals than a fortnight, probably monthly or quarterly, like the *Journal of the Royal Agricultural Society of England.* **Special articles** by the leading authorities on various agricultural, horticultural, viticultural, forestal, and other subjects, ought to be secured and paid for, and concise *resumés* of important original articles which occur in other journals, made and incorporated. **Illustrations** by figures, diagrams, and full-page plates would be an attractive and most valuable feature of such a publication. It might probably be made to pay its way by putting up to auction every two or three years the contract for printing, and the right to secure advertisements. The practice of distributing it free to certain farmers could then be extended to all who made application for it.

Professor MacOwan's suggestion that some of the more interesting papers which have appeared in the *Journal* might be republished, is well worthy of adoption. If the *Journal* were issued in the form suggested, these articles could be incorporated from time to time as the subjects with which they deal come up for discussion.

It would be well to **cultivate** a more intimate and more friendly **relation** than at present exists **with the newspaper press**. Advance proofs of special articles should be sent to all newspapers, so that they might reproduce the parts of interest to the district in which the papers circulate before their appearance in the copy of the *Journal* in which the articles are to be issued. In this way they would have a greater chance of becoming of general service to those interested in the matters with which they deal, and they would at the same time be supplied later in a form suitable for preservation and reference.

In its present form the *Agricultural Journal* is practically boycotted by the other sections of the newspaper press—a fact which seriously curtails its general usefulness. The proposed alterations would make **correspondence** in the *Journal* on topics of passing interest impossible, but such correspondence is better confined in any case to the local press of the district to which the circumstances involved are applicable or interesting. Such correspondence would be food for the **daily and weekly press**, and might lead to a much wider interest being taken in agricultural matters by that extremely important and influential section of passing literature. If a movement were in this way initiated which ultimately led to the publication of a **weekly letter on agricultural topics** in each of the leading newspapers circulating in important farming districts, great advance would be made in the means for imparting valuable information to the members of a class who stand much in need of it, and who are chary about being instructed unless in a manner which disarms any suspicion of a deliberate intention in that direction.

APPENDICES.

APPENDIX A. (See page 17.)

SOME archæologists maintain these drawings are relics of the termination of the Shemitic civilisation, inaugurated by Solomon, whose colonists, Phœnician and Judean, occupied Manicland and Mashonaland (the Land of Ophir), and where their ruined cities are now being discovered. The horse with the bushy tail would, in this view, represent the horse of the East, the ancestor of the modern Arab.

APPENDIX B. (See page 69.)

P. CARCINOMATIS.

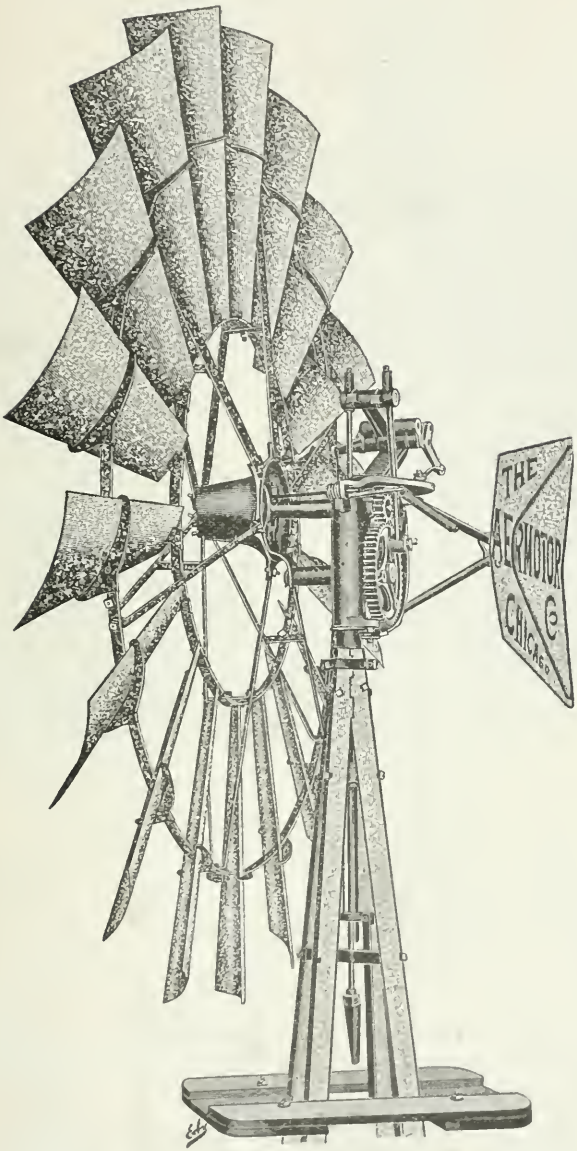
The utilisation of a **termite hill as a cooking stove** has been thus described by a resident:—"You have only to dig or cut a door-hole at the base of the ant-hill, put in half a *Cape Times* or *Argus*, light it, and blow till the heap catches fire, and you have an impromptu baker's oven. In ten minutes you put your steak in on one of the flat stones with which you beat it to make it tender, cover up the hole, and leave it for an hour or more. When you come back from your quail-shooting or botanising, you have a *plat* worthy of the table of the gods."

