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INTERNATIONAL INSTITUTE OF AGRICULTURE

OFFICE OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

THE SCIENCE AND PRACTICE OF FARMING DURING 1910 IN

GREAT BRITAIN

(ENGLAND, WALES, SCOTLAND)

AS SEEN THROUGH THE SCIENTIFIC AND AGRICULTURAL PRESS

ROME, 1910 — PRINTED BY THE UNIONE EDITRICE, via Federico Cesi, 45.

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Bureau of agricultural science and practice.

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This volume was originally intended for the first of a series of Bulletins by the Intelligence Office of the International Institute of Agriculture. It has been thought expedient to issue instead Monthly Bulletins of the Intelligence Office in a brief form, giving information gathered from the current literature of all Nations simultaneously, and limiting this international abstracting to what has been published in the month previous to the issue of the Bulletin.

The November 1910 number of the Monthly Bulletin is now published, under the title of *Bulletin of Agricultural Intelligence and of Plant Diseases.*

The present volume remains as a sample of a publication illustrating the Science and Practice of Farming in a single Country, during a recent short period of time.

The agriculture of Great Britain has for long been of interest to all nations; its study should be especially profitable to-day, when British Agriculture is entering on a period of new development and of revival. It is hoped that the present volume, extracted chiefly from the British Scientific and Agricultural Press of 1910, may prove useful and suggestive to the readers of many countries, for the service of all and each of which the International Institute of Agriculture has come into being.

Rome, December 1910.

ITALO GIGLIOLI.

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THE INTERNATIONAL INSTITUTE OF AGRICULTURE.

The International Institute of Agriculture was established under the International Treaty of June 7th, 1905, which was ratified by 40 Governments. Seven other Governments have since adhered to the Institute.

It is a Government Institution in which each Country is repre sented by delegates. The Institute is composed of a General As sembly and a Permanent Committee.

The Institute, confining its operations within an international sphere, shall:

a) Collect, study, and publish as promptly as possible statistical, technical, or economic information concerning farming, vegetable and animal products, the commerce in agricultural products, and the prices prevailing in the various markets;

b) Communicate to parties interested, also as promptly as possible, the above information;

c) Indicate the wages paid for farm work;

d) Make known the new diseases of vegetables which may appear in any part of the world, showing the territories infected, the progress of the diseases, and, if possible, the remedies which are effective;

e) Study questions concerning agricultural co-operation, insurance, and credit in all their aspects; collect and publish information which might be useful in the various countries for the organization of works connected with agricultural co-operation, insurance, and credit;

f) Submit to the approval of the Governments, if there is occasion for it, measures for the protection of the common interests of farmers and for the improvement of their condition, after having utilized all the necessary sources of information, such as the wishes expressed by international or other agricultural congresses or of congresses of sciences applied to agriculture, of agricultural societies, academies, learned bodies, etc.

The Institute publishes: *a*) a Monthly Bulletin of Agricultural Statistics; *b*) a Monthly Bulletin of Agricultural Intelligence and Diseases of Plants; *c*) a Monthly Bulletin of Economic and Social Intelligence.

It has also published a volume on " The Organization of Agricultural Statistical Services in the Several Countries ", and a volume " Statistics of Cultivated Areas and of Vegetable and Animal Production in the Adhering Countries " (an Inventory drawn up from documents published by Governments).

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EDITORIAL STAFF
OF THE BUREAU OF AGRICULTURAL INTELLIGENCE
AND PLANT DISEASES

GENERAL INTRODUCTION

AND LIST OF STATES, COLONIES AND POSSESSIONS ARRANGED IN GEOGRAPHICAL ORDER, IN THE SEQUENCE TO BE FOLLOWED BY THE BULLETINS OF AGRICULTURAL INFORMATION AND PLANT DISEASES.

GENERAL INTRODUCTION

> Bivium enim nobis ad culturam dedit Natura, experientiam et imitationem. Antiquissimi agricolae tentando pleraque constituerunt, liberi eorum magnam partem imitando. Nos utrumque facere debemus, et imitari alios, et aliter ut faciamus experientia tentare quaedam: sequentes non aleam, sed rationem aliquam.
>
> M. T. VARRONIS, *De Agricultura* lib. I, c. XVIII.

The Bureau of Agricultural Intelligence and of Diseases of Plants, in the International Institute of Agriculture, collects and compiles information published, day by day, in the whole world, on agricultural progress and on scientific and technical investigations into the several branches of farming and of the industries connected therewith.

It thus deals with all that is being done, in every part of the globe:

to reclaim and make healthy deserted regions, bringing them under the dominion of man;

to improve land already under cultivation, increasing its fitness for habitation and culture;

to increase the quantity and improve the quality of agricultural products;

to preserve or restore forests on mountains and coastlands, safe-guarding the area of fertile land and preparing sources of future energy and wealth.

Besides collecting information on the measures taken to enlarge in all countries—from the most civilised to the remote and inhospitable,—the area useful to man, the Intelligence Bureau will gather information on those more specialised studies which contribute so powerfully to the success of agricultural undertakings, directly and indirectly promoting the welfare of farmers and the prosperity of States. Such are the studies on the conditions governing the life and development of plants and animals, and of those micro-organisms which so powerfully influence the growth and health of all higher forms of life.

Thus, the Intelligence Bureau will deal with the facts involved in the study of soils, waters, manures, cultivation of plants, plant-breeding, stock-breeding, the industrial transformation of vegetable and animal products, agricultural implements and machinery, and means for preserving and preparing and bringing to market farm products: indeed, with all subjects connected with the theory and practice of agriculture and allied industries and regarding the intellectual and scientific organisation of husbandry.

No small part of the success in farming depends on the protection of crops against the many diseases and pests, which attack them with increasing virulence. These diseases and pests weave wide and varied networks of distress, passing from country to country: teaching, by mutual and increasingly interchanging losses, which afflict diverse and distant nations, the advantages of a far-reaching network of research and of defence, serving for prompt alarm at every new appearance of common and ubiquitous enemies.

Attention will be given by the Bureau to some special legislative or other measures taken by the Governments of the several countries in behalf of agriculture: by promoting technical training and experiments, by manifold land-improvements, by protecting plants against parasites and diseases, and by inspecting the trade in products, the purity and genuineness of which are of importance to agriculture. The Bureau will likewise keep in touch with the work of Agricultural Academies and Societies and with the proceedings and resolutions of national and international Congresses of Agriculture, or regarding special branches of farming.

The Agricultural Intelligence Bureau intends publishing the information gathered day by day, from all countries, in a series of Bulletins of which this is the first.

Each Bulletin will contain recent information, published during the previous months, on the agricultural development of one or several countries. The Bulletins will vary in length according to the amount and importance of the information, dealing separately with each country.

Due importance, in a special section of each Bulletin, will be given to all official communications made by the Governments of the States adhering to the International Institute of Agriculture, as to agricultural development in their respective countries, or on other questions within the purview of the Bureau of Agricultural Intelligence and Diseases of Plants.

Art. 9 of the Convention of 1905, and art. 20 of the Bye-Laws of the Institute, provide for special communications, to be supplied only by the Governments of each State as to the outbreak of new diseases of plants, or of similar pests, within the country, or in case of virulent outbreaks of old diseases. The official communications from each Government constitute the only official and original part of the Bulletins. Such communications will be transcribed as received, or merely translated. They may even be issued apart, as separate leaflets or papers: for information supplied by Governments in the interests of their national agriculture should be published and distributed with the shortest possible delay.

The Bulletins will consist mainly of summaries and reviews of the scientific and technical press on the agriculture of one or more countries, published during the previous months.

All the questions involved in the study of agricultural statistics and crop-reporting are dealt with by the Statistical Bureau of the Institute, which publishes the Bulletin of Agricultural Statistics. The problems involved in agricultural cooperation, credit and insurance and regarding general and economical legislation are the province of the Bureau of Economical and Social Institutions. Such questions will, therefore, form no part of the work and publications of the Agricultural Intel ligence Bureau.

The Bulletins of this Bureau will not as a rule, contain original unpublished matter. They consist, as said above, of reviews, summaries and extracts, regarding the more interesting subjects treated in the scientific and technical press on farming and on agricultural research in each country. Whatever may be the nature of the publications thus summarised, books, periodicals or reports, published by academies, associations or congresses, government reports and circulars, the chief object will be to give a picture of the agricultural science and practice of each country, without any attempt at criticism. The only discrimination will consist in the selection of such matter as is likely to be useful or suggestive to many, in several countries, and of general interest. The responsability for the facts and data given belongs solely, of course, to the authors whose works are reviewed, or abridged, and whose words will be in many cases quoted.

Each nation will thus speak for itself, by its statistics and enactments, through its own writers and experimentors, telling the story of the present conditions of its husbandry and of the day by day experience in farm and in scientific laboratory.

The reviews or extracts will necessarily be brief, and in some cases may even take the form of mere summaries or bibliographical data. But as the object of these Bulletins is to make the progress achieved by each country known to other countries, and to diffuse and coordinate agricultural knowledge, the reviews published must be more exhaustive than the mere references made to such subjects in the many Reviews, Records, Annals and *Centralblätter*, published in several countries. The Agricultural Intelligence Bureau of the Institute avails itself of such reviews for rapidly getting at the original sources of information; but when these are not attainable it will reprint the brief abstracts as given in the special reviews, which will always, of course,be duly recorded and quoted.

When dealing with important passages and questions, the text of the publication reviewed will often be quoted in the original words. In the case of bulky publications or books, dealing with several different questions, some of these may be recorded separately, in the prescribed order followed in the Bulletins.

Mention is made, of course, of the sources of all information published. It is intended that the abstracts themselves shall contain, as far as possible, some of the more important data, and describe some experiments, noting the concrete deductions to be drawn therefrom: so as to save the generality of readers the need of consulting the original publication (often not easily available), at the same time pointing out to specialists its value and importance.

Precedence in each Bulletin is given to official communications, and then to general agricultural information of national interest to the countries of which the special Bulletin treats. Then will follow information on research publications and on provisions regarding the special branches of agricultural science and practice in each country, or that concern its agricultural interests.

For each country the subjects are arranged in the following uniform order:

Official Communications.

Direct official communications from State authorities to the International Institute of Agriculture.

Agricultural Information.

I. Information on extent of territory, population, acreage of crops, production, live-stock, on trade in chief agricultural products.

II. Legislative provisions and measures taken by the State for the promotion of agricultural production. Information regarding Ministries and Departments of Agriculture, or other State departments connected with agriculture.

III. General considerations and inquiries into the conditions of agriculture in the country. Tenure of land in its relations to production and to technical instruction. Typical farming.

Soil-surveys.—Agricultural development. Projects or recent work in land-reclamation and conservation, in irrigation, in afforestation.

IV. Agricultural Societies and similar institutions. Their action in promoting experimentation and encouraging the technical progress of farming and of industries connected with agriculture and forestry. —Agricultural and Horticultural Shows.—National and International Congresses.

V. Agricultural Education.—Experimental Stations and the organisation of agricultural research. Intellectual development of the rural population.

VI. The history of agricultural development. History of science connected with agriculture. Biographical notices of agricultural worthies.

VII. How crops are composed, how they feed.

Chemistry of plant products and of plant-life.

VIII. Agricultural Botany.

Description and development of plants and of plant-organs. Mechanism of plant-life.

IX. How plants may be naturally or artificially modified, in special organs, or in their whole growth.—Plants in their relation to environment, to other plants, and to insects and other animals.

Plant-breeding.

X. Bacteria and Ferments. How they feed, live and increase. Special products of their activity.—Bacteria in their relations to higher organisms.

Yeasts and fermentations. Alcoholic and other fermentations.

Moulds, Algae and other inferior vegetable organisms.

Antiseptics. Means for controlling and modifying the action of Bacteria.

XI. Climate and Meteorology. Weather forecasts and meteorological organisation in the interest of agriculture.—Sunshine and atmospheric temperatures in their relation to crops.—Frost-fighting.—Hailstorms and efforts to prevent them.—Atmospheric electricity and vegetation.—Rainfall and evaporation.—The atmosphere as a source of plant food.—Atmospheric purity in respect to vegetation. Damages due to noxious fumes.

XII. Percolation of rainfall and storage of water in rocks and soils. Ground-water, springs, wells, ponds, etc. Movements of water in the soil. Conditions that affect soil-moisture.—Composition of natural waters. Drinking waters and waters for irrigation.—Protection of the purity of streams.

XIII. Geology in its relation to agriculture. Weathering of rocks and soil formation. Land- preservation.

Soil classification. Mechanical and chemical composition of soils. Soil-physics. Mineral constituents of soils.

Humus and the nitrogenous compounds of soils. Soil-bacteria and their transforming action. Nitrogen fixation and nitrogen transformation and dispersion in soils. Action of earthworms and other organisms in the soil.—Fertility.

XIV. Making and improvement of land. Warping and preservation of soil on hill-sides.—Reclamation of barren lands. Alkali soils.—Peat-burning and moor-culture. Prcservation of coast-land and cultivation of sand-dunes.

XV. Artificial water-storage.—Irrigation.—Utilising underground-water.—Land-drainage.

Legislation regarding the use of water in agriculture.

XVI. Tillage.—Tilth.—Influence of tillage, of drainage and of soil-conditions generally on root-development. Economy of soil-moisture—Trenching.

XVII. Fallowing. The resting of the soil. Soil sickness.—Control of soil-bacteria. Soil inoculation. Special bacterial cultures used for increasing fertility.—Paring and burning. Heat and antiseptics as soil-improvers.

XVIII. Theories of fertiliser action.—Experiments with fertilizers. Experimental fields.—General considerations on field experimentation. —The effect of manures on soils and on vegetation. Influence of manures on different crops. Manuring in regard to climate.

XIX. Organic fertilisers.

Green manuring. Sea-weeds and other vegetable refuse as a manure. Composts. Peat in manuring.

Dung and Urine. Farmyard manure. Night soil. Utilisation of town-sewage. Animal refuse as manure. Guanos.

Manure value of cattle-feeds.

XX. Chalking, Marling and Liming.—Gypsum as a corrective of soils. Other soil-correctives.

XXI. Special fertilisers.—Nitrates. Ammonium Salts. Lime-cyanamide.—Artificial fixation of free nitrogen.—Phosphatic fertilisers. Bone meal and bone ashes.—Mineral phosphates. Superphosphates. Basic slag, etc. Potassic manures. Stassfurt salts. Wood ashes. —Other substances used as fertilisers.

XXII. Manufacture of fertilisers. Examination and valuation of fertilisers.—Frauds in the sale of fertilisers. Trade in fertilisers. Legislation regarding fertiliser-trade.

Valuation of unexhausted manurial residues in soils.

XXIII. Systems of culture. Rotation of crops.—Culture systems in special climatic or soil conditions. Dry-Farming. Irrigation farming.—Electro-culture.—Action of crops on the soil.

XXIV. Agricultural Seeds. Composition, ripening, vitality and germination of seeds. Examination of seeds. Frauds in the seed-trade.

Legislation regarding the sale of seeds and of plants, or of living parts of plants.

XXV. Crops and experimentation connected therewith.

Corn Crops and other Food-grains.—Root and tuber plants for food and forage.

Grasses and leguminous forage crops. Meadows and Pastures. Hay. Ensilage.

XXVI. Fibre plants.—Sugar producing crops. Oil-producing crops. Tobacco and other industrial crops. Curing of some special products.

XXVII. Horticulture. The forcing of plants. Small fruit. Market Gardening.—Flower-culture as an industry.—Spice, condiment and perfume producing plants. Essence industry.

XXVIII. Arboriculture. Generalities. Pruning, Grafting, etc. Pollination and fruit ripening from a cultural point of view.

Vines.—Olives.—Citrus-trees. Fruit-trees. Mulberries. Palmtrees, etc.

Preservation and preparation of fruit. Canning-industry.

Ornamental trees and shrubs.

XXIX. Forestry. Afforestation and Forest Conservation. Forest trees: conditions affecting their growth.—Timber.—Preservation of timber. —Forest industries and special products. Charcoal. Resin. Cork. Tanning materials. Wood distillation. Cellulose paste.

Willow-culture; basket-work and similar industries.

Forest legislation. Prevention of forest-fires.

Useful wild plants.

Mushrooms and truffles and their culture. Poisonous Mushrooms.

Wild Animals and their products (furs, skins, ivory, etc.).—Game-protection.

XXX. Rubber plants and industry. Camphor, Gums, and other special products, partly spontaneous, partly produced by culture.

XXXI. Weeds and Diseases of plants.

Noxious weeds and their prevention.

Vegetable parasites.

Parasitic and saprophytic Fungi. Conditions affecting parasitism.

Bacteria and plant diseases.

Resistance of plants to disease.

XXXII. Animal and Insect pests.

Rats, field-mice, and other vermin.

Insect-life.

Insects noxious to crops, to cattle, to man and to special products. Other harmful inferior animal organisms.

XXXIII. Antiparasitic and Insecticide preparations. Spraying: contrivances and implements for combating parasites and pests.

Frauds in the sale of such preparations and measures for controlling their trade.

Legislation regarding the sale of insecticides and similar preparations.

Legislation regarding plant diseases and pests. Legislation against weeds.

Protection of plants against wanton destruction.

XXXIV. Animal physiology, chiefly in regard to nutrition, growth and fattening. Animal Chemistry.

Feeding and fattening experiments.—Breeding and Selection.

XXXV. Cattle-foods: Composition and feeding-value. Frauds in the sale of feeds. Legislation regarding cattle-foods.

Housing and hygiene of domesticated animals.

XXXVI. Special Stock-breeding.—Horses. Cattle. Sheep and Goats. Swine. Other higher domesticated animals.

Meat production and connected industries.

Production of Wool. Trade in Wool.

Some special products of domesticated animals.

XXXVII. Dairy farming and dairying.—Breeding and improvement of dairy cattle. Feeding experiments.—Physiology of milk-production. —Chemistry of milk.

Storing, preservation and carriage of milk. Preservation against noxious germs.

Butter-making. Cheese-making. Other industries connected with milk. Bacteriology of milk and milk products.

Legislation regarding the sale of milk and of dairy products.—Trade of dairy products.

XXXVIII. Aviculture.—Poultry. Pigeons, etc. The feeding and fattening of poultry.—Production, preservation and trade of eggs.—Ostrich-raising.

Trade in feathers and bird-skins.

Bird-life in connection with agriculture. Protection of bird-life from wanton destruction. Wild birds.

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Honey. Wax. Silk. Trade in these products.

Other useful insect products.

XL. Fresh-water fish-culture in its relations to agriculture.

XLI. Industries connected with agriculture. Fermentation industries. Technical mycology and bacteriology connected with these industries.

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Beerwort and Beer.

Cider and other fruit-wines.

Spirit industry and special alcoholic beverages.

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XLII. Cane sugar and Beet sugar industries.—Other sugar industries. —Industries of starch and glucose.

XLIII. Milling industry. Flour. Bread. Bye-products.

Other industries for the preparation of grain-foods. Preservation of grain-foods.

Seed and olive oils and other vegetable oils.—Legislation regarding fraud in the oil-trade.—Secondary products of the oil-industry.

XLIV. Foods. Dietaries of rural population. Legislation regarding the purity of food.

XLV. Tannin industry. Hides. Leather.

Trade in these products.

Other animal industries.

XLVI. Land Sanitation. Inquiries on some diseases connected with agriculture. Measures for promoting the health and physical welfare of the rural population and favouring country-life. Repression of Malaria.

XLVII. Farm-Buildings. Roads. Waterways. Transports.

XLVIII. Agricultural implements ond machinery. Legislation regarding agricultural machinery.

XLIX. Preparation of products for the market. Marketing.

Storage and Refrigeration of Agricultural Products. Industrial refrigeration.

L. Weights and Measures. Miscellaneous Notes.

Weights and measures and values of exchange present difficulties when summarising the information contained in the agricultural and scientific press of some countries. Scientific publications generally make use of the decimal metric system and measure temperatures by the centigrade scale. But farmers are unwilling to change the systems to which they are accustomed; and in agricultural experiments, especially in some countries, data are generally reckoned in accordance with the old prevailing local usage.

For the sake of comparison it would be desirable that all measures and values be converted to that metric and monetary system which France, with justifiable pride, dedicated " to all ages and all peoples." In many cases this will be done; but as the original figures will always be given, brevity and the fear of overloading the pages with numbers, will often compel us to give the original data only, converting into the metric system the more important and conclusive figures. Tables of reference and coefficients of reduction, for converting measures and values into the decimal metric system, will be given in those Bulletins where such information is required.

Translating from the periodical press and from books and reports written in many different languages, mistakes may easily be committed in the names of plants and their diseases, and in the names of insects, of allied pests, and of other animals. In the case of scientific names, whether botanical or zoological, efforts will always be made to verify them by trustworthy books of reference: for instance, in the case of flowering plants, by the *Index Kewensis*. Unfortunately, such complete and handy nomenclators as this Kew Index, due to the initiative and generosity of Charles Darwin, do not exist for other branches of botany and for zoology. The need is also felt of international books of reference for agricultural and industrial terminology.

It is still more difficult to render correctly from the original languages the common names of plants and of animals, of diseases of plants or of pests, as those given are sometimes unaccompanied by the scientific name. In these cases, except when the names are quite well known, search will be made for the corresponding scientific name, to be given under the responsability of the editor, the name in the original language being always quoted.

It is proposed to render reference more easy by means of indexes, annexed to the Bulletins, these indexes serving as glossaries of the common names of plants and of insects, in some of the more important languages.

The habitable globe can be divided politically and agriculturally into 170 regions. Some of these represent vast territories, others comparatively small ones, others, again, quite tiny areas. There are huge empires and dominions, such as Russia and China, Canada and the United States of America (not including the detached territories, such as Alaska, Porto Rico, the Hawaii and Philippine Islands, which must be dealt with separately), in which, spite of wide differences in climate, products, modes of cultivation and habitability, the territory is politically united and continuous. Other divisions include small countries, several of which, though geographically small, are intellectually important and expansive, and in which production is intense and trade active.

Again there are colonies and possessions belonging to different countries, some of which extend over large continents, whilst others are remote archipelagos or solitary islands. They are regions that must be considered separately, forming distinct and distant territories, differing in climate and products from the mother-country.

The 170 countries will be dealt with in geographical order. Beginning with Great Britain and Ireland and then France, in the extreme North-West of Europe, and proceeding through part of northern, and then central, and southern Europe (with some inevitable breaks in continuity), thence through the Empires of Russia and Turkey, which unite Europe and Asia, we pass to the purely Asiatic States and Dominions. Persia with its surrounding countries, India, Siam, Indo-China, and Malaya, China and the Japanese Empire, the Dutch Indies and other insular possessions in the Far East: ending with the Dutch, German and British possessions in New Guinea. Then come the flourishing colonies of the Commonwealth of Australia, New Zealand and the many island groups of the Pacific, leading on to America. Beginning with Alaska and Newfoundland, we pass to the vast, fertile and active territories of Canada and the United States, dealing separately with the several States of the Union, so varied in climatic and agricultural conditions. Next come Mexico, the islands and states of Central America, and the great countries of South America.

Last in the series of continents comes Africa. Beginning with Egypt, a country venerable for its ancient glory and fertility, and now growing to a new age of plenty by means of admirable works of agricultural improvement, we proceed through the states and possessions of Northern Africa, descending southwards along the Atlantic coast. Next follow the new and varied dominions and protectorates of Central Africa, where agriculture is developing under the adverse conditions of disease-spreading pests, fatal to men and beasts.

Passing through the several possessions on the East Coast of Africa and on to Madagascar and to the less distant islands, then back to the continental more southern possessions of Portugal, Germany and Great Britain, we end with the Union of South Africa and the minor and more remote ocean-islands.

Thus, from arctic Iceland, to antarctic Kerguelen (where, the first attempts at cattle raising and farming are now being made) every region and centre of human activity should be dealt with. Under every clime and for all the products of forest, field, and pasture land, we shall endeavour to follow the more important undertakings, explorations and researches which aim, by promoting agriculture, to increase the measure and to widen the area of human prosperity.

Information will thus be given, in the present Bulletins, from time to time, on each of the many regions into which we have divided the habitable globe. For the more important countries from which regular and manifold information is obtainable, constant and varied news will be supplied. On the other hand, efforts will be made to collect information on the less accessible and known countries. Knowledge regarding the opening up of new regions may be of great advantage to the future progress of agriculture, and of much actual value to industrial and commercial undertakings, with reciprocal advantage to the civilisation of old and of new countries.

It may sometimes happen that more space will be devoted to a small and remote island than to a country far in advance both in population and activity. In all agricultural matters the final test of importance is their utility and the suggestions they may contain for new developments in suitable places. Their value is often more dependent on locality than on the intrinsic nature of the question itself.

The object kept in view in selecting information will be to give a general account of the present agricultural aspect in each country, delineating the intellectual movement which urges on to increase and improvement of production. A picture of the active life of the farm, where science is already being transformed into action, is preferable, for the purposes of the present publication, to an account of the details of laboratory work.

This series of bulletins, dealing with separate countries, all reduced to the common denominator of a single language, will supply each State with material for comparisons, in themselves a most valuable form of international cooperation.

" Nations figure by comparison " (wrote Arthur Young, chief of pioneers in the study of Comparative Agriculture); " and those ought to be esteemed the benefactors of the human race, who have most established public prosperity on the basis of private happiness. "

Comparisons are valuable even when drawn between countries differing in climate, conditions and development, whether they deal with recent experiments or with customs and traditions handed down from of old. Experiments carefully carried out over a series of years always teach valuable lessons, even to countries widely different in climate and natural conditions. An American writer recently remarked that no single bit of land has exercised so powerful, beneficent and enduring an influence over the agriculture of the vast territory in the United States so varied in climate, soil and social conditions, as a few acres of land at Rothamsted, in England. Indeed, the persistent experiments, started by Sir John B. Lawes in 1843, and rendered famous by Lawes himself and his life-long co-worker Sir J. H. Gilbert, experiments which have been carried on now over a period of nearly 70 years, teach the most valuable lessons to agriculture in all countries, stimulating all to go and do likewise.

Both field experimentation and laboratory work, besides being of particular national importance, are of universal interest. The patient work, going on these last twenty years at Svalöf, is not of interest to Sweden alone, but promotes crop-improvement the wide world over. Names that are the pride of some nations, as Saussure, Boussingault, Liebig, Pasteur, Claude Bernard, Julius Sachs, H. Hellriegel, Chr. Hansen, M. Maercker, J. Kühn, have become household words suggesting research wherever agricultural science is taught. The admirable organisation of the agricultural experiment stations, by which to-day the United States of America contribute so abundantly to the progress of farming in all countries, has its root and example in the solid ground of German research and German scientific organisation upon which all nations build, receiving day by day new material for increase.

Exchange of agricultural knowledge between different nations has at all times, in some way, been practised. But modern needs require, more than in the past, that knowledge applicable to good and abundant production of the soil be rapidly increased and widely diffused. For now that each country is becoming an important producer of one or another staple, and is obliged to seek far and near the material necessary for food and for its industries, more than ever there is need of wide and above all of prosperous markets. The wealth of all is advantageous to each taken separately; and in agriculture, more than in other industries, it can be truly said that by contributing to the prosperity of other countries each country promotes its own.

The experimental stations which are now being established in India to study the diverse features of the ancient agriculture of that country, even in the arid districts of the peninsula, will probably repay Southern Europe for the valuable lessons which Indian engineers learnt from the irrigation systems of Italy and Spain, and from the wise legislation which in Lombardy allowed the growth of irrigation during the stormy Middle Ages. At the present day, experience acquired in India and Egypt is being applied to restore to Mesopotamia, now a desert, the marvellous fertility which irrigation had procured in Biblical times to the land between the Euphrates and the Tigris.

Often the wisdom of centuries of experience and of adaptation is stored in those ancient systems of agriculture which seem backward and unwilling to progress; they should therefore be studied rather than ignored, or despised. Traditionary practice may yet be able to teach valuable lessons in the cultivation of the soil to those younger countries which sometimes think they have made new discoveries when in fact they are applying methods which elsewhere are as old as the hills. Perhaps knowledge of the traditional methods of cultivating the soil in Sicily and Apulia and in some parts of Spain and the Levant might be more instructive to those practising the rising systems of dry farming, which rouse so great an interest in the West of the United States and in the arid regions of the Australian and South African Colonies, than is now supposed.

It is not sufficient, in picturing the life and advance of agriculture amongst the nations, to collect the evidence, however precious, supplied by laboratory work and agricultural experiment stations. Agriculture ought to be minutely studied as practised on the farm, and data be gathered as to the yields obtained from the different soils and the various crops. Too often the student of agriculture is inclined to neglect the lessons taught by wide everyday experience, forgetting that the real experimental ground, the greatest laboratory for agriculture, is in the infinite variety of fields, crops, climates, seasons, in which the practical farming of the world is carried on. Daily experience and practice often teach what remains a sealed book to those who study only in laboratories and libraries. The opinion of a hundred country-folk may be well worth that of a single academician: wrote an eminent French chemist and agriculturist.

The intuition of humble and unknown experimentors has often given rise to admirable systems of cultivation. Practical farmers, whose names are forgotten, found out some of those efficient means for protecting crops from disease and injury which the laboratories have only been able to study and endorse late in the day. Along a sandy track of the Atlantic Coast of Spain, which stretches from the mouth of the Guadalquivir towards Cadiz, prosperous market-gardens have grown up, out of what were formerly sterile and deserted wastes. No laboratory has ever taught such a valuable lesson on sand-culture. These *navazos* of Spain offer an example which might well be imitated in both the old and the new world, in many a sterile and deserted coast-land.

" Experience and imitation are the two paths marked out
" by Nature for husbandry. Much did the ancients establish
" by experiment: much have their descendants done by
" imitation. We should do both the one and the other: imi-
" tate the old, and, by experimenting, try the new, governed
" not by chance, but by reason ".

By these words of M. Terentius Varro, twenty centuries ago, Ancient Rome taught the fundamental ideas of true husbandry, indeed, of all agricultural and scientific progress. They may well be taken as a text to-day: now that, by collecting and coordinating agricultural knowledge and experience from all parts of the world, an effort is being made in Modern Rome to bring the agriculture of many nations into fruitful contact.

Rome, Sept. 1910.

ITALO GIGLIOLI.

States, Colonies and Possessions arranged in Geographical order, in the sequence to be followed by the Bulletins of Agricultural Information and Plant diseases.

The area, number of inhabitants and density of population are given according to recent statistics, as published in *The Statesman's Yearbook for 1910* (Edited by J. Scott Keltie & I. P. A. Renwick) and in the *Almanach de Gotha*, for 1910.

	Area in Square Km.	Population	Density populat. Inhab. per square Km.
1. Great Britain and Ireland	314 339	45 526 000	132
2. France	536 464	39 252 267	73
3. Monaco	20.6	19 121	—
4. Belgium	29 456	7 386 444	251
5. Luxemburg	2 586	246 455	95
6. Netherlands	33 000	5 825 198	176
Kingdom of Denmark:			
7. Denmark and Faeroe Islands	40 384	2 605 268	66
8. Iceland	104 785	78 470	0.7
9. Norway	322 987	2 330 364	7
10. Sweden	447 864	5 429 600	12
11. Germany	540 777	60 641 278	112
12. Switzerland	41 324	3 525 256	85
13. Liechtenstein	159	9 650	60
Austro-Hungarian Monarchy:			
14. Austrian Empire	300 193	27 995 986	93
15. Hungarian Kingdom	325 325	20 469 157	63
16. Bosnia and Herzegovina	51 027	1 828 379	36
17. Montenegro	9 080	250 000	27
18. Servia	48 303	2 824 844	59
19. Romania	131 353	6 771 722	51
20. Bulgaria	96 345	4 035 575	42
21. Greece	64 657	2 631 952	41

	Area in Square Km.	Population	Density populat. Inhab. per square Km.
22. Samos (Turk.)	468	53 424	114
23. Crete (Turk.)	8 618	310 056	36
24. Cyprus (Brit.)	9 282	256 433	28
25. Italy	286 682	34 269 764	120
26. San Marino	61	11 002	180
27. Malta (Brit.)	303	212 888	703
28. Spain (with Canary Islands, Ceuta, etc.)	504 517	19 712 585	39
29. Gibraltar (Brit.)	5	18 316	—
30. Andorra	452	5 231	11
31. Portugal (with Azores & Madeira)	91 943	5 423 132	61
Russian Empire:			
32. Russia and Finland	22 575 804	155 439 504	6
33. Bokhara	205 000	1 500 000	7
34. Khiva	60 000	800 000	13
35. Turkey in Europe and Asia	1 936 100	23 813 600	12
36. Oman (Muscat)	194 200	500 000	3
37. Persia	1 645 000	9 000 000	—
38. Bahrein Islands (Brit.)	600	68 000	113
39. Aden, Perim, Sokotra & Kuria Muria I. (Br.)	44 086	195 974	—
40. Afghanistan	558 000	5 000 000	—
41. British India and Dependencies	4 592 110	294 317 082	61
42. Sikkim (Brit.)	7 300	59 014	8
43. Bhután	34 000	400 000	12
44. Nepal	154 000	3 000 000	19
45. French India	509	277 723	546
46. Portuguese India	3 807	531 798	145
47. Ceylon and Maldives (Brit.)	65 907	4 068 456	62
48. The Straits Settlements (Brit.)	4 140	620 197	150
49. The Federated Malay States, Kelantan and Keda (Brit.)	101 640	1 534 000	16
50. Johore State (Brit.)	18 000	200 000	11
51. Siam	600 000	7 500 000	12
52. French Indo-China	663 700	16 315 063	25
53. China	11 138 880	330 130 000	30

	Araa in Square Km.	Population	Dansity populat. Inhab. per square Km.
54. Hong Kong and territory (Brit.).	1 009	421 499	116
55. Weihaiwei (Brit.)	738	130 792	178
56. Kiau-Chau (Ger.)	501	36 858	73
57. Macao (Port.)	10	63 991	—
58. Concession of Tientsin (Ital.) .	46	17 000	370
Japanese Empire:			
59. Japan, Formosa, etc.	452 922	53 355 313	118
60. Corea	218 650	9 781 671	40
61. Philippines (U. S.)	296 310	7 635 426	27
62. Guam (U. S.)	514	11 760	22
63. British Borneo (N. Borneo, Brunei, Sarawak)	204 850	698 286	3
64. Dutch East Indies.	1 915 417	38 938 000	21
65. Portuguese Timor.	18 989	200 000	12
66. German New Guinea & Dependencies (Carolines, etc.) . .	241 131	419 968	1,7
67. Territory of Papua (Australia, Brit.)	229 102	500 000	—
68. The Commonwealth of Australia (Brit.)	7 704 298	4 306 000	0,6
69. New Zealand (Brit.)	271 059	989 560	4
70. Fiji (Brit.)	20 045	130 891	6
British Pacific Islands:			
71. Tonga	1 010	21 695	21
72. Ducie, Pitcairn, Union, Ellice, Solomon, S. Cruz Islands, etc.	23 713	189 504	8
73. New Hebrides (Brit. and Fr.) .	13 227	85 000	6
74. German Samoan Isl.	2 572	37 436	14
75. Amer. Samoan Isl. . . .	199	4 000	19
76. New Caledonia and Dependencies (Fr.)	20 078	61 886	3
77. French Est. in Oceania (Tahiti, Marquezas, etc.) . . .	4 140	30 974	7
78. Hawaii (U. S.)	16 702	192 407	12
79. Alaska (U. S.)	1 530 327	82 516	0.05
80. Greenland (Dan.)	88 100	11 895	0.1

	Area in Square Km.	Population	Density populat. Inhab. per square Km.
81. Newfoundland and Labrador (Brit.).	128 670	237 047	—
82. St. Pierre and Miquelon (Fr.) .	242	6 482	27
83. Dominion of Canada (Brit.) .	9 659 400	6 153 789	0.6
84. United States of America . .	7 839 064	83 941 510	11
85. Mexico	1 987 201	13 607 259	7
86. Guatemala	113 030	1 882 992	16
87. British Honduras	19 580	42 406	2
88. Honduras.	114 670	500 136	4
89. Salvador	21 160	1 707 000	81
90. Nicaragua	128 340	459 888	3
91. Costa Rica	48 410	360 326	7
92. Panama	87 480	419 029	5
93. Bermudas (Brit.)	50	19 229	385
94. Bahamas (Brit.).	11 405	60 309	5
95. Barbados (Brit.)	430	194 518	453
96. Jamaica and Depend. (Brit.) . .	11 918	847 087	71
97. Leeward Is. (Antigua, Dominica, Montserrat, etc.) (Brit.) . .	1 816	135 849	75
98. Trinidad and Tobago (Brit.) .	4 839	334 543	69
99. Windward Islands (Grenada, S. Lucia, etc.) (Brit.) . . .	1 307	178 378	136
100. Danish West Indies	359	30 527	85
101. Guadeloupe and Depend. (Fr.).	1 780	190 273	107
102. Martinique (Fr.)	987	182 024	184
103. Cuba	118 833	2 048 980	17
104. Haiti	28 676	1 800 000	62
105. Rep. of Sto. Domingo . . .	48 577	610 000	12
106. Porto Rico (U. S.)	9 314	953 243	102
107. Curaçao (Dutch)	1 130	53 065	47
108. Columbia	1 127 372	4 320 000	3
109. Venezuela	942 300	2 661 569	3
110. British Guyana	233 808	304 549	1.3
111. Dutch Guyana	129 100	84 103	0.6
112. French Guyana.	78 900	39 117	0.5
113. Ecuador with Galapagos I. .	307 243	1 272 000	4
114. Peru	1 769 804	4 559 550	2.6
115. Bolivia.	1 470 196	1 953 916	1.3

	Area in Square Km.	Population	Density populat. Inhab. per square Km.
116. Brazil	8 550 000	20 515 000	2.5
117. Paraguay	253 100	631 347	2.5
118. Uruguay	186 925	1 042 668	4
119. Argentine Rep.	2 806 400	6 130 000	2
120. Chile	758 206	3 249 279	4
121. Falkland Islands and Dep. (Brit.).	424 800	2 289	—
122. Egypt	994 300	11 287 359	11
123. Anglo-Egyptian Sudan . . .	2 470 000	2 363 000	1
124. Tripoli (Turk.)	1 051 000	1 000 000	1
125. Tunis (Fr. Protect.)	167 400	1 830 000	11
126. Algeria (Fr.).	890 000	5 158 051	6
127. Morocco	439 240	8 000 000	—
128. Rio de Oro and Adrar (Sp.) .	185 000	130 000	0.7
129. Cape Verde Islands (Port.) .	3 822	147 424	38
130. Portuguese Guinea	33 900	170 000	5
131. Gambia Colony and Protectorate (Brit.)	9 373	161 000	17
132. French West Africa & Sahara .	6 774 800	9 279 000	—
133. French Congo	1 762 000	3 652 000	2
134. Sierra Leone (Brit.)	77 700	1 326 700	17
135. Liberia.	95 400	1 500 000	16
136. Gold Coast (Brit.).	308 870	1 696 965	5
137. Togoland (Germ.).	87 200	1 000 268	11
138. Northern Nigeria Protectorate (British)	200 100	6 000 000	30
139. Southern Nigeria Protect. & Lagos (Brit.)	664 100	7 000 000	11
140. Kamerun (Germ.)	495 600	3 001 128	6
141. Spanish Guinea.	25 700	139 000	5
142. Fernando Po, Annabon, etc. (Sp.)	2 015	21 946	11
143. S, Thomé and Principe (Port.)	939	42 103	45
144. Angola (Port.)	1 270 300	5 800 000	3
145. Congo (Belg.)	2 382 800	15 500 000	—
146. The Uganda Prot. (Brit.) . .	578 800	3 520 000	6
147. Abyssinia	520 000	8 000 000	—
148. Eritrea (It.)	118 610	279 551	2

	Area in Square Km.	Population	Density populat. Inhab. per square Km.
149. French Somali Coast. . . .	21 000	208 061	10
150. Somaliland Protectorate (Brit.)	176 100	348 076	2
151. Italian Somaliland.	336 040	400 000	1
152. British East Africa Protectorate	454 754	4 038 256	9
153. Zanzibar and Pemba Protect. (Brit.)	2 640	225 000	85
154. German East Africa	995 000	10 002 845	10
155. British Nyasaland Protectorate.	106 134	928 270	9
156. Portuguese East Africa . . .	761 100	2 300 000	3
157. Madagascar (Fr.)	592 100	2 706 661	4
158. Mayotte and the Comoro Islands (Fr.)	1 980	96 314	43
159. Réunion (Fr.)	1 980	177 677	90
160 Mauritius and Dependencies (Brit.).	2 166	382 399	177
161. Seychelles (Brit.)	386	21 982	57
162. Rhodesia (Brit.)	1 138 494	1 398 700	1.2
163. Bechuanaland Protect. (Brit.) .	712 200	133 100	0.2
164. Swaziland (Brit.)	16 928	90 890	5
165. Basutoland (Brit.)	26 658	351 000	12
166. German S.-W. Africa. . . .	835 100	175 213	0.2
167. Union of South Africa (Brit.).	1 227 490	5 471 490	4.4
168. Ascension Island (Brit.) . . .	88	410	5
169. St. Helena and Tristan da Cunha (Brit.)	238	3 595	15
170. Kerguelen, St. Paul and New Amstérdam I. (Fr.)	3 487	59	—

UNITED KINGDOM

OF

GREAT BRITAIN AND IRELAND

I.

GREAT BRITAIN

ENGLAND, WALES, SCOTLAND, ISLE OF MAN

CHANNEL ISLANDS

GREAT BRITAIN

AGRICULTURAL INFORMATION

I.

Information on extent of territory, population, acreage of crops, production, number of live-stock, on trade in chief agricultural products.

Area and Population of the United Kingdom, estimated for 1909, except for the Isle of Man and the Channel Islands for which the figures for 1901 are given. The total population includes Army, Navy and Merchant seamen abroad.

United Kingdom of Great Britain and Ireland	Area in square km.	Population	Density of population. Inhab. per sq. km.
I. — England & Wales . .	151 015	35 756 615	215
II. — Scotland	78 748	4 877 648	56
III. — Ireland	83 792	4 374 158	53
IV. — Isle of Man	588	54 752	93
V. — Channel Islands . . .	196	95 618	489
United Kingdom . . .	314 339	45 526 000	132

General distribution of the surface in 1905
in the United Kingdom of Great Britain and Ireland, in acres.

Division	Total surface land & water	Woods and plantations	Mountain & heath grazing land	Permanent pasture	Arable land
	Acres	Acres	Acres	Acres	Acres
England	32 552 000	1 716 000	2 366 000	13 760 000	10 851 000
Wales	4 777 000	184 000	1 293 000	1 989 000	805 000
Scotland	19 459 000	868 000	9 104 000	1 451 000	3 430 000
Ireland	20 711 000	301 000	. .	11 637 000	3 626 000
Isle of Man. . . .	141 000	1 000	24 000	19 000	74 000
Channel Islands . .	44 000	. .	2 000	9 000	22 000
Total. . .	77 684 000	3 070 000	12 789 000	28 865 000	18 808 000

1 Acre = 0.4046 hectare.

General distribution of the surface in 1905
in the United Kingdom of Great Britain and Ireland, in hectares.

Division	Total surface land & water	Woods and plantations	Mountain & heath grazing land	Permanent pasture	Arable land
	Hectares	Hectares	Hectares	Hectares	Hectares
England	13 170 539	694 294	957 284	5 567 296	4 390 315
Wales	1 932 774	74 446	523 148	804 749	325 703
Scotland	7 873 111	351 193	3 683 478	587 075	1 387 778
Ireland	8 379 671	121 785	. .	4 708 330	1 467 080
Isle of Man. . . .	57 049	405	9 710	7 687	29 940
Channel Islands . .	17 802	. .	809	3 641	8 901
Total . . .	31 430 946	1 242 123	5 174 429	11 678 778	7 609 717

Acreage under Crops and Grass, and number of Live Stock, in June 1909, in the United Kingdom including Ireland, Isle of Man, and the Channel Islands. — (*Statistics affecting British Agricultural interests. Journ. of the R. Agric. Soc. of England*, Vol. 70. London, 1909).

	Acres	Hectares
Total area, excluding water	76 644 480	30 964 370
Arable land	19 457 566	7 860 856
Permanent grass	27 428 244	11 081 010
Total acreage under crops and grass	46 885 810	18 941 866

PRINCIPAL CROPS IN THE UNITED KINGDOM.

	Acres	Hectares
Total Corn crops, Cereals, Beans, Peas	8 299 797	3 353 118
Potatoes	1 167 084	471 502
Turnips and Swedes	1 840 602	743 603
Clover, Sainfoin and Grasses under rotation	6 587 772	2 661 460
Cabbage, Kohlrabi and Rape	215 064	86 886
Mangold	530 930	214 496
Vetches or Tares	138 386	55 908
Hops	32 539	13 146
Small fruit	100 181	40 473

LIVE STOCK IN THE UNITED KINGDOM, JUNE 1909.

	Number
Horses	2 091 681
Cattle	11 760 678
Sheep	31 838 833
Pigs	3 542 867
Cows in milk and in calf in June 1909	4 360 620

Acreage under crops and grass, 4th June 1909 and 1908 in Great Britain, with average of the ten years 1899-1908. (*Board of Agriculture and Fisheries. Agricultural Statistics*, 1909, Vol. XLIV, Part. I. Acreage and Live Stock returns of Great Britain. London, 1910, Cd. 5064, p. 20).

	Acres 1909	Acres 1908	Acres Average of the Ten Years' 1899-1908
Total Area (excluding water)	56 211 830		—
Total Acreage under Crops and Grass (*a*)	32 183 073	32 211 386	32 336 951
Arable Land	14 730 668	14 795 517	15 320 444
Permanent Grass	17 452 405	17 415 869	17 016 507
Wheat	1 823 498	1 626 733	1 703 520
Barley or Bere	1 664 386	1 667 437	1 839 780
Oats	2 981 877	3 108 918	3 075 927
Rye	55 566	52 744	58 657
Beans	313 864	295 024	264 786
Peas	183 910	163 739	167 105
Total Corn crops	7 023 101	6 914 595	7 109 775
Potatoes	575 461	562 105	568 010
Turnips and Swedes	1 555 548	1 550 897	1 620 433
Mangold	456 490	427 772	414 248
Cabbage	66 854	69 120	66 080
Kohl-Rabi	17 734	17 252	18 590
Rape	87 443	86 495	97 755
Vetches or Tares	136 245	126 083	152 535
Lucerne	65 327	65 156	52 071
Hops	32 539	38 921	47 759
Small Fruit	87 116	84 880	77 589
Clover, Sainfoin, and Grasses, under rotation	4 214 575	4 421 587	4 656 553
Other Crops	123 094	115 402	108 217
Bare Fallow	289 141	315 252	330 829

(*a*) Not including Mountain and Heath Land.

Acreage under carrots, onions, buckwheat, flax and other crops, as returned on the 4th June 1909, in Great Britain. —(*Board of Agriculture and Fisheries. Agricultural Stat.*, 1909, vol. XLIV, part I: Acreage and Live Stock Returns of Great Britain. London, 1910, Cd. 5064, p. 60).

	England	Wales	Scotland	Great Britain
	Acres	Acres	Acres	Acres
Carrots	10 394	342	490	11 226
Onions	3 593	25	205	3 823
Buckwheat.	4 530	149	80	4 759
Flax	275	18	2	295
Other Crops	100 557	576	1 858	102 991

R. H. Rew. **Utilised Area in the Agricultural Divisions of Great Britain.** (*Report to the Secretary of the Board of Agriculture and Fisheries. Board of Agriculture and Fisheries. Agricultural Statistics*, 1909, Vol. XLIV, Part I. *Acreage and Live Stock Returns of Great Britain*, 1910, Cd 5064. London).

"The latest measurements of the Ordnance Survey show a slight increase of the land area of Great Britain as compared with the figures published last year, the total now stated being 56 211 830 acres. The extent to which it is utilised for agricultural purposes varies considerably in different districts. The following table gives the total area, the cultivated area, and the area of rough grazings returned in each of the main divisions of Great Britain, the figures being given in thousands of acres (000's omitted). The proportion of the total area thus used for agriculture, together with the proportion which was returned under woods and plantations in 1905, is also added.

Divisions	Total Area	Cultivated Land	Rough grazings	Percentage of Total Area utilised	
				For farming or grazing	For wood land
	Thousands of acres	Thousands of acres	Thousands of acres	Per cent.	Per cent.
I. Eastern. . . .	7 393	6 200	89	85.1	3.3
II. Mid. and S. E. .	7 202	5 576	138	79.3	8.4
III. Western . . .	8 074	6 342	435	83.9	5.8
IV. Northern . . .	9 723	6 423	1 754	84.1	4.1
England	32 392	24 541	2 416	83.2	5.3
Wales	4 750	2 782	1 324	86.4	3.9
Scotland	19 070	4 860	9 103	73.2	4.6
Great Britain. .	56 212	32 183	12 843	80.1	4.9

"The proportion of the surface of the country which is not used either for farming or grazing or woodland is therefore about 15 per cent in Great Britain as a whole, and varies from about 22 per cent in Scotland to less than 10 per cent in Wales, where mountain and heath land is largely used for the support of stock."

Agricultural Returns of Great Britain for 1909. The British Crops in 1909. (*The Journal of the Board of Agriculture*, Vol. XVI, no. 7, pp. 571-575. Idem, no. 9, pp. 731-735. London, October and December, 1909).

The total acreage as well as the changes in the extent of arable and pasture land, respectively, and in the chief categories of crops for 1909, are summarised in tables corresponding to those previously given and of a more recent date.

The large increase in wheat brings the area under this cereal almost up to that returned in 1900, the further decline in barley makes the area under this crop the lowest on record, and area under oats this year is the lowest returned since 1899.

With the increase in potatoes the loss of 1907 has now been more than recovered. The area devoted to mangold shows the largest figure ever returned, and the vetches or tares have also increased. The area under small fruit has steadily increased since 1897.

The details of permanent or rotation grass are given as follows:

Crops	1909	1908	Increase or Decrease	
			Acres	Per cent.
	Acres	Acres		
Clover and rotation grass:				
For hay.	2 035 827	2 232 353	— 196 526	— 8.8
Not for hay	2 178 763	2 189 234	— 10 471	— 0.5
Total. . .	4 214 590	4 421 587	— 206 997	— 4.7
Permanent grass:				
For hay.	4 777 559	4 949 791	— 172 232	— 3.5
Not for hay	12 674 846	12 466 078	+ 208 768	+ 1.7
Total. . .	17 452 405	17 415 869	+ 36 536	+ 0.2

Clover shows the lowest figure recorded since 1869.

With regard to the total production and yield per acre of the corn and pulse crop of the past two seasons the returns are given in the following table:

Crops	Estimated total produce		Estimated yield per acre		Average —	Difference from	
	1909	1908	1909	1908	1899-1908	1908	1899-1908
	Quarters	Quarters	Bushels	Bushels	Bushels	Bushels	Bushels
Wheat. . . .	7 694 858	6 566 892	33.76	32.29	31.46	+ 1.47	+ 2.30
Barley	7 620 962	6 840 055	36.63	32.82	33.09	+ 3.81	+ 3.54
Oats	15 397 308	15 453 404	41.31	39.77	39.65	+ 1.54	+ 1.66
Beans	1 117 180	1 105 442	28.66	30.16	29.97	— 1.50	— 1.31
Peas.	550 117	544 533	25.89	28.21	27.35	— 2.32	— 1.46

Over 800 000 quarters of the increase in the total production of wheat is accounted for by the extension of nearly 200 000 acres in the area of land planted with the crop. The total production

3

of barley is the highest recorded since 1902, and is, as shown, 780 000 quarters above that of last season, although the area sown was practically the same. The yield per acre for Great Britain and also for England constitutes a record for this crop.

The oat crop has proved better than anticipated earlier in the season, and in fact the total production is only 56 000 quarters lower than last year, in spite of a reduction of 127 000 acres in the area cropped; this result is due largely to the satisfactory returns in Scotland, where the production is the most abundant obtained since 1894, and the yield the highest hitherto recorded.

The estimated total production and yield per acre of the potato and root crops are as follows:

Crops	Estimated total produce		Estimated yield per acre		Average —	Difference from	
	1909	1908	1909	1908	1899-1908	1908	1899-1908
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Potatoes . . .	3 675 994	3 917 618	6.39	6.97	5.85	— 0.58	+ 0.54
Turnips and swedes	25 132 497	23 768 235	16.16	15.33	13.49	+ 0.83	+ 2.67
Mangold . . .	9 565 523	8 995 267	20.95	21.03	19.62	— 0.08	+ 1.33

In England the total crop of potatoes is the largest recorded, except in 1908, but owing to the less satisfactory results in Scotland, the total for Great Britain comes out below that of 1905 also. The yield per acre of turnips and swedes creates a new record for Great Britain, and the total mangold crop of 1908 is the largest ever returned.

The following table gives the total production and estimated yield per acre of hay and hops.

Crops	Estimated total produce		Estimated yield per acre		Average —	Difference from	
	1909	1908	1909	1908	1899-1908	1908	1899-1908
	Tons	Tons	Cwts	Cwts	Cwts	Cwts	Cwts
Hay from clover, etc.	2 936 177	3 506 784	28.85	31.42	29.73	— 2.57	— 0.88
Hay for permanent grass. . .	5 432 360	6 213 355	22.75	25.11	23.11	— 2.36	— 1.05
	cwts	cwts					
Hops.	214 484	470 761	6.59	19.10	9.33	— 5.51	— 2.74

Statement showing the Yield per Acre of the Corn, Pulse, and Hay Crops, and of Potatoes, Turnips and Swedes, and Mangold in Great Britain in the year 1908-1909, with Comparisons for 1907, and the Average Yield per acre of the ten years 1898-1907. (Compiled from the Preliminary Official Statements of the Board of Agriculture and Fisheries.—*Produce of Crops.*—*British Year-Book of Agriculture and Agricultural Who's Who*, 1909-10. London, 1909, p. 394).

Crops		Average estimated yield per acre			Average of the ten years 1898-1907
		1907	1908	1909	
		Bushels	Bushels	Bushels	Bushels
Wheat	England	33.97	32.15	33.61	31.65
	Wales	27.65	27.08	28.09	26.37
	Scotland	39.15	41.39	41.12	38.97
	Great Britain	33.97	32.29	33.69	31.70
Barley	England	35.66	32.47	36.78	33.20
	Wales	30.86	29.99	31.88	31.37
	Scotland	34.41	36.43	37.48	35.59
	Great Britain	35.26	32.81	36.61	33.38
Oats	England	46 66	40.82	42.45	42.01
	Wales	37.44	34.30	35.32	34.69
	Scotland	36.76	38.88	40.18	36.41
	Great Britain	43.04	39.80	41.26	39.75
Beans	England	34.45	29.94	28.42	29.85
	Wales	28.68	27.43	26.91	26.64
	Scotland	36.43	36.99	36.99	34.61
	Great Britain	34.50	30.16	28.66	30.06

Crops		Average estimated yield per acre 1907	1908	1909	Average of the ten years 1898-1907
		Bushels	Bushels	Bushels	Bushels
Peas . . .	England . . .	29.49	28.24	25.90	27.34
	Wales	20.96	22.46	21.86	21.47
	Scotland . . .	27.86	28.76	28.15	26.34
	Great Britain. .	29.44	28.21	25.89	27.29
		Cwts	Cwts	Cwts	Cwts
Hay from Clover, Sainfoin etc.	England . . .	33.31	31.93	28.85	29.85
	Wales	27.57	25.59	22.63	25.21
	Scotland . . .	34.01	31.94	31.38	32.53
	Great Britain. .	32.97	31.42	28.84	29.95
Hay from permanent grass	England . . .	27.79	25.40	23.11	24.57
	Wales	21.73	21.16	18.31	19.66
	Scotland . . .	30.23	30.91	28.32	29.73
	Great Britain. .	27.23	25.11	22.75	24.21
		Tons	Tons	Tons	Tons
Potatoes . .	England . . .	5.49	6.95	6.52	5.75
	Wales	4.09	5.55	5.57	4.99
	Scotland . . .	5.50	7.30	6.16	6.03
	Great Britain. .	5.43	6.97	6.39	5.78
Turnips and Swedes.	England . . .	13.84	13.76	15.65	12.25
	Wales	15.08	16.26	16.49	14.73
	Scotland . . .	14.63	18.86	17.30	15.22
	Great Britain. .	14.11	15.31	16.15	13.16

Crops		Average estimated yield per acre			Average of the ten years 1898-1907
		1907	1908	1909	
		Tons	Tons	Tons	Tons
Mangold	England	19.92	21.06	21.03	19.35
	Wales	18.44	18.80	18.98	17.16
	Scotland	15.14	21.47	17.56	17.33
	Great Britain	19.85	21.01	20.97	19.28

Area and produce of the chief cereal crops and yield in Great Britain in the year 1909, calculated in hectares and hectolitres.

Crops		Area in hectares	Produce in hectolitres	Average yield hectolitres per hectare
Wheat	England	700 631	21 186 251	30.24
	Wales	15 907	404 153	25.28
	Scotland	20 070	743 898	37.07
	Great Britain	736 608	22 334 302	30.32
Barley	England	557 170	18 438 407	33.10
	Wales	34 450	988 252	28.69
	Scotland	80 792	2 715 784	33.73
	Great Britain	672 412	22 142 443	32.94
Oats	England	743 324	28 393 343	38.20
	Wales	80 205	2 548 636	31.78
	Scotland	381 148	13 777 717	36.16
	Great Britain	1 204 677	44 719 696	37.13

Live stock on the 4th June 1908 and 1909 in Greaf Britain, with the average of the Ten years 1899-1908.—(Board of Agriculture and Fisheries. *Agricultural Statistics*, 1909, Vol. XLIV, Part I. *Acreage and Live Stock Returns of Great Britain.* London, 1910, Cd 5064, p. 20).

	1909	1908	Average of the Ten years 1899-1908
	No.	No.	No.
Horses used for Agricultural purposes (*a*)	1 132 014	1 119 324	1 103 023
Unbroken Horses: One years and above	294 657	299 809	303 069
Unbroken Horses: Under one year	126 322	126 538	131 262
Total of Horses	1 552 993	1 545 671	1 537 354
Cows & Heifers in Milk (*b*)	2 232 218	2 197 763	2 668 630
Cows & Heifers in Calf but not in Milk (*b*)	561 958	566 017	
Other Cattle: 2 years & above	1 317 215	1 371 688	1 388 215
Other Cattle: 1 year & under two	1 473 918	1 415 483	1 426 248
Other Cattle: under one year	1 435 673	1 354 183	1 346 788
Total of Cattle	7 020 982	6 905 134	6 829 881
Ewes kept for Breeding	10 810 476	10 569 089	10 157 527
Other Sheep: 1 year & above	5 860 907	5 632 767	5 531 532
Other Sheep: under 1 year	10 947 036	10 917 874	10 384 301
Total of Sheep	27 618 419	27 119 730	26 073 360
Sows kept for breeding	316 552	369 476	357 019
Other pigs	2 064 335	2 454 006	2 167 188
Total of Pigs	2 380 887	2 823 482	2 524 207

(*a*) Including Mares kept for Breeding.
(*b*) Not separately distinguished before 1907.

The total of sheep is the highest recorded since 1892, and the number of ewes kept for breeding is the largest returned since this class was first separately distinguished in 1893, whilst the number of other sheep under one year is greater than in any year since the returns were first collected, with the exception of 1868, when it was just over 11 000 000.

About pigs a considerable decline of over 442 000 is stated, or nearly 16 per cent., the decline in breeding sows being 53 000, or over 14 per cent., and in other pigs 390 000, or 16 per cent.

Acreage under Crops and Grass in Scotland, June. 1908.— (*Agricultural Statistics for Scotland. Trans. Highl. and Agric. Soc. of Scotland,* Vth series, Vol. XXI. Edinburgh, 1909, p. 343).

	Acres		Hectares
Total acreage under crops and grass, not including mountain and heath land	4 863 473	equal to	1 968 102
Arable land	3 389 331		1 371 564
Permanent grass	1 474 142		596 542
Corn crops: Wheat, Barley, Oats, Rye, Beans, Peas	1 206 520		488 243
Potatoes	143 692		58 147
Turnips or swedes	440 903		178 457
Mangels	1 980		801
Cabbage	7 914		3 203
Rape	7 550		3 055
Vetches or Tares	7 963		3 222
Clover, sainfoin and grasses under rotation	1 553 692		628 734
Other crops	2 798		1 132
Bare fallow	8 261		3 343
Small fruit	7 930		3 209

Number of horses, cattle, sheep and pigs in Scotland, as returned on June 4th 1908. — (*Agricultural Statistics. Trans. Highl. and Agric. Soc. of Scotland,* V series, Vol. XXI. Edinburgh, 1909, p. 348).

Horses, including ponies and mares kept for breeding	204 507
Cattle	1 174 405
Cows and heifers in milk (included in above cattle)	364 684
Sheep	7 439 495
Pigs	143 784

II.

Legislative provisions and measures taken by the State for promoting agricultural production. Information regarding Ministries and Departments of Agriculture.

The Agricultural Holdings Act 1908. — (*The Journal of the Board of Agriculture*, Vol. XVI, n. 2, 113-117, London, May, 1909),

This Act (8 Edw. VII. Ch. 28), which came into operation on January 1st, 1909, is an Act "to consolidate the enactments relating to agricultural holdings in England and Wales." For that purpose it repeals and reproduces those enactments, which were contained in the Agricultural Holdings Acts of 1883, and 1900, the Tenants' Compensation Act, 1890, and the Market Gardeners' Compensation Act, 1895. But, although the new Act is a purely consolidating statute, it may be desirable to call attention to such of its provisions as reproduce those of the Agricultural Holdings Act, 1906, more directly bearing upon agricultural practice, inasmuch as the date of the commencement of that Act was therein expressed to be the 1st day of January, 1909, so that its provisions came into operation for the first time under the new Act.

SECTION 1. *Compensation for Improvements.* — This reproduces the corresponding Section of the Act of 1900, with the omission of the proviso as to "the inherent capabilities of the soil," and to that extent alters the law.

SECTION 10. *Compensation for Damage by Game.* — Where the tenant has sustained damage to his crops from game, and the right to kill and take it is not vested in him nor in anyone claiming under him other than the landlord, and he has not permission to kill it, he is, subject to certain conditions, entitled to compensation from his landlord for such damage, if it exceeds in amount one shilling per acre of the area over which the damage extends; and any agreement to the contrary, or in limitation of such compensation, is void. In default of agreement (made after the damage has been suffered) as to the amount of compensation, it is to be determined by arbitration

The expression "game" is defined as meaning, in this section, deer, pheasants, partridges, grouse, and black game.

SECTION 26. *Freedom of Cropping and Disposal of Produce.* — Subsection 1) gives to the tenant — notwithstanding any custom of the country or the provisions of any contract of tenancy or agreement respecting the method of cropping of arable lands — full right to practise any system of cropping of the arable land and to dispose of the produce of the holding; subject to the proviso that he shall previously have made, or as soon as may be shall make, suitable and adequate provision to protect the holding from injury or deterioration; which provision is, in the case of disposal of produce, to consist in the return to the holding of the full equivalent manurial value to the holding of crops sold off or removed in contravention of the custom, contract or agreement. But this sub-section does not apply: *a*) in the case of a tenancy from year to year, as respects the year before the tenant quits; or any period after he has given or received notice to quit which results in his quitting; or *b*) in any other case, as respects the year before the expiration of the contract of tenancy.

If the tenant exercises his rights under this section in such a manner as to injure or deteriorate the holding, he is to be liable to pay damages or be restrained by injunction; and he is not entitled to compensation for improvements made by way of provision to protect the holding from injury or deterioration as required by the section.

"Arable land" does not include land in grass, which by the contract of tenancy is to be retained in the same condition throughout the tenancy.

The farmer is then freed from those restrictions as to cropping and the sale of straw and hay which used to hamper him.

Summing up, it may be expected, that from coming into force of this Act the English farmer will sit more secure, and enjoy greater freedom than he has ever done before. He appears to be on the high way for a modified form of fixity of tenure, and to be at least likely to be freer from the danger of capricious ejectment.

AUBREY J. SPENCER. **Contemporary Agricultural Law in Great Britain.** — (*Journ. R. Agr. Soc. England*, Vol. 70, 139-50. — London, 1909).

During the Parliamentary session of 1909 there has been no Act passed directly affecting agricultural interests.

There are, however two Acts of 1909 which are likely to be of considerable importance to agriculture.

The first of these, the Housing, Town Planning Act, 1909 (9 Ed. VII c. 44), is divided into four parts. Part I so far as it may affect the supply of houses for agricultural labourers alone requires notice. Section 1 extends Part III of the Housing of the Working Classes, 1890 (53 and 54 Vic. c. 30), which enables local authorities to provide dwellings for the working classes in districts where there is, by the failure of private enterprise or from other causes, a dearth of accomodation, to every urban or rural district.

The second new Act of Parliament which requires notice is the Development and Road Improvement Funds Act, 1909 (9 Ed. 7 c. 47). It enables, by Section 1, the Treasury, upon the recommendation of Development Commissioners appointed under the Act, to make advances to a Government department, or through a Government department, to a public authority, university, college, school, or institution, or an association of persons or company not trading for profit, either by way of grant or by way of loan, for any of the following purposes:

a) aiding and developing agriculture and rural industries by promoting scientific research, instruction and experiments in science, methods and practice of agriculture (including the provision of farm institutes), the organisation of co-operation, instruction in marketing produce, and the extension of provision of small holdings, and by the adoption of other means;

b) forestry (including (I) the conducting of inquiries, experiments and research for the purpose of promoting forestry and the teaching of methods of afforestation; (II) the purchase and planting of land found after inquiry to be suitable for afforestation);

c) the reclamation and drainage of land;

d) the general improvement of rural transport (including the making of light railways, but not including the construction or improvement of roads).

H. M. V. **The Development Act, 1909.**—*The Gardener's Chronicle*, no. 3621, p. 336. London, May 21st, 1910.

The Development Act of 1909 is intended to provide certain machinery for aiding and developing: *a*) Agriculture and rural industries; *b*) Forestry; *c*) the reclamation and drainage of land; *d*) the general improvement of rural transport; *e*) the construction and improvement of harbours and inland navigation ; *f*) the development and improvement of fisheries and *g*) any other object calculated to promote the economic development of the United Kingdom.

The expression "agricultural and rural industries"(clause *a*) includes agriculture, horticulture, dairying, the breeding of horses, cattle, other live stock and poultry, the cultivation of bees, home and cottage industries, the cultivation and preparation of flax and tobacco, and any industries connected with these pursuits.

The nature of the assistance to be rendered under the Act includes: 1) the promotion of scientific research, instruction and experiments in the science, methods and practice of the industries in question; 2) the organization of cooperation; 3) instruction in marketing produce; 4) the extension of the provision of small holdings.

The assistance to be rendered takes the form of a monetary advance to be made either by way of gift or loan by the Treasury, on the recommendation of a body of persons to be known as the Development Commissioners. Advances may be made *a*) to a Government Department, or *b*) through a Government Department to a public authority, university, college, school or institution, or an association of persons or company not trading for profit.

For the present, a sum of £500 000 a year is to be allocated for the ensuing five years, thus furnishing a total fund of $2^1/_2$ million pounds, together with any interest or profit which may result from the loan or investment of the capital money. (Two and $^1/_2$ million pounds are equivalent to 63 125 000 francs; the annual sum of 500 000£ is equivalent to francs 12 625 000).

The Development Funds are to be administered by a new body, to be called the Development Commissioners, two of whom may be paid salaries not exceeding in the aggregate £3 000 per annum. The Commissioners will hold office for 10 years, but one Commissioner must retire every second year though he may be reappointed. The Commissioners have power to create a staff of salaried officers and servants, as well as to appoint advisory committees.

Advisory Committee on Agricultural Research. Society for Extending the Rothamsted Experiments. (*The Journ. of the Board of Agriculture.* July 1910, p. 318 — *Nat.*, 83, 2121, 507. Lond., June 23, 1910).

At the last meeting of the executive committee of the British Science Guild, a memorial to the Prime Minister on the subject of agricultural research was approved. The President of the Boarp of Agriculture and Fisheries has now appointed a Committee to advise the Board as to how agricultural research may be best encouraged and improved.

This Committee will deal with the methods to be adopted: *a*) for promoting agricultural research in universities, and other scientific schools; *b*) for aiding scientific workers in the study of agricultural problems, and *c*) for ensuring that the new scientific discoveries are utilised for the benefit of agriculturists.

The Committee consists of the Duke of Devonshire, Lord Reay, the chemist Sir Edward Thorpe, C. B., F. R. S., Mr. David Davies M. P., Dr. J. J. Dobbie, F. R. S. (Principal of the Government laboratories), Prof. J. B. Farmer, F.R.S., Dr. S. F. Harmer, F. R. S. (Keeper of zoology at the Natural History Museum), Dr. R. Stewart MacDougall (Technical advisor in zoology to the Board of Agriculture and Fisheries), Mr. Spencer P. Pickering, F. R. S.; Lieut-Colonel David Prain, C.I.E., F. R. S. (Director of the Royal Botanic Gardens, Kew), Mr. H. S. Staveley-Hill M. P., Mr. Steward Stockman (chief veterinary officer of the Board of Agriculture and Fisheries), Dr. J. J. H. Teall F. R. S. (Director of the Geological Survey and Museum) and Dr. David Wilson. Mr. Middleton will act as Chairman of the Committee, and one of the officers of the Intelligence Division of the Board will act as Secretary.

A Society has also been formed for the development of the agricultural investigations at Rothamsted, carried on for so long by the late Sir John Lawes, and the Lawes Agricultural Trust which he afterwards founded.

The Society for Extending the Rothamsted Experiments, met at Rothamsted on June 16, under the presidency of the Duke of Devonshire. The immediate object of the Society is to obtain a sum of £ 5000 (francs 126 250) in order to secure about 200 acres of land adjoining the present experimental fields, and erect thereon the buildings required for feeding experiments with the crops under investigation. A subscription list has been opened and £ 1450 (equal to 36 612 francs) have already been secured.

P. G. Craigie. **Board of Agriculture and Fisheries.**—(*Standard Cyclopedia of Modern Agriculture*, edited by Prof. R. P. Wright. Vol. II, London, 1909, pp. 166-168).

For twenty-nine years of our agricultural history (1793-1822) the title Board of Agriculture was applied to a body, which was not a Government Department, but rather a chartered Society with many ex-officio, ordinary, and honorary members, and a Government grant of £3000 a year (Francs 75 750).

It was formed on the suggestion of Sir John Sinclair to promote improved methods of husbandry and to encourage a development of agricultural production, in an age when England was seriously concerned with the sufficiency of the food supply of a population not one-fourth of the present. The old Board, under the secretaryship of Arthur Young, doubtless succeeded in giving an impulse to the enclosure and cultivation of unproductive land. Its local surveys, moreover, provided a valuable record of the agricultural conditions of Great Britain a hundred years ago.

The present Board of Agriculture, or, to give it its full title, as expanded by later legislation, "the Board of Agriculture and Fisheries," is the youngest Department of the State. No doubt another office "the Board of Education" came into its statutory designation at a still more recent date; but the change in that case was one of name only. The Board of Agriculture Act of 1889, on the other hand, not only took over and concentrated a series of duties previously scattered among older offices or casually administered, after a fashion now generally discarded as inconvenient, by separate Commissions, but actually established a new Ministry. The designation of "Board" as applied to certain Governments is sometimes misapprehended; but it has its explanation in the development of English history, and even the apparent anomalies of organization mark successive changes in the relations of the Executive Government and the Legislature. The Boards are indeed survivals of the older committee of the Privy Council, and they are now manned by high officers of State, with departmental duties of their own, while the President of each Board is alone the Minister responsible to Parliament for the doings of his office.

The Board of Agriculture, besides its President, has a nominal roll of members, comprising technically all the Secretaries of State, the Lord President of the Council, the Secretary for Scotland, the First Lord of the Treasury, and the Chancellors of the Exchequer and of the Duchy of Lancaster, but the executive duties are discharged by the usual establishment of a Ministry, with Parliamentary head, Permanent Secretary, Assistant Secretaries, and Staff.

The cattle plague of 1865 forced into prominence the question of the necessity for some distinctive representation of the agricultural interest, but it was not until the agricultural depression of 1879 that a Royal Commission formally recommended a complete Ministry of Agriculture; and after some temporary arrangements, in 1889, the Board of Agriculture Act was passed, In 1903 the control of the inland and sea fisheries of England and Wales was transferred from the Board of Trade to that of Agriculture, forming a Division by itself.

The other Divisions are the Intelligence, the Animals Division and the Land and Statistical Divisions.

The Intelligence Division among other duties, has that also of diffusing direct technical information throughout Great Britain by means of a monthly journal and by reports and leaflets, the gratuitous distribution of the latter often exceeding a million a year.

The Land and Statistical Division has a very varied set of functions, one of the most important being the supervision and sanctioning of Land Improvement Loans, under which £18 000 000 (equal to 754 500 000 francs) have already been invested; four fifths of this sum represent outlays on drainage, farm buildings, labourers' cottages, etc.

The Annual Agricultural Returns of crops and live stock, begun in 1866, have been much improved and extended in later years with the willing cooperation of half a million occupiers of land and the active assistance of a considerable army of officials.

Estimate of expenditure for financial year 1908-1909, as passed by Parliament for the Board of Agriculture and Fisheries. (*British Year-Book of Agriculture and Agricultural Who's Who 1909-10.* Vinton & Co., p. 5. London).

Salaries and wages	£	69 750
Travelling and removal expenses	»	17 500
Special services, legal and incidental expenses	»	6 110
Collection of agricultural and fishery statistics	»	9 950
Agricultural and dairy education	»	12 300
Diseases of animals (grants in aid)	»	40 100
Expenses repayable	»	3 700
Total	»	159 419
Royal Botanic Gardens Kew	»	22 055
Gross total	»	181 474
Deduct appropriations in aid (various receipts by the Board)	»	33 350
Net total	»	148 124
Net increase on 1907-1908	»	10 284

Note.—There was a supplementary estimate for £ 100 000 taken for 1907-8 for the purposes of the Small Holdings and Allotments Act, 1907.

The net total of £ 148 124 is equivalent to francs 3 740 131.

The right to free culture.—(Mark Lane Express. London, March. 1910).

The official concessions granted by the English government in Ireland and in Scotland, and the support promised in England by the leader of the opposition to the growers of sugar beets, have raised the question as to the right of free landowners to free culture, expecially in a country like the United Kingdom where agriculture is so highly developed.

Every restriction of this liberty favours foreign producers and places them in a position of superiority over the home farmer.

III.

General inquiries regarding Agricultural Conditions. Soil-surveys. Agricultural Development.

Sir Horace Plunkett. **The launching of a new agricultural policy for English-speaking Nations: Better farming, better business, better living.** — (*The Rural Life Problem of the United States.* New York, Macmillan Company, 1910, p. 33).

. . . " It has to be brought home to those who lead public opinion that for many decades we, the English-speaking peoples, have been unconsciously guilty of having gravely neglected one side, and that perhaps the most important side, of Western civilisation.

" To sustain this judgment I must now view the sequence of events which led to the subordination of rural to urban interests, and try to estimate its probable consequences. It will be seen that the neglect is comparatively recent, and of English origin. I believe that the New World offers just now a rare opportunity tor launching a movement which will be directed to a reconstruction of rural life. It is this belief which has prompted an Irish advocate of rural reform to turn his thoughts away for a brief space from the poorer peasantry of his own country and to take counsel with his fellow-workers in the United States and Canada on a problem which affects them all." . . .

"Agriculture, the basis of a rural existence, must be regarded as a science, as a business and as a life. I have already adverted to President Roosevelt's formula for solving the rural problem—"better farming, better business, better living." Better farming simply means the application of modern science to the practice of agriculture. Better business is the no less necessary application of modern commercial methods to the business side of the farming industry. Better living is the building up, in rural communities, of a domestic and social life which will withstand the growing attractions of the modern city.

"This threefold scheme of reform covers the whole ground and will become the basis of the Country Life movement. But in the working out of the general scheme, there must be one important change in the order of procedure—'better business' must come first. The dull commercial details of agriculture have been sadly neglected, perhaps on account of the more human interest of the scientific and social aspect of country life. Yet my own experience in working at the rural problem in Ireland has convinced me that our first step towards its solution is to be found in a better organisation of the farmer's business. It is strange but true that the level efficiency reached in many European countries was due to American competition, which in the last half of the nineteenth century forced Continental farmers to reorganise their industry alike in production, in distribution and in its finance. Both Irish experience and Continental study have convinced me that neither good husbandry nor a worthy social life can be ensured unless accompanied by intelligent and efficient business methods." . . .

"*Better Farming and Better Living.*—We want two changes in the rural mind—not omitting the rural teacher's mind. First, the interest which the physical environment of the farmer provides to followers of almost every branch of science must be communicated to the agricultural classes according to their capacities. Second, that intimacy with and affection for Nature, to which Wordsworth has given the highest expression, must in some way be engendered in the rural mind. In this way alone will the countryman come to realize the beauty of the life around him, as through the teaching of science he will learn to realise its truth.

"Upon this reformed education, as a basis, the rural economy must be built. It must, if my view be accepted, ensure, first and foremost, the combination of farmers for business purposes in such a manner as will enable them to control their own marketing and make use of the many advantages which a command of capital gives." . . .

"I hold, then, that the new economy will mean a more scientific mastery of the technical side of farming, when farmers will make a much larger use of the advice, instruction and help which the Nation and the States offer them through the Department of Agriculture and the Colleges. It is equally certain that there will arise a more human social life in the rural districts, based upon the greater share of the products of the farmer's industry, which the new business organisation will enable him to retain; stimulated by the closer business relations with his fellows which that organisation will bring about, and fostered by the closer neighbourhood which is implied in a more intensive cultivation." . . .

"In the more intelligent scheme of the new country life, the economic position of woman is likely to be one of high importance. She enters largely into all three parts of our programme,—better farming, better business, better living. In the development of higher farming, for instance, she is better fitted than the more muscular but less patient animal, man, to carry on with care that work of milk records, egg records, etc., which underlies the selection on scientific lines of the more productive strains of cattle and poultry. And this kind of work is wanted in the study not only of animal, but also of plant life.

"Again, in the sphere of better business, the housekeeping faculty of woman is an important asset, since a good system of farm accounts is one of the most valuable aids to successful farming."

JAMES S. MACDONALD (Editor of the "Farmer and Stockbreeder"). **A Bird's-Eye View of English Agriculture.** — (*Fry's Magazine*, London, May 1910, pag. 127). Illustrated with an interesting map.

The following are some extracts from this important article on English agriculture:

"The oldest and the largest of all our industries, no country can be truly prosperous that neglects the soil. There are 77 000 000 acres of land and water in Great Britain and Ireland, and nearly 47 000 000 are under corn and grass. At the last decennial census 1 000 225 males and females over ten years of age in England and Wales were engaged in or directly connected with agriculture, and if we add to this the huge village population of the country practically dependent upon the success of rural pursuits, we are enabled to form some conception of the importance of the oldest of the industries to the prosperity and well-being of the community.

" There are, broadly speaking, two distinct branches of agriculture: 1. the tillage of the soil, 2. the rearing of live stock.

" Not many farmers own their farms, preferring in the majority of cases to rent them rather than incur the responsibility attaching to land ownership, except where the soil is of the best. As a general rule it may be taken that the cheaper class of arable farm leaves the smallest proportion of profit. Thus, assuming for argument's sake that one holding produced a six-ton crop of potatoes, and another, with the same cost of working and manuring, twelve tons, when the difference in rent had been subtracted there would probably be a credit balance of about £. 8 or £. 9 to the acre in favour of the dearer land. Rents vary, and farming itself has come to represent nearly every shade and colour of the kaleidoscopic market which lies at our doors.

" In the main our agriculture is prosperous. Many changes have been brought about by changing times, but having equipped himself to meet the new set of circumstances, the English farmer of to-day has only two things to fear: low prices and high railway rates.

" A great problem in successful agriculture is the fixation of a fair rent. If land carries too great a burden it impoverishes the working capital of the agriculturist. In the south-west of England the rents generally vary from 10 s. to 60 s. an acre, 30 s. being a very fair average. When estates have been sold, quite seven-eighths of the sales have been effected upon the basis of twenty-three years' purchase. In the Eastern counties, from 10 s. to 70 s. would cover the rentals, probably with 25 s. as a good average. There are not many occupying owners. Lincolnshire is possibly our best farming county, and for the rich lands contiguous to the Wash, £. 3 10 s. down to 50 s. is given for the acre, and the black land brings from 45 s. to 30 s. The tenants of the marsh lands have bought freely, and as much as £. 70 has been given per acre, prices varying down to £. 50. These figures are for farms 100 acres and over. Small farms are rather dearer. In the middle of the county rents run from 12 s. to 25 s., the wold land being let at about the same figures in all counties — in Gloucester from 12 s. to 18s, in Yorkshire up to 25 s., and in Lincolnshire as noted. When we get further north, into the mineral counties of Durham and Northumberland, rents range from 20 s. to 60 s. per acre, with about 28 s. as an average. Very few farmers own their holdings, as the coal and other minerals underlying have a tendency to elevate the price, which ranges from £. 20 to £. 100 an acre. Taking the country through, probably the average of arable and pasture farms would be about 21 s. per acre.