It is on the decayed *débris* of grass stored in these hills that the mycelium of that most extraordinary fungus *Podaxon carcinomatis* grows. The sporiferous form or finished mushroom is exactly like a folded umbrella in Cruikshank's illustrations. This fungus, like the fungus of a fairy ring in old pasture, being engaged in preparing the insoluble decaying organic matter into available plant food, has no doubt much to do with the increase of temporary soil fertility which results from breaking up an ant-heap.

APPENDIX C. (See page 147.)

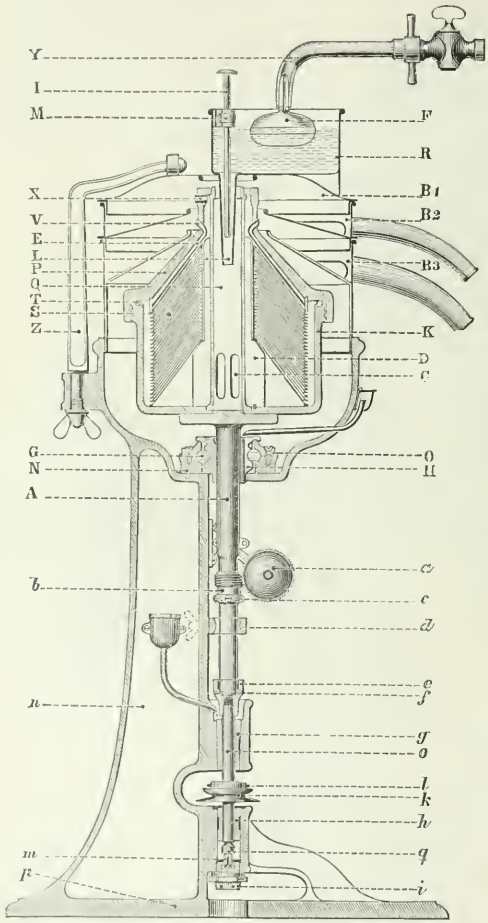
Vermorel's "Torpille" or Sulphur Bellows is a most useful and effective apparatus for distributing **flowers of sulphur** to prevent the development of the **oidium fungus** on vines, or flower of lime to kill the pear-slug. The apparatus consists of "a knapsack bellows, holding 22 lbs. of sulphur, and delivering it in a uniform dusty cloud," the density of which can be regulated. "At the top is an elastic cap, rising and falling in obedience to the movements of a hand-lever. A mixer, reciprocating over a fine grating, drops the sulphur into the air chamber at the base, whence the blast delivers it through a length of hose into a tin distributing tube." The bellows **cap** is now made of **leather** in preference to indiarubber. The **illustration** at page 147 shows at a glance the structure of the apparatus, with the exception of the tin distributing tube (held in the operator's left hand), and the hose by which it is united to the body of the apparatus.

APPENDIX D. (See page 62.)



THE CHICAGO AERMOTOR.

APPENDIX E. (See pages 272, 273.)



A —Spindle of Bowl.
B1—Top Cover with Regulating Cup.
B2—Cream Cover.
B3—Skim-Milk Cover.
C — Milk Openings, Tubular Shaft.
D —Wings of the Tubular Shaft.
E —Skim-Milk Tubes.
F —Float.
G —Top-Bearing Ring.
H —Top-Bearing.
I —Regulating Pin.
K —Separating Bowl.
L —Regulating Pipe.
M —Ring for Regulating Pin.
N —Top-Bearing Plate.
O —Top Plate.
P —Hood.
Q —Tubular Shaft.
R —Regulating Cup.
S —Alpha Discs.
T —Bowl Ring.
V —Skim-Milk Outlet.
X —Cream-Screw.
Y —Faucet.
Z Cover Arm.
a —Speed Indicator.
b —Sleeve for Speed Indicator.
c —Set Screw for Sleeve.
d —Guard for Bowl Spindle.
e —Head of Lower Spindle.
f —Pin for Head.
g —Upper Bushing.
h —Lower Bushing.
i —Bottom Screw.
k —Pulley for Spindle.
l —Tapered Pin for Pulley.
m —Tread Wheels.
n —Frame of Machine.
o —Lower Spindle.
p —Bottom Plate of Frame.
q —Steel Point.