" *Changes in farming.*—Agriculture is subject to all mutations of time, climate, and circumstance. Nature is one prolonged change, a wearing out and renewing of life, and every violent fluctuation of the market produces some corresponding reaction in farming. It is somewhat difficult to define when modern farming was shaped, for even as I write there are great changes taking place, the result of which we cannot foresee ».

" The first great change was precipitated in the eighties and nineties, when, owing to the very low price of wheat, the stiffer soils went out of cultivation. In the nineties it was the continuous cry that the derelict lands of Essex should be settled by the unemployed. Land was laid down to pasture with the primary object of saving the labour bill, the older style of mixed farming being considered to employ more labour than grazing and feeding. To-day, labour-saving machinery has entirely altered the situation, and by the irony of fortune many of those farms which were laid down to grass employ more labour in dairying than they would if recovered to the plough. Thus, if on a farm of 300 acres there is kept a herd of fifty to sixty cows it would require at least five men to deal with the cattle milked twice daily, apart from those employed for other purposes, whereas on a mixed holding three to four pairs of horses, with a man for each, would easily do the work, unless the soil is very heavy, when the horse-power would be augmented.

" The increase of the fresh milk trade has been rapid, and a goodly proportion of the rent is earned by the milch cow. Labour-saving machinery is almost universally employed, the capitalisation in this respect being very much heavier than it was twenty years ago. In the olden days the seed was sown by hand, and the wheat was hoed in spring; it was cut by hook or scythe, and the labour rewarded at a fixed price per stook. In these more prosaic times the sowing is performed by machinery, the hoeing is not so frequently done, and the binder cuts and binds without extra labour being employed. To the invention of the binder we owe cheap grain. Steam power is used where the fields are large enough and work is behind. It costs about the same as horse labour per acre, but one plough does nine times as much in a day as a pair of horses.

The motor has a limited use, being convenient, but is as yet somewhat complicated, and only to be trusted in skilled hands. In one way the greatest of all changes has come through the Agricultural Holdings Act. Agreements between landlord and tenant with regard to repairs are still necessary, but the principle of free cropping has been made law, and greater security has been provided for the tenant who is a good husbandman and puts his capital into the land.

"Everything, therefore, tends to encourage enterprise, for the land is a poor servant if starved ».

"*Specialised cropping.*—The tendency in farming is to specialise. A man may be jack of all trades, but master of none; and while it is not advisable to become dependent upon one market only, it pays to exploit a speciality. Whether it takes the form of cropping or stock-breeding is immaterial, but one generally finds that the best farmers develop a particular line of farming. Edinburgh has the second largest number of cows within the city boundaries of any town in Great Britain and Ireland. Hence the opportunity of farmers in the vicinity! They grow green crops, which they cut three or four times a year, putting on the exceptionally heavy dressing of 3 cwt. of nitrate of soda per acre after every cutting. Many farmers grow seed under contract with the large seed firms, and one finds that on the alluvial soils in the neighbourhood of the Wash, where probably the highest farming in England is pursued, the raising of seed is quite a small industry. Mustard, too, is grown by contract with the large mustard makers, although it is also used as a sheep food, or a green manuring crop ploughed under to smother weeds. Probably few people know what woad is, and that such a crop is grown. There are only two or three woad-growers left. The substance of the plant is used to make fast vegetable dyes in cloth, but the discovery of aniline dyes has greatly limited its use. Lavender is grown near Mitcham, in Surrey, and also round about London. Black peppermint, another plant that gives an essential oil, is cultivated in Surrey and the southern counties.

"Hemp is produced in small quantities in Lincoln and the southern Fen districts, and also in Dorset, but sugar beet cannot be grown profitably in quantity until local factories spring up. The cost of transport must be low.

"In the Spalding neighbourhood the bulb and fruit industries have striven to find a footing. Roughly speaking there are about 250 acres devoted to bulbs, the annual labour expenditure being from £. 15 to £. 20 per acre. The crop probably represents a capitalisation of £. 70 per acre. Like many innovations that give promise of a successful future, it is liable to be overdone, and after a season such as growers experienced last spring it is found to be less remunerative than ordinary market gardening ».

... " *English Agriculture contrasted with foreign agriculture.*—The elaborate returns evolved by the statistical department of the Board of Agriculture are interesting, but there is every reason to think that they do this country the barest justice. It is a well-known fact that not only has the farmer a wider choice of manures than he formerly had, but there has been a marked improvement in the yielding capacity of the cereals he grows. One can scarcely believe that the mean average of ten years is 33.81 bushels of wheat per acre. I have seen the agriculture of the country in nearly all its phases, and very few crops under four quarters to an acre are grown, while the great bulk of the real wheat lands produce from five to eight quarters. The same criticism is applicable to the other figures issued by the Board of Agriculture. Taken in the average one must expect the countries supporting the smaller acreages of a particular crop to grow the highest yield, for they usually sow it on picked land. Belgium is officially credited with over 35.19 bushels of wheat on the decennial average per acre; while the 1907 statistics of Denmark show an average of 42.10 bushels. The latter country, however, has only one-seventieth of her arable and grass lands under wheat, whereas Belgium has one-eleventh, and Great Britain rather more than one-twentieth. Comparisons are thus very difficult to draw on the basis of statistics which are entirely computed. One notices again that France's average is the extraordinarily low figure of 20.46 bushels, and Germany can only average 29.44 bushels.

" The burden of my contention is further apparent while contrasting the estimated yields of barley in 1908. Great Britain had one-twentieth of her arable and grass area under this crop, having an average of 33.81 bushels to the acre as the mean of ten years. This compares indifferently with 47.41 bushels, the corresponding average for the Netherlands, but that country had only one-seventy-seventh of her cultivated and grass area devoted to barley growing, implying that it was raised on soil specially suitable for the purpose. On the whole, I think he is a bold critic who would charge the English farmer with incapacity, having regard to the storms he has weathered and the international reputation he has established ».

" Agricultural education is not so well advanced or so well organised in this country as we find it in the United States and the Continent. It may be that we have not quite the same need of it, for men do not usually take up farming in England without some previous experience. But in the undeveloped States they are less particular, and very rudimentary is the knowledge of a considerable proportion of those who settle on the soil. We have many colleges, some eighteen in all, I think, as well as many county institutes, but only a very small number of our future farmers are trained under their enlightening influence. The Board of Agriculture and the Board of Education have now joined hands to administer funds, and in consequence of this union we expect that a larger sum of money will be available for agricultural education than has hitherto been the case. The Board of Agriculture has only had a few paltry thousands to dispense for research work, and complaints are heard that an inadequate share of the "whisky" money is allotted to agricultural teaching by the County Councils which usually work in harmony with the colleges. Apart from scientific degrees, the only diplomas are provided by the Royal and Highland and Agricultural Societies jointly, and in the matter of dairying by the British Dairy Farmers' Association."

JOHN WRIGHTSON. **Agricultural Divisions of England and their chief characteristics in soil and climate.** (Agriculture of England.—*Standard Cyclop. of Modern Agric.* Edited by R. P. Wright. Vol. V. London, 1909, p. 54).

Agricultural Provinces adopted by the Board of Agriculture.

Division I 10 Eastern & North-eastern Counties.	Division II 12 South-eastern & East Midland Counties.	Division III 10 West Midland & South-Western Counties.	Division IV 10 North & North-Western Counties.
Bedford	Berks	Cornwall	Cheshire
Cambridge	Bucks	Devon	Cumberland
Essex	Hants	Dorset	Derby
Hertford	Kent	Gloucester	Durham
Huntingdon	Leicester	Hereford	Lancaster
Lincoln	Northampton	Monmouth	Northumberland
Middlesex	Notts	Salop	Stafford
Norfolk	Oxford	Somerset	Westmoreland
Suffolk	Rutland	Wilts	Yorks, North Riding
Yorks, East Riding	Surrey	Worcester	Yorks, West Riding
	Sussex		
	Warwick		

"These groups represent different types of farming. Divisions I and II, if taken together, comprise the principal corn-growing areas and the chief barley-growing districts. Fifteen of them are traversed by chalk hills or downs, and they also comprise the great level tract of the Fen country, and some of the richest land of the kingdom. Bedford, the first mentioned, is noted for its agriculture, and contains between Sandy and Biggleswade an extremely rich tract of soil devoted to the cultivation of exceptional crops, such as pickling onions, cucumbers, the raising of mangel, swede, cabbage, and turnip seed, and of choice potatoes. It is worth £5 per acre, and is only devoted to corn growing when it is worn out for other crops. Cambridgeshire, Lincolnshire, Norfolk, and Kent form a group of counties in which the highest farming obtains. Nottingham is the site of the 'Dukeries', or union of four noted ducal properties. Hertford is distinguished by the celebrated Rothamsted experimental station; while Berks, Hants, Oxford and Sussex are famous for sheep-farming on a large scale. Middlesex boasts of the most approved system of haymaking in the country, and Suffolk is the home of the celebrated Suffolk Punch breed of horses. The Shire horse is bred with the greatest possible success in Beds, Berks, and Lincolnshire, and Northampton grazing is justly celebrated. Essex has suffered in an especial degree owing to its being, or having been, one of the chief wheat-producing English counties. Leicester is famous as the birthplace of the improved Leicester sheep, Long-horn cattle, and the Shire horse, and as the birthplace of Bakewell, the first improver of live stock. Huntingdon forms part of the great level of the fens.

In these counties the rainfall measures about 25 in. per annum, and the climate is bracing, and well suited for agricultural pursuits. They are mostly farmed upon the four-course system, but potatoes are largely grown in south-east Yorkshire, Lincolnshire, and Kent. Beans are almost entirely restricted to this province, and peas are widely cultivated. The climate favours arable cultivation, and rotation grasses are not often allowed to lie a second year. The best quality of both wheat and barley is produced in these counties. The farmers are men of ability and of capital, and great supporters of the London Farmers' Club, Chambers of Agriculture, and agricultural societies. That they are as a rule prosperous there is every reason to believe, as they have adapted their methods to the times. The marshes of Lincolnshire, Norfolk. Essex, Huntingdon, and Kent (Romney Marsh) are abundantly stocked with cattle and sheep, and the metropolis is supplied with beef from them in summer, and from the winter graziers in the same counties during the remainder of the year.

If a line is drawn from Berwick-on-Tweed to the centre of the Isle of Wight, almost the whole of these counties will be found on its eastern side. It is the arable portion of England, the corn-growing area—comparatively flat and lowlying, in comparison with the more elevated tracts of the west.

Upon the other side of this line will be found the other two divisions. They are of a different nature, being subiect to a rainfall of from 30 to 40 in., and in some cases to a great deal more. They are less strictly agricultural, and are rather pastoral in character. If, as in the case of Divisions I and II, we briefly review them, we find in the counties of Dorset, Shropshire, and Wilts, centres of first-rate arable farming. On the other hand, Gloucestershire, Hereford, and Somerset are famous grazing counties. Cornwall boasts a mild and humid climate, which with Scilly contributes large supplies of early vegetables for the London market. In Devonshire agriculture is backward, but a redeeming feature is found in the Red Cattle of the North and the lighter-coloured South Devon breed. Worcestershire is the home of orchards, and the source of the best cider and perry; while the market-gardening around Evesham is well worthy of a visit. Some of the best land in the county is found on the middle series of the Old Red Sandstone, in Hereford and Monmouth, and the Hereford cattle form another most interesting feature. Herefordshire is celebrated for its oaks, which have earned the title of Herefordshire weeds.

In Division IV, Cheshire not only stands first on the list, but well deserves its position as the theatre of the Cheshire cheese manufacture. The county was severely punished in 1866 by the cattle plague, when no fewer than 32 148 cattle were compulsorily slaughtered, or died, out of a total of 93 044. This must have been a crushing blow, requiring years to recover from. Both the divisions under consideration are mountainous or elevated in character. From the fells and moors of Northumberland and Durham, the hills and dales of West Yorkshire and East Lancashire, the Lake districts of Cumberland, Westmorland and North Lancashire, we pass southwards into the Peak district of Derbyshire, and the high lands of Staffordshire. Another feature is the distinctly mining and manufacturing nature of almost the whole area".

JOHN WRIGHTSON. **High Farming in England.** — (*The Standara Cyclopedia of Modern Agriculture, edited by P. Wright.* London, 1909, vol. V, pag. 144).

" An important feature in high-class Wiltshire farming is the devotion of the entire area of wheat stubbles to catch crops. The barley and oat stubbles are sown with clovers or with sainfoin; but the wheat stubbles, which in ordinary farming are winter fallowed for roots, are in this case broken up at once after harvest and apportioned to trifolium, winter barley, winter rye, winter oats, and winter vetches. The farm is therefore one continuous expanse of green in spring without any bare winter fallow. "

" The fertility of the land is almost entirely kept up by sheep folding, and the amount of purchased manures employed is small, and consists of some 2 to 3 cwt. of superphosphate applied to the roots. Nitrate of soda is occasionally used for the second corn crop. The down land is naturally poor and easily run out, so that this system of farming requires to be maintained, and if relinquished, two years are enough to reduce the yield to 24 bushels of wheat or barley and 40 bus. of oats to the acre. This system pays through the sheep, and so liberally are the lands treated that the best 100 wethers are often sold at 56 s. to 60 s. per head in August or September. Even those who do not aspire to ram-breeding follow out the same system. In the case of ram-breeders, averages of 10 and 12 guineas (318 francs) per head are realized, and sometimes 80 to 150 gs. for individual lambs (from 2120 to 3975 francs); so that in these cases the profit comes directly through the sheep; but in the case of wether-lambs it comes jointly through sheep and corn.

" As an example of high or intensive cultivation, the farm of Mr. Teasdale H. Hutchinson, The Manor, Catterick, may be taken. It was the first-prize farm in the competition for 1891, and is situated in one of the most favoured parts of Yorkshire, and is 600 ac, in extent. The chief points to be observed upon, in respect of intensity of cultivation, are the amounts of live stock and of foods and manures purchased. Next come the yields of crops and the rotation pursued. We have little to do with buildings or implements, because some of the best farming in the kingdom is carried on with poor buildings, and implements which may be old fashioned in construction. Good farming does not consist in externals or in show, but in results; and we therefore pass on to consider this prize farm on its intrinsic merits. The stubbing up of ' miles of fences,' and the outlay of £2500 on buildings made by Mr. Hutchinson, although only tenant, are much to his credit, but might be accompanied by bad farming. *C'est magnifique, mais ce n'est pas l'agriculture.* On the other hand, clean land, good crops; good stock, and good and profitable management sum up the whole matter, and in all these respects Mr. Hutchinson excels. The total area of about 617 ac. is thus divided:

Roots	90 ac.
Wheat	51 »
Barley	85 »
Oats.	54 »
Clover	68 »
Meadow mown	22 »
Permanent pasture.	247 »

The management of the roots is as follows. They consist of swedes, manured with twelve loads of dung turned in with the chill plough. The land is then ridged, the artificial manures sown by hand, the rows split, and the swedes sown with a Scotch drill. The manures broadcasted are: 2 cwt. guano, 2 cwt. bone meal, 2 cwt. rape dust, 1 cwt. kainit, and 1 cwt. nitrade of soda = 8 cwt. in all per acre. This dressing is modified according to circumstances and according to weather dung is applied or withheld. Sowing takes place about April 28, and singling begins about the middle of June. The amount of live stock is thus given, subject to variations due to sales:

28 cows in calf or in milk.
12 heifers served.
54 fat bullocks 2 $^1/_2$ to 3 years old.
34 heifers and bullocks rising two years old.
23 yearlings.
6 bulls.
157

10 Shire horses.
7 Clydesdales.
16 hunters.
1 hunter brood mare.
1 hack.
1 pony.
36 horses.

80 pure Leicester ewes to lamb.
145 Border Leicester ewes to lamb.
403 hoggets.
8 aged rams.

636 sheep.

Mr. Teasdale Hutchinson is an eminent agriculturist. He is known as an excellent and accredited judge of stock and a breeder of pedigree animals, so that the quality of the animals he maintains is beyond question. The fact that he obtained the first place in a keen competition, renders it unnecessary to expatiate upon the cleanliness and good condition of his farm. He owned, for example, one game cock 'for which it is said he refused £1000.' He had taken £9000 in prizes for cattle, sheep, and horses at the time of the inspections of his farm, and the value of his stock must have amounted to many thousands of pounds. He sells ewes at 20 gs. (530 francs) each, and had just given 94 guineas (2490 francs) for a Border Leicester ram.

The capital invested in his holding must be extremely large, and we do not venture to assess it. Particulars as to his cake bill and his crops are not supplied in the report, but they are scarcely needed. The entire effect must be pleasing to a visitor, for the buildings are praised as excellent, and the engines, threshing machine, chaff-cutters, pulpers, mills, cake-breaker, hoists, saw-table, and grindstones are all worked by steam, and 'make up a list more for a factory than for a farm.' 'The waste steam is not lost, but is led by a pipe, and used to cook some of the food for the stock. More expensive buildings may be seen, but for completeness and usefulness nothing better could be wanted.' When we consider the value of the herd of fifty Shorthorns, all entered or eligible for the herd book, the value of the horses, the sheep, and the poultry, this farm well diserves to stand at the head of a list representing intensive cultivation. It bears out what was stated earlier, that this particular class of high farming is inseparable from high-class live stock, and that good stock and plenty of it is still the backbone of profitable farming.

Lastly, and in proof of the excellence of Mr. Hutchinson's cultivation, the enormous size of the swedes arrested the attention of the judges. Mr. Hutchinson mildly suggested 50 tons per acre as the yield, and on weighing 100 roots they were found to turn 76 stone, or nearly half a ton. This was actually 0.76 st., or $10^1/_2$ lb. each.

With reference to the cleanness of the land it is pronounced 'absolute,' and it is further related that one inspector did succeed in finding a string of couch, and this he held up in triumph and asked — 'What is this?' To which Mr. Hutchinson asked him to find another and he would tell him!"

James S. Macdonald. **Is the British Farmer content? No; but he has good cause to be.**—(*Fry's Magazine*, June 1910; *Review of Reviews*, June 1910, p. 538).

Great recent progress has been made in the improvement of live-stock.

Three years ago a flock of Lincoln sheep was sold for exportation to the Argentine Republic for £4000 (equal to 101 000 francs).

The greatest herd of milk-cows in England belongs to Lord Rayleigh, in Essex. It is composed of upwards of a thousand cows. The highest yield of milk obtained from one cow during $10^1/_2$ months was 1 674 gallons (7 600 litres).

The head cow-herd gets a bonus of £3 if the average milk yield of the cows under his care reaches 650 gals. per year. The bonus is increased to £4 10*s.* if the average attains 700 gals, and to £6 2*s.* 6*d.* and £10 for 750 and 800 gals. respectively. A production of 800 gallons is equivalent to 3632 litres par year.

Notwithstanding all the progress in the motor-car industry it is worthy of note that the breeding of heavy draught horses for agricultural purposes is becoming always more and more profitable. "Heavy draught horses are not bred fast enough to meet the demand for them; as for carriage and saddle horses the demand has no limit."

A. D. Hall, **Agriculture and the Development Grant.**—(*The English Review*, April 1910.—London Chapman and Harr Ltd., p. 117).

The following are some extracts from an article of Professor A. D. Hall, Director of the Rothamsted Experiment Station, at present one of the Development Commissioners:

"As a manufacturing country doing a great export trade, as a rich country constantly investing capital in new territories, the

United Kingdom has to be paid for these commodities and services very largely in agricultural produce. Furthermore, the United Kingdom is the open agricultural market of the world, for though Denmark and Belgium are equally free, they have not the wealth to attract a great volume of international trade, and in consequence every developing country wishing to sell corn or meal or other foodstuff must make an effort to secure a footing in the British market. And many countries, especially our own colonies, exert themselves to secure this footing by devices which the abstract economist might designate as unfair or at least unsound, i. e. by bounties on exportation, more often by services rendered in the way of organisation, sometimes by assisted freights and reduced rates. At any rate the net result is to focus on the British farmer an exceptionally severe competition, the competition of every other country in the world that has agricultural produce to export.

Nor does the competition end here; the British Islands are so small that the manufacturing districts and the towns set the standard of wages and of what we might call expenses of administration. It is true that the agricultural labourer in many districts still receives a wage which on paper is far below that of the workers in the towns, but the disparity is not so great as it appears, and with the freedom of communication that now prevails we may take it that the farmer has to pay very little less than the manufacturer for the same class of labour. „

" Farming is, afterall, a very primitive occupation and whatever skill or scientific assistance may be brought to its assistance, it still cannot be hustled into growing two crops in one year, nor organised into ensuring the most profitable type of weather; it therefore fits in with a somewhat primitive community and finds a difficulty in carrying all the burdens of a high civilisation.

“ Twenty or thirty years ago, when the successive waves of agricultural depression were beating upon the landowner and farmer, many men accepted this point of view and mentally jettisoned agriculture as a factor in British life; let it die naturally and quietly, they thought, and leave the countryside as the playground of the town dweller. Even when this opinion was not avowed or even recognised it was still operative in the apathy and neglect with which all agricultural matters were regarded, But since that time a considerable shift of public opinion has taken place; the countryman is seen to be of value as constituting the most stable and the most healthy class in the State, until the sociologist would now admit that the State may wisely tax itself to maintain and strengthen the agricultural community if only as a measure of national assurance.

"To Protection, a purely negative policy, the alternatives are constructive schemes that will aid the farmer to extend his industry in novel directions, schemes that will remove the difficulties standing in the way of success in his ordinary business, that will provide him with information and advice and thus minimise the disadvantages which the farmer suffers in the world's market through his business. Such a policy has the greet advantage over Protection of helping the most capable and active-minded among the farmers, it offers assistance to the men who will improve their methods, and thus advances agriculture as a whole instead of allowing the weaker members to set the pace.

"It is not a new policy, because it has been adopted in combination with Protection by most foreign countries and particularly by our Colonies. In Europe, Hungary provides perhaps the most advanced instance of such nursing of agriculture by the State; Ireland, too, has achieved some good work in that direction, but we must go to the United States, to Canada, or the Transvaal if we wish to see the system at its best."

"As regards agriculture we need only reflect that within the last hundred years, a period contemporaneous with the growth of any science of agriculture, the production of wheat per acre in this country has been practically doubled. The causes have not been improved cultivation, because the older methods, if costly in labour, were very effectual, nor has the kind of wheat grown brought about the difference, because many varieties more than a hundred years old are still grown to-day and yield well up to the average; the chief factor of change has been the introduction and general use of imported fertilisers which have brought about a general rise in the productivity of the soil. Agriculturists are apt to forget that the first step in these matters, the step that counts, was originally due to science; the use of fertilisers has now been absorbed into the stream of tradition, every farmer knows the value of superphosphate, but he "specs it growed," without any reference to the work of Lawes and Liebig in inventing it.

"To-day, when the great discoveries of the prime fertilisers are over, the work of the man of science in that connection consists rather in examining the new sources and in following out the secondary actions of the manure upon the soil and upon the quality of the crop. But in other directions almost virgin fields of work offer themselves; for example, the British farmer has always prided himself on his skill in raising breeds of plants and animals. Just as one or two English types of wheat and turnips and clover are recognised as yielding the heaviest crops, so the Shorthorn cattle have spread from Teesdale the world over, the Clydesdale horse is almost as plentiful in Canada as in his own country, and few foreign flocks exist which have not somewhere a cross of Leicester or Southdown blood. The methods by which the old breeders worked formed the basis of Darwin's speculations on the origin of species; now the debt of science is going to be repaid by the enormously increased powers which certain recently discovered laws of heredity have put into the hands of the breeders.

"Led by Professor Bateson, Cambridge has distinguished itself by its working out the applications to practice of Mendel's rediscovered principles; already some of the improved wheats there raised have reached the stage of being put on the market; the florists, particularly the sweet-pea enthusiasts, have learnt to rely entirely on the Cambridge work for their methods of raising and fixing new varieties; while Professor Wood's work in crossing sheep breeds has demonstrated practically that desirable characters can be selected from any and every breed and combined in one ideal type. Only time and continuity of work on a large scale are required.

"At no period can we hope to dispense with investigation and content ourselves with applying the knowledge that has already been gained; the most humdrum farmer following a routine consecrated by generations of practitioners may any day light upon a problem which cannot be answered from the books but must be solved by actual trial. New diseases are always arising; it is within the experience of most fruit-growers that practically every black currant plantation in England has been destroyed by the "*big bud*" mite, a disease which had long been known, though only of late years has it become virulent. The old grounds have been rested and then replanted with clean and possibly disease-resisting stocks of French origin, various other palliatives have been resorted to, but no real remedy has been discovered, possibly because the study of the disease has never been taken up in any thorough fashion. Similarly, only a few years ago what had hitherto been a harmless fungus living upon dung and similar decaying matter suddenly developed, apparently in one place only, a power of attacking the living cucumber plant. From that centre it was rapidly distributed, probably by market baskets and packages, all over the South of England, until the growth of cucumbers under glass bade fair to become impossible. None of the remedies suggested by the very imperfect scientific study of the disease, which alone was possible with our existing equipment for such work, proved of any value; the only way out has been through the chance discovery of a disease-resisting seedling, but the disasters and impoverishments which those years of destroyed crops brought in their train have not yet wholly come to light.

"It is difficult to make the layman appreciate how lamentably deficient is the equipment of Great Britain for dealing with these sorts of problems; although English science in this department as in all others has been distinguished by signal discoveries and by the pioneering work it has done, it has always been unorganised and unsupported by the State. What success has been gained has been due to those qualities of originality and imagination which we may fairly claim as racial characteristics. When we find that in the last financial year for which statistics are available the United States Department of Agriculture expended two and a half million pounds on agricultural research, whereas our Board of Agriculture only claims to have allocated L. 6910 (1) we get some sort of measure of the relative importance that has been attached to agricultural research in the two countries previous to the Development Act.

" Until within the last decade the experimental station at Rothamsted has represented practically the whole of the work done in this country for agricultural research; it was the first of all such institutions to be founded, and it has retained its honourable position throughout the whole of its seventy years' record. But Rothamsted owed both its creation and its continued existence to the munificence of one man, the late Sir John Lawes; its income is less than that of any one of the fifty odd experiment stations that are attached to each of the American States, the appropriations for which were not counted in the sum of two and a half millions stated above as devoted to research by the Federal

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(1) This is the figure given in a return to the House of Commons paper 278, Sept. 14, 1909; but from the published accounts of the Board of Agriculture it is difficult to see how one-tenth of this sum has been expended.

6910 £ are equivalent to 174 477 francs.

The 2 $^1/_2$ million pounds expended by the United States Department of Agriculture on Agricultural research are equivalent to a sum of 6 312 000 francs.

Department of Agriculture. The work of Rothamsted is starved in all directions to a degree that is incredible to its foreign or colonial visitors, it cannot develop to keep pace with the new possibilities and more drastic requirements of science because its income is fixed and limited; hitherto it has been refused assistance by the Board of Agriculture on the ground that the Board had no funds for research. However, now that the State has accepted research as part of its duty to the community there should be no doubt about the Rothamsted station getting that measure of assistance which it merits, both by its distinguished history and by the work it has latterly turned out.

"Of course, Rothamsted is not the only institution in the country now engaged in agricultural research; on the Royal Agricultural Society's farm at Woburn experiments of a similar character have been in progress since 1876 and many of the University Departments and Colleges which came into existence in the early seventies through the Grant of the "Whisky Money" for technical education have developed specialists who are turning out an increasing amount of investigation every year. We have already mentioned Cambridge with its school of plant and animal breeders; the principles have been established, the men have been found (and at bottom it is only men, individuals not institutions, who make discoveries), all that is necessary for the attainment of practical results is more money to conduct the work on a large scale. At present the investigations are paid for out of the savings of the Teaching Department, the work has largely to be done in the private time of the staff and not infrequently in their own gardens and at their own expense, it cannot be increased or hastened because of the sheer physical inability of one or two men to count, measure, and record to a sufficient extent at the appropriate season. For practical work of this kind it is the big battalions that tell; our present neglect is like asking Wren to build St. Paul's with his own hands and such assistance as he can get from the pupils whom he is teaching in order to earn a living.

"One of the first objects of the Commissioners of the new Development Grant ought to be to build up a great "National Breeding Institute" at Cambridge.

"There are similarly other institutions doing good work in a quiet way that should be encouraged in their special directions rather than replaced by any new State foundation; for example, the Agricultural College at Wye has already won a name for its investigations into the diseases of plants, both insect and fungoid. At that college are men who know their work, who have already won the confidence of the farmers and fruit-growers, they only need more scope and to be made available for the Kingdom instead of for the counties of Kent and Surrey alone.

The "Midland College of Agriculture" is a valuable school of instruction in dairy work of all kinds, and as far as lies in the power of one man who is busy with teaching and routine work of all kinds, it has contributed to our knowledge of the conditions governing the manufacture of cheese and butter in this country. But of the dozen or so indigenous cheeses we can only claim that the theory of manufacture of one of them—Cheddar—has been worked out, and that chiefly by American investigators. The complex processes which go to make up the texture and flavour of that peculiarly English product—Stilton—are still unknown, the manufacture is conducted by rule of thumb, and the occasional breakdowns have still to be thrown on the broad back of Providence. Here then is an opportunity for building up a Dairy Institute which may claim the title of national by the quality and range of its work.

Other nuclei exist—the "Experimental Fruit Farm" which the Duke of Bedford founded and maintains at Woburn, the "Fruit and Cider Institute" near Bristol, the newly founded "Innes Horticultural Institution" near Wimbledon; they are all doing good work, but they are limited and starved both by lack of funds and by the policy which lack of funds compels of doing work that pays or advertises.

We look to the Board of Agriculture; working with the Commissioners of the Development Grant, to single out the institutions which have got the right kind of men and possibilities of growth, and to subsidise each for work along special lines until the whole field is covered."

Drainage and Reclamation of Land.—"As another item in its object the "Development Act" specifies the drainage and reclamation of land. Here is a wide field for work of a different type, not merely in the reclamation of the foreshores near the mouths of many of our rivers where the land is gaining on the sea, and where the erection of sea-walls coupled with an extension of the process known in the Humber Estuary as "warping" and in France as "colmatage" will gain great areas for cultivation, but in those other processes of reclamation which consist in the conversion of waste into farming land.

Seventy years ago many of the great landlords of this country were at work making land on the sands, by marling and chalking, on the heavy clays by drainage, by paring and burning etc. Some of the best land in Cheshire and Norfolk grew out of pure wastes in this fashion. The process stopped, partly because labour grew dearer, partly because the organising and speculative instincts of the landlords were turned in other directions that promised a bigger return, but with our improved means of moving earth on a large scale it ought to be possible to repeat the old successes. There is a lot of poor Crown land on the borders of Surrey, Berks, and Hampshire (Bagshot Sand, unfit to grow anything but villa residences and rhododendrons) yet bordering the area occurs both the London Clay and the Chalk, the two materials which if incorporated with the sand would make of it a fertile soil. Similar waste sands are to be found all over England, and in the East Midlands are many weary miles of poverty-stricken Oxford Clay, too heavy and wet for the plough, growing only miserable grass, land that can be bought for £10 an acre and rented for 10*s*. But on a big scale it is almost certain this land could be profitably reclaimed by close drainage, making the tiles on the spot, and by incorporating a certain amount of burnt clay with the soil, to which improvements must be added a judicious manuring with lime and basic slag. These experiments in reclamation, since they mainly require unskilled labour judiciously organised might be coupled with social experiments in utilising the unemployed."

FREDERIC IMPEY. **Small Holdings in England.**—London, P. S. King & Son, 1909.

For more than 30 years it has been the Author's constant study to urge the great gain which would accrue to the national welfare if there were a great increase in the numbers of cultivators of small portions of land.

He has visited many parts of England where successful small farms exist and made the personal aquaintance of the hard working people who cultivate them.

In the year 1884 the Allotment and Small Holdings Association published a leaflet, written by Mr. Impey, entitled "Three acres and a cow" and the agitation thus commenced has been continued until the Small Holdings and Allotment Act 1907 was passed.

Necessity for establishing experimental Small Holdings.—Before long it will be necessary for the Government, through the Board of Agriculture, to devote, more generously than hitherto, the funds needed for careful and continuous instruction in the cultivation and stocking of Small Holdings throughout the country. The small holder's margin of profit is not sufficient to allow him to make many experiments. As is done in the United States and Canada and to some extent in Denmark, Germany and France, national institutions for the training of small holders, and experimental farms will be found needful and profitable.

Small holders a substantial class.—In spite of the gradually lessening numbers of small holdings for many years, a very substantial portion of Great Britain is still cultivated in small farms.

Out of the 32 577 000 acres (13 163 000 hectares) of cultivable land in Great Britain, 4 899 000 acres (1 972 400 hect.) are in farms of from 1 to 50 acres (0.4 to 20.2 hect.) whilst 27 700 000 acres (11 190 000 hect.); are in farms of from 50 to 1000 acres (20.2 to 404.6 hect.).

The value of live stock per acre on the small farms is greater than that kept on the larger holdings.

According to recent returns the value of live stock per acre:

On farms of 50 acres (20.2 hect.) and under is £4. 17*s*. 3*d*. per acre.

The average on all other farms: £4. 1*s*. 5*d*. per acre.

The Author proceeds to give some accounts of the visits which he has paid to small holders in several parts of England, among which the following deserve special mention:

Worcestershire.—In this county, where Mr. Impey has lived for upwards of thirty years, successful Small Holdings of almost every type may be found. It is frequently asserted that Worcestershire affords special facilities for them; but beyond those in the Vale of Evesham it is doubtful if this holds true. The northern part of the county is hilly and cold and the soil a poorish red marl. It suits stock rearing and the small farmers avail themselves of this. In one parish the A. found 150 holdings of under 50 acres each—many being quite small. The soil is poor, but hard work, and thrift, with butter making, pig-keeping and stock rearing enable the people to live and thrive.

Near Worcester a working gardener had enlarged an allotment of half an acre (2023 sq. metres) of wheat into two acres (8092 sq. metres) of rose trees and was sending them all over the world.

The well known Vale of Evesham was formerly chiefly in large farms and it was only when these proved unprofitable that "little men" got a chance on the land and they pay more rent than their predecessors did. A fair sized market garden holding would be five acres (2 hectares).

The following statement is based on the practical experience of a small holder, £ 50 to £ 100 capital would not be too much for a good start. The holding would be worked by a father and son, and help at special seasons. At least £10 per year should be spent in planting fruit trees until the capital would be £150. Then would be grown asparagus, lettuce, spring cabbage, onions, wall flowers radish, peas and potatoes for use. The land is laid out in strips 15 yards (13 met. 70 c.) wide. Between each strip rows of plums and small bush fruit underneath.

Fertilisers are liberally used, chiefly fish manure, nitrate of soda and shoddy. Ploughing is hired, chiefly at 2 shillings an hour, and constantly a horse and cart are kept. Rent would be up to £50 including a house.

Railway vans circulate pretty widely to collect produce and many people send small lots to the frequent Evesham auctions.

Tomatoes and marrows are favourites with these who have capital for a glass-house, and some grow cucumbers also under glass. Some make tomato sauce and there is an important move to "can" surplus fruit. A land agent told Mr. Impey that he knew scores of men who 12 or 15 years ago were labourers at 15 shillings a week who were now worth from 100 to £500 each.

Lincolnshire offers as remarkable and suggestive a variety of Small Holding industries as anywhere in England, though without any great advantage in the way of climate.

Sheep and Small Holdings.—One man whom the author visited had begun with 4 acres (1.6 hectares) and then got on a little and kept sheep, and now he and his five sons farmed 800 acres (320 hectares). Another had a 30 acres (12 hectares) holding, 26 arable, of which 5 were roots, 12 barley, and paid £60 rent. He kept 12 to 15 ewes and reared last year 18 lambs.

Shropshire and Cheshire afford instances of successful and long-continued labourers' dairying Small Holdings which are of great value in giving the occupiers the opportunity of earning a margin out of which it is possible with thrift to build up a capital for a larger farm.

Lord Tollemache's three acres and a cow Small Holdings.—The best known Small Holdings in Cheshire are those which the author visited on Lord Tollemache's Estate in 1884 and described under the name of "Three Acres and a cow."

He found 300 labourers earning wages of 12 shillings a week as cowmen, each occupying a house with 3 acres (1.2 hectares) of grass land for which they paid a rent of £6 per year. On each holding was a cow and often a yearling heifer, with pigs and poultry, and with the hay stack the capital was not less than £30. The system attached the people to their homes, giving them the opportunity to save, besides affording the children plenty of milk and better food than they would have got by their father's wages alone.

The author recently revisited the Tollemache Estate Small Holdings and found them still flourishing.

Somersetshire. — Is a county where a great area of land has been applied for under the Small Holdings Act 1907—not less than 20 000 acres (8093 hectares). The district near Axbridge is well known for early strawberries of which there are many plantations.

The advantage this district has is the warm shelter of the Mendip slopes combined with suitable soil. One case was noticed by Mr. Impey where a man was paying £5 rent for $^1/_4$ of an acre (1012 square metres) from which he had in the preceding year sold £58 work of strawberries.

In this neighbourhood Cheddar cheese is made and there are numerous cases of successful Small Holdings on which good cheese was made. One man on 10 acres (4.04 hectares) kept 4 cows and was satisfied with the returns.

Small farming a lost art.—Improved methods of working, and especially by means of cooperative action will assuredly be gradually developed. In many parts of the United Kingdom the business of successfully working a Small Holding has been forgotten.

R. F. **The Agricultural Population of Great Britain.** [Fifty years of social progress]. — (*Contemporary Review*, 529, 17-32. — London, Jan. 1910).

The Local Government Board have recently issued, under the title "Public Health and Social Conditions," a Report, containing valuable statistical memoranda, tables, and graphic charts.

A fact of primary importance brought out in the Report is the tendency of population to aggregate in urban centres. The tendency is of long standing in Great Britain. A similar tendency, though of more recent date, is observable in most other European countries.

The distinction between urban and rural sanitary districts furnishes an approximately accurate measure of urban and rural population, and is adopted for this purpose in the Census Reports. The Census returns of 1901 showed 77 per cent of the population of England and Wales living in urban districts, of this 77 per cent, 46 lived in cities having a population of over 50 000 inhabitants, 22 in cities of 10 to 50 000 inhabitants, and 9 in villages or small towns with less than 10 000, thus only 23 per cent of the population were living in rural districts.

The progress of the tendency towards urban aggregation is shown by the fact that the population of the urban areas was 50 per cent of the population in 1851, 68 per cent in 1881, and 77 per cent in 1901.

The agricultural population, as a whole, has declined in the half-century by over 30 per cent, and the aggregate number of labourers (male and female), as distinct from farmers and graziers, by as much as 64 per cent. The area of arable land has also declined, while the area of pasture land has increased; but the decline in the former class of land has occured at a slower rate than the decrease in the number of agricultural labourers and farm servants employed on it: in other words, an economy of labour has been effected, largely by means of labour-saving machinery, over and above the reduction of labour consequent on the decrease of land under cultivation. There is, however, some reason to believe that prior to 1870 a certain proportion of the agricultural population was actually superfluous, and that the amount of labour required in agriculture was insufficient to provide permanent employment for the existing agricultural population.

On the other hand, concurrently with the decline in agricultural labour, there has been a substantial rise in agricultural wages, which were in 1907 56 per cent higher than they were in 1850.

E. Dommen. **Essay on British Agriculture.** — (Monographie agricole de la Grande-Bretagne. — Paris, J. B. Baillière, 1908, p. 68).

A short essay on British agriculture. The crop yields of Great Britain are compared with those of other countries.

« The following table shows that only Belgium and the Netherlands are above Great Britain in regards to the yields per hectare. These yields are calculated in metric quintals (100 kgr.) per hectare:

Countries	Wheat	Oats	Barley
	(100 Kg. per Ha.)		
United Kingdom	20.07	17.95	18.23
France	12.93	11.64	12.42
Germany	19.00	17.42	18.40
Austria	11.70	9.80	11.72
Hungary	11.83	10.85	11.73
Denmark	18.98	14.73	17.30
Netherlands	20.70	23.10	26.00
Belgium	23.20	23.65	27.35
Italy	8.59	6.85	5.94
Rumania	10.94	9.22	9.17
Russia (mean) Europe / Asia	7.56	7.06	7.94
New Zealand	21.81	17.93	19.22
United States	8.80	12.72	14.20

« The relative areas under the principal crops are reported as follows:

	Arable land	Wheat	Rye	Barley	Oats	Potatoes	Roots	Fallow
United Kingdom	1000	98	4	100	220	66	125	19
France	1000	253	49	27	149	57	38	131
Germany	1000	73	225	62	158	126	46	87
Hungary	1000	261	79	77	77	42	18	97
Austria	1000	89	155	95	146	102	27	..
Belgium	1000	122	199	31	191	117	200	..
Netherlands	1000	58	232	23	155	170	65	7
Denmark	1000	5	105	109	167	21	50	83

« This table clearly illustrates the high proportion of the area in roots in the United Kingdom. Notwithstanding the decrease in area of the wheat crop, the yields from the arable land have remained high to the advantage of dairing and of the raising of live-stock ».

A German view of English Farming.—(*Mark Lane Express*, London, January 1910.

This article criticises a note on British agriculture, presented to the Agricultural Association of Stettin, in which British Farming is described as decadent, the land being left untilled for sheep to graze on. The writer defends British Agriculture pointing out its merits, especially in the field ot stock-breeding, in which it has a world-wide reputation.

PHILIPPE MILLET. **The Agricultural Crisis in England: A French view of English Agriculture..** — (*Rev. de Paris*, 17th year, no. 6, p. 426. Paris, March 1910).

From 1878 to 1908 the area under wheat has decreased in the United Kingdom by one half, falling from 1 500 000 hectares to about 750 000 hectares. This phenomenon is unique not only in Europe, but in the civilised world taken as a whole. During the same period the area under wheat has increased by one half in Russia and the United States; it is fifteen fold larger in Argentina; in Germany and France it has remained nearly stationary. In 1878 the English wheat fields were one fifth of those of France, to-day they are one ninth. It is true that the area which has been lost to cultivation proper has been transformed into pasture lands. But from 1878 to 1908 the increase in cattle and swine has been less considerable in England than in France,and much lesss so than in Germany.

The sheep have even diminished:

	Millions of Cattle 1878-1908		Swine 1878-1908		Sheep 1878-1908	
United Kingdom	9,8	11,7	3,8	4,1	32,6	31,3
France	11,7	13,9	5,7	7,0	23,5	17,5
Germany (1883-1908)	15,8	20,6	9,2	22,1	19,2	7,7

The returns of the Income-tax Commissioners clearly prove that there is a general decline in British agriculture. In 1870-71 the revenue obtained from landed-property in Great Britain (exclusive of Ireland) was estimated at £56 239 212; since 1881 this revenue has constantly declined and in 1906-07 it had fallen to £42 326 989. In 30 years the soil of England has lost one third of its income, representing alone a capital of, perhaps, 1 000 000 000 pounds sterling (1).

On an average from 10 to 15 thousand country-people migrate to the big cities each year, or embark for the colonies. Two hundred years ago, four out of every five Englishmen lived on the land. "The last census returns of 1901" writes Mr. Jesse Collings, "reveal an amazing state of affairs. Whilst the population of England and Wales has increased by 12 % in 10 years, 77 % of the total population lives in urban districts which cover a little over one tenth of the total area."

Progress in Lancashire Agriculture. — (*Journal of the Royal Lancashire Agricultural Society*, pp. 208. Liverpool, 1910).

The Royal Lancashire Agricultural Society was instituted in 1767, the principal objects of the Society being the encouragement and general advancement of the science and practice of English agriculture.

From an interesting historical retrospect on Lancashire agriculture, by Mr. R. J. Penke, the following passage on "Improved Systems" may be quoted:

"Mr. Ffrance, of Rawcliffe Hall, improved the chain harrow, and also contrived, in wood, a cultivator on Lord Ducie's plan for moss land. Wooden railways for marling and carrying off turnips, etc., were half-a-century ago adopted by some of our Fylde agriculturists. Sixty years ago there were, as far as records show, no reaping machines in Lancashire, grain being cut with the sickle or reaping hook and sometimes with the scythe. A few machines for spreading grass were adopted, and ploughs similar to the Scotch iron swing plough were in general use. In the arable districts of the Fylde and South and West Lancashire, ploughing competitions were inaugurated, and these led to great improvements in the skill of the farm hands. However, with the growth of facilities for travel and marketing, the Lancashire farmers, became as well equipped

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(1) Cf. *Agricultural and Live Stock Returns*, 1909. Cd. 4834. *Colonial and Foreign Statistics*, 1909. Cd. 4989.

as most of the tenantry of England, and not one whit behind them in intelligence and adaptability.

Draining has proceeded on a great scale, and the water courses and fences are generally first class."

This volume of the Lancashire Journal contains also some useful hints on "the availability and manurial value of purchased fertilisers," by the Consulting Analytical Chemist of the Society, Dr. A. Smetham; as well as a review on "the agricultural legislation of 1909" by T. C. Jackson.

Reports are included on the Society Exhibition at Southport and on the Dairy Show at Preston, as well as on the list of prizes awarded.

T. Mc K. and Mary C. Hughes. **Cambridgeshire** (Pp. XIII 271).
T. A. Coward. **Cheshire** (Pp. X, 207).
Cambridge County Geographies. [Cambridge, University Press. Maps and Illustrations, 1 s. 6 d. each]. — (*The Geographical Journal*, Vol. XXXV, n. 3. — London, March 1910, p. 322).

« The authors, editor, and publishers of this series continue a good work. These volumes bulk larger than earlier ones, and maintain their standard, that on Cambridgeshire being especially well done. Moreover, it possesses an index, an adjunct which has not been regarded as necessary in other volumes, and this is a move in the right direction ».

Lord Rayleigh's Farm in Essex. Home Counties. — (*The World's Work*, April, 1910. *Review of Reviews*, April 1910, p. 365).

On Lord Rayleigh's Farm at Terling, near Witham, in Essex, fifteen years ago the men began receiving bonuses out of profits paid on their wages. Even the boys received these bonuses, and now as much as £500 has thus passed into the workers' pockets. The bonus system has been succeeded by a system of copartnership, which, the writer thinks, is unique, and by which the men can, if they like, invest their money in the farm itself, at a rate of interest much more liberal than that of the Post-Office Savings-Bank.

W. E. Bear. **Agriculture of Jersey.** — (*The Standard Cyclopedia of Modern Agriculture, edited by P. Wright,* Vol. VII, Gresham Publ. Co., London, p. 188, 1910).

"Although the total area of Jersey is only 27 717 ac. (equivalent to 11 197 hectares) including water, or less than one-third of that of the smallest English county other than London, and its cultivated area is but little over 19 000 ac. (hectares 7676), the agriculture of the island is of considerable importance. Favoured by a beneficial climate, an aspect gently sloping from north to south, and a soil which, if not strikingly fertile naturally, is admirably suited to tillage and responsive to applications of manure, Jersey is an ideal spot for small holders. The agricultural prosperity of the island however is largely due to the great industry and enterprise of its cultivators, who have not failed to put its natural advantages to the utmost use.

The prosperity of Jersey is mainly dependent upon potatoes and dairy cattle, though in recent years the tomato crop, grown largely in the open, as well as in glasshouses, has grown into considerable importance. In 1907, out of a total cultivated area of 19 171 ac. 16 010 ac. were arable, and of this quantity 8577 ac. were under potatoes as a first crop, roots mainly being grown after them in the same season, except when the land is to have a rest from potatoes, in which case « seeds » are sown. The importance of forage crops for live stock, and mainly for cattle, in addition to those grown after potatoes, is shown by the growing of clovers and grasses under rotation on 4601 ac. while a small acreage of roots and cabbages was grown apart from potato land, and 3161 ac. were permanent pasture. The total area under corn crops was only 1931 ac., about half being devoted to oats for the farm horses and other stock.

The farms are small, only six being of 50 ac. or more, while the great majority are under 15 ac. In 1907 there were 620 holdings over 1 ac. and not over 5 ac. out of a total of 1886 holdings, not including plots of land under 1 ac.

. . . In the season of 1908 the shipments of potatoes from Jersey from the first week in April till the last in July, when the exports ceased, amounted to 53 100 tons, the returns for which on the quay at St Helier were £356 305. If the area of crop was about the same as that of 1907, the average yield was over 6 tons, and the average return was over £40 per acre, not including potatoes saved for seed or sales for home consumption. Both quantity and value have been much greater in some previous season. Records kept from 1883 show 77 800 tons, shipped in 1907, as the maximum quantity, and £487 642 in 1891 as the highest returns, although in the latter year the quantity was about 11 000 tons less than in the former. A few pence over £10 per ton is the highest average price; but growers who pay extreme rents for specially favoured plots obtain much higher averages, as the earliest shipments are commonly sold at between £25 and £30 per ton. The expenses for manure and labour, as well as for rent, are extremely high, the total in many rases being £30 per acre, and in some much more. The shipments of tomatoes in 1907 amounted to 2528 tons, valued at £78 331.

Other important returns are those of the famous Jersey cattle, which are exported to all the civilized countries of the world, and those of dairy produce, chiefly butter. The number of cattle in 1907 was 11 968, a large number for the acreage. The pigs numbered 5012, and horses 2347, while sheep amounted to the insignificant number of 162.

The glasshouse industry of Jersey is small in comparison with that of Guernesey, but still is a valuable asset to the wealth of the island.

Grapes, tomatoes, potatoes, French beans, and peas are the principal crops raised in the structures, some of which are heated, and others cool houses. Outdoor fruit and culinary vegetables other than potatoes are much less grown than they were in former times.

JOHN DRYSDALE. **Carse Farming in Stirlingshire, Scotland.** — (*Trans. Highl. and Agric. Soc. of Scotland.* Vol. XXI, Vth series. Scotland, 1909, pag. 74-101).

There is probably no system of tillage of arable land which has undergone greater change during the last 20 to 30 years than that pursued on the alluvial clay soil usually termed Carse-land, which stretches for about 28 miles along the Forth valley and which embraces about 36 000 acres. Much of this land has been reclaimed from the sea and from moss and then improved by drainage and liming.

The author gives a sketch of the more usual rotations used on Carse land and the crops and grasses grown on it.

On some of the best managed farms where proper attention is paid to poultry raising, it is now found useful to have portable poultry houses in which the fowls can be taken out to stubble fields and left for a few weeks to pick up all spilt grain. The poultry benefit immensely by the change to clean ground, and brace up for winter laying.

The author mentions also the application of lime which is no longer used to the extent that it was about 30 or 40 years ago. Then about 6 to 8 tons of shell-lime per acre were applied to a sixth or seventh of the arable land annually. The general opinion seems to be that tenant farmers are not justified in incurring so much outlay, so long as compensation for such improvement is so uncertain. Considerable quantities of gas-lime are used with good results in the Kippen and Gargunnock districts.

Artificial manures are much more extensively used now than formerly, especially nitrogenous manures which are applied to oats and hay. Basic slag is much used in top dressing for grasses. Superphosphate is used, principally for turnips, its use as a top dressing for hay seldom producing marked results. Potash is seldom used on clay lands.

It is complained that damage by grub is more common than formerly, but this may be due to the absence of severe frosts during winter.

Much progress has been made in the rearing and feeding of stock.

Thirty years ago it was mostly Ayrshire cattle that were reared in the Kippen district, now it is nearly all Shorthorn or Polled crosses. There has also been a great increase and improvement in the rearing and breeding of Clydesdale horses.

The foregoing extracts shows how the intelligent Carse farmer is gradually changing his system of cultivation and adapting it to altered conditions, by adopting simpler and less expensive methods of culture so as to be able to compete with his foreign and colonial rivals. But more must be done if the home farmer is to hold his own. Every important industry with which he has dealings is highly organised, he alone remains isolated..

His home markets are being captured by the organised foreign and colonial farmers who, acting in combination, can both produce and sell cheaper. Agriculture continues to bear quite unnecessary burdens.

The farmer must get into closer touch with the manufacturer and wholesale merchant, and employ the middlemen as little as possible.

ARCHIBALD MAC NEILAGE. **Typical farms in the West of Scotland.**—(*Trans. of the Highl. and Agric. Soc. of Scotland*). Vth series. Vol. XXI. Edinburgh, 1909, Pp. 24-42).

The county of Dumbarton presents a considerable diversity of agricultural practice due to the diversity of the soil. Along the shores of the Firth of Clyde and in the Clyde valley there is much free "potato land." And it is the farming of Dumbartonshire where the soil is kindly and the leading characteristics are potato growing and dairying that the author describes.

He makes a brief survey of several of these farms giving data as to their drainage, fencing, cattle, cropping, etc.

Thus at *Fiunick Bog*, *Inverkip*, as in many other cases, the farmer complains of the manner in which draining was carried out under the Government scheme about 50 years ago, which consisted in 1 $^{1}/_{2}$ inch (37 mm.) tiles 4 feet (1 m. 20) deep and 15 feet (4 m. 50) apart: These are in course of being replaced by new drains with 2 $^{1}/_{2}$ or 3 inch (63 to 75 mm.) tiles, 3 feet (0 m. 90) deep and 12 feet (3 m. 60) apart.

The cost of recent draining runs to about £ 12 per acre (750 frs per hectare). Land in the neighbourhood is generally well drained and fenced.

Mid Ascog. Bute.—Here also the land is fairly well drained. The drains are being gradually renewed and put down 15 feet (4 m. 50) apart and 2 feet 9 inches (0 m. 83) deep.

The cost is about 9 pence per fall (16 frs 30 c. per 100 lineal mètres).

Buildings and fencing are generally in good order. According to modern ideas there might perhaps be more hay sheds. The leading feature on the farm is dairying, to which everything is subordinated.

Shiels, Renfrew. — This farm extends to 160 imperial acres (65 hectares) of which 135 (54,5 hect.) are arable and 25 (10,5 hect.) pasture. The farm carries 25 Ayrshire cattle, the produce of which is sold, one half wholesale and the other is retailed.

The rotation is a four years shift. Wheat, hay, oats, green crop. This shows that it is rather cow-feeding than dairying proper. Wheat is sown at the rate of 3 bushels, oats 4 bushels, turnips or swedes 5lbs, and cabbages (Drumheads) 10 000 to the acre (corresponding respectively to 270 litres, 360 litres, 5 kg. 600, and 25 000 per hectare). Wheat seed is got from England, and oats from Angus.

In preparing the land for wheat, the green crop land of the previous season is turned over with the swing plough and twice harrowed. For oats following hay, the hay stubble is turned over and the seed sown either by hand or with the corn drill.

For green crop the oat stubble is twice ploughed and the drills drawn with a "double breisted" plough. Farmyard manure is applied at the rate of 30 tons per acre (75 000 kgs per hectare) and artificials at the rate of 3 cwt per acre (375 kg. per hect.) of a mixture of nitrate of soda, superphosphate, etc.

Potassic manures have been found useful in strengthening the straw, but basic slag has not proved satisfactory.

The varieties of oats sown are Potato, Black Tartarian. on about one fifth of the whole farm. Timothy occupies one fourth of the area and a meadow will last for ten years. It is top dressed every season with either artificial or farmyard manures. Hay harvest may begin about the first week in July, and oat harvest seldom before the first week of September.

IV.

Agricultural Societies. — Agricultural and Horticultural Shows. — National and International Congresses.

The Royal Agricultural Society of England.—(*The British Year-Book of Agriculture and Agricultural Who's Who 1909-10*— London, Vinton & Co., 1909, p. 19).

"The Royal Agricultural Society of England was founded May 11, 1838. Incorporated by Royal Charter, 1840. Supplemental Charter, 1905. Ordinary Subscription, £1. Life Members and Governors may pay a compounding subscription. Number of members, 10 000,

"Ordinary income 1908, £8442 (equivalent to francs 213 160) including £7487 subscriptions, the total income being £143 greater than in 1907. Ordinary expenditure, £7879 (francs 198 944). This included £1613 salaries, etc.; £757 rent, etc.; £737 printing, advertising, postage, etc.; £600 cost of *Journal*; £615 Laboratory; £677 other Scientific Departments; £171 Examinations for National Diplomas; £209 Miscellaneous.

The total receipts from the 1908 Show were £35 598. This included £2000 from the Newcastle Local Committee, £4049 Prizes by Breed Societies and Newcastle Local Committee, £5766 entry fees for implements, £3814 other entry fees, £1081 for Catalogue, £17 792 for admission to show-yard and horse ring, £515 from refreshment contractors, £581 auction sales, etc. The cost of the Show was £25 544. The principal items in this expenditure were £9449 for erection of show-yard, £8847 prizes, £1572 printing, £1139 advertising, £743 forage, £496 judges' fees, £3298 general administration, management, and show-yard expenses, etc. The profit on the Show was £10 054 (equivalent to francs 253 863). The balance of the available capital at Dec. 31, 1908, was £43 592 (equivalent to francs 1 086 568) as against £29 267 in 1907. The Reserve fund early in 1909 stood at £37 700 (equivalent to francs 941 925).

"In addition to the ordinary funds the Society holds in its corporate name £8126 Consols, representing a legacy of £9000 received in 1896 under the will of the late Mr. E. H. Hills. The income is applied under the will to the investigation of the value and uses of the rarer forms of ash in the cultivation of crops.

"*Annual Show.*—The great feature of the Society since its establishment has been its annual exhibition of stock, implements, etc., and as the Show has been held in different parts of the country, and all the recognized British breeds have been represented and encouraged, the Society has from the first acquired a national character. A change of policy was introduced in 1903 by the acquisition of what was intended to be a permanent site for the Show at Park Royal, near Ealing, London, but the losses from the three shows held on the new ground compelled the Society to resume the migratory system, and the Show of 1906 was accordingly held at Derby, and was successful.

"The Show of 1908 was held at Newcastle-upon-Tyne, Tuesday to Saturday, June 30 to July 4, on ground covering an area of 105 acres (42.4 Hectares). The entries were 2619 live stock, 768 poultry, 416 produce, 114 horse-shoeing, and 22 farm prizes. In the implement yard there were 389 stands, and, apart from open space exhibits, 12 035 feet of shedding was allotted."

JOHN GILLESPIE, **The Highland and Agricultural Society of Scotland.**—(*The Standard Cyclopedia of Modern Agric. & Rural Economy*, edited by R. P. Wright, vol. VII.—London, 1910, p. 21).

" The membership of the Society in 1909 numbers 6829. The funded capital of the Society has been steadily on the increase, and now amounts to about £110 000 (equivalent to francs 2 777 500).

There are two grades of subscription. The higher annual subscription is £1 3*s*. 6*d*. Life members pay £.12 12*s*. Proprietors farming the whole of their own land, not exceeding £500 in annual value, and all tenant farmers, secretaries or treasurers of local agricultural societies, factors resident on estates, land stewards, foresters, agricultural-implement makers, and veterinary surgeons, none of whom are owners of land to the value of £500 per annum, are admitted on a payment of 10*s*. per annum, or a single life subscription of £7 7*s*.

Not unnaturally, for a lengthened period the management of the affairs of the Society was to a large extent in the hands of gentlemen whose residences were within easy access of Edinburgh, and it was felt as a grievance that comparatively few tenant farmers were admitted as members of the Board. Since 1882 the election of the directors has been put on a representative basis. In addition to the office-bearers, the Board consists of 52 directors; 32 of these are ordinary directors, 4 being from each show district, each of whom holds office for four years. One of these is nominated by the members in each show district each year. Of the 20 extraordinary directors, 10 are chosen from the district in which the show for the year is to be held, and the other 10 are chosen because of their known interest in, and their work for, the Society. One-half of the directors in each of these classes must be landed proprietors or other persons paying the higher subscription, and the other half must be tenant farmers or other persons paying the lower subscription.

For many years Scotland has been divided into eight show districts: (1) The Lothians, (2) South-east of Scotland, (3) South-west of Scotland, (4) West of Scotland, (5) District around Stirling, (6) Perthshire and adjoining districts, (7) North-east of Scotland, and (8) Inverness-shire and North-west of Scotland, and annual shows have been held in the month of July at some centre within these districts in successive years.

The sums given in prize money at general shows from the funds of the Society amount to upwards of £2 500 annually (equal to 63 125 francs); and this sum is largely supplemented by liberal special prizes generally offered by private individuals and societies. In addition, from £600 to £700 are annually given as district grants to local agricultural societies in all parts of Scotland. In connection with many of these grants it is stipulated that in alternate years, when the prizes from the national society are suspended for the year, prizes of an equal amount must be offered out of the funds of the local society."

Bath and West and Southern Counties Society.—*The British Year-Book of Agriculture and Agricultural Who's Who 1909-10.*—London, Vinton & Co., 1909, p. 12.

" The Bath and West of England Agricultural Society was established in 1777, for the encouragement of agriculture, arts, manufactures, and commerce. Subscription from 10 s.; 1200 members. Finance-Receipts in 1908, £10 155 (equivalent to 256 413 francs). This included a grant of £25 from the Board of Agriculture for experiments; £670 dividends on investments; £1128 subscriptions; £33 from sale, etc., of Journal; £300, sale of sheep, etc., in connection with manure and mutton experiments; £7995 receipts from the Dorchester Show; and £800 subscription from Exeter for 1909 Show.

The payments amounted to £11 096 (francs 280 174). This included £1125 salaries; £230 printing, postage, etc.; £408 cost of Journal: £508 experiments and research; and £8823 cost of Show. The Show receipts included £1793 for fees, etc., from implements, and £1632 from stock; £2388 gate money, and £488 contract premiums. The Show payments included £561 shedding, etc., for implements; £4338 prizes, shedding, and judges, etc., for live stock; £1897 dairy, etc.; £393 advertising, etc.; £1530 erection of offices and miscellaneous. There was a net loss of £809 on the Dorchester Show of 1908. The balance of the Society's assets on December 31, 1908, amounted to £19 845 (501 086 francs), principally in Consols, and India and Colonial Stocks.

"*Annual Show.*—The 1908 Show was held at Dorchester, May 27, June 1 (Wednesday to Monday). The total entries, which had been 1752 in 1907, at Newport, and 2193 in 1908 at Swindon, were 1975. They included 239 horses, 562 cattle (Shorthorns 71, and Jerseys 137), 262 sheep, 133 pigs, 495 poultry, and 284 produce. The prizes offered, in addition to medals, etc., were £3345, of which the Society provided £2821, the remainder being given by the breed societies, local societies. and other donors. The prizes were allocated thus: Horses, £850; cattle, £1176; sheep £618; pigs, £227; poultry, £167; produce, £209; horse-shoeing, £38."

Central and Associated Chambers of Agriculture.—(*British Year-Book of Agriculture and Agricultural Who's Who, 1909-10.*— London, 1909, p. 15).

"Founded 1865. Subscription from £1. 350 members and 105 associated bodies, with 20 000 nembers. Annual receipts, including £440 from affiliated societies, £1100 (francs 27 775). Payments, £1 100. Balance of assets, nearly £1 000.

The objects of the Central Chamber are to promote the best interests of agriculture, and with that view to watch over all measures affecting agriculture in and out of Parliament. It took the leading part in the demand for the creation of a Board of Agriculture (1889), the promotion of the Diseases of Animals Acts; the Agricultural Rates Act; and Agricultural Holdings Act.

The Council of the Chamber meets eight times in the year. The subjects under discussion by the Chamber within recent times are revealed in a statement which was prepared and issued for the General Election in 1906, setting forth the legislation required in the interests of agriculture: 1) Sale of Butter Bill; 2) Dogs Bill; 3) Local Taxation-relief from excessive burdens imposed on agriculture, and provision of one uniform assessment for all purposes, both imperial and local; 4) Railway Rates, prohibition of preferential rates for foreign produce, and better means for obtaining reduction of unreasonable rates on English produce; 5) Tuberculosis, no further powers to be given to local authorities with regard to tuberculous meat or milk, pending report of Royal Commission, and that when report is issued the consequent measure should be made to apply to the whole country generally, due provision being made for payment out of imperial funds of compensation in respect of animals or carcasses seized as tuberculous; 6) Beer duties to be adjusted in favour of beer brewed only from barley malt and hops, brewers to be compelled to declare ingredients used; 7) Uniform system of agricultural weights and measures; 8) Retail vendors of foreign meat to be registered; 9) Margarine to be coloured with some innocuous substance; 10) Preservatives and colouring matter in milk to be prohibited; 11) Railway Companies to be made liable for damage from sparks; 12) Amendment of law of trespass; 13) Recommendations of Departmental Committee on Fertilisers and Feeding Stuffs to be carried out; 14) Amendment of Agricultural Holdings Act, so as to protect capital invested by farmer in his holding.—Since the issue of this statement the subjects numbered (1), (2), (11) and (13) have been satisfactorily settled by legislation.

"The official organ of the Chamber is "*The Agricultural Record*," containing the Proceedings of the Council, published monthly at 6 d. to non-members. A recent special publication is "Agriculture and Railway Rates," by Thomas Waghorn, price 1 s.

"Chairman, 1909: G. L. Courthope, Esq.. M. P. Secretary: A. H. H. Matthews, 1 and 2, Orchard St., Great Smith St., Westminster, S. W.

Rules of the Agricultural Organisation Society, London.

The Society called the Agricultural Organisation Society, Limited, with offices at Dacre House, Dacre Street, Westminster, London, has the following objects and powers as set forth in its rules.

The objects of the Society shall be to carry on the trades, industries, or business of accountants, booksellers, commercial, agricultural and general advisers, publishers and teachers of the principles and methods of co-operation, as applicable to farming and the allied industries, and of promoting the formation of Agricultural Co-operative Societies for the purchase of requisites, the sale of produce, for Agricultural Credit Banking and Insurance, and for all other forms of co-operation for the benefit of agriculturalists. The Society shall have full power to do all things necessary for the accomplishment of all objects specified in its rules, including the power to purchase, hold, sell, mortgage, rent, lease, or sub-lease, lands of any tenure, and to erect, pull down, repair, alter, or otherwise deal with any buildings thereon.

Arboricultural Societies in England and Scotland. — (*British Year-Book of Agriculture and Agricultural Who's Who. 1909-10.*— London, 1909, p. 93).

"*Midland Re-afforesting Association.*—150 members.

President: Sir Oliver Lodge, Birmingham. Hon. Secr.: Herbert Stone, Bracebridge Street, Birmingham.

Royal English Arboricultural Society.—Founded 1882. Subscription, from 4*s.* to £1 1*s.* 110 members. Balance, 1908, £300. Meetings are held at various places; visits of inspection are made to forest areas; medals and prizes are offered to young foresters and others for essays connected with Forestry; and an examination for proficiency in Forestry is conducted under the Society's auspices. The annual summer meeting in 1908 was held in Denmark. The *Transactions* are published annually. The *Quarterly Journal of Forestry* is also issued for the Society at 2*s.*, by Simpkin, Marshall and Co. London.

President: Sir Hugh R. Beevor, Bart., 17, Wimpole Street, Cavendish Square, London, W. Secretary: Edward Davidson, Haydon-Bridge-on-Tyne Northumberland.

Royal Scottish Arboricultural Society.—Founded 1854. Subscription, from 4*s.* to £1 1*s.* 1300 members. Receipts, 1908, £529. Funds, December, 1908, £1 706. Meetings are held at various times for discussion, etc.; excursions are made to British and Continental forests; medals, etc., are awarded for essays on practical subjects, and for inventions connected with Forestry; and an annual exhibition is organised in connection with the Highland and Agricultural Society's Show, prizes of about £30, besides medals, being usually offered.

Recent discussions, "Planting of Waste Lands," "State Forestry," "Forestry Education," "Larch Disease" (a Report of an investigation into the latter was issued in June, 1905), "Trees of Western America," "A Scheme for Establishing National Industry of Forestry," "The Forest Resources of the United Kingdom," "Demonstration Forests for Scotland."

The *Transactions* are now published twice a year, at 3*s.* to non-members, by Douglas & Foulis, 9, Castle Street, Edinburgh. For the benefit of proprietors a Register of Foresters and others desirous of obtaining situations is kept.

President: Sir Kenneth J. Mackenzie, Bart., of Gairloch, 10, Moray Place, Edinburgh. *Hon. Secretary:* R. C. Munro Ferguson, M. P. *Secret. and Treas.;* Robert Galloway, S. S. C., 19, Castle Street, Edinburgh."

Horticultural Societies in England and Scotland.—(*British Year-Book of Agriculture and Agricultural Who's Who 1909-10.*— London, 1909, p. 93).

"*Royal Caledonian Horticultural Society.*—Founded 1809. Incorporated by Royal Charters in 1824 and 1898. Subscription from

5*s.* to £1 1*s.* 1500 members. Annual receipts, £1 500, including £900 gate money from the shows. Payments, £1 534, including £623 in prizes. Funds, November, 1908, over £750, and the Neill Prize Fund of £450. The main features of the Society are the flower shows, which are held in Edinburgh in April and September, and are open to the United Kingdom and Ireland.

President: Lord Balfour of Burleigh. Secretary: Donald Mackenzie, 23, Rutland Square, Edinburgh.

Royal Horticultural Society (England). — Founded 1804. Subscription, from £1 1*s.* to £4 4*s.* Nearly 10 500 Fellows. Income, £18 000 (francs 456 500). Assets, £70 000 (francs 1 767 500), exclusive of gardens at Wisley.

The objects of the Society are to encourage and promote the cultivation of plants and flowers, fruit and vegetables, and fortnightly exhibitions are held throughout the year at the Society's Hall. The members and fellows are entitled to purchase, at reduced rates, such, fruit, etc., as are not required for experimental purposes; to obtain analyses of manures, soils, etc.; to have their gardens inspected at stated fees; to have a share of surplus plants; and to have a copy of the Society's Journal. Members may use the libraries, including the "Lindley Library," containing an incomparable collection of horticultural works. Examinations in horticulture are conducted under the Society's auspices. Nearly 200 Societies are affiliated.

The year 1904 was the centenary year, and to mark the event a new Hall, costing £42 000, was opened by H. M. the King at Vincent Square, Westminster, on July 22. A new garden of sixty acres at Wisley, near Ripley, has also been recently purchased (by the late Sir Thomas Hanbury), and placed on trust for the use of the Society. Courses of instruction for young gardeners are provided at the gardens—an elementary or first year course and an advanced or second year course. A laboratory, opened in 1907, forms part of the equipment of the gardens, and affords facilities for advanced research.

The following are among the principal exhibitions held each year (with some provisional dates for 1909): Show of Colonial grown Fruit and Vegetables, to be held on December 1-4; National Auricula and Primula Society's Show, April; National Tulip Society's Show, May; Flower Show, Inner Temple Gardens, May 25, 27; National Sweet-Pea Society's Show, July; Great Summer Show at Holland Park, July 6, 7; National Carnation and Picotee Society's Show, July; National Rose Society's Autumn Show, September;

British Fruit Show, October 12; Show of Colonial Fruits and of Home Bottled Fruits and Vegetables, December 1-4.

President: Sir Trevor Lawrence, Bart. Secretary: Rev. W. Wilks, M. A., Shirley Vicarage, Croydon.

Address of Society: Vincent Square, Westminster, London, S. W.

General Show of the Highland and Agricultural Society of Scotland at Aberdeen, 1908.—(*Trans. Highl. and Agr. Soc. of Scotland,* Vol. XXI, 1909, pp. 367-388).

As a display of live stock the show was a conspicuous success. Larger entries have sometimes been recorded, but in regard to general standard of merit a higher level has rarely been reached.

The following table gives a comparative view of some of the most successful shows the Society has held.

	Cattle	Horses	Sheep	Swine	Poultry	Total live stock	Implements	Premiums £	Drawings at show £	Profit £
Glasgow, 1867 . .	286	212	257	58	150	963	1344	1600	3005	1307
Edinburgh, 1869 . .	310	212	340	22	239	1123	1900	1600	4078	2067
Glasgow, 1875 . .	411	405	296	48	479	1639	2220	2665	6231	3316
Edinburgh, 1877 . .	339	342	305	30	234	1250	2292	2714	6734	3710
» 1884 . .	530	453	493	35	253	1814	2282	4343	6548	1855
» 1893 . .	380	349	294	31	360	1414	2268	2600	4918	2323
Aberdeen, 1894 . .	314	324	184	34	365	1221	2532	2440	5121	1678
Perth, 1896 . . .	292	258	204	20	374	1148	1945	2205	4788	2511
Glasgow, 1897 . .	317	350	245	30	275	1217	2227	2897	4392	2021
Edinburgh, 1899 . .	386	518	477	46	551	1978	2585	3844	10285	3911
Stirling, 1900 . .	321	288	369	28	457	1463	2095	2915	4305	1078
Inverness, 1901 . .	360	257	204	22	499	1340	1460	2806	2485	99
Aberdeen, 1902 . .	330	253	243	42	475	1343	1988	2796	4413	1604
Perth, 1904 . . .	348	315	283	35	413	1394	1972	3058	4993	1828
Glasgow, 1905 . .	310	462	284	60	534	1750	1875	3702	4473	1203
Peebles, 1906 . .	253	258	291	40	438	1280	1658	3072	2596	416
Edinburgh, 1907 . .	363	464	352	58	605	1842	2140	3614	7061	2309
Aberdeen, 1908 . .	331	299	237	42	509	1418	1931	3045	4596	1881

Wm. Hogg. **Farm Prize Competition, 1909.** — (*Journal of the Royal Agric. Soc. of England*, Vol. 70. London, 1909, pp. 269-310).

The Farm Prize Competition held in connection with the Royal Agricultural Society's Show at Gloucester covered the four counties of Gloucester, Wilts, Hereford and Worcester.

Prizes ranging from £5 to £100 were offered by the Gloucester Local Committee and by the Herefordshire and Worcestershire Agric. Societies for the best managed farms.

The farms were divided into eight classes according to their extent, which varied from 300 acres or over, to 10 acres or over, but not exceeding 50. This latter class being chiefly devoted to Fruit Growing and Market Gardening.

The Judges were requested specially to consider:

1) General management, with a view to profit.

2) Productiveness ot crops.

3) Quality and suitability of live-stock, especially that bred upon the farm.

4) Management of grass land.

5) State of gates, fences, roads, general neatness and state of cottages, so far as tenant is liable.

6) The bookkeeping, if any.

7) Management of dairy and dairy produce.

8) Management of orchards, fruit plantations and hop yards.

9) Duration of the tenancy.

The first prize in class 1 was awarded to a farm of about 750 acres of which 392 arable, 50 pasture, 50 water meadows and the rest, down land, homestead and a small orchard.

The soil is a light loam with chalk subsoil. It is not rich soil, and must only be ploughed to a depth of three or four inches on account of the subsoil. It is essentially sheep land.

The tenant is not bound to any prescribed form of cropping, but is under agreement not to crop more than half of the land with corn in any one year. Of the arable land 332 acres are worked on a four course system.

Most of the manuring is done through the stock, but chemical manures are also used. All turnip and swede seed is steeped in paraffin, to guard against the turnip "fly."

There are 13 working horses, 40 cows in milk and 44 dry cows, heifers, calves etc., all of the Shorthorn type.

The flock of registered Hampshire Downs sheep consists of 470 ewes, 170 ewe tegs, and 4 rams.

The chief items of annual expenditure are the following: Labour £830; purchased foods £976; manures £115.

International Horticultural Exhibition, 1912. — (*The Gardener's Chronicle,* n. 3615; p. 237. London, April 9, 1910).

The Royal Horticultural Society, has unanimously passed the following resolution " that this public meeting is of opinion that it is desiderable to hold an international Horticultural Exhibition in May and June 1912 ,,. In proposing the resolution the President, Sir Trevor Lawrence, who was in the chair, pointed out the great advance that had been made in horticulture since the last great exhibition in 1866, and referred to the hospitality which British horticulturists had received in France, Germany, Italy, Belgium and Holland in recent years.

V.

Agricultural Education. Experiment Stations and the organisation of agricultural research. Intellectual development of the rural population.

T. H. Middleton. **Cost of Agricultural Education in England.** — (*Board of Agriculture and Fisheries.* Annual Report on the Distribution of Grants for Agricultural Education and Research in the Year 1907-1908; with Statements respecting the several Colleges and Institutions aided, and a Summary of the Agricultural Instruction provided by County Councils in 1907-08, together with the Expenditure on the same. Pp. XLII + 161, London, 1909).

There is no doubt that agriculturists benefit from the twenty millions of public money (505 millions of francs) expended by the country upon education, and it is admitted that the cost of the general education of agriculturists cannot be estimated with any degree of exactitude.

Twenty years ago there was no public system of Agricultural Education. A system, imperfect it is true, has been developed. What has it cost? What direct expenditure has been incurred? As the Board have been associated with the movement from the beginning, the difficulty of forming a tolerably accurate estimate is not very great.

The funds now available for agricultural education come from three sources:

1) Private benefactions.

2) Government Grants.

3) The "Higher Education" Funds of Local Education Authorities.

Several of the institutions aided by the Board are indebted for buildings, scholarships and equipment to private munificence, and in a few cases a substantial portion of the annual income is derived from the same source. These gifts have from time to time been referred to in the Board's Reports. Among important benefactions may be mentioned the contributions of the Worshipful Company of Drapers to the Agricultural Department of Cambridge University (£1 000 per annum for professorships, and a donation of £6 000 to the School of Agriculture now building). Further instances of the extent to which Agricultural Education is indebted to benefactors are afforded by the "Harper Adams Bequest," which provided for the building of a College in Shropshire, and has endowed it with about £800 per annum; the "Seale Hayne" and "John Innes" bequests, providing respectively for agricultural instruction and horticultural research, the building of a School of Rural Economy and the augmentation by £600 per annum of the income of the Sibthorpian Foundation by St. John's College, Oxford; and also by the substantial sums (amounting in the case of the Cambridge School alone to over £12 000 (303 000 francs), given chiefly by landowners) which have been subscribed for buildings and other objects connected with our agricultural institutions.

With the exception of the grants earned for classes in the principles of Agriculture from the Science and Art Department, all the State aid available for technical instruction in Agriculture was, until 1902, given in the form of grants to institutions through the Board of Agriculture. These grants increased gradually from £1 630 (paid by the Agricultural Department of the Privy Council) in 1888-9 to £12 100 in 1907-8 (305 525 francs).

After the Education Act of 1902 came into force the Board of Education grants paid to Local Authorities for the purposes of Higher Education became applicable to agricultural instruction, but so far as can be gathered from the accounts and reports of that Board no substantial sum was applied to agricultural purposes until the Board introduced the new "Block Grant" regulations in 1906.

In the Memorandum recently published by the Board of Education, to which reference has above been made, tables are given containing estimates of the grants which in 1907-8 were awarded for "Specialised Agricultural Technology." The total sum disbursed in the year in question was estimated at £7 787 (francs 196 621). Of this amount £1 329 was paid to seven agricultural institutions, and the remainder to County Education Committees in respect of local work.

Tables of Expenditure for Agricultural Education (apart from secondary schools and elementary schools). — (*Board of Education.* — London, 1909, p. 13. — E. S. R., March 1910, Washington).

This report explains the relations of the general Board of Education and the Board of Agriculture and Fisheries in the support of agricultural teaching in the universities, independent colleges and the secondary and elementary schools of England and Wales in the counties named.

J. MIDDLETON. **Number of Agricultural Students in England.** — (*Board of Agriculture and Fisheries.* Annual Report on the Distribution of Grants for Agricultural Education and Research in the Year 1907-1908; with Statements respecting the several Colleges and Institutions aided and a Summary of the Agricultural Instruction provided by County Councils in 1907-8, together with the Expenditure on the same. London, 1909, Cd. 4802, p. VII).

"The total number of students attending the institutions aided by the Board was 1 146 in 1905-6, 1 221 in 1906-7 and 1 313 in 1907-8 (1). While these figures indicate that in the aggregate a con-

(1) These figures do not include students attending the Royal Veterinary College, of whom there were 236 in 1907-08, nor do they include 300 elementary school teachers who attended short courses at the colleges during the year.

siderable number of the future farmers of the country are now receiving some instruction in agriculture, it is clear that relatively but a small proportion of the English cultivating population is being reached.

There are in England and Wales some 340 000 holdings of five acres and upwards. Occupiers of these holdings may be assumed, on the average, to begin business between the ages of 25 and 30, when the expectation of life of a healthy male is from 38 to 34 years. If we further assume that in the case of farmers the expectation of life is 40 years, there must be about 8 500 occupiers entering into possession in each year. In addition to occupiers of land there are others who study at agricultural institutions as, for example, land-owners, land agents, teachers, and those preparing for farming or planting in the colonies. Thus in any one year the number of young men in England and Wales for whom agricultural instruction in some form would appear to be desirable must be not far short of 10 000. An examination of the College registers for 1907-08 indicates that of this number less than 7 per cent. are actually receiving agricultural education."