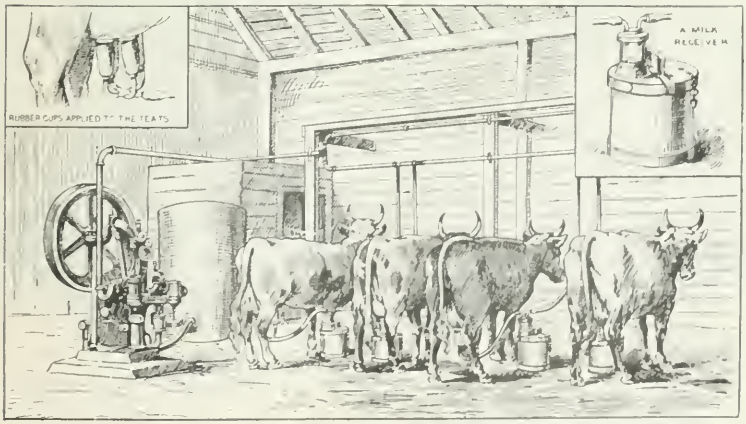
SECTION OF LAVAL'S ALPHA AI OR AKTIEBOLAGET SEPARATOR, STOCKHOLM (DAIRY SUPPLY CO., LONDON).

The Alpha AII Separator worked at a speed of 5,600 revolutions per minute (the temperature of the milk being 86° F. [30° C.]) will skim 400 gallons per hour.

The Alpha AI Separator under similar conditions will skim 265 gallons per hour.

APPENDIX E.—*continued.*

THE HUMMING-BIRD MILK SEPARATOR.

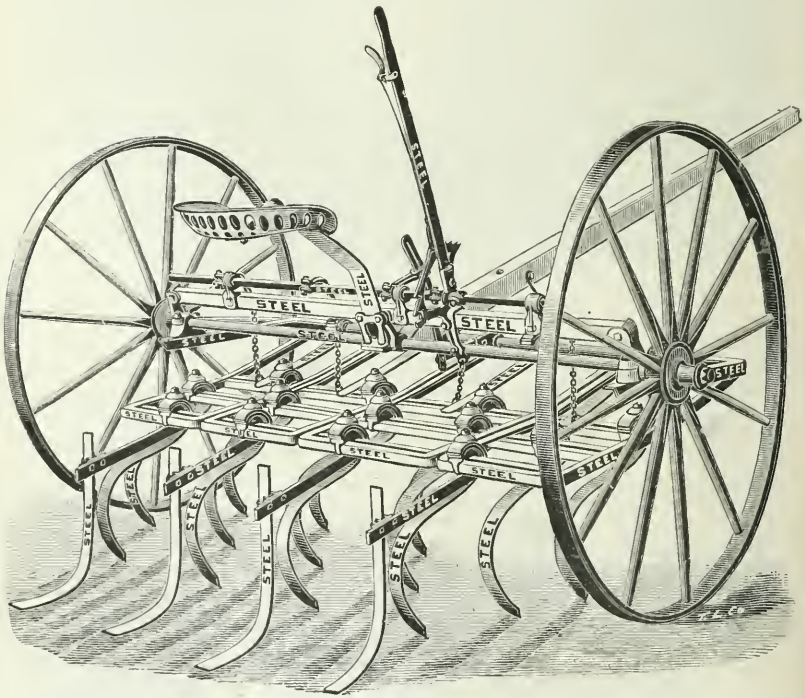


THE THISTLE MECHANICAL MILKING MACHINE (DR SHIELDS' PATENT) AT WORK.
(*Explanation next page.*)