Inter-departmental Committee for Agricultural Education in England and Wales. — (*The Journal of the Board of Agriculture;* London, October 1909, Vol. XVI, No. 7, pp. 529-533).

The following memorandum of arrangements between the Board of Agriculture and the Board of Education in England and Wales has been presented to both Houses of Parliament (Cd. 4886).

"After careful consideration of the many matters and interests involved in the promotion of Agricultural Education, we have decided upon making the various arrangements set out in the following paragraphs as regards the work of the two Boards. Our object has been to provide suitable means for focussing the special needs of Agriculture in relation to Education and to secure the practical consideration of the particular problems of this branch of education, and effective cooperation in relation to all educational work carried on for rural areas. These arrangements aim in particular at the improvement and extension of specialised instruction of all grades bearing on agriculture and the maintenance of a close relationship between such instruction and the practice and progress of the various branches of the industry.

1. We propose to constitute a Rural Education Conference for

the discussion of all questions connected with education in rural districts and for the periodical exchange of views between representative agriculturists and the two Departments. This Conference, which will be constituted by a later minute to be issued in the course of the Autumn, will consist of members nominated by the County Councils Association, the Agricultural Education Association, the Royal Agricultural Society of England and other leading agricultural organisations, together with six additional members to be nominated by the Presidents of the two Boards so as to provide for the inclusion: *a*) of persons specially competent to deal with educational questions so far as the rural districts are concerned, and; *b*) of representatives of districts not adequately covered by existing agricultural organisations. The Conference will be attended also by such Officers of the two Boards as may be nominated by their respective Presidents to take part in its deliberations and to supply information or to give explanations with regard to any questions that may be raised.

2. In order to avoid overlapping or duplication of work in the sphere of Agricultural Education between the Board of Agriculture and the Board of Education, and at the same time to secure that every portion of the field is as largely aided and developed as possible, by the combined and separate efforts of the two Boards, it has been arranged that in future all Parliamentary Grants in respect of Agricultural Education shall be distributed, in the case of Institutions giving instruction to students taking Advanced Courses in Agriculture or in some special branch thereof as further defined below, by the Board of Agriculture, and as regards other forms of Agricultural Education by the Board of Education. But this distribution will be carried out by both Boards under conditions which will secure that the various sections of work thus aided are in due relation to one another. And, in order to facilitate this, an Inter-departmental Committee consisting of responsible Officers of the two Boards will be constituted, to consider and report to the Boards on all questions which may arise either as to the correlation of the duties of the two Boards or as to the grants to be made in cases in which they are mutually interested. This Committee will meet from time to time as may be required. Officers of either Board, other than those appointed as members of the Committee, may assist the Committee from time to time as the Committee or either Board may think desirable.

3. The sphere of work thus falling to the Board of Agriculture and Fisheries will comprise institutions of two types:

a) Those whose predominant purpose and work it is to provide comprehensive courses of Agricultural instruction of an advanced nature, of which the proper benefits can only be received by students who, on admission, have received a satisfactory general education, whole-time, up to the age of 17 (or thereabouts) or later, or who have otherwise obtained a preliminary education of a similar standard. Each such institution should serve more, usually considerably more, than one Local Education Authority's area.

b) Institutions restricted to one special section of Agricultural Instruction (e. g. Forestry, Dairying, Cider-making), the main purpose of which is to provide a course of specialised teaching in that subject on such a plane as will equip those who pass satisfactorily through it to be competent Instructors in that section of Agricultural work in Agricultural Institutions or as local Instructors in all parts of the country.

Government grants will thus be paid by the Board of Agriculture and Fisheries in respect of their agricultural work to the following Institutions, and to such others as may in future be found to be of a similar character or on the same educational plane:

University College of North Wales, Bangor.
University of Leeds.
Armstrong College, Newcastle-on-Tyne,
University College of Wales, Aberystwyth,
University of Cambridge.
University College, Reading.
Royal Agricultural College, Cirencester.
South-Eastern Agricultural College, Wye.
Midland Agricultural and Dairy College.
Harper Adams Agricultural College.
College of Agriculture and Horticulture, Holmes Chapel.
Harris Institute, Preston.
Royal Veterinary College.
British Dairy Institute, Reading.
Royal Horticultural Society's Garden School, Wisley.
Horticultural College, Swanley.
National Fruit and Cider Istitute.

4. While the special functions of the Board of Agriculture will, as above shown, be to deal with and to influence the Agricultural Colleges and other independent Institutions named in the foregoing

list, the relations of the Board of Education will, in the main, be with the County and other Local Authorities and such other Bodies as are supplying part of the local system of provision of Public, including Agricultural Instruction. And it will be the business of the Inspectors of the Board of Education to represent to the County and other Local Authorities the need for continuous development of special provision for Agricultural Education, and to draw attention to the various types and grades of work thus required, particularly as regards the need for a largely increased provision of Farm Schools. The Inter-departmental Committee with the views of the Rural Education Conference before them will give to the Board of Education all the advice and information they can as to types of School, methods of instruction and lines of organisation of instructional staff, most needing to be encouraged in particular parts of the country.

5. There is, at the same time, an important matter in connection with some of the cases comprised in the foregoing paragraph for which some special arrangement seems desirable: *viz.*, the provision and efficient maintenance of Farms and Experimental Stations in connection with Farm Schools and such other similar places of Agricultural Instruction as fall within Section 4 above. These Farms and Stations are greatly needed if the educational work of institutions of this type is to be carried on with full efficiency; and, as it is in the highest degree desirable that such forms of practical work should be kept in close touch with the latest and best developments in practical agriculture, it is believed that such Government supervision and aid as is made to them should be from the Board of Agriculture. It has, therefore, been arranged that such Parliamentary Grants as may be, or become, available for the estabishment and maintenance of the Farms and Stations, and of any experiments or investigations carried on in connection therewith, shall be distributed by the Board of Agriculture: the Grant in respect of the Educational work of the Farm Schools being made by the Board of Education, and all necessary arrangements for maintaining due relation between the two functions of the Schools and Stations, and for making the corresponding grants, being determined by the two Boards on the report of the Inter-departmental Committee above described.

6. We believe that the adoption of the foregoing arrangements will be welcomed by all those who are concerned with the development and extension of existing arrangements for the supply of

all grades of education and specialised agricultural instruction in the rural districts. They will afford opportunities for bringing those Officers themselves into closer and more continuous relationship one with the other. It cannot be doubted that much still remains to be done in order to bring the facilities for agricultural education at the disposal of British agriculturists to the level of those enjoyed by many of their competitors elsewhere, and we trust that important advance in this direction may result from the working of the arrangements here described."

County Organization for Agricultural Instruction: Agricultural Instruction in Somerset. — (*The Dairy*, vol. XXII, n. 259 (8), July 15, 1910. London).

The county of Somerset has for some years taken great interest in agricultural instruction. Immediately after Parliament created facilities for technical instruction a subcommittee of the County Education Committee dealt with this special feature, the duties of which Committee have been merged into the Agricultural Instruction Committee, which is mainly composed of members of the County Council which appoints it. They are however selected for their knowledge and interest in agriculture.

The Committee employs a considerable staff of instructors and lecturers, men and women, all experts of reputation, other departments having their special instructors or lecturers, on horticulture, poultry-keeping, cheese and butter-making, bee-keeping, and veterinary science. The Committee divides itself into sub-committees, one taking charge of the cheese school, another of experiments, and a third being concerned with the administration of a comprehensive scheme of scholarships. The character of Somerset and the needs of its agricultural population have been studied with great care, and every possible effort is being made to meet the requirements.

The classes for young farmers are excellent, and it is impossible to think that the satisfactory attendances at the different centres — Bridgwater, Taunton, and Washford — and the keenness of the students can bring other than the most gratifying improvement in the cultivation of farms in the near future.

Practical instruction in the manual processes, hedging, ditching, and thatching, is being given with the cordial approval of farmers, who hope that thereby a better supply of skilled labour will be available. The scholarships awarded at such schools as Sexey's, Shepton Grammar School, and the County School at Wellington are enabling promising boys to continue their studies at agricultural colleges or elsewhere, and the reports are most encouraging. A growing work is that done through the post. The instructors are constantly giving information and advice by letter. In dairying the Committee owes much to the initiative and enterprise of the Bath and West Society, which for many years carried on a Cheese School in the county. At first the County Council contented itself with making grants varying in amount from £250 to £300 a year. Eventually, three years ago, the Agricultural Committee assumed the management of the school. The school has been in favour with agriculturists from its start and it has well deserved that favour, for there is abundant evidence of its influence for good on the quality of Cheddar cheese made in Somerset. The great practical feature of the school is the production of cheese under right conditions. The school is itinerant—that is, it is carried on at some suitable farm during the cheese-making season. During the past three seasons, from special causes, the site has been Dudwell Farm, Chewton Mendip, but ordinarily the locality is changed yearly, so as to get the fullest advantage from the school.

Agricultural Education Exhibition at the Gloucester Show of the Royal Agricultural Society.—(*Journ. of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 239-244).

Among the number of institutions devoted to either agricultural teaching or research, or to both, which took advantage of the Society's show of Gloucester the following deserve to be mentioned.

The first exhibit in the catalogue was *Lawes' Agricultural Trust* which presented a series of maps of extraordinary interest. These maps showing how certain crops, different kinds of live-stock and other agricultural matters may be found to be associated with different soil formations, made up an agricultural survey of the south-eastern counties, without parallel in the history of British rural investigations. The authors of this work have set an example to all those who seek for truth in the world's knowledge of agriculture.

The *Royal Agricultural Society of England* had many interesting items besides the collection of its publications. The *Botanical department* showed many exhibits illustrating the latest developments in the various problems under investigation. The *Zoological dept.* showed some coloured diagrams of insect pests. There were also a number of graphic answers to the many questions that Dr. Voelcker is investigating at the *Woburn Experimental Station.*

The *Cambridge University Department of Agriculture* occupied almost the whole of their space in showing, chiefly graphically, how the problems of plant breeding, of crossing and hybridization are being investigated. Here were to be seen the different varieties, gathered from all over the world, of wheat and barley used as " parents."

The *South-Eastern Agric. College, Wye, Kent,* showed chiefly fungoid and insect pests attacking fruit. For the most part the exhibits were living examples, and admirably set out as they were, they had an inestimable educational value. " *Wools of various breeds of sheep illustrating different qualities,* etc. " was also an excellent exhibit.

The *Agricultural Education Association's* collection of leaflets was much the same as in previous years.

The *Royal Agricultural College, Cirencester,* ably represented local advanced agricultural education; some very excellent working models made by the students deserve especial mention.

The *Harper Adams Agric. College, Newport, Salop,* had an excellent display of Nature-study matter. The *portable* model of a working garden was useful, simple, and ingenious, and there was also a very complete exhibit of *Dairy produce to illustrate the work done by students.*

The *National Fruit and Cider Institute* showed prominently the results of many investigations in the interest of the fruit-growers of Great Britain, and among other exhibits a new, cheap and efficacious wash for apple trees, the *Methylated spirit and colza oil mixture.*

The *Royal Meteorological Society, Westminster,* exhibit illustrated their educational work, including much local information as regards rainfall etc., chiefly in a diagrammatic form.

Mr. W. Marriot in the grounds adjoining the Exhibition gave daily demonstrations on the " *Method of taking Weather Observations* ", which included the ascent of registering balloons.

A. SENIER. **General instruction, training by Research and coordination with technical Training.** — (*Nature*, Vol. 83. London, June 30, 1910, p. 539).

An abstract of a lecture on University teaching, delivered by Professor A. Senier before the Royal Dublin Soc. on March 9, 1910.

A brief history is given of the rise and of the influence on industries of experimental researches in the German Universities. Research Universities realise better than other institutions Carlyle's idea that "the end of man is an action not a thought."

Ample freedom of study and research, both for teachers and for students, is what is most required in a University.

Prof. Senier concludes thus: "If we desire to rival the work of the German Universities, we should seriously attempt the better organisation and coordination of our entire educational system.

One might imagine a trunk railway with stopping-places and branches. The trunk line might represent pure science, literature and philosophy and be always extending itself further; the stopping-places to where the scholars or students branch off to apply their training to livelihood occupations. Where exactly these stopping-places should be placed should be fixed after careful deliberation. Most would branch off for arts and crafts from the primary school most of the remainder would branch off after the secondary school; a small proportion would enter the University, branching off for the professions at places decided upon.

Encouragement to enter the University should only be given after careful consideration. Far too many men nowadays are painfully struggling against Nature in the University, to the detriment of the occupations for which Nature really equipped them. Even in the German Empire only 13 out of every 1000 of the male population enter the University."

Instruction in Agriculture at the University of Oxford.— (*The Journal of Board of Agr.*; Lond., Dec. 1909, n. 9, p. 749).

"One of the most recent additions to the list of institutions providing instruction in agriculture is the University of Oxford, which, in 1907, definitely recognised Agriculture or Rural Economy as a subject of study within the University.

"Agricultural education had, indeed, received some recognition in the University more than a century before, when, in 1796. Dr. Sibthorp, then Professor of Botany at Oxford, bequeathed land worth about £200 a year for the endowment of a Chair of Rural Economy. The Sibthorpian Professorship, as it was called, was, however, practically amalgamated with the Professorship of Botany, and from 1796 to 1884 it was never held independently. In the latter year Sir Henry Gilbert was appointed to the Sibthorpian

Professorship, and held the post for two periods of three years each, during which he gave lectures chiefly on the results obtained experimentally at Rothamsted. During the agricultural depression which occurred after 1878 the income from the endowment fell to about £ 120 a year, and this was absorbed during 1891-4 in the maintenance of farm buildings and expenditure on improvements on the estate. After an interval of three years, Prof. Warrington was appointed in 1894, and held the post until 1900. On his resignation no further appointment was made, owing to the reconstitution of the Professorship being under discussion.

"For some years prior to this, proposals for including agricultural science in the curriculum of the University had been made, but, although they obtained considerable support, no definite action was taken until 1905, when, on the abolition of the Royal Engineering College at Cooper's Hill, Oxford was charged with the education of the selected probationers for the Indian Forest Service. In order to provide for the instruction of these probationers, the University agreed to reconstitute the Sibthorpian Professorship. The College of St. John's came forward and augmented the stipend of the professor by £ 600 a year (francs 15 150), and subsequently associated the professorship with a fellowship in that College, and also undertook the erection of a laboratory with the necessary class-room accommodation, the cost of which has been approximately £10 000 (francs 252 500).

"The duties of the Sibthorpian Professor, as amended by Statute in 1905, are defined to be the giving of lectures and instruction on the scientific principles of agriculture and forestry, including the pathology of plants. Dr. W. Somerwille was appointed to the Professorship in 1906. Shortly afterwards the Hebdomadal Council instituted a Committee for the organisation of the study of Rural Economy, and also established a Diploma in the subject.

"At the present time the Diploma in Agriculture and Rural Economy is granted to candidates who have pursued a course of study approved by the Committee, and have passed certain examinations. Before admission to the course, candidates must satisfy the Committee that they have received a good general education.

"The course of study must extend over two academical years and must be pursued at Oxford; but members of the University who have kept by residence all the terms required for the Degree of Bachelor of Arts may be permitted by the Committee to pursue it elsewhere. The course of study comprises the following subjects: Principles of Agriculture, elements of Chemistry, elements of Botany, Rural Economy, Agricultural Zoology, Surveying, and at least one of the three subjects—the elements of Economics, the elements of Forestry, the elements of Geology.

" The examination for the diploma is held annually about July 1st. It includes written work, practical work, and a *viva voce* examination. Every candidate must 1) have been admitted as a student for diploma; 2) have satisfied the examiners in the preliminary examination in the Honour School of Natural Science in Chemistry (or in some other examination accepted by the Committee as equivalent); 3) have satisfied the examiners in the Pass School in the elements of Rural economy; 4) have satisfied the Committee that he possesses a sufficient knowledge of Surveying; and 5) present certificates showing that he has attended approved courses of instruction in the subjects which he offers.

" The subjects of examination for the diploma are: elements of Botany, Rural Economy, Agricultural Zoology, together with at least one of the following subjects; elements of Economics, elements of Forestry, elements of Geology.

" Candidates may offer the subjects of the diploma at separate examinations, and may offer more than one subject at the same examination.

" Candidates who have obtained honours in Botany or in Geology in the Final Honour School of Natural Science will be exempted from the diploma examinations in Botany and Geology respectively; also candidates who have satisfied the examiners for the diploma in Forestry in subjects auxiliary to Forestry will be exempted from both, and candidates who have obtained the diploma in Economics, or the diploma in Forestry will be exempted from the diploma examination in those subjects.

" In addition to granting the Diploma in Agriculture, the University also recognises Rural Economy as a subject for the ordinary B. A. degree. The scope of the subject for this purpose is the same as that included under principles of agriculture in the diploma course."

Opening of the New School of Agriculture, Cambridge.— (*Nature*, Vol. 83, April 28th, 1910, p. 260).

The New School of Agriculture of Cambridge was inaugurated on April 26th, 1910.

The new school is situated close to the Botany School.

It was erected at a cost of £20,000 (505 000 francs), after the designs of Mr. Arnold Mitchel.

The accomodation is designed for 100 students. The building contains three lecture rooms, two large elementary laboratories for chemistry and botany respectively, seven smaller rooms for private research, as well as a library and private rooms for the teaching staff.

The building is barely sufficient for the number of students coming forward.

Among the works exhibited at the inauguration was a series illustrating the work of Professors Wood and Biffen in connection with the improvement of English wheats.

Establishment of a Department of Agriculture at Manchester University. — (*The Journ. of the Board of Agric.*; London, March 1910, vol. XVI, No. 12, p. 1037).

In view of the increasing importance of the scientific aspects of the subject, the University of Manchester has decided to establish a course in Agriculture leading to a degree in Science.

The course will extend over three years, the first of which will as a rule be taken entirely at the University, while the second and third years will be taken partly at the University and partly at the College of Agriculture of the County Council of Cheshire at Holmes Chapel.

British Deputation investigating methods of Agricultural Education and Research in the United States. — (*Nature*, Vol. 84, July 7th, 1910, p. 28).

Early in the present year University College, Reading, appointed a deputation to visit certain Universities of Canada and of the United States with the object of investigating methods of Agricultural education and research. The Deputation left England on May 6th, and was absent about six weeks. The tour included the McGill University at Montreal, the Macdonald College at St. Anne de Bellevue, the State Experimental Farm at Ottawa, the University of Toronto, the Ontario College of Agriculture at Guelph, Cornell University, Wisconsin University and Harvard University. In each case the members of the Deputation made it their principal object to acquaint themselves with the agricultural activities of the institution visited, and their work was greatly facilitated by the cordial assistance of the Government and other authorities, both in Canada and the United States. It is hoped to publish a Report during the course of the ensuing autumn.

A Chair of Agriculture for Aberdeen University. (*Nature*, vol. 84, p. 96. — London, July 21,1910).

Lord Strathcona has given Aberdeen University a sum of £10 000 (252 500 francs) towards the endowment of a Chair of Agriculture. The interest on this money along with the annual revenue of the Fordyce lecture-ship on Agriculture and Rural Economy and £450 a year in the charge of the governors of the college for the same purpose will enable the University to secure the services of a thoroughly competent authority on the subject.

The John Innes Horticultural Institution.—(*Journal Board of Agric.*—London, p. 853, Febr. 1909).

The late Mr. John Innes, of Merton, in Surrey, who died in 1904, left a large sum of money for various charitable objects, one of which was the foundation of a School of Horticulture. A scheme for the administration of the charity has been prepared by the Charity Commission, and has recently been published. The scheme provides for the payment by the trustees of yearly sums out of the income of the charity for the maintenance of a park and a boys' club at Merton, for the provision of scholarships tenable at a local school, and for other charitable objects. With the exception of these sums and certain annuities left by the late Mr. Innes, which together amount to an aggregate yearly sum of about £4 400, the residue of the estate, which is estimated to produce about £5 000 per annum (126 250 francs), will be applied to the purposes of an institution, to be called the John Innes Horticultural Institution, for the promotion of horticultural instruction, experiment, and research. For the purposes of the Institution the house formerly known as the Manor Farm, Merton, and such portion, not exceeding two acres, of the grounds as the trustees may select, will be used, and in addition the trustees are empowered, subject to the approval of the Charity Commissioners, to provide further land, of which a sufficiently large acreage in the immediate neighbourhood is available.

The Institution will be placed under the management of a Council consisting of three trustees (*ex-officio* members) and nine representative members. Two of the representative members will be appointed by the Board of Agriculture and Fisheries, and one by each of the following:—the Royal Horticultural Society, the Fruiterers' Company, the National Fruitgrowers' Federation, the Hebdomadal Council of the University of Oxford, the Council of the Senate of the University of Cambridge, the Senate of the University of London, and the Governing Body of the Imperial College of Science and Technology.

"The functions of the Council are defined in the scheme for the administration of the charity as follows:—

a) To establish and maintain the Institution for the purposes of affording practical and scientific training for those engaged, or desiring to be engaged, in the industry or employment of horticulture.

b) To carry out investigations and research, whether of a practical or scientific nature, into any matters having reference to the growth of trees and plants generally, but especially of fruit trees, shrubs, fruit, vegetables, and flowers, and to investigate and demonstrate the best methods of their cultivation, their habits and leading characteristics, together with the soils and localities in which they may be most inclined to flourish.

c) To endeavour to improve existing varieties, or to create and introduce new ones.

a) To impart information, whether of a practical or scientific character, on all matters connected with the above, and generally to endeavour to promote as far as may be in every way the interests of all connected with, or desiring to be connected with, the industry or employment of horticulture.

e) Generally to pursue any course incidental or conducive to the attainment of the objects referred to in paragraphs (*a*), (*b*), (*c*), and (*d*) of this clause."

Swanley Horticultural College. — (*The Gardeners' Chronicle*, No. 3615, p. 233. — London, April 9, 1910).

The Annual Report of the Swanley Horticultural College states that there is a steadily increasing demand in secondary schools for "Garden Mistresses" who are competent to teach out-door work as well as scientific subjects. Nine students have started market gardens of their own in England, one in Ireland, and two in California.

JOHN PRINCE SHELDON. **Dairy Schools in the United Kingdom.** —(*Standard Cyclopedia of Modern Agriculture*, edited by R. Patrick Wright. Vol. IV, p. 109. London, 1909).

"Tuitional establishments, at once technical and scientific in scope and practice, are highly important characteristics of the new era in dairying which unfolded itself in the last quarter of the century recently closed. A generation ago they were not yet in being—were only just beginning to be thought of. But they are prominent features in the dairy world of to-day in the British Islands. Their existence is owing to the sharp awakening which occurred in the early seventies from a careless slumber of centuries duration in British dairying, and that awakening in turn was the sequel of the rapidly developing foreign competition of the period in dairy products, most of all in cheese.

Ireland was early in the field with dairy schools well-nigh thirty years ago—almost literally in the field, inasmuch as the first schools were itinerant, especially in the southern shires of the Emerald Isle."

. . . .

The following is a list of the chief dairy schools in England: Midland Agricultural and Dairy College, Kingston, Derby; British Dairy Institute, Reading; Lancashire County Council Dairy School, Hutton, Preston; Essex County Council Dairy School, Chelmsford; Cheshire County Council Dairy School, Worleston; Yorkshire Dairy School, Garforth, Leeds; Eastern Counties' Dairy School, Ipswich; Cumberland and Westmorland Dairy School, Newton Rigg; Shropshire Dairy School, Harper-Adams College, Newport; Warwickshire County Council Dairy School, Griff House, Nuneaton.

In Scotland: West of Scotland College Dairy School, Kilmarnock.

In Wales: Lleweni Dairy School, Aberystwith Dairy School.

In Ireland: Glasnevin Dairy School, Munster Dairy School.

British School of Sugar Refinery in Glasgow. —(*La Sucrerie indigène et coloniale*, n. 23, June 7th, 1910, p. 541),

A circular issued by the West Indian Commission announces the foundation of a Sugar Refinery School in Glasgow, Scotland, as an annex to the Technical College, for the training of chemists and engineers for cane sugar refineries.

Teaching Agriculture in Railway-Trains. — (*Mark Lane Express*, London, March, 1910. —*Journal of the Board of Agriculture*, April 1910, p. 52).

Great Britain has followed the example set by America in building railway cars which can be fitted up to demonstrate the utility of improved methods of poultry raising. The car serves at the same time the purpose of a small travelling exhibition of Welsh products and implements, and as school, with comparative tables showing the results obtained by different methods and with different products. This new departure has met with great success.

" Great efforts are made by the agricultural colleges in the United States to attract and interest farmers in their work. One method, which seems to be increasingly popular, is to bring instruction to the farmer's door by the use of a special train, from which lectures are given at wayside stations. An instance of the use of a train in this way was mentioned in the *Journal of the Board of Agriculture* in July 1909, and a similar, but somewat novel, form of giving instruction has recently been tried in Indiana.

The train was supplied without charge by the Erie Railway Company for the agricultural Experiment Station of Purdue University, Lafayette, which provided the lecturers and exhibits.

The train was composed of three coaches and a double side-door horse and carriage car. Lectures of 45 minutes' duration each were given at the stations where the train stopped. The lectures were given in the coaches, which had been fitted up with charts by the University; and the horse and carriage car contained three cows for demonstration purposes.

After a lecture of 30 minutes had been delivered, a 15 minute demonstration was given in regard to the cows. When the people had assembled on the platform, one of the doors of the car in which the cows were kept was thrown open, and two Jerseys were shown to the spectators. The general run of the demonstration lecture was as follows:

" Here you see two Jersey cows. Can anyone say off-hand which is the better? The first cow cost about £ 10 (252 francs) per annum to feed. She produced £ 11 10 s. (287 frcs) worth of milk or £ 11 15 s. (293 frcs) worth of butter fat, so you had about 35 s. profit per annum for the pleasure of milking her twice a day. The second cow, another Jersey, is a better producer, and gave £ 19 (479 frcs) worth of milk. This cow also cost £ 10 (252 francs) per annum to feed, but she showed a much larger profit. We get at the value of these cows by record. Every farmer should keep a record of his cows, the same as every other business man does of his business and manufacturing costs. The record is the only way to get at the value of cows for dairy purposes".

Pamphlets were then handed round explaining the importance of milk records, and the lecturer continued:

"There are over 600 000 cows in the State of Indiana. One-third of them are of the same type as the first cow shown, so that about 200 000 cows in this State are producing practically no profit at all. These Jersey cows are more suitable for a district where butter is made. You have the great Chicago market for fresh milk before you, and you should see to it that you get cows that will produce plenty of milk".

The second door was then thrown open and a Holstein cow shown, the lecturer continuing:

"This is a Holstein cow. She cost £2 more per annum to feed than the Jersey cow, or £12. She produced butter fat valued at £17, or milk valued at £38. The milk from a Jersey cow contains a larger percentage of butter fat, but the Holstein is the milk producer for this fresh milk district. This cow, by record, produces over 1100 gallons of milk per annum (4163 litres), or about ten times her own weight".

The lecturer then went on to explain the build of the cow, the udder, the milk veins, and the general characteristics that mark a good cow, thus supplementing the points mentioned in the preceding lecture.

From 50 to 200 farmers were present at every station.

At an evening meeting the Railway Industrial Commissioner of Erie, who had accompanied the train, said that he had noticed a wonderful change in the interest taken by the farmers in this train, compared with that taken by them in the first train on milk production, some three years ago. Even when a similar train for improving maize growing went through last spring a great many farmers were too shy to go into the coaches, but this time as soon as the train arrived at the station the farmers rushed into the coaches and took a lively interest in the whole matter.

These trains are provided by the railway companies with the object of developing the agriculture of the district through which their lines run. In this particular case, the railroad company were endeavouring to promote the trade in fresh milk for the Chicago market, by encouraging farmers to keep cows for milk production rather than for butter ".

Forestry Education in Great Britain. — (*The Journal of the Board of Agrieulture.* London, March, 1910, vol. XVI, n. 12, p. 961).

" At the present time there exist the following centres; — The University of Oxford, to which the Indian School of Forestry has been transferred: the Forest of Dean, where a School of Forestry has been established by the Commissioners of His Majesty's Woods and Forests; and eight other institutions, at each of which systematic courses of study in Forestry are provided, *viz.*, the University College of North Wales, Bangor; Armstrong College, Newcastle-upon-Tyne; the University of Cambridge; and the Royal Agricultural College, Cirencester; the University of Edinburgh; the Glasgow and West of Scotland Agricultural College; the Edinburgh and East of Scotland College of Agriculture; and the Aberdeen and North of Scotland College of Agriculture.

In addition, mention should be made of the Inverliever Estate, in Argyllshire, which has been purchased by the Commissioners of His Majesty's Woods and Forests for the purpose of carrying out an experiment in afforestation on scientific and economic lines, and of the Alice Holt Woods, which are now being worked as a demonstration area for the practical study of Forestry. In certain Agricultural Colleges other than those mentioned, lectures of Forestry are delivered. but instruction in this subject has not been developed sufficiently at these institutions to require specific mention here.

The increase in the facilities for instruction in Forestry during the past seven years has been brought about in the first place by the attention drawn to the subject by the Report of the Committee; secondly, by the action of the Commissioners of His Majesty's Woods and Forests in certain areas of land belonging to the Crown: and thirdly, by the financial assistance given by the Board of Agriculture and Fisheries to the University College at Bangor, to Armstrong College, and to the University of Cambridge, to enable these institutions to appoint lecturers in Forestry.

The agricultural colleges in Scotland are in receipt of grants in respect of the whole of their work from the Scotch Education Department while for the past two years the Royal Agricultural College has been similarly aided by the Board of Education."

University of Oxford. — "In 1905 the training of Indian forestry students, which had previously been conducted at the Royal Indian Engineering College at Cooper's Hill, was transferred to the University of Oxford. The School of Forestry which was then established is attended principally by probationers for service in the Indian Forest Department, who have been nominated by the Secretary of State for India, but other members of the University may attend the instruction in Forestry.

The Diploma in Forestry is granted to members of the University who have pursued a prescribed course of study extending over two years; undergone a course of practical work lasting nine months, of which about seven are spent with selected German forest officers in Germany; and satisfied the examiners in prescribed examinations.

The fees for instruction in Forestry and subjects auxiliary to it amount to about £63 (1590 francs) during the two years, or an average of £10 10 s. a term. In addition, students must meet the expenses (except railway fares) of the excursions in Great Britain which form part of the course. Students who are probationers for the Indian Forest Service are required to defray all their expenses at Oxford, but they receive, under certain conditions, a sum of £240 (6060 francs) from the Secretary of State for India during the course of probation, which, in the case of those who have already passed with Honours in Natural Science, lasts for two years, and, in the case of the remainder, for three years."

School of Forestry, Forest of Dean. — "This school was established in January, 1904, with the object of carrying out in one of the Crown Forests the recommendations made by the Departmental Committee. The course of instruction extends over two years. The number of young men entering each year is usually eight. Since the School was started 27 students have received certificates. The minimum age of entry has recently been raised from 16 years to 20. The young men are paid 15s. a week for their work, they receive practical instruction in the woods and attend lectures in a class room, the subjects of instruction being Forest Botany, Sylviculture, Forest Mensuration, and the Protection of Woods. A special building has been built for the purposes of the School and contains a class room, museum and carpenter's shop."

University College of North Wales, Bangor. — "A lecturer in Forestry at this College was appointed in the spring of 1904. At first Forestry was attached to the Department of Agriculture, but since July, 1907, it has occupied an independent position as regards both the College and the University.

Two courses of study are offered by the College, one of these qualifying for the degree of B. Sc. in Forestry in the University of Wales, and the other for a College Certificate. A third course, leading up to a Diploma, is at present under consideration. The degree course extends over three years subsequent to passing a Matriculation Examination, while the course for the Forestry Certificate may be covered during a single session. Candidates taking the degree course devote their first qualifying year to general scientific study, attending classes In Botany, Chemistry, Physics and Zoology. During their second year they pursue the study of these subjects to a more advanced stage, and enter upon Forestry work. In the third year Forestry is continued and final courses taken in certain prescribed science subjects. In order to obtain the Forestry Certificate students need not matriculate, but have to satisfy the examiners in Chemistry, Botany, Zoology, and Agriculture, in addition to Forestry.

The number of students attending Forestry classes averages seven or eight each session. The fees are low, amounting only to £15 15s. per annum (francs 396).

Several large proprietors have kindly placed their woods at the disposal of the College for Forestry instruction and practice, while an experimental area has been laid out by the Department at Chirk in Denbighshire. Lord Penrhyn allows the classes to visit his park, which immediately adjoins the College. In the park there is an excellent collection of conifers and broad-leaved trees, while there is also a large estate nursery which is useful for demonstration purposes. There are woods amounting to several hundred acres within a comparatively short distance of the College, and use is made of these for excursions.

The freehold of the land at Chirk was presented in 1906 to the Denbighshire County Council by Mr. John Mahler of Penissa Glyn, upon condition that it should be devoted to Forestry investigation carried out by the Department at Bangor. The land is 50 acres (20 hectares) in extent and it has been divided into some thirty-two plots, each plot constituting a separate experiment. It is situated at a high elevation (850-1250 feet, equal to 258 to 380 metres) and is of a character frequently found in Wales. The planting has now been completed, and already some interesting results have been obtained. Through the generosity of the donor of the land, facilities have been given which enable students to visit the area several times each year."

Armstrong College, Newcastle-upon-Tyne. — "Lectures in Forestry have been given to the agricultural students in this College since 1892, but it was not until 1904, when the Board of Agriculture and Fisheries made its first annual grant in respect of Forestry, that a Lecturer in Forestry was appointed. Since this date special efforts have been made to develop the Forestry Department, and the success which has been achieved has been owing largely to the hearty co-operation of owners of woodlands in the neighbourhood. The Chairman of the Agricultural Committee of the College, Lord Barnard, has taken a special interest in the work of this Department.

Instruction in forestry forms a part of the regular courses of study for the B. Sc. degree in Agriculture (University of Durham) and for the College Diploma in Agriculture. In addition there is a special course in Forestry, which includes practical work and demonstrations in the Chopwell Woods, and in other woods and nurseries during one or two days in each week, together with lectures additional to those given in the ordinary course. There is also a short course for young working foresters which lasts for four weeks."

University of Cambridge. — "Instruction of Forestry was instituted at Cambridge University in 1907, when a Forestry Committee of the Board of Agricultural Studies was formed, and a Reader in Forestry appointed.

The course of study for the Diploma in Forestry may be summarised as follows: Candidates for admission to the examination for Diploma must have (1) obtained the degree of B. A.; (2) passed qualifying examinations in Botany, Geology, Physics, and Chemistry; and (3) attended for two years courses of instruction in Forestry and cognate subjects.

The course for the first year includes lectures and practical work in Forest Botany, Sylviculture and General Forestry. During the Long Vacation the student spends ten weeks on a British woodland estate, in practical work under the superintendence of an experienced forester.

The course for the second year includes similar instruction in Forest Management and Forest Utilisation, and in Diseases of Trees and Timber, Forest Zoology, Surveying, and Engineering. During the long vacation of this year, the student has ten weeks' practica work in a Continental forest, under the superintendence of a state forester.

The total fees for instruction in Forestry for the Diploma course at the University amount to 9 £ 19s. 6d (252 francs). The fee for admission to the examination for the Diploma 2 £ 2s (53 francs). The student in addition incurs the expenses which are variable, of instruction during the two Long Vacations in a British and in a Continental forest.

An elementary course in Forestry has been established for agricultural students, who are now encouraged to take Forestry as an optional subject in the examination for the Diploma in Agriculture, and for B. A. degree in Agricultural Science. This elementary course is identical with the first year's course for the Diploma in Forestry.

The average number of students who have attended courses of instruction in Forestry during the last two years is twelve.

The woods used for the purpose of demonstration are all privately owned, and lie in the neighbourhood of Cambridge and in the adjoining counties."

Royal Agricultural College, Cirencester. — "The course of instruction in Forestry was established in this College in 1903. There are two branches of the curriculum of the College, *viz.*, the Estate Management and Forestry Branch, and the Farming and Colonial Branch. The majority, however, of the subjects are common to both Branches; and the Diploma may be taken in either Branch of the College.

The full Diploma course occupies three years of three terms each. In addition, there is a two years' course. The fees are 45 £ (1136 francs) a term for in-students and 25 £ (631 francs) a term (with an entrance fee of 5 £, equal to 126 francs) for out-students. The average number of students in the Forestry Branch is about thirty. Instruction is given in the General Principles of Sylviculture, Forest Management, Preparation of Working Plans, Forest Protection, Forest Utilisation, and English Forest Law.

By the permission of Earl Bathurst, the Oakley Park and Woods, which over an area of over 3000 acres (1212 hectares), and have been for many years under systematic management, are used for instructional purposes. They comprise fine woods of oak, ash, Scots pine, beech and larch. About 90 acres (36 hectares) of coppice are annually cut over. Lord Bathurst has also placed some acres of the Park at the service of the College for an experimental area of forest garden. This is divided into ten half-acre plots (2023 sq. meters) surrounded by screen belts. A useful *Guide to the Forest Garden* was printed in 1907 for the use of students. Visits for class instruction are also made to the estate nurseries and trade nurseries in the immediate neighbourhood; and periodical excursions are made to Gloucestershire forest areas, and in the Summer Vacation (if so desired) to Continental forests with the Professor of Forestry."

University of Edinburgh. — " The first course of lectures in Forestry in this University was delivered during the Winter Session of 1888-89, and the course has been conducted annually since that year. The Degree of B. Sc. in Forestry has recently been instituted with special courses in Advanced Forestry, Forest Botany, Forest Entomology, Chemistry of Forest Soils, and Forest Engineering with Drawing and Surveying. The Degree Course extends over three academic years, of which two and one-third are spent in residence. In addition, there is a First Course in Forestry which occupies a single Winter Session and forms part of the course for the Degree of B. Sc. in Agriculture.

The class-fee for the First Course of Forestry is £3 3*s.* (79 frcs.) and that for the Advanced Course of Forestry is £2 2*s.* (53 frcs.). The fees for the other Degree Courses amount to about £47 (1186 francs). The Degree Examination fees are £6 16*s.* 6*d.* and the total, including the annual Matriculation fee of £1 1*s.* is thus about £60 (1515 francs). The cost of board and lodging in one of the Halls connected with the University for each academic year of 30 weeks ranges between about £40 and £50, which for two and one-third years of residence comes to from about £90 to about £120 (from 2278 francs to 3030 francs). The total estimated expenditure by a Degree student for board and lodging, and University fees, with excursions and the practical course on the Continent, is about £300 (7575 francs) or £100 a year (2525 francs).

During the 21 years of the existence of the Forestry Department, 201 students have passed through the First Course of Forestry, and during 14 years, from 1895-96 to 1908-909, 51 Agricultural students have passed in Forestry for the Degree in Agriculture. The University has no woods under its control, but practical instruction is given by means of visits paid to privately-owned woods in the neighbourhood. "

" In connection with Advanced Course of Forestry, more extensive excursions are prescribed; and Degree students are required to undergo a training of six months in Continental forests. "

Edinburgh and East of Scotland Agricultural College. — " Instruction in Forestry has been given at this College almost since its foundation. The courses of study prescribed are: *a*) A course for the College Diploma in Agriculture, given at the University by the University Lecturer in Forestry, to whose salary the College contributes in respect of this work. *b*) An evening class instituted in 1905-1906, and held annually since that date. A course at this class consists of 21 lectures, besides excursions for demonstration purposes. The attendance is principally composed of foresters, gardeners, nurserymen, and the young men employed in the estate management departments of large legal firms. *c*) Extension courses consisting of from 12 to 20 lectures. Since the foundation of the College in 1901, courses of this kind have been given at eleven different centres within the College area, the average attendance at each course being 48.

Some of the classes of this college are recognised by the University of Edinburgh as qualifying for the B. Sc. in Forestry."

Aberdeen and North of Scotland Agricultural College. — "This College provides: *a*) A course of fifty lectures, with excursions, for students who take Forestry as one of the subjects for the B. Sc. degree of the University in Agriculture. The fee for the course is £2 2*s* (52 frcs.). Provision is also made for a supplementary course of fifty lectures accompanied by laboratory work and practical demonstrations for students who intend to make a special study of Forestry or who wish to prepare for the Forestry Diploma of the Highland and Agricultural Society. There are large wooded areas in the neighbourhood of Aberdeen and, through the liberality of several of the landed proprietors, excellent facilities are afforded for practical work. *b*) There are further courses of instruction in connection with the extension scheme of the College. These are delivered to foresters and forest workers at centres, within the district that naturally falls within the sphere of interest of the College, where there are suitable and sufficient wood areas. In 1907-1908 there were given sixteen such lectures, at which 650 persons were in attendance. In 1908-1909 there were fifteen lectures with an attendance of 820."

Inverliever Estate. — « This estate, containing about 12 530 acres (5062 hectares) situate on the west side of Loch Awe, Argyllshire, and lying at an elevation of between 120 and 1 400 feet above sea level (36 to 425 meters), was purchased by the Commissioners of His Majesty's Woods and Forests in the year 1907. It is proposed to plant it gradually at the rate of about 150 acres per annum. Planting has been commenced this season near the centre of the Estate. A nursery is being formed at Ford and a number of seed beds have been sown and seedlings planted. A forester has been appointed, who resides on the estate and acts under the general supervision of the Committee. At present eleven men and four boys are employed. (Further information respecting this estate appeared in the *Journal of the Board of Agriculture* for June, 1909, p. 219»).

Alice Holt Forest. — « In the Report of the Departmental Committee on Forestry, to which reference has been made, it was recommended that the Forest of Alice Holt should be made available as a demonstration area for the practical study of Forestry. In order to carry out this recommendation as far as possible the Commissioners of His Majesty's Woods and Forests obtained in 1904 from Dr. Schlich, Ph. D., C. I. E., an exhaustive report on the condition of each of the woods comprised in the Forest. In this Report Dr. Schlich expressed his general approval of the operations which had recently been carried out, and developed in detail a working plan for their continuation in the future. In drawing up the working plan regard was had to this point, one of the objects being the provision of the best object-lesson in the treatment of woods of this description from a practical point of view, according to the methods of scientific forestry ».

A. D. Hall. **Annual Report, for 1909, on the Rothamsted Experiments.** — (*Lawes Agricultural Trust.* Rothamsted Experimental Station. Harpenden Annual Report for 1909. — St. Albans, 1910).

John Bennet Lawes founded the Rothamsted Experimental Station in 1834. In 1843 systematic field experiments were begun and the services of J. H. Gilbert were obtained as Director. The long association of these two gentlemen terminated with the death of Lawes in 1900.

The station has been maintained entirely at the cost of the late Sir John B. Lawes. In 1889 he constituted a Trust for the continuance of investigations, settling upon it the Laboratory (built by public subscription and presented to him in 1885), certain areas of land on which the experimental plots were situated, and £100 000 (equal to 2 525 000 francs).

The management is entrusted to a committee nominated by the Royal Society, the Royal Agricultural Society, the Chemical and Linnean Societies, and the owner of Rothamsted.

In 1906 Mr J. F. Mason presented the Committee with £1000 (25 250 frcs.) for the Bacteriological Laboratory, together with a grant towards its maintenance. In 1907 the Goldsmiths Company made a grant of £10 000 (252 500 francs).

The Permanent Nitrate Committee have also made a grant of £2000 (50500 frcs). The Society for extending the Rothamsted Experiments founded in 1904 has collected donations amounting to £500 (12625 frcs) and annual subscriptions of nearly £150 (3787 francs).

The field experiments which began in 1843 have on some of the plots been continued without break or alteration up to the present day.

In 1852 the Barley experiments on the Hoos Field began. The leguminous crops on the Hoos Field were started in 1848. The experiments on roots have been continued on the same field since 1843 and on the same plan since 1853. The grass plots began in 1856 and the rotation experiments in 1848.

It is impossible to exaggerate the importance of continuing the experimental plots at Rothamsted without any change, as nowhere else in the world do such data exist for studying the effect of season and manuring upon the yield and quality of the crop, and for watching the progressive changes which are going on in the soil. Year by year these plots are found to throw light upon new problems in Agricultural Science; in all directions they continue to provide material for investigations upon points which were not contemplated in the original design of the experiments, so that it is impossible to foresee when and how they will not become useful and provide indispensable material for the solution of problems undreamt of at the present time.

The maintenance, however, of the old data throws a heavy burden upon the Experimental Station. There are 210 plots, and every year 243 samples have to be taken with proper precautions and put into store for future reference. In addition there are made 486 determinations of dry matter, 234 of ash, 170 of nitrogen, 50 of phosphoric acid, and 24 of potash, also 180 determinations of nitrates, etc., in rain and drainage waters, and 17 botanical analyses of hay. This does not include examinations of soils, the complete grass separations, and other extensive series of determinations which are made at longer intervals. All the above determinations however are part of the necessary routine which must be completed before any new investigations can be undertaken.

During 1909 the yield of wheat was generally below the average and that of straw was high. The quality of the grain was also poor, as shown by the very low weight per bushel, because of insufficient warmth during the ripening period.

The unmanured and partially manured plots suffered most from the season. On the unmanured plot (66th successive crop, no manure since 1838) only 9.1 Bush. of grain and 9.2 cwt. of straw were produced (equivalent to 8.19 hectolitres of grain and 1155 kgr. of straw per hectare).

The most noticeable feature in the season was the exceptional reduction of the crop wherever potash had been omitted from the manure.

The following table gives a comparison between the results of the two years 1908 and 1909.

Plot	Manuring	1908			1909		
		Dressed grain		Straw	Dressed grain		Straw
		Yield	Weight per Bush		Yield	Weight per Bush	
		Bushels	lbs	Cwts	Bushels	lbs	Cwts
2	Farmyard Manure . . .	38.6	64.9	32.2	31.6	60.9	49 —
3	Unmanured	12.4	63.5	7.7	9.1	60.8	9.2
5	Complete mineral manure.	16.2	64.8	10.9	10.4	60.5	12.2
6	As 5, and single ammonium salts.	22 —	64.9	19 —	17.4	59.2	22.2
7	As 5, and double do. .	33.3	64.7	30.2	28.9	58.8	35.8
8	As 5, and treble do. .	47.5	63.4	43.9	32.3	59.5	47 —
9	As 5, and single nitrate of soda.	31.7	65 —	26.7	24.3	59.9	29.9
10	Double amm. salts alone.	21.8	64 —	15.3	10.5	57.6	17.4
11	As 10 and superphosphate.	21 —	62.9	19.4	6.2	55.4	16.5
12	As 10 and super. and sulph. of soda.	32.9	64.6	24.2	19.6	59.9	29.1
13	As 10 and super. and sulph. of potash.	36 —	63.9	29.6	27.8	60.5	39.7
14	As 10 and super. and sulph. of magnesia.	26.1	63.8	21.4	16.1	55.8	26.4
15	Double amm. salts in autumn and minerals.	32.3	63.4	25.7	25.8	60.9	38.6
16	Double nitrate and minerals.	38.1	64 —	35.8	26.9	59.4	42.8
19	Rape Cake alone . . .	28.2	63.1	21.2	20 —	59.8	29.6

Besides continuing the field and other experiments on barley, grasses etc., some of which were begun many years ago, several new experiments and investigations were started. Among the former may be mentioned one bearing on the comparative values of the new fertilisers—cyanamide and nitrate of lime. Among the latter one aided by a special grant from the Board of Agriculture, into the causes of the superiority of certain pastures in Romney Marsh over the surrounding fields. Daily observations of the temperature, water level, etc. were taken; regular samples of the grass, soil, etc. were forwarded to the Laboratory, and are now being worked up.

Dr. Miller has been following up some earlier investigations on the amount of ammonia which can be absorbed from the atmosphere. It is interesting to note that the amount of ammonia in the air above Broadbalk was notably increased for some time after the application of ammoniacal manures.

Dr. Miller in also estimating the amount of ammonia and nitric acid in rain water that is sent regularly from the extreme West of Scotland, and obtains results much below those yielded by inland stations.

During the year the following papers have been published in the *Jour. of Agric. Science*, Vol. III, Part. 2.

" *The effect of Partial Sterilisation of Soil on the Production of Plant Food* "

" *Direct Assimilation of Ammonium salts by Plants* ".

" *The Development of the Grain of Wheat* ".

" *The amount of free Lime and the composition of the soluble Phosphates in Basic Slag* ".

" *The estimation of Calcium Carbonate in Soils* ".

The above papers are reviewed elsewhere in the present Bulletin of Agricultural Information.

The English Peasant. — *The Edinburgh Review.* April, 1909, p. 338-364.

1. A History of the English Agricultural Labourer. By Dr. W. Hasbach, *Professor of Political Economy in the University of Kiel. Newly edited by the author and translated by Ruth Kenyon. London: P. S. King and Son. 1908.—2. Life in an English Village: an Economic and Historical Survey of the Parish of Corsley in Wiltshire. By* M. F. Davies. *London: T. Fisher Unwin. 1909.*

" The historian of the nineteenth century will certainly note among its salient features a remarkable movement which has resulted in the regeneration of the peasantry of England, and in a marked improvement of their condition. From a state of hopeless dependence they have risen to one of some independence, from paupers paid by the parish they are gradually becoming men of self-reliance, who earn substantial, if not high, wages. The labourer is now always in theory, and often in fact, a free and independent elector, one with a voice in the government of his country, whereas at the beginning of last century he had no more influence on the course and the management of public affairs than the cattle whom he tended in the fields. From a state of ignorance he is being raised to one of partial knowledge; his children no longer use their strength in manual labour fields when they should be acquiring necessary elementary knowledge, and they receive a sound education without cost to their parents. They are thus placed, as they should be, in a position of equality with the children of the townsman; they have before them a career. His wife and daughters have ceased to toil in the fields, and they can give to his home due attention as housewives. Those homes are not—through no fault of his—as healthy and commodious as they should be, but even the rural cottage is becoming better and more wholesome.

Such are the broad characteristics of the change which has come over this class of the community during the last century, in the beginning of which, owing to various causes, economical and social, the peasantry of England had fallen into a hapless state, and if Dr. Johnson's doctrine be sound, that the condition of the poor is the true mark of national discrimination, then one must admit that, though the state of the peasantry is neither perfect nor ideal, the advancement in their condition is a sign of national prosperity ".

VI.

The history of agricultural development. History of science connected with agriculture. Biographical notices of Agricultural worthies.

W. H. R. Curtler. **A Short History of English Agriculture.** — Oxford, 1909, pp. VIII+371. (Notice in *Exper. Stat. Rec.*, Vol. XXII, May 1910, No. 6, Washington).

This volume gives an account of the whole period of English agriculture, but with more particular emphasis laid on the period from the beginning of the seventeenth century to 1908, inclusive.

H. L. Gray. **Yeoman Farming in Oxfordshire from the Sixteenth Century to the Nineteenth.** — (*The Quarterly Journal of Economics*, February 1910, p. 263. Cambridge, Mass., U.S.A.).

J. Reynolds Green. **A History of Botany, 1860-1900: being a continuation of Sachs' "History of Botany, 1530-1860."** — Pp. 542. Oxford, 1909.

This is a worthy continuation of Sachs' classical *History of Botany*. Adhering to Sachs' main lines of treatment, the book aims to show what has been the trend of thought in the different sections into which Sachs divided the subject, selecting for notice some leading memoirs.

The work is divided in three Books: Morphology, Anatomy of Plants, Physiology of Plants. There is a good bibliography on the subjects treated.

" The application of research, says the author, in vegetable physiology to the problems of agriculture was a feature of the whole period under review. At its close those problems were as insistent as at any time during its process. Though many new facts were ascertained they gave rise themselves to further inquiry and new questions continually came to the front. Among the latter, good results have already been obtained by the study of the problems of heredity, hybridization, variation, and kindred subjects, and botanical questions are competing in interest with those of zoology. "

More than half of the volume is devoted to eleven chapters regarding the functions of water, the assimilation of carbon dioxide, the absorption of nitrogen, the rôle of the ash constituents, the chemosynthesis, the metabolic processes, the catabolic processes, on heterotrophic plants, the problems of growth.

A chapter is devoted to the development of the theory of special sensitiveness as developed under the influence of the *Origin of Species*.

On a question specially interesting to the theory of fertilisers, the following statement, on p. 357, may be quoted:

" Perhaps there is no department of vegetable physiology in which so little progress has been made as *in the knowledge of the rôle of the ash constituents of plants*: in no department of vegetable physiology have the results of investigation been so unsatisfactory. It has been found possible to determine what elements can be detected in greater or less quantity in plants; which of them are of widespread occurrence; which only appear occasionally or in special individuals. Within certain limits their distribution in the plant-body has been ascertained, but nearly all attempts to associate particular elements with definite functions have resulted in more or less complete failure to gain any accurate information. "

The concluding words of this History of Botany show that the world is changing since the days in which Julius Sachs wrote his history on the same subject.

" In all European and most American countries research has assumed an almost national importance, and its economic value is beginning to be properly appreciated, while the spirit of enthusiasm is spreading beyond the older borders to the remoter regions of Asia and Africa. The work carried out so far from the older centres promises to vie in completeness, thoroughness, and importance with that of European schools. "

J. H. Maiden. **Sir Joseph Banks, the Father of Australia.** — Sydney, William Applegate Gullick, 1909. London, Kegan Paul, Trench, Trübner & Co., Ltd. Pp. XXIV + 244 with map.

The following is an extract from the preface of this interesting biography of the eminent British botanist, who first introduced India-rubber into England, in 1767:

"He was first of all a scientific man—a botanist mainly—and the advancement of science was the mainspring of his long career. But his tastes and inclinations were catholic, and his letters show his robust common-sense, sound judgment, and kindly disposition, when applied to questions very diverse in character.

"No subject was too unimportant, no correspondent too humble, to secure his attention, and his letters alone show him to be a broad-minded, courteous, cultured, philantropic gentleman.

"Prominence will be given to his work in botany and horticulture. I make no apology for this, since any life of Banks which did not emphasis his pursuits in these directions would simply not be a faithful portrait. I have not done this, however, at the expense of an account of his activities in other directions. Furthermore, the work being mainly intended for Australians, attention has been specially drawn to his connection with this (*the Australian*) continent.

"At a time when it was considered a sign of patriotism to detest France and the French, he soared above national antipathies, and, actuated by the strongest feelings of fair play and justice, he secured the respect, and even the affection, of all Frenchmen who had heard of his attitude, during the frequent and long-continued wars between Great Britain and France, towards her men of science.

"During his life he spent the bulk of his fortune in the advancement of science and the amelioration of his fellow-men; at his death he took care that a large share of his wealth should be devoted to noble objects."

The book contains interesting notices on Solander, Dryander, Robert Brown and other co-workers of Sir Joseph Banks.

Hon. Mrs. Evelyn Cecil. **A History of Gardening in England.** Third and enlarged edition, London, John Murray.

A. C. Chapman. **Obituary Notice on Charles Graham.**—(*Journal of the Chemical Society*, p. 677. London, April 1910).

Charles Graham (1836-1909) was noted for his many studies on the chemistry of brewing and bread-making. He studied chemistry under Nesbit at the Chemical and Agricultural College at Kennington, and took his degree of B. Sc. at University College, London, in 1864, when he became assistant to the famous chemist, Dr. Williamson. Afterwards he went to Germany where he studied the utilization of the Nassau phosphates for agriculture. On his return to London he published in 1873 a course of lessons on the " Chemistry of Brewing ,,. In 1879 he published his better known work " On the Chemistry of Bread Making ,,. Prof. Graham's appointment to the Chair of Technological Chemistry at University College, London, led him to study many of the applications of chemistry to manufactures, more especially those which affect the brewing and bread making industries.

On his death, at the age of 74, he has left the major part of his fortune to University College for the promotion of experimental studies, " more especially research work which aims at preventing and diminishing suffering and disease in man ,,.

William Culverwell. — (*The Gardeners' Chronicle.* June 25, 1910).

William Culverwell died on June 19th, 1910, at Bedale, York. Mr Culverwell was a well-known hybridator. His cross between the black currant and the prickly gooseberry was remarkable. He also crossed the raspberry with the common blackberry. The *Gardeners Chronicle* of July 15, 1899, announced the cross obtained by Culverwell between the strawberry and the raspberry.

He paid much attention to the hybridation of green-peas: two of the best varieties obtained by Culverwell are the Invincible and the Telegraph Pea.

A. C. Seward. **Darwin and Modern Science.** — *Essays in Commemoration of the Centenary of the birth of Charles Darwin and of the fiftieth anniversary of the publication of the Origin of Species.* Edited, for the Cambridge Philosophical Society and the Syndics of the University Press. — Cambridge, 1910, pp. XVII+595.

The following extract from the introductory letter of Sir Joseph Hooker is sufficient to point out the importance of this Collection of Essays:

" The publication of a series of Essays in Commemoration of the century of the birth of Charles Darwin and of the fiftieth anniversary of the publication of " The Origin of Species " is assuredly welcome and is a subject of congratulation to all students of Science.

These Essays on the progress of Science and Philosophy as affected by Darwin's labours have been written by men known for their ability to discuss the problems which he so successfully worked to solve. They cannot but prove to be of enduring value, whether for the information of the general reader or as guides to investigators occupied with problems similar to those which engaged the attention of Darwin.

The essayists have been fortunate in having for reference the five published volumes of Charles Darwin's Life and Correspondence. For there is set forth in his own words the inception in his mind of the problems, geological, zoological and botanical, hypothetical and theoretical, which he set himself to solve, and the steps by which he proceeded to investigate them with the view of correlating the phenomena of life with the evolution of living things. In his letters he expressed himself in language so lucid and so little burthened with technical terms that they may be regarded as models for those who were asked to address themselves primarily to the educated reader rather than to the expert."

As a text to this volume is given the memorable passage from the Autobiography of Charles Darwin, in which the great naturalist sums up the story of his life of research and of comparison:

"My success as a man of science, whatever this may have amounted to, has been determined, as far as I can judge, by complex and diversified mental qualities and conditions. Of these, the most important have been—the love of science—unbounded patience in long reflecting over any subject—industry in observing and collecting facts—and a fair share of invention as well as of common sense. With such moderate abilities as I possess, it is truly surprising that I should have influenced to a considerable extent the belief of scientific men on some important points."

Of special interest, from an agricultural point of view, are the following Essays contained in this volume:

August Weismann, "The Selection Theory."

W. Bateson, "Hereditary and Variation in Modern Lights."

Hugo de Vries, "Variation."

E. Strasburger, "The Minute Structure of Cells in Relation to Heredity."

Georg Klebs, "The Influence of Environment on the forms of Plants."

J. Loeb, "Experimental Study of the Influence of Environment on Animals."

W. Thiselton-Dyer, "Geographical Distribution of Plants."

H. Gadow, "Geographical Distribution of Animals."

K. Goebel, "The Biology of Flowers."

VII.

How crops are composed, how they feed. Chemistry of plant-products and of plant-life.

Jay Duncan. **The fruit of Cornus (?) stolonifera** (1). — (*Chem. News*, 1910, 101, pp. 217-218; *Journ. Chem. Soc.*, London, June 1910, abs. ii, 534).

The dry berries contain 3 % of ash, 11.5 % of a substance resembling dextrin, about 38 % of sugars, and 3.5 % of fixed oil. The sugars present include dextrose and maltose. Tartaric, oxalic or citric acid could not be detected.

D. Thoday. **Experimental Researches on Vegetable Assimilation and Respiration.** — (Some Experiments on Assimilation in the open air.—Royal Soc. June 16, 1910.—Reviewed in *Nature*, Vol. 83. London, June 23, 1910, p. 511).

In these experiments Sachs' half-leaf dry-weight method has been employed, with modifications suggested in a previous paper for avoiding errors due to shrinkage of the insolated half-leaves. Turgid leaves of *Helianthus annuus* were found in bright sunlight to increase in dry weight 17 mg. per hour per sq. decim.; thus Sachs' high value is confirmed. Even a slight loss of turgor, however, was accompanied by a diminution in the rate of increase.

For this high rate of assimilation a leaf-temperature of 23°C to 24°C is probably required. It is suggested that Brown and Escombe's low results in bright diffuse light indicate that the stomata of *Helianthus* leaves open to their full extent only in light which is similar in quality to sunlight and approaches it in intensity.

Detached leaves of *Catalpa bignonioides* when fully turgid increased

(1) In the text of the Abstracts of the *Journ. of the Chem. Soc.* the name given is *Cornacea stolonifera*, corresponding probably to the *Cornus stolonifera* of the *Index Kewensis* (Ed).

5 to 6 mg. per hour per sq. decim. in bright sunlight; in this plant stomata occur only on the underside of the leaf.

The effect of detachment from the plant upon the rate of assimilation is considered, and evidence is adduced in support of Sachs' assumption, in the case of *H. annuus*, that concurrently with assimilation, part of the products of photosynthesis are translocated from leaves still attached to the plant.

S. B. Schryver. **The Photochemical Formation of Formaldehyde in Green Plants.** — (*Proc. Roy. Soc.*, 1910, B. 82, 226-232. — *Jour. Chem. Soc.*, April 1910, Abs. 334).

When grass was washed with warm water no formaldehyde could usually be detected in the washings; if, however, the grass was extracted with methylated spirit, the extracts on evaporation and treatment with ether gave a solution which almost always contained formaldehyde. It is argued that chlorophyll contains the aldehyde in a state of stable combination.

The photochemical formation of formaldehyde by chlorophyll was confirmed; 1 c. cm. of an ethereal solution of chlorophyll was allowed to evaporate at room temperature on a strip of glass 140×20 mm.

Some films thus prepared were kept in the dark, others were exposed to moist carbon dioxide in sunlight, others to sunlight over lime or soda-lime, and others, again, were exposed to moist carbon dioxide in the dark. No formaldehyde was formed in the dark, very minute quantities were detected in the films kept in sunlight over lime or soda-lime, whilst a distinct reaction was obtained from films kept in sunlight over moist carbon dioxide.

In attempting to explain the non-accumulation of formaldehyde in the plant-cell, the author supposes that the reaction is similar to one studied by Schiff.

In presence of sunlight and carbon dioxide there is probably a continuous synthesis of formaldehyde and a continuous condensation of the latter to sugars, without that at any time such an accumulation of aldehyde be toxic to the cell.

In testing for formaldehyde a modified and much more sensitive form of Rimini's test was used.

H. B. Hutchinson and N. H. J. Miller. **Direct Assimilation of Ammonium Salts by Plants.** — [Rothamsted Experiment Station]. (*The Journal of Agricultural Science*, Vol. III, Part 2, October 1909).

See also: *Contributions from the Laboratory of the Rothamsted Experimental Station.* Cambridge, 1909, p. 171.

Whilst non-leguminous crops, whether able to assimilate ammonia or not, undoubtedly take up, under normal conditions, most of their nitrogen in the form of nitrates, we have no knowledge of the form of nitrogen appropriated by leguminous plants from their root nodules. The authors before describing in this article the experiments on assimilation of ammonium salts by plants, take into consideration recent experiments in which nitrification has been taken into account, in order to show in some detail what has been already done:

A. Griffiths: Direct absorption of ammoniacal salts by plants. *Chem. News* 1891.

A. Müntz: Sur le rôle de l'ammoniaque dans la nutrition des végétaux supérieurs. *Comptes-Rend.* 1889.

M. Gerlach and P. Vogel: Ammoniakstickstoff als Pflanzennährstoff. *Centbl. Bakt. Par.*, 1905.

If some plants (*Sorghum*) are not adapted for an ammoniacal nourishment, others (maize) prefer it, others again (rice) grow better when nourished both with nitrates and with ammonia salts.

Sterilisation of seeds, and all other precautions were taken to avoid the possibility of nitrification in the reported experiments, and the results show that ammonium sulphate is directly assimiated by wheat and peas and that in the case of peas there was no difference between the plants supplied with ammonium salt and those which had sodium nitrate. The wheat plants however showed a decided preference for nitrogen in the form of nitrate.

In each case in which nitrogen was applied as ammonium salts the dry matter of the plants contained higher percentages of nitrogen than when sodium nitrate was employed. An explanation of the high nitrogen percentages seems to be afforded by Suzuki's results (*Bull. Coll. Agric.*, Tokyo, 1894-7, 2, 409-457) which showed that ammonium salts are rapidly converted by the plants into asparagine and so give rise to conditions favourable to renewed absorption whilst nitrates tend to accumulate and thus check further diffusion from outside.

It would seem possible that the highly nitrogenous character of leguminous plants may have been acquired as a result of long continued nutrition with nitrogen, supplied from the root-nodules in a form which lends itself to more rapid production of proteids than is possible when practically the whole of the nitrogen is taken up as nitrates as is the case with non-leguminous crops.

W. J. V. OSTERHOUT. **On similarity in the behaviour of sodium and potassium in plants.** — (*Bot. Gaz.*, 48, 1909, No. 2, p. 98-104. — *E. S. R.*, XXI, December 1909).

The author carried on two extensive series of experiments with the chlorides of sodium and potassium to determine the commonly accepted statement that potassium and sodium, while agreeing closely in chemical behaviour, have fundamentally different effects upon plants. Most of the experiments were carried on with wheat, but other plants as algæ, liverworts, equisetum, and various genera of flowering plants were also used.

The results obtained show that the accepted idea that sodium and potassium have entirely different effects upon plants is not valid in the field of toxic and protective action, but that their behaviour shows the close similarity which would be expected when their near chemical relationship is considered.

W. E. BRENCHLEY (of the Rothamsted Exp. Station). **The influence of Copper Sulphate and Manganese Sulphate upon the Growth of Barley.** — (*Annals of Botany*, vol. XXIV, No. XCV, p. 571. — London, July 1910).

The following is the summary of Miss Brenchley's paper:

" 1. The action of plant poisons in dilute solutions is masked by the presence of nutrient salts, which thus enable plants when grown in such solutions as water-cultures to endure a much greater concentration of the toxic substance than in the absence of nutrients.

2. Copper sulphate, which is a definite poison to barley, does not have any stimulative effect in very dilute solutions, even at so low a concentration as 1 : 10 000 000.

3. Manganese sulphate, though not an actual toxic to barley, retards the growth very considerably if supplied in moderate quantities. Minute traces of the salt have a decided stimulative action both on the root and shoot.

4. When supplied in sufficient concentration manganese is taken up by the plant and deposited in the lower leaves."

E. F. Armstrong. **The Simple Carbohydrates and the Glucosides.** — Longman's Green & C°, London, 1910, Pp. VI + 112.

The " *Gardeners' Chronicle,* (n. 3615, p. 230. London, April 9, 1910) writes as follows on this volume of the Collection *Monographs on Biochemistry*, edited by R. N. Aders Plimmer and F. G. Hopkins:

" Dr. Armstrong has done a difficult piece of work in an admirable manner. Starting with glucose — the sugar which green plants synthesise from carbon-dioxide and water — he proceeds to deal with the more complex sugars and then with the sugar containing glucosides, of which large numbers occur in plants. He suggests that the sugars which occur in plants represent, as it were, a survival of the fittest, and thus opens up vistas of long lines of chemical evolution. The book will prove of the greatest value both to chemists and botanists, and in particular to that small band of workers on the border-line between the two sciences „.

A useful Bibliography of 18 pages in given at the end of the volume.

C. T. Kingzett and R. C. Woodrock. **The production of Formic Acid by the Atmospheric Oxidation of Turpentine.** — (*Journ. of the Soc. of Chem. Ind.*, XXIX, 13, 791-2. — London, July 15, 1910).

When American or Russian turpentine is oxidised in the presence of water, the aqueous solution reveals an increasing acidity during the process. On further examination the authors found that the acidity results from the presence of an appreciable amount of acetic and formic acids.

The authors mean to carry the investigation further.

T. B. Osborne. **The Vegetable Proteins.**—London and New York, Longmans, Green e C., 1909, pp. XIII+125. (Noticed in E. S. R., XXII, May 1910).

This is a timely discussion of the general chemical and physical properties of the vegetable proteins. As stated in the preface, it was the intention of the author to present a general description of these proteins as a group or class rather than to consider them individually. Among the subjects discussed are a historical review, the occurrence of proteins in the different parts of plants and their general characteristics, the isolation and preparation of seed proteins, the basic and acid properties of proteins, the solubility, precipitation, denaturing, physical constants, products of hydrolysis, and classification of vegetable proteins, some physiological relations of vegetable proteins to the animal organism, and the biological relations of seed proteins to one another. An extensive bibliography is appended.

This book is published in the Collection of *Monographs on Biochemistry*, edited by R. H. Aders Plimmer and F. G. Hopkins.

VIII.

Agricultural Botany. Description and development of plants and of plant-organs. Mechanism of plant-life.

JOHN PERCIVAL. **Agricultural Botany, Theoretical and Pratical.** Pp. XIV+828+fgs. 264. Fourth Ed. Duckworth & C.°, London, 1910.

This is the fourth edition, a proof that the work is appreciated by teachers and students in all countries wherever English is spoken.

The importance of practical work is recognised as absolutely essential to a proper understanding of the subject, and therefore numerous experiments, 334 in all, illustrative of the principles and facts studied, are introduced in the text.

As interesting and useful parts may be cited the « Methods of crossing plants » on Pp. 299-302, the chapters on « Farm-Seeds: general and special », as well as those on Weeds and on Diseases of farm-plants.

The details given concerning the principal agricultural crops are very serviceable.

D. THODAY and M. G. SYKES. **Transpiration current in submerged water plants.**—(*Ann. Bot.*, London, 23, 1909, No. 92; *E. S. R.*, March 1910, Washington).

On account of the possible bearing of the subject on the explanation of the ascent of water in tall trees, the authors have made an investigation of the transpiration current in submerged plants studying various species of *Potamogeton* and other aquatic plants. The results showed that there was a decidedly rapid movement of water in detached rootless stems of *Potamogeton lucens* and that this current was largely dependent on the leaves.

PEIRCE and MOLISCH. **The temperature of respiring plants.**— *Gard. Chron.*, 3 ser., 45 (1909), No. 1161, 200. (Reviewed in *E. S. R.*, Aug. 1909).

A review is given of some recent investigations by Peirce and Molisch on the temperature of respiring plants.

Peirce has recently shown the value of Dewar flasks for use in determining the rising temperature due to the respiration of seeds, peas giving an increase of temperature from 17° C. to a maximum of 56° in 8 days.

In the experiments of Molisch cited, leaves of different trees were used, precautions being taken to prevent any loss of heat by radiation. It was found that the temperature within the mass of leaves rose rapidly, in the course of 12 to 15 hours the temperature of apple leaves rising to 59° C., hornbeam 51.5° and linden 50.8°. The leaves of a number of other plants, particularly evergreens, gave less striking results.

In both experiments there is said to have been no question of any fermentation, the action being simply that of the normal respiration. In the experiments of Molisch, when the experiment was stopped before the highest temperatures were reached, the leaves upon examination were found to still be alive and fresh (1).

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(1) Compare with:

H. MOLISCH. *Ueber hochgradige Selbsterwärmung lebender Laubblätter.* Bot. Zeitung LXVI, 1908, I Abt. p. 211-233, mit 2 Text fig.; reviewed in Just's Botanischer Jahresb. XXXVI Jahrgang (1908). Erstes Abt. V Heft. Leipzig, 1910, p. 686.

By using large quantities of living leaves (3 to 5 Kgr.) and protecting them from the cooling influence of transpiration and of radiation, H. Molisch observed remarkably high temperatures, the rise of temperature occurring within the space of one day. The following are maxima temperatures observed in the case of leaves of some plants: *Pyrus communis*, 59° C.; *Carpinus Betulus*, 51°.5; *Robinia Pseud-acacia*, 51°; *Tilia* spec. 50°.8; *Juglans regia*, 49°.7; *Salix Caprea*, 47°.1; *Cytisus Laburnum*, 45°.6; *Vitis vinifera*, 43°.3 C. (Ed.).

IX.

Plants in their relation to environment. — How plants may be naturally or artificially modified, in special organs, or in their whole growth. — Plant-breeding.

G. Klebs. **Alterations of the Development and Forms of plants as a result of Environment.** — (Abs. of the *Croonian Lecture* delivered at the Royal Society on May 26th, 1910. *Nature*, Vol. 83, June 2nd, 1910, p. 414).

The fungus *Saprolegnia* is chosen as an example among the lower plants. This fungus lives on dead insects, and shows three distinct stages of development: 1) vegetative growth of the mycelium; 2) asexual reproduction by motile zoospores; 3) sexual reproduction by male and female organs. Under ordinary conditions these three stages follow one another quite regularly until, after ripening of the resting spores, the fungus dies. But according to the special conditions it is possible to produce a particular stage, and also to alter the succession of the stages.

Under very favourable conditions of nutrition the fungus must continuously grow, without propagating and without dying. Numerous other lower plants, as fungi and algae, show the same relations to environment.

Flowering plants present far greater difficulties in consequence of their very complicated structure.

Experiments were made, which are being continued, with *Sempervivum Funckii* and *Sempervivum acuminatum*. Under very favourable conditions of nutrition, a rosette ripe to flower can be transformed again into a vegetative one, which must always grow without sexual reproduction. We come to a new serie of forms by replacing flowers by leaf-rosettes, which can be produced on all parts of the inflorescence. The plants of which the inflorescence bears rosettes, do not die at the end of summer, as is normal, but live another two or more years, appearing in peculiar forms.

M. Wheldale. **The colors and pigments of flowers with special reference to genetics.** — (*Proc. Roy. Soc.*, Ser. B, 81, 1909, No. 3545, pp. 44-60; Abs: *E. S. R.*, XXI, Aug. 1909).

A series of investigations on the color of flowers has been undertaken with a view to the interpretation of the phenomena in the inheritance of flower color. The author makes an attempt to classify roughly the pigments found in flowering plants and at the same time to determine whether there is any connection between the genetic behavior of the pigments and their chemical reactions. He classifies the pigments into those in solution in the cell sap and those associated with specialized protoplasmic bodies, the chromoplasts. The first group includes the soluble red, purple, and blue pigments known as anthocyanin and the soluble yellow pigments called xantheïn. The second group, which is insoluble in water, includes carotin, xanthin, etc.

About two dozen natural orders of plants were examined, and summarizing his results, the author states that anthocyanin includes several pigments differing as regards their inheritance, the colors to which they give rise in variation, and their behavior toward chemical reagents. The colors of the varieties arising from the anthocyanic type may be regarded as components of the original anthocyanin, and the type may be supposed to lose its components in succession, thus giving rise to color variations.

Broadly speaking, the author states that there are two series of color variations, one containing a xantheïc derivative and the other without any such derivative. Albinism in the first series is due to a lack of anthocyanin and xantheïn; in the second series to a deficiency in anthocyanin only. Xantheïn includes several different yellow pigments.

So far as the investigations have proceeded, there appears to be a correlation in genetics between the behavior of pigments and their relation toward chemical reagents.

In the case of plastid pigments, the type may contain carotin, xanthin, or both, and varieties arise in some cases from loss of power to produce carotin, or in others from loss of some of the constituents of xanthin. Anthocyanin may exist together with plastid pigments, in which case derivative products of both forms of pigmentation are found among the varieties.

Wild Plants on Waste Land in London. — (*Nature*, August 11th 1910, No. 2128, Vol. 84, p. 184; Sept. 22, 1910, p. 369).

The waste ground between Aldwych and the Strand has been colonised by a variety of plants most of which show luxuriant growth. Many of the colonists have fruits or seeds adapted to wind distribution, as in the case of the winged fruit of the sorrel (*Rumex Acetosa*), and of the plumed seeds of the hairy willow herb (*Epilobium hirsutum*), and French willow, or rose bay (*E. angustifolium*), by far the most conspicuous plant on the ground.

It is of interest that *E. angustifolium* which is absent in many of the waste places of London, occurs in the garden of Fountain Court, near the Strand. Among wind-distributed forms are also numerous Compositae, the fruits of which are furnished with a pappus; these include the spear thistle (*Cirsium lanceolatum*), the groundsel (*Senecio vulgaris*) and its ally *S. viscosus*, the dandelion (*Taraxacum vulgare*), the butter bur (*Tussilago petasites*), and the Canadian fleabane (*Erigeron canadensis*). Fruits and seeds of these various types might be blown with some readiness from neighbouring districts, or from one part of London to another.

To a varying extent, wind may be also efficient in carrying the seeds of hedge mustard (*Sisymbrium officinale*), London rocket (*S. irio*), which appeared in quantity after the Great Fire of 1666, and shepherd's purse (*Capsella bursa-pastoris*); and the same is the case with chickweed (*Stellaria media*), white campion (*Lychnis alba*), opium poppy (*Papaver somniferum*), a garden escape, frequently established in waste places, great plantain (*Plantago major*), pale persicaria (*Polygonum lapathifolium*), and scentless mayweed (*Matricaria inodora*). In several of the above the seed is small or flattened, but it is not elaborately adapted to wind dispersal, and it may be questioned whether wind alone will account for the presence of these plants.

A probable auxiliary exists in the sparrow, through the alimentary canal of which various seeds and fruits no doubt pass, and it is not unlikely that others become attached to its feet by means of the sticky London mud. It will be remembered that Darwin in the "Origin of Species" describes eighty-two plants as springing from the earth obtained from the feet of a single partridge. This method of distribution no doubt accounts for the presence of Dutch or white clover (*Trifolium repens*) and of two balsams, the pink-flowered *Impatiens glandulifera* and a white variety. The explosive fruit characteristic of this genus could certainly not shoot its seeds across the traffic of a London street. Possibly cats may be effective as agents of distribution in this case, and they may also account for the presence of cleavers (*Galium Aparine*), the hooked fruits of which would readily cling to their fur.

Among garden escapes, the marigold, nasturtium (*Tropaeolum*), wallflower, and a species of *Prunus* can be observed, as well as the opium poppy mentioned above; in connection with these, and with many of the wild species also, the neighbourhood of Covent Garden must be recalled.

The above list is by no means exhaustive, none of the grasses, for instance, having been mentioned; in one or two cases the identification had to be made from a distance and through the fence surrounding the waste ground.

The Selborne Society has been investigating a still more interesting building site in Farringdon Street, in London, scarcely removed from the heart of the city. Although this plot has only been cleared for about two years, no fewer than twenty-eight species of flowering plants and ferns have established themselves upon it. Mosses, liverworts and others of the more simple plants are also represented. Mr. J. C. Shenstone is preparing a detailed list, which will be published in the October number of the Selborne Magazine.

SAMUEL MARGERISON. **The Vegetation of Some Disused Quarries. The conquest of new ground by plants.** — (*Bradford Scientific Journal*, 1909, pp. 52. Sketch map and illustr.) Reviewed in *Geographical Jourual*, Vol. XXXV, No, 6, June 1910.

L. S. KLINCK. **Individuality in Plants.** — (*Supplement to the Journ. of the Board of Agric.*, vol. XVII, No. 3. — London, June 1910, p. 37). Papers read at meeting of the British Association for the Adv. of Science at Winnipeg, Aug, 1909.

« No two plants are exactly alike... In well established varieties of oats of known breeding and purity some strains have been isolated which ripened two weeks before others, and equally striking differences have been observed and perpetuated. This holds true under practically every heading under which oats are judged in the field or in the laboratory. Even among the most productive individuals the range in yield is surprising; the area covered in the third generation from one kernel of Joanette Oats in one case being 127.78 square feet and in the other 0.89 square feet: one 144 times the other. The latter, in addition to being a very low yielding strain, was also very poor in quality.

" Sufficient work has been done to direct attention to the need of a more careful study of the individuality of plants and to emphasise the still more important point that this range is as wide in the projected efficiency of the plants as it is in the morphological differences. It may also be of service in drawing attention to the necessity of obtaining fuller knowledge of the parentage of plants mated, before breeding is undertaken by crossing or by hybridising."

D. Dewar and F. Finn. **The Making of Species.** — London and New York, 1909, pp. XIX+400, pls. 16. (Reviewed in *E. S. R.*, March 1910. Washington).

This book attempts to present in simple language biological problems such as the natural selection theory, hybridism, fertility of hybrids, Mendelian inheritance, and other factors concerned in the evolution of species in Nature and under the influence of man. Throughout the book there is a strong protest against the views of the post-Darwinians. It is pointed out that bionomics, or the science of living animals, occupies too small a place in English scientific literature. In a discussion as to what species will survive in the future, it is stated that the making of species, their survival, and the future of biology lie largely in the hands of the practical breeder.

Dr. Paul Knuth. **Handbook of Flower Pollination.** Based upon Hermann Muller's work *The Fertilisation of Flowers by Insects.* Translated by Prof. J. R. Ainsworth Davis, Vol. III.— Reviewed in *Nature,* Vol. 84, p. 66, London, July 21, 1910.

Vol. I. *Introduction and Literature.* Oxford, 1906, pp. XIX+382.

Vol. II. *Ranunculaceae to Stylidieae.* Oxford, 1908, pp. VIII+703.

Vol. III. *Observations on Flower Pollination made in Europe and the Arctic Regions on Species belonging to the Natural Orders. Goodenovieae to Cycadeae.* Oxford, 1909, pp. IV+644.