APPENDIX E.—*continued.*

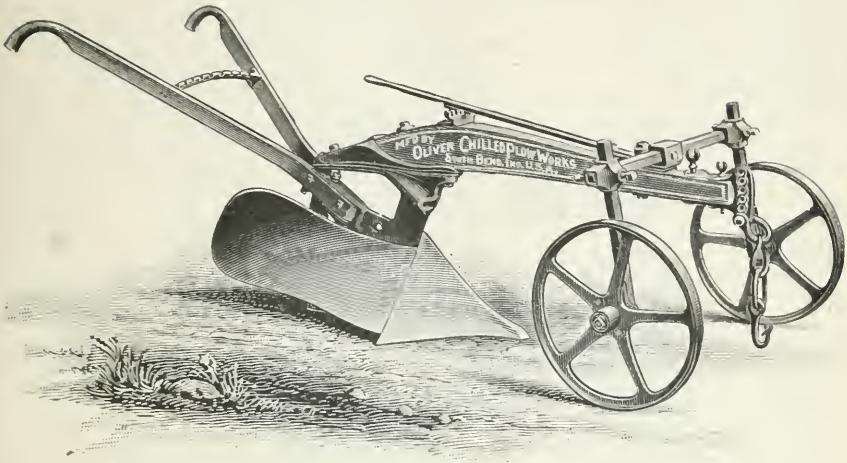
The Thistle Mechanical Milking Machine (Company's Office, 25 Gateside Street, Glasgow), invented by Dr Shields, competes favourably with **that of Gray** of Stranraer, in Scotland, which may fairly claim to have been the first really successful machine worked on a large scale. The chief drawback is the cost, which may be stated at £100 for a power machine to milk ten cows at one time, in addition to that of a 1.8 horse-power engine required to drive the vacuum pump to create suction. The action of the machine imitates, as far as possible, the movements of the calf or of the hand of a milker, having a pulsating motion as well as intermittent suction. The time required for one man to adjust the teat caps and complete the milking of ten cows is twelve minutes. The milk in the udder is completely extracted, and no injury results either to the teats or to the udder, although the action goes on for a time until all are finished after milk has ceased to flow from some of the cows.

APPENDIX F. (See page 444.)

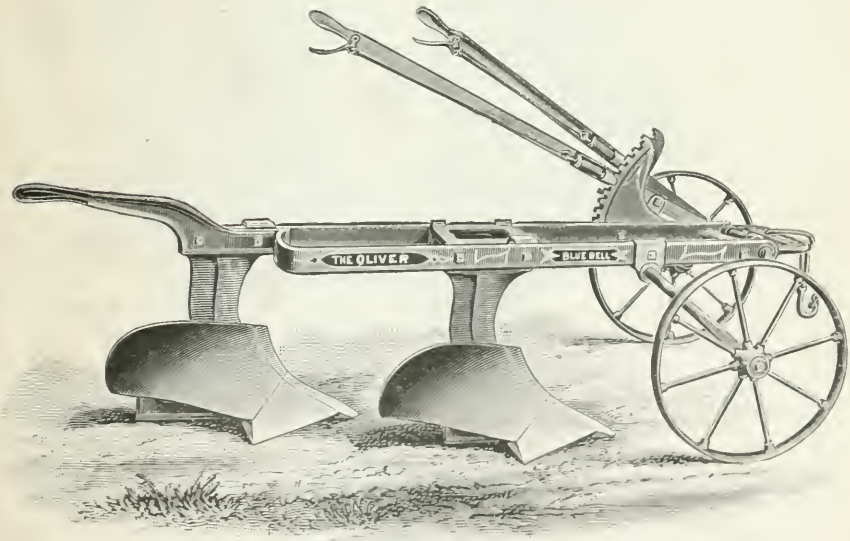


MASSEY-HARRIS STEEL-TINED CULTIVATOR.

APPENDIX G. (See page 441.)



Oliver's No. 56 X Double-Wheel Steel Mould-Board, Hillside Plow.



Oliver's Chilled-Bottom, "Blue Bell," Gang Plow.

APPENDIX H. (See page 446.)

MASSEY-HARRIS SELF-BINDER.

The Edinburgh Geographical Institute

English Miles

The Edinburgh Geographical Institute

The Edinburgh Geographical Institute

The Edinburgh Geographical Institute

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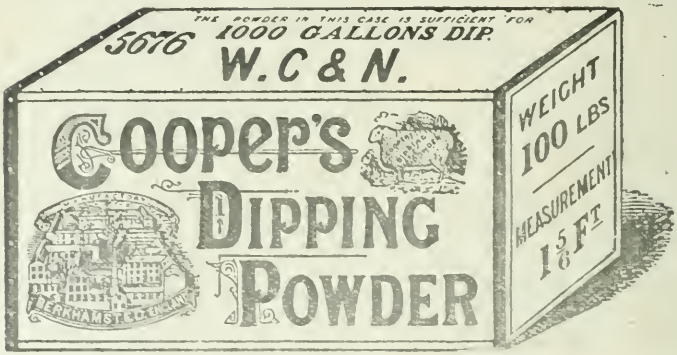
Printed at The Darien Press, *Edinburgh.*

"You can fool some people all the time,
You can fool all the people some time,
But you can't fool all the people all the time."

—*President Lincoln.*

COOPER'S DIP

NEVER FOOLS ANYBODY AT ANY TIME.



THIS IS WHY IT HAS BEEN

FOR OVER FIFTY YEARS

THE WORLD'S SHEEP DIP,

AND IS EVERY YEAR USED UPON

A QUARTER OF THE WORLD'S SHEEP.