The English translation of this work, appearing ten years after the publication of the German original, has been brought up to date in many respects.

Knuth gives an interesting summary of the method he has adopted to detect the presence of a nectary when the position of that organ is not obvious at first sight. By suitable treatment of flowers with Fehling's solution or Hoppe-Seyler's sugar reagent, he was able to detect the nectar-secreting part of most flowers. Sometimes even fairly conspicuous flowers, as, for instance, those of *Pyrola uniflora*, were found to be nectarless, and in this case, though the flower is otherwise obviously adapted to insect pollination, no insect visitors are recorded in the handbook.

Some of the orders, like the *Ericaceae* and others are of interest, because in some genera, e. g., *Calluna*, *Erica*, and *Cyclamen*, the flowers, though adapted to insect pollination, and eagerly visited by insects, are, during their later stages, anemophilous, the pollen becoming dry and powdery and being readily carried by the wind.

The anemophilous Gramineae offer many points of interest in connection with the frequent occurrence of cleistogamy and self-pollination of their flowers. Insect visits are occasionally observed in this group. Ludwig considered that the succulent shining lodicules of many grasses sometimes attract flies which are often imprisoned by the rapid closing of the glumes. These flies seem often affected by the entomophthora disease, and it is suggested that when so suffering they are often compelled by thirst to seek the juice of the lodicules. In other cases, no doubt, they visit the flowers for the purpose of collecting pollen.

This translation is enriched by a valuable appendix which gives a systematic list of the various insects which have been observed visiting flowers and the flowers they frequent.

A. W. Sutton. **Crossing of the genus "Brassica."** — (*Linnean Society Journal, Botany*, October 1908). *Bied. Zentralblatt für Agrikulturchemie*, 39, pp. 23-25, Jan. 1910.

A crossing between the various species of the genus *Brassica*, which are indiscriminately cultivated together, was believed unattainable; but now, the author's experiments show the possibility of it.

H. H. Biffen. **On the inheritance of strength in wheat.** — *The Journ. of Agric. Science*, Vol. III, P. I, Dec. 1908 (issued Jan. 1909), p. 86-101.

X.

Bacteria, Yeasts, Fermentations.

J. PERCIVAL. **Agricultural Bacteriology.** London, 1910, Duckworth & Co., pp. x-408.

As to the scopes of this book, the author says in the preface that, " the science of Bacteriology, which has been so much the domain of the student of disease, is now being applied to the elucidation and solution of many of the problems which confront the farmer, gardener, and dairyman in their daily life.

" The extensive development of the dairying industry has been greatly assisted by the bacteriologist, and very material advances may be expected in the near future in the application of the science to the study of the soil and the phenomena connected with the economical and efficient use of fertilisers for the nutrition of farm and garden crops.

" For some time a knowledge of bacteriology has been demanded of candidates for examinations in agriculture, dairying, and horticulture, but experience has shown that few of them have had any practical acquaintance with the subject, mainly, we believe, from lack of suitable opportunities for proper training and absence of a textbook dealing with the subject in a practical way.

" It is to supply the needs of such students that the present textbook has been written. "

G. E. STONE. **Influence of electricity on micro-organisms.** — (*Bot. Gaz.*, 48, 1909, No. 5, pp. 359-379, figs. 2). *E. S. R.*, March 1910, Washington.

The results of investigations showing the influence of electricity on the growth and multiplication of micro-organisms are given. The studies were carried on to determine the influence of electricity on bacteria in water, milk, and soils, as well as the influence of electrical stimulation on yeasts.

The studies with water were taken up primarily to determine the possibility of obtaining pure water by means of electricity, but it was soon found that instead of a decrease in the bacterial content there was an increase from the electrical stimulation. This was found to be quite constant where the strength of the current was not too great.

Similar results were obtained with milk, and where static electricity was used a positive charge was found to favor the development of bacteria to a very considerable extent. Where heavy charges were used the number of organisms decreased very decidedly, but feeble electrical currents and small static charges acted as stimuli to bacteria in milk, increasing their number perceptibly. In this connection it is stated that conditions during thunderstorms may accelerate bacterial action by electrical stimulation and thus increase the number of bacteria and incidentally hasten souring.

As a result of all the experiments in the growing of plants, it was found that when currents of 0.1 to 0.6 milliampere were used all forms of plant life were stimulated.

The stimulating effect of weak currents on yeast is shown in the increased amount of carbon dioxide given off by the yeast.

Benjamin Moore and Stenhouse Williams. **Influence of Oxygen on the Vitality and Growth of Bacteria.** — (*Biochemical Journal*, June, vol. V, n. 4). *Nature*, August 1910, n. 2128, vol. 84, p. 181.

In the Bio-chemical Journal for June Prof. Benjamin Moore and Dr. Stenhouse Williams detail experiments on the effect of an increased percentage of oxygen on the vitality and growth of bacteria. Of twenty-six organisms tested, two may be termed oxyphobic. These are the tubercle bacillus, which is not only arrested in growth, but is actually killed by a high percentage of oxygen, and the plague bacillus, which, though not killed, uniformly refused to grow in percentages of oxygen from 60 to 91. The staphylococcic group was also adversely affected, but the remainder, including the typhoid, dysentery, glander, diphtheria, anthrax, and cholera organisms, was unaffected.

G. B. Lipman. **On the Lack of Antagonism between certain Salts in the case of *Bacillus subtilis*.**—(*Bot. Gaz.*, 49, 1910, No. 1, pp. 41-50, figs. 2.)—*Exper. Stat. Rec.*, Vol. XXII, May 1910, n. 6, Washington.

In continuation of earlier work with respect to ammonification by *Bacillus subtilis*, an account is given of further experiments as to the effect of calcium, magnesium, and sodium salts on this organism.

The results of these experiments are in marked contrast to those generally obtained with green plants. The author found that for *B. subtilis* there was no antagonism between magnesium and calcium or between sodium and calcium. Any combination of magnesium and calcium proved more toxic than magnesium chloride, and any combination of sodium and calcium salts was more poisonous than sodium chloride alone. In these respects the behaviour of *B. subtilis* is said to have no parallel among plants so far as studied, and scarcely any among animals.

C. B. Lipman. **Toxic and antagonistic effect of salts an related to ammonifications by Bacillus subtilis.** — (*Bot. Gaz.*, 48 (1909), n. 2, pp. 105-125, figs. 5). *E. S. R.*, XXI, December 1909.

The effect of the chlorides of calcium, magnesium, potassium, and sodium, as shown on the activity of *B. subtilis*, is reported upon.

Each of the four chlorides was found toxic in the order enumerated, calcium chloride being the most toxic and sodium chloride the least. This is said to be quite different from the results with higher plants, where magnesium is the most toxic and calcium the least. There were found to be marked antagonisms existing between calcium and potassium, magnesium and sodium, and potassium and sodium. No antagonism was found to exist between magnesium and calcium, but the toxic effect of each is increased by the addition of the other.

These experiments are held to have practical application because of the fact that the salts experimented with are all found in soils in greater or lesser amounts, and in some soils they are present in excess.

G. E. GAGE. **Biology and Chemistry of Nitroso-Bacteria.** — (*Centr. Bakt. Par.*, 1910, ii, 27, 7-48). *Journ. of Chem. Soc. Abstr.*, June 1910.

The weakest strains of *Pseudomonas radicicola* can be made capable of fixing considerable amounts of nitrogen by constantly growing on non-nitrogenous media. As regards the utilisation of sugar, it was found that maltase gives the best results. With carbohydrates containing less than five carbon atoms gum is not produced. In old cultures, especially on solid media, *Pseudomonas radicicola*, develops a membrane which appears cell-like in structure, but does not give cellulose and starch reactions.

When inoculated from such cultures into artificial culture solutions, it may be capable of producing considerable amounts of nitrites and nitrates. There is, at present, no evidence that nitrates are produced without nitrite production.

H. M. VERNON. **Intracellular Enzymes.** — London, John Murray, Albemarle Street, W., 1908, pp. XI-234.

The following is from the preface of this book:

"The progress of research renders it more and more evident that the cellular protoplasm of all living organisms is made up very largely of ferments or enzymes, and that many or most of its properties are dependent upon their activities. The literature dealing with these intracellular enzymes is scattered and somewhat fragmentary, and comparatively little of it has as yet found its way into text-books. This is partly because of its recent origin, for reference to the authorities cited at the foot of the pages in this book will show that almost the whole of the research work described has been carried out during the course of the last decade. If such rapid rate of progress be continued in the future, the subject of intracellular enzymes bids fair to become, if it has not already become, one of the most important branches of bio-chemistry, for it alone seems to offer a clue to the solution of the most fundamental of all biological problems, the nature and constitution of protoplasm."

A. Harden and J. Young. **Alcoholic Ferment of Yeast-Juice. Function of Phosphates in Alcoholic fermentation.** — (*Proc. Roy. Soc.*, 1910, B. 82, pp. 321-330). — *Jour. Chem. Soc.*, July 1910. Abs. ii, 643.

Addition of dextrose or laevulose to yeast-juice in presence of excess of phosphate results in a period of accelerated fermentation; 1 mol. of carbon dioxide is evolved for each mol. of sugar added.

When the available phosphate present is greatly reduced, the total fermentation is very small. Addition of small amounts of phosphate produces a relatively large increase in the total fermentation.

A hexosephosphate when digested with yeast-juice is hydrolised by an enzyme, hexosephosphatase, with production of free phosphate and a sugar capable of being fermented by yeast.

In the chemical changes which the mol. of sugar may undergo in fermentation, 2 mols. of sugar are involved.

Olive Eveline Ashdown and J. Th. Hewitt (East London College). **The By-Products of Alcoholic Fermentation.** — *Journ. of Chem. Soc.*, London, August 1910, Trans. Pp. 1636-1648.

The formation of small quantities of carbon compounds other than carbon dioxide and alcohol during the fermentations of various sugars by yeast has attracted much attention and during the past few years considerable light has been thrown on the formation of some of these by-products.

Comparatively little attention has been devoted to the acetaldehyde which accompanies the alcohol in varying quantity and which sometimes is formed in considerable amount.

The occurrence of notable amounts of aldehyde might be referred to one of several possible causes:

1) Subsequent oxidation of alcohol by atmosferic oxygen. This hypothesis necessitates the presence of a catalytic agent, which might either be derived from an inanimate source, for example some metallic salt the presence of which had been overlooked, or might be of an enzymatic nature and be derived from the yeast or some other organism.

2) The acetaldehyde may be produced from the sugar by a fermentation due to some other organism.

3) Sugars when fermented by yeast normally give ethyl alcohol and carbon dioxide, but owing to malnutrition of the yeast or some similar cause, acetaldehyde may make its appearence in place of ethyl alcohol to a greater or less extent.

The first two hypotheses are now out of the question since by the authors' experiments it was shown that yeast will give very varying amounts of acetaldehyde, according to the materials on which it is nourished being altered. Moreover the results obtained by the authors with yeasts from different breweries point to the same conclusion: the production of aldehyde varying at different times with yeast from the same brewery. Any possibility of the aldehyde having been produced by subsequent catalytic oxidation, owing to the presence of small amounts of salts of heavy metals, was carefully excluded, by performing all fermenting and distilling operations in glass vessels.

Evidently, then, the aldehyde must be a product derived from the sugar under the action of the yeast, the cause of the variation in amount being due to the different food the yeast is supplied with during fermentation.

In order to obtain an idea as to which of the other constituents of the mash could affect the greater or lesser production of aldehyde, systematic experiments were carried out, solutions being made up, of known composition. Generally, crystallised sucrose or dextrose was employed, togethers with necessary mineral constituents, nitrogen being also supplied either in the form of ammonium salts or as amino-acids.

In view of the work of F. Ehrlich (*Zeitsch. Ver. deut Zuckerind.*, 1905, *55*-539; *Biochem. Zeitsch.*, 1906, *1*, 8, *2*, 52; *Ber.*, 1907, *40*, 1027) on the production of higher alcohols from the amino-acids with extra carbon atoms, (for example, of ordinary iso-amyl alcohol from leucine) complications were avoided by using alanine as amino-acid, since this can give no other alcohol but ethyl alcohol. In fact, the present authors started the work quite expecting to find that deficiency in available nitrogen would mean increase in aldehyde content, and it was thought not at all unlikely that the function of amino-acids and their conversion into alcohols during fermentation might be connected with the formation of ethyl alcohol and carbon dioxide from some intermediate product, possibly lactic acid. These experiments evidently showed that lack of nitrogenous food is not the cause of aldehyde formation.

In view of the observations made by E. Drechsel (*Ber.*, 1892, 25, 3502) that alanine heated alone, or, still better, with an excess of concentrated phosphoric acid, to 220-230°, is decomposed into acetaldehyde, carbon monoxide and ammonia, a systematic search for ferments whether inorganic or enzymic which can effect a catalytic decomposition of alanine with production of acetaldehyde seems desiderable.

Schade found (*Zeitsch. physikal Chem.*, 1906, I, 57) that dextrose is decomposed by alkalis with the formation of acetaldehyde and a formiate, whilst acetaldehyde and formic acid yield ethyl alcohol and carbon dioxide under the influence of rhodium sponge.

Schade thinks it is not improbable that yeast effects the conversion of dextrose into ethyl alcohol and carbon dioxide in a somewhat similar manner, dextrose decomposing into an intermediate product, which in turn yields formic acid and acetaldehyde, an enzyme functioning in a similar manner to rhodium sponge then coming into play. P. B. Jensen supposes that zymase consists of two enzymes (*Ber. Deut. bot. Ges.*, 1908, *26*, A, 666) the first capable of effecting the conversion of dextrose into dihydroxyacetone, the second decomposing the latter into ethyl alcohol and carbon dioxide.

Buchner and Meisenheimer consider Schade's view quite untenable (*Ber.*, 1906, *39*, 4218; 1910, 43, 1782) but there seems to be a consensus of opinion that some intermediate product, probably of the formula $C_3H_6O_3$ is produced, and that this gives rise to alcohol and carbon dioxide either directly or possibly with the intermediate formation of acetaldehyde and formic acid.

From the experiments of Buchner and Meisenheimer it would appear that any possibility of formic acid playing a part in fermentation was out of the question, but, the authors' experiments show that the amount of acetaldehyde formed is largely reduced when a formiate is present, whilst the use of small quantities of formic acid as an aid to good fermentations has been strongly advocated by H. Lange (*Zeitsch. für Spiritusind.*, 1905, *28*, 341). With reference to the possibility of formic acid playing a part in alcoholic fermentation, attention may be drawn to F. Ehrlich's views on the decomposition of leucine and the occurrence of valeraldehyde as a by-product (*Ber.*, 1907, 40, 1046).

The authors conclude that it seems not improbable that some substance, possibly alanine, which should ferment normally to give ethyl alcohol and carbon dioxide, may be formed either as a product of the decomposition of the dextrose or perhaps as a trasformation product of dihydroxyacetone in presence of nitrogenous material.

Such a substance can give rise to acetaldehyde (Drechsel, loc. cit.); it may be that in presence of formic acid this latter reaction takes place to a more limited extent; certainly the fact remains that the presence of formates strongly diminishes the amount of acetaldehyde produced in alcoholic fermentation.

"Our experiments conclusively show that the amount of aldehyde is markedly diminished by the presence of formates during fermentation, and although Schade's original theory as to the rôle played by formic acid in fermentation may need modification, it should not too lightly be set on one side."

A. Slator and H. J. Salomon Sand (University College, Nottingham). **Studies in Fermentation: Part III. The Rôle of Diffusion in Fermentation by Yeast Cells.** — *Journal of the Chemical Society.* Trans., May 1910. Pp. 922-927.

A consideration of the influence of various factors on the rate of alcoholic fermentation, shows that under ordinary conditions, diffusion supplies the yeast cells rapidly and efficiently with sugar. The high temperature-coefficient and the constancy of the velocity with different concentrations of the sugar, constitute, practically conclusive evidence on this point. In the present investigation the limiting conditions have been examined under which diffusion alone would no longer be capable of supplying the yeast cells efficiently with sugar, and under which the apparent velocity of the reaction would thus be influenced by convection currents produced either owing to the evolution of gas in the liquid or by external means. From these experiments the conclusion can be drawn that during fermentation diffusion supplies the yeast cells very efficiently with sugar and further, it is unlikely that conditions could be experimentally realised under which diffusion becomes a controlling factor of the rate of fermentation.

XI.

Climate and Meteorology. — Weather forecasts and meteorological organisation in the interest of agriculture. — Sunshine and atmospheric temperatures in their relation to crops. — Frost-fighting. — Hailstorms and efforts to prevent them. — Atmospheric electricity and vegetation. — Rainfall and evaporation. — The atmosphere as a source of plant food. — Atmospheric purity in respect to vegetation. — Damages due to noxious fumes.

JOHN MOORE. **Meteorology, Practical and Applied.** London, Rebman, 1910. — Reviewed in *Nature*, N. 2132, Vol. 84, p. 293. September 8, 1910.

"It is an admirable treatise on the methods of observation, it demonstrates very satisfactorily what can be accomplished by instrumental means, and what are the objects and advantages to be gained by the systematic collection of details. The principles underlying this aspect of practical meteorology are well illustrated by the description of the official weather service at home, in the United States and in Canada. This information is thoroughly modern, trustworthy, and interesting.

One section is devoted to the consideration of climate as deduced from the records supplied by instrumental means and one to the influence of season and of weather on disease. Perhaps the last is a larger subject than can be discussed adequately in the space allotted to it, but it is a subject on which the writer is an authority, and constitutes an important branch of meteorological science".

Meteorology in Great Britain, 1908. — [Fourth Annual Report of the Meteorological Committee.] — (*Ann. Rpt. Met. Com., Gr. Brit.*, 4, 1909). Reviewed in *E. S. R.* March 1910. Washington.

This consists as usual of administrative reports regarding organisation and operations (during the year ended March 31, 1908) in marine meteorology, forecasts and storm warnings, climatology, publications, investigation of the upper air, and miscellaneous subjects, with appendixes as follows: Financial statement, supply of information to the public, lists of observers who sent in "excellent" meteorological logs during the year and logs and documents received from ships, distribution of instruments, report on inspection of meteorological stations, and lists of persons and institutions from whom publications and meteorological data have been received and to whom publications are sent.

In 1908 the percentage of complete success in forecasts for the British Isles was 58, of the sum of complete and partial successes 92. This is above the average for 10 years.

W. R. Dunlop. **Meteorology as a Branch of Agricultural Science.** [Rainfall Averages].—*Agric. Gaz.*, LXX, London, 1909.

Agriculture and climate are so intimately connected that the study of meteorology seems to deserve a more prominent position than is at present accorded to the subject.

Rainfall averages are very instructive, and remain pretty constant. In England most rain falls in the autumn and least during the spring. Going from the West of England to the East there is a more or less steady gradient, starting with average 36 inches in the West down to 26 inches in the Eastern Counties. Thus the rainfall of different districts varies, and should where possible be recorded from day to day. This would suggest how much more rain could be expected.

A proper understanding of the nature of dews and mists, evaporation and radiation, is of much use; the hygrometer and the thermometer should be frequently referred to. The variation of temperature from day to day should be noticed, and it should be remembered, for example, that there is a greater daily range of temperature in June than in January.

The study of weather, like agriculture itself, is based on science, but in practice it is an art; the study of it demands but a very short time each day, but the work must be rigidly systematic, otherwise it is absolutely valueless.

F. F. Blackman. **Vegetation and frost.** — (*Phytol.* 8 (1909), No. 9-10 pp. 354-363). *E. S. R.*, Abstr, June 1910. Washington.

The Author gives a summary of the present state of our knowledge regarding the action of frost on vegetation. Metz holds that the protoplasm of the plant is directly susceptible to cold and that each cell has a fatal minimum temperature.

Gorke showed that freezing causes a precipitation of some of the soluble proteids and that the temperature required for this purpose varies widely with different species of plants.

Lidforss has recently found an agency in plants that protects them against cold.

He finds that all winter-green leaves are quite free from starch but contain sugar and oil in the mesophyll; in the summer these same leaves contain abundant starch. Tbe only exception found by him was in submerged plants which show starch throughout the winter.

The sugar in the cells aids in keeping down transpiration and enables the plants to withstand lowered temperatures.

The frequent killing of trees early in the spring, is held to be due to the regeneration of starch, making the plants more susceptible to sudden cold.

The occurrence of sugar and oil in winter in the periderm of tree trunks has also been reported.

Protection of Fruit against Frost by Smudging.—(*Jour. of South-Eastern Agric. Coll.*, No. 17, 1908). *The Jour. of the Board of Agric.*, March 1910, London, vol. XVI, No. 12. p. 1024.

" Owing to the absence of severe frosts it was impossible to test the effect of smudging, but some progress was made in discovering that the best method employed was that of making a hot black smoke by burning a mixture of naphthalene and creosote in the iron pots recommended in an article in the *Journal of the Board of Agriculture,* April 1907, p. 23, forty pots being used to the acre.

It was found that lighting up forty pots took one man about twenty minutes. If the pots are lit up early, as appears to be necessary, and the frost continues till sunrise, it is necessary to relight them, and the refilling and relighting of forty pots took three men a considerable time.

The dense black smoke did not scorch the bushes, but those near the pots were covered with black smuts. These washed oft after a few days' rain, but smudging would be impracticable if early rhubarb or other low-growing plants and vegetables nearly ready for market were grown between the rows, or where the plantation is close to houses. The cost, including labour, five acres being done at a time, is estimated at 25*s.* 4*d.* per acre. If a refill is necessary, the cost would be about 22*s.* more."

B. Latham. **Percolation, Evaporation and Condensation.** (*Quart. J. Roy. Met. Soc.*, 35 (1909), No. 151, pp. 189-211, figs. 8). Abs. *E. S. R.*, XXII, Jan. 1910.

This article gives the results of observations with rain gages and percolating gages on chalk soils.

Each of the percolating gages was exactly one square yard (0.836 $m.^2$) in area and contained 1 cub. yd. (0.7645 m^3) of material. The edges of the gages stood about 1 $^1/_2$ in. (38.10 mm.) above the surface of the soil inside and outside of the gage. One gage was filled with chalk soil, the other with a gravel soil containing vegetable remains. The observations recorded began in 1878 and have been continued daily up to the present time. The amount and composition of the percolating waters and the evaporation as measured by standard evaporators are reported. The results are summarized in the following table.

Monthly average Rainfall, Percolation, Evaporation and Condensation at Croydon, Surrey, in England, for the 30 years 1879 to 1908.

Month	Rainfall	Percolation, chalk	Percolation, gravel	Evaporation, floating evaporator	Condensation, floating evaporator	Evaporation, exposed evaporator	Temperature of water, floating evaporator 9 a. m.	Temperature of dew-point at 9 a. m.
	Inches	Inches	Inches	Inches	Inches	Inches	oF	oF
January	1.849	1.0795	1.6446	0.246	0.0608	0.743	36.15	34.45
February	1.854	1.6275	1.5150	.344	.0460	0.994	36 86	34.81
March	1.733	1.2730	1.1346	.936	.0180	2.189	39.88	36.53
April	1 616	.5472	.3893	1.808	.0040	3.515	47.34	40.02
May	1.806	.4045	.2056	2.698	.0012	4.893	55.53	45.31
June	2.253	.4387	.3089	3.116	.0028	5.261	62.16	51.18
July	2.299	.3096	.2881	3.305	.0003	5.549	65.30	54.48
August	2.265	.3240	.2645	2.679	.0018	4.658	63.38	54.71
September	2.007	.1686	.1217	1.521	.0018	2.931	57.61	52.22
October	2.963	.9876	.9567	.825	.0378	1.554	49.26	45.75
November	2.612	1.4314	1.6811	.426	.0654	893	42.79	40.96
December	2.199	1.6221	1.8324	2.233	.1190	.670	37 75	35.93
Yearly average	25.456	10.8447	10.3425	18.137	.3589	33.850	49.50	43.87

Monthly average Rainfall, Percolation, Evaporation and Condensation at Croydon, Surrey, in England, for the 30 years 1879 to 1908, calculated in millimeters and in Centigrade degrees. (The English inch is calculated as equal to 25.4 millimeters).

Month	Rainfall	Percolation, chalk	Percolation, gravel	Evaporation, floating evaporator	Condensation, floating evaporator	Evaporation, exposed evaporator	Temperature of water, floating evaporator, at 9 a. m.	Temperature of dew-point at 9 a. m.
.	mm.	mm.	mm.	mm.	mm.	mm.	oC	oC
January	46.9646	43.4213	41.7728	6.2484	1.5443	16.8722	2.30	1.36
February.	47.0916	41.3385	38.6325	8.7376	1.1684	25.2476	2.69	1.56
March	44.0182	32.3342	28.8188	23.7744	0.4572	55.6006	4.38	2.51
April.	41.0464	13.8988	9.8882	45.9232	0.1016	89.2810	9.63	4.45
May	45.8724	10.2743	5.2222	68.5292	0.0305	124.2822	13.07	7.39
June.	57.2262	11.1429	7.8486	79.1464	0.0711	133.6294	16.75	10.66
July	58 3946	7 8638	7.3177	83.9470	0.0076	140.9446	18.50	12.49
August.	57.5310	8.2296	6.7183	68.0466	0.0457	118.3132	17.43	12.61
September	50.9778	4.2824	3 0912	38.6334	0.0457	74.4474	14.22	11.23
October	75.2602	25.0850	24.3002	20.9550	0.9601	39.4716	9.58	7.63
November	66.3648	36.3575	42.6999	10.8204	1.6612	22.6822	5.44	4 97
December	55.8546	41.2013	46.5429	5.9182	3.0226	17.0180	3.19	2.38
Yearly average. .	646.6024	275.4296	262.8533	460.6798	9.1160	857.7900	9.76	6.60

E. A. Bunyard. **The effect of cold upon pigments in plants.** (*Gard. Chron.*, 3 ser., 46 (1909), No. 1180, pp. 97, 98). *E. S. R.*, XXI, Dec. 1909.

After giving an account of the experiments of Kraemer, the author calls attention to the effect of cold on the changing of color in plants. The rose « Frau Karl Druschki » had the outer petals changed to a deep carmine after the cold nights of the early summer, and a red pigment was noticed in white geraniums which does not appear when the flowers are grown in greenhouses at high temperatures. Other examples are cited where low temperatures produce red pigments in otherwise white flowers.

The British Rainfall Organization. — *The Geographical Journal*, Vol. XXXVI, No. 1, July 1910, p. 98.

" An important development in the position of this organization took place during June 1910. The valuable work of the organization is quite unofficial, and has hitherto been carried on purely at the personal responsibility firstly of its founder, Mr. J. G. Symonds, and later of his successors, Mr. Sowerby Wallis and Dr. H. R. Mill, under the latter of whom its activities have been extended and its methods reorganized and improved. Feeling that the time had come for placing the enterprise on a more permanent and secure basis, Dr. Mill has, with great public spirit, made over the complete rainfall records of the organization (which has now been in existence just fifty years), together with the lease of the house in Camden Square with which the work has been so long associated, to a body of trustees—all of them interested in rainfall observation, and of a standing to ensure the efficient prosecution of the work in the future. As a representative of the Royal Geographical Society, Mr. D. W. Freshfield is included among the trustees. A beginning has been made towards the collection of an endowment fund, and it is hoped that this may in time attain sufficient proportions to permit a further development of the important work of the organization. "

W. Hayhurst and John N. Pring. **The Examination of the Atmosphere at Various Altitudes for Oxides of Nitrogen and Ozone.** — *Journal of the Chemical Society*, Trans., London, May 1910.

These experiments were made systematically above Glossop Moor in Derbyshire, during three or four months in summer, and were supplemented by a number of tests on sea and mountain air at various places in England. It was found that oxides of nitrogen were always present in quantities which vary largely from time to time, and that the amount of ozone was, in every case too small to be detected in the experiments conducted at ground level and at intermediate altitudes, that is up to 8000 feet. The amount of ozone is less than 1 part in 4 000 000 000 parts of air; at very high altitudes (ranging up to 10 miles), one part in three to nine million parts of air by volume. The quantity of oxides of nitrogen was shown to be less than this.

J. B. Cohen and A. G. Ruston. **The nature and extent of Air Pollution by Smoke.** — *Nature*, 81, 2085, Oct. 14, 1909, pp. 468-469, figs. 2, London.

Abstract of a paper read at the Health Congress at Leeds July 17, giving the results of detailed examinations of samples of air taken at 10 representative stations in Leeds and one at Garforth about $7^1/_2$ miles from Leeds.

"The impurities, in the form of suspended matter, consist of soot, tar, sand, mineral substances, and, in solution, of sulphurous and sulphuric acid or their salts, chlorides, largely in the form of hydrochloric acid or common salt, and nitrogenous matter, in the form of nitrates or free and albuminoid ammonia."

Injurious effects of these substances on vegetation are discussed.

"It is the sulphurous acid which imparts to town fog its choky and irritating effects. The large amount of this acid present in fogs may be gauged from the fact that the hoar-frost collected during the dense fog of January 27 (1909) contained acid corresponding to 10.29 parts per 100 000, or more than ten times the average acidity of the same station."

"To demonstrate the detrimental effect of sulphuric acid upon vegetation, Timothy grass was sown on May 12, 1908, in boxes 1 foot square, the soil being uniform. The seed was watered at a rate corresponding to the average rainfall of 25 inches with water containing different amounts of sulphuric acid. In addition to this, three other samples were watered, with Garforth rain water in which the acidity was neutralised, the second with ordinary Garforth rainwater, and the third with Leeds rain water. The results were instructive. In the case of Leeds rain water and of those waters containing a high degree of acidity, germination was distinctly checked, and the delicate green of the young grass quickly changed to yellow or brown. Grasses watered with water containing 32 parts per 100 000 were killed in a little more than three months, and with 16 parts per 100 000 in less than a year."

"Chlorides are found in large quantities, especially in the industrial centres, where, expressed as common salt, they sometimes reach as much as 3 or 4 cwt. per acre, a quantity which must be distinctly prejudicial to vegetation."

"The nitrogenous impurities, on the other hand, would be beneficial by acting either as direct stimulants and fertilisers or by neutralising the acidity of the sulphur and chlorine compounds."

SAMUEL MARGERISON. **Effects of noxious vapours and salt-spray on the Vegetation of Oak-trees in England. The Vegetation of Some Disused Quarries.** — Reviewed in *Geographical Journal*, Vol. XXXV, N. 6, June 1910, p. 718.

The oaks, owing to the somewhat polluted atmosphere consequent upon the industries of the West Riding of Yorkshire, are failing somewhat rapidly. To the writer of the review in the Geographical Journal on Mr. Margerison's paper it has always seemed most remarkable that the oak indigenous to the British soil is, with the exception perhaps of the conifer tribe, the very first to succumb to the injurious effects of sulphurous and carbonaceous impurities in the atmosphere, arising from the combustion of coal, where some imported species like the plane-tree are good smoke resisters. Not only does the oak fail in the great industrial areas of the North and Midlands of England, but also in the comparatively pure atmospere of inner London, the parks of which are thus deprived of one of the most essential and striking features of normal English botanical landscape.

The British oak, in fact, with all its strength and rugged grandeur, has many points of weakness, and does not endure the salt spray of the sea so well as many other trees, with the consequence that it rarely fringes the seashore.

XII.

Percolation of rainfall and storage of water in rocks and soils. Ground-water, springs, wells, ponds, etc. Movements of water in the soil. Conditions that affect soil-moisture. Composition of natural waters. Drinking waters and waters for irrigation. Protection of the purity of streams.

A. C. HOUSTON (Director of Water Examination: Report to the Metropolitan Water Board, London). **Water purification: Advantages of storing previous to its filtration.** — *Monthly Consular and Trade Reports*. June 1909. Washington, 1909.

The U. S. Consul-General Robert J. Wynne, of London, transmits the following synopsis of a report made by Dr. A. Houston, director of water examinations, to the Metropolitan Water Board.

Storage reduces the number of bacteria of all sorts. If sufficiently prolonged, storage devitalizes the microbes of water-borne disease (typhoid bacillus and cholera vibrio). An adequately stored water is to be regarded as "safe."

The use of stored water enables a constant check to be maintained on the safety of London's water, antecedent to and irrespective of filtration. It renders any accidental breakdown in the filtering arrangements much less serious.

The habitual use of stored water would lighten the grave responsabilities of the Water Board as regards the safety of the London water supply, and would tend to create a sense of security among those who watch over the health of the metropolis.

Raw river water should be stored antecedent to filtration preferably for 30 days. The question of whether the 30 days' storage should be fixed on a maximum or a minimum basis must be left unanswered; but if the former alternative be chosen, the desirability of employing supplementary processes of water purification to tide over emergencies is worthy of consideration.

Sims Woodhead. **The Results of Sterilisation Experiments on Cambridge Water.** — (*Cambridge Philosophical Society*, June 6th 1910). *Nature*, Vol. 84, July 14th, 1910, p. 63.

Sterilisation by chlorine and chlorine compounds gave most startling results. In a series of preliminary experiments, it was found that 1 part of available chlorine to 2 million parts of water was sufficient to kill all non-spore-bearing bacteria of the *Bacillus coli* type, and therefore of the typhoid bacillus type, and probably also of the cholera bacillus type. Sterilisation occurred within half an hour, even in the presence of appreciable amounts of organic matter.

A. H. Hayes. **A new suggestion for the preparation of potable water.** — (*Journ. Roy. Army Med. Corps*, 14 [1910], No. 1, pp. 75-77, figs. 2). *E. S. R.* June, 1910. Abstr N. 9.

A simple portable apparatus for the clarification of muddy water by means of a gelatinous precipitate of aluminium hydroxide is described, and tests of its efficiency are reported.

William Ralph Baldwin-Wiseman. **The increase in the National Consumption of Water.** — (Reprinted from Journal of the *Royal Statistical Society*. Vol. 72, part. II, 1902). London 1909, pp. 58.

H. S. Shelton. **The correlation of rock and river-water analyses.** — *The Chemical News*. August 12, 1910, N. 2646, p. 75.

XIII.

Geology in its relation to agriculture. Weathering of rocks and soil formation. Land-preservation.—Soil classification. Mechanical and chemical composition of soils. Soil-physics. Mineral constituents of soils.—Humus and the nitrogenous compounds of soils. Soil-bacteria and their transforming action. Nitrogen fixation and nitrogen transformation and dispersion in soils. Action of earthworms and other organisms in the soil.—Fertility.

F. S. Marr. **Estimation of Calcium Carbonate in Soils.** [Rothamsted Experiment Station]. — *The Journal of Agricultural Science*, Vol. III, Part 2nd, October 1909, pp. 155-160.

The estimation of calcium carbonate in certain soils characterised by their high humus content and their acid reaction to litmus paper leads to some abnormal results. The boiling with acid at atmospheric pressure decomposes organic matter in the soil with evolution of carbon dioxide, and thus renders the results obtained for carbonate too high. In soils containing less than 1% of calcium carbonate and especially in acid soils the error introduced by thus boiling with acid may be very considerable. For most soils 5 cc. of strong hydrochloric acid to 100 cc. of water will be found convenient; for acid soils and those containing low percentages of carbonate 2 cc. in about 100 cc. of water. As a rule, the weaker the acid used, the better, so long as it is in fair excess.

J. A. Voelcker. **Soils rendered unfertile by excess of Magnesia.** — *Journ. R. Agric. Soc. of England*, 1909, pp. 339 352.

At the Woburn Experim. Station the Author has frequently if not universally found that crops will not thrive uniformly well on soils containing magnesia in excess of lime.

The following are four analyses of unfertile soils which illustrate this cause of unproductivenes:

Soils dried at 212° F (100° C)	*A*	*B*	*C*	*D*
Organic matter and loss on heating	5.66	5.05	5.24	11.95
Oxide of iron	2.69	2.36	5.24	5.91
Alumina	4.38	3.85	7.17	6.72
Lime	1 05	0.23	0.66	0.73
Magnesia	1.99	1.53	2.32	0.80
Potash	0.47	0.38	1.72	0.39
Soda.	0.26	0.26	1.53	0.23
Phosphoric acid	0.08	0.06	0.22	0.17
Sulphuric acid	0.05	0.10	0.10	0.07
Insoluble silicates and sand . .	83.37	86.18	75.80	73.03
	100 —	100 —	100 —	100 —
Nitrogen	0.114	0.234	0.154	0.418

A and *B* were soils from Staffordshire, and though basic slag had been applied and also farmyard manure the grass would hardly keep any stock on it.

C was from Worcestershire. Oats would not grow properly on it. This had been the general experience on this field with corn crops during recent years.

D was from Gloucestershire. Here grass would not grow properly. The herbage was poor and wiry, containing little or no clover.

E. J. Russell. **Phosphorus Compounds in Soils.** — *The Standard Cyclopedia of Modern Agriculture and Rural Economy, edited by Professor R. P. Wright.* Vol. IX, The Gresham Publ. Cy., p. 210. London, 1910.

"Large quantities of organic phosphorus compounds occur in peaty and moorland soils, but they are of little value as plant food. Thus the Swedish moorland soils contain 0.15 per cent of phosphorus (as $P_2 O_5$), and the fen soils of the Isle of Ely contain 0.3 or 0.4 per cent, soluble in hydrochloric acid, and 0.03 to 0.077 soluble in 1—per—cent citric acid, yet all these soils give considerable returns for phosphatic manures. When these soils are burned a certain amount of calcium phosphate is formed, and there is a marked gain in fertility."

J. M. Hector. **Nitrogen, the Plant and the Farmer.** — *Scot. Farmer*, 18, 1910, No. 891-894.

A review of investigations on the fixation of free nitrogen by plants.

Prof. W. B. Bottomley. **The fixation of Nitrogen by free living soil Bacteria.** Paper read at the Sheffield Meeting of the Brit. Assoc. 1910. — *The Chemical News and Journal of Physical Science*, p. 155. Sept. 23rd, 1910.

Since the discovery of the Azotobacter group of nitrogen-fixing organism by Beijerinck in 1901 numerous attempts have been made, but with little success, to utilise these organisms for increasing the store of soil nitrogen. Gerlach and Vogel (1902) and Freudenreich (1903) obtained negative results in soil experiments. Lipman (1904), experimenting with *Az. Beijerincki* and *Az. Vinelandii*, found that out of ten experiments there was a *loss* of nitrogen in every case but one, and this showed a gain of only 4 mgrms.

Certain results from inoculation experiments on clover with oats in 1907, and the discovery that species of Azotobacter and Pseudomonas are always found in association in the algal zone of the root-tubercles of Cycas, suggested that a mixed culture of these organisms might be effective in fixing nitrogen in the soil.

Pure cultures of the organisms obtained from Cycas root-tubercles incubated for fifteen days at 24° C., gave the following results:

	Mgrms. N. per unit carbohydrate per 100 cc.
Control	0.48
Azotobacter	0.56
Pseudomonas	0.91
Azotobacter + Pseudomonas	1.24

Hence Azotobacter and Pseudomonas fix more nitrogen per unit of carbohydrate when grown together than when grown separately. Further investigation showed that this increased fixation applied also to Azotobacter and Pseudomonas from ordinary soil and leguminous nodules respectively. Pure cultures grown in a solution consisting of mannite, 0.5 grm.; maltose, 0.5 grm.; potassium phosphate, 0.1 grm.; magnesium sulphate, 0.92 grm. per 100 cc. of water, at 24° C. for ten days, gave the following averages:

	Mgrms. N. per 100 cc.
Control	0.53
Azotobacter	2.19
Pseudomonas	2.30
Azotobacter + Pseudomonas	4.51

Owing to the different cultural conditions prevailing in soil and culture solutions an attempt was made to acclimatise the pure cultures to ordinary soil conditions. About 14 pounds of autoclaved garden soil was well moistened with the mixed culture and incubated for twenty-one days at 24° C. A culture solution was then obtained by mixing 5 grms. of this inoculated soil in 100 cc. of water with 1 grm. of sugar and incubating for twenty-four hours only; 50 cc. of this solution was then applied to pots containing 5 ounces of soil each, and incubated at 24° C. for ten days. The nitrogen determinations yielded:

	Mgrms. N. per 100 grms.
Soil 50 cc. distilled water	324
Soil 50 cc. autoclaved culture	330
Soil 50 cc. living culture	359

An increase of 35 mgrms. nitrogen per 100 grms. of soil, which represents an increase of about 350 pounds of nitrogen per acre, taking an acre of soil 4 inches deep as weighing 1 000 000 lbs.

To further test the effect of the mixed culture (both pure culture and soil culture) under ordinary conditions on different soils, a number of shallow plant-dishes, each containing 3 pounds of soil and inoculated with 300 cc. of the culture, were kept in one of the greenhouses at the Chelsea Physic Gardens for fourteen days. Analyses of these gave the following averages:

	Mgrms. N. per 100 grms. soil			
	Soil A	Soil B	Soil C	Soil D
Control. . . .	371	375	312	402
Pure culture . .	403	396	336	421
Soil culture . .	406	395	333	424
	Increase			
Pure culture . .	32	21	24	19
Soil culture . .	35	20	21	22

Experiments in progress indicate that this fixed nitrogen is readily assimilated by plants, and crops are benefited by an application of the mixed culture.

H. Friend. **Worms in a Cornish Garden.** — *The Gardeners' Chronicle*, N. 3619, p. 294. London, May 7, 1910.

In spite of the fact that thirty years have gone by since Darwin wrote his remarkable volume on Vegetable Mould and Earthworms, no systematic effort has yet been made in England to ascertain what species of worms produce vegetable mould, to master their geographical distribution, the nature of the soil on which they operate and the many other problems which the subject involves.

The writer has studied 50 worms from heavy soil, at Pencarrow, Washaway, for which he gives the following tabular return:

Lumbricus terrestris L, or true earthworm. . .	1
Allolobophora longa, Ude, long worm.	3
» *caliginosa*, Savigny	4
Aporrectodea chlorotica, Sav. Green worm . . .	1
Elisenia rosea, Sav. mucous worm.	6
Octolasion studiosum, Rosa	30

The last species is a strong worm of a steel blue colour with bright yellow tail and orange yellow girdle.

Out of 270 specimens examined, no fewer than 240 belonged to 4 species, the remaining 30 being distributed among 7 or 8 other species. They stand thus and the list may be taken as a basis for further Cornish records:

Lumbricus terrestris	1
» *castaneus*	3
» *rubellus*	4
Allolobophora longa	4
» *caliginosa*	4
Dendrobaena subrubicunda	4
Aporrectodea chlorotica	5
Octolasion studiosum	40
Elisenia rosea	40
» *veneta*	60
» *fœtida*	100

HILDERIC FRIEND. **Ooze and Irrigation.** — *Nature*, Vol. 84, July 14, 1910, p. 39; July 21, 1910, p. 70.

The ooze of the English rivers is often just as fertile as that of the Nile, and the number of annelids found in the ooze is enormous... Mr. Shrubsole, the Author, and others have frequently examined the ooze from various parts of the Thames, and the number of different species of mud-frequenting worms is very great.

" It would be of great value to science if some one would carefully examine the ooze before and after passing through the bodies of annelids, and ascertain what is the nature of the change that has taken place. Is there any difference between the quantity of nitrogen in pure mud and that which has been digested?"

These problems, having a vital bearing on agriculture, need attention.

It has been assumed that British Annelids were limited to a few species of earth-worms and a few aquatic forms lumped together as Tubifex. But this is a far from being the case. There are at least four distinct forms of indigenous worms, important amongst which are the ooze formers, which are exceedingly numerous and occur in almost all lakes, ponds, streams, ditches and pools, doing an immense work as scavengers and mould makers. Besides these there are the white worms or *Enchytraeid*, which appear when decaying vegetable matter is in a state of fermentation and apparently clear off the fermenting matter. The study of these Annelids opens a wide field of observation of interest to the geologist, and of supreme importance to the biologist and the student of agriculture.

E. J. RUSSELL. **Factors which determine Fertility in Soils.** —(Rothamsted Experimental Station Harpenden). *Science Progress,* No. 15, January 1910. — London.

The profound effect on the fertility of soils which is exercised by their organic contents is not yet sufficiently appreciated; some of the products, the simpler ones in particular, are of great value as plant food whilst others may be deleterious. The effect of the decomposition of organic matter in the soil has always interested agricultural chemists and in early years it was thought to be purely chemical.

Soil bacteriology may be said to date from 1878 when Schlœsing and Müntz observed a delay of twenty days in the commencement of nitrification in an artificial soil in contact with sewage, and argued that nitrification must therefore be a biological, not a chemical process. The new hypothesis was put beyond question by Warington and in course of time the suspected organisms were actually isolated. In a not unusual case the soil consists of about 80 °/₀ of inert mineral matter, 15 °/₀ of water and 5 °/₀ of organic matter only part of which, however, can be readily decomposed.

Bacterial counts show that some millions are present in each gram of soil.

The micro-organisms show great diversity in their food requirements, their mode of life, and in the way they are influenced by external conditions.

The organic matter is finally resolved into carbon dioxide, water, nitrogen, ammonia, calcium carbonate and other mineral matter, as well as into more or less stable organic substances which tend to accumulate in the soil.

Normally ammonia does not remain as such in the soil, but is either absorbed by some of the clay constituents to form a curious compound not yet investigated, or it is oxidised by bacteria to nitrite, and finally to nitrate.

The nitrifying organisms derive their carbon not from organic matter, which indeed is rather injurious to them, but from carbonic acid, which they assimilate and convert into complex cell substances, without the aid of sunlight or the intervention of chlorophyll; apparently they utilise the energy set free by the oxidation of ammonia.

Another set of organisms possesses the remarkable property of absorbing gaseous nitrogen from the air and converting it into protein.

A considerable amount of energy is of course necessary and is derived from the oxidation of organic matter.

Between this fixation of nitrogen and the liberation of nitrogen already mentioned there is generally an equilibrium. The steps in these changes are entirely unknown.

It is impossible at present either to make soil artificially, or to reconstruct the bacterial flora in a sterilised soil; it is even impossible to sterilise soil without profoundly altering its character.

The culture solution used in working with the nitrogen-fixing organisms is one containing sugar, potassium phosphate and calcium carbonate but no nitrogen compound. The solution used in studying nitrifying organisms contains an ammonium salt, phosphates, etc., but no organic matter; whilst in investigating the decomposition process it is customary to use a solution of a highly nitrogenous organic compound such as peptone.

The results obtained are very valuable but they throw more light on the morphological und physiological characteristics of the soil organisms than on the changes actually going on in the soil.

The total chemical change may be ascertained by determining ammonia and nitrates in the soil.

The total bacterial activity has been estimated in two ways: Hiltner and Störmer count the number of colonies developing on gelatine or agar plates inoculated with known weights of soil and reduce the results to numbers per gram of soil; the second method devised by the Author consists in measuring the rate at which oxygen is absorbed by the soil. The rates for a series of comparable soils are found to run in the same order as the relative productiveness.

A third method has been used in the Rothamsted laboratories by Dr. Hutchinson and the author, which is really a combination of these two methods.

The author, after giving a brief historical notice on the experimental work on the effect of partial sterilisation describes the experiments made at Rothamsted in conjunction with Dr. H. B. Hutchinson on this subject.

From the results obtained a clear picture of the microscopic life of the soil can be given.

The micro-organism flora of an ordinary soil is very mixed, including, as it does, a wide variety of organisms performing very different functions.

They may be divided roughly into two classes: saprophytes which live on and effect the decomposition of organic matter, and a class comprising: *a*) phagocytes which consume living bacteria; *b*) large organisms inimical in other ways to bacteria. The action of the saprophytes tends to increase the fertility of the soil; they produce ammonia, fix nitrogen and so on.

Some of them cause a liberation of nitrogen during the decomposition of organic matter and are to this extent injurious. This action, however, is either much restricted or is counterbalanced by fixation processes.

On the other hand, the phagocytes and similar organisms are detrimental to fertility, because they limit the number of bacteria and therefore the rate at which ammonia is produced.

Between those two classes of organisms there is an equilibrium under natural conditions and the amount of decomposition is much less than might be expected from the quantity of organic matter present.

When toluene is added or when the soil is heated to 98° C. the phagocytes are killed but not the bacterial spores, which germinate when toluene is removed and the soil again moistened, and the resulting organisms multiply with great rapidity since they are now freed from the attacks of their enemies and the competition of larger organisms.

The removal of nitrifying organisms seems to have little effect on the growth of plants.

A. D. HALL. **The Conservation of the Fertility of the Soil.**— *The Journal of the Board of Agriculture.* Vol. XVII, n. 2. London, May 1910, p. 114.

"In considering the value of various systems of farming it becomes a matter of prime importance to get some idea of how far the fertility of the land is being preserved, and whether the succeeding generation of farmers is likely to find the cropping power of the soil improved or deteriorated by the treatment it has received. It is pretty clear that in many parts of the world the natural riches contained in the virgin soils are being rapidly depleted; this may be deduced from the constant westward movement of certain classes of farmers in the United States and Canada, though in some parts of America the soil seems to be able to yield good crops for an indefinite period. On the other hand, many European soils have reached a sort of constant level of production, and get neither richer nor poorer, although they have been in cultivation for many centuries. We also occasionally hear of worn out soils, but it would be more correct to say badly managed or spoilt soils, because there is no evidence that the productivity of a soil ever declines under suitable treatment.

In tracing changes in the fertility of soil, we may content ourselves with following up the changes in the amount of nitrogen present, because though phosphoric acid, potash, and lime are important factors in plant nutrition, these elements are not susceptible to the gains and losses from external operations like cultivation, by which the stock of nitrogen is so greatly affected.

There are various processes at work which will diminish or add to the stock of nitrogen in the soil, and these may be summarised as follows:

1) The growth of plants simply removes some of the nitrogen that has reached an available form, and if the crop is taken off at harvest, there is so much direct loss to the soil. As it may also be accepted that the plant itself, apart from bacterial action, neither converts any of the combined nitrogen it obtains into gas, nor brings into combination any of the free nitrogen of the air, there is neither gain nor loss of soil nitrogen when the growth of the plant is returned to the soil.

2) Various bacteria are capable of bringing atmospheric nitrogen into combination, and so increasing the stock of soil nitrogen. They may either live in symbiosis with higher plants (*Pseudomonas*), or exist free in the soil (*Azotobacter*, *Clostridium*).

3) Another group of bacteria in the process of breaking down organic matter liberate the nitrogen in the free state, and so reduce the stock of soil nitrogen.

4) Natural drainage waters contain nitrates which have been derived from the soil nitrogen by bacterial oxidation.

5) The rain annually contributes a certain amount of combined nitrogen to the soil. The amount is greater in the proximity of towns; the average amount at Rothamsted is 3.84 lb. per acre per annum, and other results would show that this is a very representative figure for ordinary country air.

In practice most of these factors giving rise to gain or loss are at work together; which of them will predominate will depend upon the style of farming and cultivation the land receives. Some of the Rothamsted plots with their long-recorded history afford an opportunity of estimating the interplay of the various factors.

A. The simplest case to take is that of land under arable cultivation when nothing is restored to the soil. The unmanured plot on the Broadbalk wheatfield at Rothamsted affords a useful example, and we have figures which show the change in its fertility between 1865 and 1893, a period of 28 years.

BROADBALK FIELD, ROTHAMSTED, PLOT 3. NITROGEN, LB. PER ACRE.

In soil 1865	In soil 1893	Loss in 28 years.	Added by rain.	Removed by crop.	Unaccounted for.
2722	2437	285	107	428	36

In the first place it will be seen that the nitrogen in the soil declines when the crop is wholly removed and no manure is added, though the decline becomes slow after the first large loss of condition has taken place. It will be remembered that the yield of the unmanured wheat plot at Rothamsted fell off pretty quickly for a few years, but for the last fifty years has remained almost constant at an average of about 12.5 bushels per acre.

If we make out a balance-sheet and set off the nitrogen removed in the crop against that which the soil has lost, as shown by analysis, together with that which has been brought down by the rain, we find that the soil contains about 36 lb. per acre more nitrogen at the end of the period than we should have expected. This quantity is too small to be significant; it would be more than covered by the experimental errors in the determinations; we may, therefore, conclude that the nitrogen required by the crop has just about been supplied by the soil and the rain. There must, however, have been other losses from the soil; a good many weeds are annually removed, and they contain some nitrogen; drainage water flows away containing, as we know by trial, some nitrates; there must also have been some bacterial liberation of nitrogen gas. These losses of nitrogen may not be large in the aggregate, but as there is no such falling off in the stock of nitrogen in the soil as would balance them, it follows that some recuperative agencies must have been at work in the soil restoring the stock of nitrogen. We know that Azotobacter and similar bacteria are present in this soil; we know also that there is a certain amount of weed of a leguminous nature growing every year among the wheat; these are the two sources of combined nitrogen which we may credit with the restoration of the stock of nitrogen in the soil.

However, their action is not sufficient to maintain the stock unimpaired, even in this impoverished soil, when the crops are wholly taken away.

B. We may now take another case, that of land very rich in organic matter and under arable cultivation, the crop as before being wholly removed. An example of this kind is afforded by the farmyard manure plot on Broadbalk, where 14 tons per acre of farmyard manure, containing about 200 lb. of nitrogen, are applied every year.

BROADBALK, PLOT 2. NITROGEN, LB. PER ACRE.

In soil 1865.	In soil 1893.	Gain in 28 years.	Added in manure.	Added by rain.	Removed in crop.	Unaccounted for.
4343	4976	633	5600	107	1361	— 3713

Under these conditions the losses of nitrogen are enormous; of the yearly supply of nitrogen not quite a quarter has been recovered in the crop, and less than a quarter remains behind as an enrichment of the soil; more than half has been permanently lost through the destructive agencies enumerated above (3 and 4).

The production of this plot of land with its annual application of manure greatly in excess of the requirements of the crop still tends to reach an equilibrium; after the first few years the crop does not increase any further; nor does the soil become any richer, because the agencies destructive of the combined nitrogen increase at an accelerating pace until they balance the greater intake of nitrogen. Of course, the equilibrium thus attained is at a much higher level of production than is attained on the unmanured plot, being an average of 38.6 against 12.5 bushels per acre for the last twenty years.

C. We may now take a case where the crop is not removed, but the whole of the vegetation is allowed to die down and fall back on the land. At Rothamsted portions of the Broadbalk and of the Geescroft fields have been allowed to run wild since 1881; they are covered with a rough natural vegetation, which on Broadbalk contains about 25 per cent of leguminous plants, but on Geescroft is almost exclusively grassy. The vegetation is neither cut nor grazed by stock, and analyses of the soil after about 23 years had elapsed since the land had been under the plough show the following changes:

NITROGEN, LB. PER ACRE, on soil left wild.

	In soil to 27 inches.		Added by rain.	Gain in soil per annum.
	1881-83	1904		
Broadbalk. 1881	5910	8110	88	92
Geescroft, 1883	6040	6980	80	41

The very remarkable gain of nitrogen in the soil of these two plots must be put down to the action of bacteria; on Broadbalk there are leguminous plants with which are associated the nodule bacteria (*Pseudomonas radicicola*), but that these are not the only or even the main agents in fixing nitrogen is seen from the gain of nitrogen in the soil of the Geescroft field, which is almost devoid of leguminous plants. The main factor has been the Azotobacter, the bacterium which fixes nitrogen when free in the soil, and its presence has been verified in the soil from both plots. The reason for its activity on these pieces of land lies in the fact that the yearly growth of vegetation is allowed to die back and fall on to the land. Thus the soil receives an annual contribution of purely carbonaceous material previously elaborated by the plant from the carbon dioxide of the atmosphere, and by the oxidation of this carbonaceous material the Azotobacter organism derives the energy necessary to bring the free nitrogen gas into combination. In the laboratory Azotobacter must be supplied with sugar or similar carbohydrates and fixation of nitrogen will then take place to an extent that is proportional to the amount of sugar oxidised; in Nature the requisite oxidisable carbohydrate is supplied by the debris of previous vegetation. We have seen that on the adjoining unmanured plot of Broadbalk from which the wheat is removed every year, fixation is so small that it only just balances the yearly loss of nitrogen due to drainage, etc.; fixation is kept down at this low level because, beyond the small root and stubble residue of the wheat plant, there is no carbonaceous material supplied for the Azotobacter. The much greater nitrogen fixation in the Broadbalk than in the Geescroft soil may be set down to the presence of a fair amount, 2 to 3 per cent of calcium carbonate, a substance which is almost absent from the Geescroft soil, yet without it the Azotobacter cannot function properly.

It is to the activity of Azotobacter when thus supplied with carbohydrate by the annual fall of vegetation that we may attribute the accumulation of nitrogen in virgin soils. The higher plants alone, however long they might have occupied the land, could only restore what they had previously taken from the soil, and thus could originate no such vast stores of nitrogen as are found in the virgin soils like the black steppe soils of Manitoba and the North-West. This conclusion is strengthened by the fact that such steppe soils are always well supplied with calcium carbonate, a necessary factor in the action of Azotobacter. The organism itself has also been isolated from all such soils.

We are now in a position to see how far these various examples can be made to interpret the conditions which prevail in practice.

In the first place, it is clear that the growth of successive cereal crops which are wholly removed from the land will rapidly reduce the stock of nitrogen originally in the soil, not only by the amounts withdrawn in the crop, but also because of the oxidising actions which the cultivation sets up in the land. Moreover, the richer the land to begin with, the greater will be the annual losses; when the land gets anywhere near the pitch of impoverishment represented by the Broadbalk unmanured plot, not only is the annual conversion from dormant into available plant food small, but the wasteful oxidation is similarly reduced, and the stock of nitrogen is only slowly depleted. If instead of cropping continuously with cereals a more conservative system of farming is introduced, in which leguminous crops become a regular feature in the rotation, and a certain amount of carbonaceous matter is returned to the land, as by the folding off of green crops by sheep, then the recuperative agencies fixing nitrogen become sufficient to repair the losses due to the crops and the waste by drainage and oxidation, and a moderate level of fertility may be maintained indefinitely without the introduction of any extraneous source of nitrogen.

Such, indeed, was the state of affairs in Europe prior to the discovery of artificial manures and foods; the farm had to be self-supporting, the nitrogen that came back to the land in the farmyard manure had all been taken from the land previously; it was less than that which left the land by the amounts in the corn. meat, milk, and wool sold off the farm, and by all that was lost and wasted in making the farmyard manure. These losses were however, so far balanced by the gains of nitrogen due to bacterial agencies that the fertility of the soil at its low level remained unimpaired; e. g., there is evidence that the average production of wheat in the South and East Midlands of England had remained at about 20 bushels per acre (18 Hectol. per hectare) for a long period up to the early years of the nineteenth century. That the land can attain such an equilibrium of production and fertility is indicated by some of the results obtained on the Agdell Field at Rothamsted, where a four-course rotation of swedes, barley, clover or bare fallow, and wheat is followed. The experiment started in 1848, and since that time the soil has been analysed in 1867, 1874, 1883, and 1909. For our purpose the instructive plot is that which receives no nitrogen as manure, but minerals, i. e., phosphoric acid and potash, once in each rotation; it is divided into four sub-plots, two on which clover (or beans) is grown before the wheat, two on which there is a bare fallow; on each of these two again has the swede crop returned to the land, whereas on the other it is carted away. The following table shows the percentage of nitrogen in the surface soil (9 inches) at the respective dates, together with the average crops on each plot over the period 1852-1903:

NITROGEN PER CENT IN SOIL OF AGDELL FIELD, ROTHAMSTED.

The plots all receive mineral manures, but no nitrogen.

	Fallow		Clover	
	Roots carted off. 13/14	Roots returned 9/10.	Roots carted off. 15/16.	Roots returned 11/12.
1867	0.1224	0.1240	0.1327	0.1380
1874	0.1147	0.1238	0.1241	0.1321
1883	0.1161	0.1228	0.1329	0.1383
1909	0.1159	0.1195	0.1347	0.1498
1852-1903				
Wheat average. . . .	31. 2 bushels	32.2	32.2	35.1
Clover »	—	—	41.0 cwt.	47.7
Swedes »	151.0 cwt.	268	160	187
Barley »	22.1 bushels	28.7	24.5	34.5

The changes indicated in the amount of nitrogen in the soil are not large, being, indeed, very close to the experimental error but, reviewing the numbers altogether, it may safely be concluded that the first plot, $^{13}/_{14}$, from which the roots are carted and where no clover is grown, is declining in fertility. The two plots $^{9}/_{10}$ and $^{15}/_{16}$ are practically stationary; if anything, $^{9}/_{10}$ without clover may be losing ground, whereas $^{15}/_{16}$ with clover, but from which the roots are carted, may be gaining ground; while the plot $^{11}/_{12}$, on which both the roots are returned and clover is grown, is still more probably gaining a little fertility. This last plot has yielded on the average over 52 years 35 bushels of wheat, 34 bushels of barley, over 9 tons of swedes, and nearly $2^{1}/_{2}$ tons of clover hay per acre, which is nearly equal to, if anything higher than, the average production of the whole of Great Britain during that period. Such a yield, which, though equal to the average, may be taken as lower than a good farmer would expect from that class of land, has been obtained without bringing in any external source of nitrogen, without even returning to the land all that would come back under ordinary conditions of farming. In practice it would not always be possible to feed off the root crop on the land, and even then not so much carbonaceous material would be returned as is the case in the experiment, where it has been necessary to cut up the roots and plough them in, but, on the other hand, the manure made from the straw of both the wheat and barley crops and from the clover hay would also come back to the land.

The evidence provided by this plot is strengthened by the results obtained on the three other plots, on which the recuperative operations of clover growing, and returning the roots to the land, are either singly or together omitted; under such conditions the gross production is distinctly less, and the fertility of the land is stationary or declining very slowly, so that an equilibrium at a lower level of production has been or will shortly be attained.

We may then conclude from these Agdell Field results that a conservative system of farming on the four-course system, in which clover is grown at least once in every two rotations, in which the roots are consumed on the land, and the dung made by the straw and hay comes back to the land, will maintain the fertility of the soil and support for an indefinite period a gross production at about a 4 qr. of wheat per acre level without any necessity for importing nitrogen. The natural agencies of nitrogen fixation due to the growth of the clover crop and the bacteria depending on the supply of oxidisable carbonaceous matter returned to the soil are capable of restoring sufficient nitrogen to the land to balance such an output and to repair other unavoidable waste. Of course, such a conclusion deals with nitrogen alone; it assumes that the supply of phosphoric acid, potash, and calcium carbonate is adequate, and, indeed, on much British land the potash and calcium carbonate will be furnished by the soil, while 4-5 cwt of superphosphate per acre for the roots will maintain or even increase the stock of phosphoric acid (1).

The 4 qr. of wheat per acre level of production is, however, a low one to aim at; although it is the actual average production of the country at the present time, it is below that which a good farmer expects today, and must, indeed, attain if he is to make a satisfactory profit on his land. But if the general level of production is to be raised from the 4 qr. of wheat to, say, the 5 qr. of wheat standard, then an external supply of nitrogen will be required, either in the form of nitrogenous fertilisers for the root and wheat crops, or of purchased feeding-stuffs to enrich the dung. Nor will it be sufficient, and this a very important point, merely to add as much nitrogen as is taken away from the land in the increased corn crops; we have to add enough to get the land into much higher condition, and this means greater wastage at every stage. We have seen in the case of the Rothamsted plot receiving dung how great the wastage becomes when a large amount of dung is put on the land every year, and though the losses in this case are excessive, they will always become greater at an ever-increasing ratio the higher the condition of the land. It is another example of the well-known law of diminishing returns; the first addition of manure produces the best effect; each succeeding application produces a smaller increase in the crop till at a certain point nothing further is gained, however much manure is put on.

We may conclude, then, that with every system of farming a certain position of equilibrium will be reached (viewed over a term of years long enough to smooth out seasonal effects) when the natural recuperative agencies and the additions of fertilising material in the manure are balanced by the removals in crops and stock

(1) A production of 4 quarters of wheat per acre, i. e. 32 bushels, corresponds to 28.8 hectolitres per hectare. Aiming at a standard of 5 quarters per acre corresponds to raising the average production to 36 hectolitres per hectare. Ed.

and the inevitable waste. The higher the level of production, the greater will be the waste, and, in consequence, the additions of fertilisers must be doubly increased to maintain the balance. How high a level of production can be profitably maintained is determined by the prices that rule for the crops, but there will always come a limit when the production can be no longer increased by additions of fertilisers except at a loss; at such a stage it is only the introduction of improved varieties or some variation of the fertiliser which will still profitably increase the production per acre.

On examining the variations in farming systems in different parts of the country, it will be found that farmers do instinctively adapt their expenditure on fertilisers (including feeding-stuffs), and, therefore, their level of production to the magnitude of the returns they can get for their produce; one man will have a large cake bill and spend 40 s. per acre on artificial fertilisers during his rotation: he can maintain a high level of condition, and therefore of waste in his soil, because he can get good prices for potatoes or barley or sheep, whatever his staple product may be. But on poorer land and with less suitable markets a man may be driven to cut down his cake bill and spend only 10 s. per acre on fertilisers, because his products are not valuable enough to compensate for the waste at the higher level of condition in the land. Thus the problem of what is a profitable manure for a given crop becomes a very complex one, and the biggest factor is perhaps the level of production at which the individual farmer can conduct his business remuneratively ».

A. D. Hall. **The Adaptation of the Plant to the Soil.** [Third Masters Lecture]. — *The Gardeners' Chronicle.* N. 3609, p. 143. London, Feb, 26, 1910.

In delivering the first of the Masters lectures for 1910. Professor A. D. Hall Director of the Rothamsted Experiment Station, referred to the experiments made at Rothamsted where, ever since 1856, a piece of grass-land had been divided into plots, each plot being continuously manured with a different manure. The leguminous plants make up nearly half the vegetation on the plots receiving phosphates and potash only, while they are absent from plots receiving large quantities of nitrogen in the form of ammonium salts. *Festuca ovina* is abundant on plots receiving ammonium salts and little seen on plots receiving nitrate of soda. In some cases the causes for this distribution can be apprehended, e. g. the leguminous plants are supplied with nitrogen from the atmosphere and are therefore fully fed by a fertiliser containing phosphates and potash but no nitrogen, a mixture which is of little or no use to the grasses. Again, ammonium salts encourage shallow rooting plants, because they are retained by the surface layer of soil; nitrate of soda is, on the contrary, washed down by the rain and encourages deep, tap-rooting plants. Such explanations do not, however, cover all the facts observed. In view of the great divergencies in vegetation thus artificially induced it might seem a simple problem to find out by the analysis of a particular soil and plant how to adapt another soil to that plant: at once however, there are difficulties. All plants contain the same elementary substances derived from the soil and in very much the same sort of proportions. We can group plants into silica lovers, lime lovers and potash lovers by the prominence of these particular constituents in their ash, but on experiment these groupings possess little significance, because the differences betwen the composition of the same plant growing on different soils are often greater than those separating the various groups. Soils of the most diverse type possess much the same chemical composition. How, then, reconcile these facts with the great differences in the nature of the herbage of the Rothamsted plots which have been established by differences in the chemical nature of the food supply? The intense competition existing between the various species on these plots must be taken into consideration; if the treatment, chemical or otherwise, establishes only a small difference in favor of one species as against another, then the pressure of competition acting over a long period, may easily eliminate the one species or make the other predominant. It thus becomes necessary to look for very small factors and not expect any large special correlation of the chemical composition of plant and soil.

A. D. Hall. **The Association of Plant and Soil.** [Fourth Masters Lecture]. — *The Gardeners' Chronicle*, N. 3613, p. 206. London, March 26, 1910.

Delivering the second of the Masters Memorial lectures for 1910, Mr A. D. Hall, Director of the Rothamsted Experimental Station, said that in order to obtain some basis of knowledge for the associations of given plants with certain soils, one must turn to farm crops, about the requirements of which so much was known. A map had been prepared showing the distribution of fruit in the counties of Kent, Surrey and Sussex, on which the acreage in each parish was indicated by a series of black dots, thus forming together a shading showing the density of plantation. Such a map considered alongside a geological map of the same district, at once showed that the fruit was congregated on certain formations and absent from others. Similar maps showing the distribution of hops, turnips, barley etc., revealed a simular correlation between the crop, the geological formation and the structure of the soil as determined by mechanical analysis. In deciding upon the kind of soil required by a plant empirical methods alone can be followed; it is impossible to decide *a priori* what the requirements of the plant will be.

But though the mechanical composition of soils reveal the chief factor in the association of plant and soil, one or two chemical factors of importance can be discerned. A distinction must be made between acid and non-acid soil, the acid soils being generally recognizable in nature by the tendency of peat to accumulate upon them. It is problable that the plants themselves are indifferent to any acidity of the soil water from which they are drawing nutrition; but in an acid medium the action of bacteria is generally suspended, nitrification ceases, and the soil becomes wholly permeated by the mycelium of various moulds and other microfungi.

The other factor of importance is the amount of carbonate of lime in the soil, but a distinction must be drawn between the cases in which carbonate of lime acts merely as maintaining a neutral reaction, and those in which it acts positively and is of direct benefit to certain plants. Carbonate of lime is regarded as poisonous to certain plants, e. g. Erica and Rhododendron; but this is probably not a positive injurious action of the lime on the plant, but a secondary one, in that the lime removes the acid soil conditions which these plants find necessary.

In the present state of our knowledge it is vanity to dogmatise about the requirements in the way of soil of more than a very few plants.

A. D. HALL. **Old and New Studies on Fertility.** — *Nature*, n. 2132. Vol. 84, September, 8, 1910, p. 310.—The British Ass. for the Adv. of Science, Sheffield Meeting. Opening Address of the Chairman of the Agricultural Sub-section of *B* (Chemistry).

“ In a paper published in the Philosophical Transactions in 1845, being the Bakerian Lecture for that year, Daubeny described a long series of experiments that he had carried out in the Botanic

Garden, wherein he cultivated various plants, some grown continuously on the same plot and others in a rotation. Afterwards he compared the amount of plant food removed by the crops with that remaining in the soil. Daubeny obtained the results with which we are now familiar, that any normal soil contains the material for from fifty to a hundred field crops. If, then, the growth of the plant depends upon the amount of this material it can get from the soil, why is that growth so limited, and why should it by increased by the supply of manure, which only adds a trifle to the vast stores of plant food already in the soil?

For example, a turnip crop will only take away about 30 lb. per acre of phosphoric acid from a soil which may contain about 3000 lb. an acre; yet, unless to the soil about 50 lb. of phosphoric acid in the shape of manure is added, hardly any turnips at all will be grown.

Daubeny then arrived at the idea of a distinction between the active and dormant plant food in the soil. The chief stock of these materials, he concluded, was combined in the soil in some form that kept it from the plant, and only a small proportion from time to time became soluble and available for food. He took a further step, and attempted to determine the proportion of the plant food which can be regarded as active. He argued that since plants only take in materials in a dissolved form, and as the great natural solvent is water percolating through the soil more or less charged with carbn dioxide, therefore in water charged with carbon dioxide he would find a solvent which would extract out of a soil just that material which can be regarded as active and available for the plant. In this way he attacked his Botanic Garden soils, and compared the materials so dissolved with the amount taken away by his crops. The results, however, were inconclusive, and did not hold out much hope that the fertility of the soil can be measured by the amount of available plant food so determined.

Daubeny's paper was forgotten; but exactly the same line of argument was revived again about twenty years ago and all over the world investigators began to try to measure the fertility of the soil by determining as "available" plant food the phosphoric acid and potash that could be extracted by some weak acid. A large number of different acids were tried, and although a dilute solution of citric acid is at present the most generally accepted solvent, I am still of opinion, that we shall come back to the water charged with carbon dioxide as the only solvent of its kind for which any justification can be found.

"Whatever solvent, however, is employed to extract from the soil its available plant food, the results fail to determine the fertility of the soil, because we are measuring but one of the factors in plant production, and that often a comparatively minor one.

In fact, some investigators — Whitney and his colleagues in the American Department of Agriculture — have gone so far as to suppose that the actual amount of plant food in the soil is a matter of indifference. They argue that as a plant feeds upon the soil water, and as that soil water must be equally saturated with, say, phosphoric acid, whether the soil contains 1000 or 3000 lb. per acre of the comparatively insoluble calcium and iron salts of phosphoric acid which occur in the soil, the plant must be under equal conditions as regards phosporic acid, whatever the soil in which it may be grown.

This argument is, however, a little more suited to controversy than to real life; it is too fiercely logical for the things themselves, and depends upon various assumptions holding rigourously, whereas we have more reason to believe that they are only imperfect approximations to the truth. Still, this view does merit our careful attention, because it insists that the chief factor in plant production must be the supply of water to the plant, and that soils differ from one another far more in their ability to maintain a good supply of water than in the amount of plant food they contain.

Even in a climate like that of England, which the text-books describe as " humid " and we are apt to call " wet ", the magnitude of our crops is more often limited by want of water than by any other single factor.

The same American investigators have more recently engrafted on to their theory another supposition, that the fertility of soil is very often determined by excretions from the plants themselves which thereby poison the land for a renewed growth of the same crop, though the toxin may be harmless to a different plant which follows it in the rotation. This theory had also been examined by Daubeny, and the arguments he advanced against it in 1845 are valid to this day. Schreiner has, indeed, isolated a number of organic substances from soils — dihydroxystearic acid and picoline-carboxylic acid were the first examples — which he claims to be the products of plant growth and toxic to the further growth of the same plants. The evidence of toxicity as determined by water-cultures requires, however, the greatest care in interpretation, and it is very doubtful how far it can be applied to soils with their great power of precipitating or otherwise putting out of action soluble substances with which they may be supplied. Moreover, there are as yet no data to show whether these so-called toxic substances are not normal products of bacterial action upon organic residues in the soil, and as such just as abundant in fertile soils rich in organic matter as in the supposed sterile soils from which they were extracted".

XIV.

Making and improvement of land. Warping and preservation of soil on hill-sides. — Reclamation of barren lands. Alkali soils. — Peat-burning and moor-culture. Preservation of coast-land and cultivation of sand-dunes.

Manuring of black Fenland. — (*Cambridge Univ. Dept. Agr. Farmer's*, Bul. 6, Pp. 4). *E. S. R.*, vol. XXII, N° 4, March 1910. Washington.

Experiments with mangolds and potatoes on several types of fen soils to determine primarily how much superphosphate can be profitably used on such soils are reported. The superphosphate was compared with basic slag and was used alone and in combination with nitrogen and potash. The best results were obtained with a heavy application (6 cwt. par acre) of superphosphate, and indicate that soluble phosphate is the most valuable form to use on fenlands. The addition of nitrate of soda with a smaller application of superphosphate gave good results in the case of mangolds but was as a rule unprofitable in the case of potatoes.

The Manuring and Improvement of Mossland in Scotland. — (*Scot. Farmer*, 17, 1909, n. 884, p. 1042). *E. S. R.*, vol. XXII, N° 4, March 1910. Washington.

An account is here given of an address by R. P. Wright based upon the results of experiments made under the auspices of the

West of Scotland College of Agriculture. The result of 6 years' experiments showed that the productiveness had been decidedly increased for the 6 years from one application of basic slag and of slag and kainit.

F. P. Gissing. **Commercial Peat: its Uses and Possibilities.** Pp. x+191. London. Charles Griffin & Co. Ltd. 1909. — Notice in *Nature*, Vol. 83. April 14, 1910, p. 182.

This volume on peat is a companion one to that published in 1907 by Björling and Gissing, the author's aim being the description, from a commercial point of view, of the various processes proposed for the utilisation of peat.

Sir John Stirling Maxwell and H. M. Cadwell. **Afforestation on moors.** — *Trans. R. Scott. Arbor. Soc.*, XXIII, II, 153, 158. Ed., July 1910.

One of the most interesting articles in these Transactions of the Scottish Arboricultural Society is a contribution by Sir John Stirling Maxwell giving early results of trials in Inverness-shire with the Belgian system of tree planting on turfs. Intended primarily for afforestation on moors, but also suitable for rough, grass-covered ground, the system consists in turning over turfs, leaving them to dry and sweeten for some months, and then planting in the centre in a heap of soil enriched with a small proportion of basic slag. The young plants take a year to become established, and then grow on quickly. The author also recommends the Sitka spruce, *Picea sitchensis*, for planting at an elevation of about 100 feet, in which there is agreement with the conclusions communicated in an article by Mr. H. M. Cadwell, who considers that it is superior to larch, Scotch pine, and Norway spruce for growing in an exposed situation.

XV.

Artificial water-storage. Irrigation. Utilising groundwater. Land-drainage. — Legislation regarding the use of water in agriculture.

Sources of Water-supply in Great Britain.

WILLIAM COLES-FINCH. **Water. Its origin and use.** — London, Alstan Rivers, 1908, pp. XXI, 483.

The following observations are contained in the preface of this interesting book:

"Being professionally interested in the finding and distribution of water, as engineer to important waterworks, I have naturally been led to give this subject some attention and study, and I have derived no little pleasure in gathering together into the present volume the notes and memoranda which I have accumulated during a number of years, in the hope that my readers may find in it some matter of interest, and may be led to the contemplation of the wonders of Nature.

Water in its various forms has been dealt with by some of the most eminent of scientists.

The subject, like the boundless ocean, is so wide, that there are few branches of scientific research in which it does not claim attention ».

As far as sources of water-supply in Great Britain are concerned, the author states, Chap. XVIII, that some of the most prolific borings are in Lincolnshire. Lincolnshire has also the distinction of possessing the deepest boring for water in the United Kingdom, $1561^1/_2$ feet. Many borings of Artesian (or Modenese) wells exist also in the valley of the Medway, Kent. Other innumerable Artesian borings are all over the country.

A very large proportion of the British supply of water is derived from the lakes and rivers. Some natural lakes are preserved for this purpose, the natural Loch Katrine in Scotland, for example;

some have their water-level artificially raised by dams, as in the case of Lake Thirlmere; and others are artificially formed by impounding the waters of streams or rivers, as the Lake Vyrnwy in Montgomeryshire, another example being the reservoirs from the rivers Elan and Claerwen.

In Great Britain, however, there is usually little need of irrigation, for there are but few districts that do not receive an ample supply of water in the form of rain, and a serious drought is of rare occurence.

D. A. Willey. **Irrigation and Engineering.** Cassier's Magazine, an Engineering Monthly. April 1910. — London, p. 663.

An important article on the irrigation schemes in the United States, with many illustrations.

XVI.

Tillage. Tilth. Influence of tillage, of drainage and of soil-conditions generally on root development. Economy of soil-moisture.—Trenching.

W. Fream. **Elements of Agriculture. A Text-Book prepared under the authority of the Royal Agricultural Society of England.** Seventh Edition. — Thirty-ninth Thousand. Pp. VIII+480 with fgs. 256. London, 1910.

The following are extracts from the prefaces to the first and fourth editions:

" The preparation of this Text-Book was undertaken by the Royal Agricultural Society of England, in compliance with the many demands that had been addressed to it for an elementary work on Agriculture adapted for use in rural and other schools and classes.

The general scheme of the work was settled by a Sub-Committee appointed by the Council of the Society, and consisting of

Lord Moreton (Chairman), Major Craigie, Mr. C. De L. Faunce De Laune, Mr. D. Pidgeon, Mr. Martin J. Sutton, and Mr. Charles Whitehead.

The Sub-Committee placed the preparation of the Text-Book in the capable hands of Dr. W. Fream, to those skill and knowledge of the subject any success which the work may attain will be chiefly due.

The Sub-Committee desire also to record their grateful acknowledgments, for valuable suggestions and revision of the proof-sheets, to Sir John Lawes, Bart., Sir John Thorold, Bart., Sir Jacob Wilson, Mr. Alfred Ashworth, Mr. Thomas Bell, Mr. J. Bowen-Jones, Mr. Chandos-Pole-Gell, Dr. J. H. Gilbert, Miss E. A. Ormerod, Mr. D. Pidgeon, Mr. Clare Sewell Read, and Dr. Voelcker."

"The first Edition of this work, consisting of 1250 copies, was practically exhausted on the day of publication, January 1, 1892, and a second Edition of 5000 copies was sold out before the end of that month. The third Edition of 5000 copies, published in February, has now been for some time out of print; but it was thought desirable that, before a fourth Edition was issued, the work should be thoroughly revised and a completely new set of illustrations prepared.

The present Edition contains 36 more pages than the others, and it includes 256 original illustrations from wood engravings, as compared with 200 process and other blocks in the previous Editions.

The engravings of live-stock are from the life, and an endeavour has been made to present the relative sizes of the animals in each of the four sections of horses, cattle, sheep, and pigs, though it has of course not been possible to show the horses and cattle on so large a scale as the sheep and pigs.

The Author has carefully revised the text, and has made additions to various parts of the work, whilst at the same time he has had in view the necessity of keeping the volume within moderate dimensions". Moreton (Chairman of Education Committee of the Royal Agricultural Society of England).

The work is usefully indexed, with an Index of Plants, and a general Index.

WALTER J. MALDEN (author of "Tillage and Improvements," "Up-to-date Farm Implement"). **Ploughing and Ploughs.** — *The Standard Cyclopedia of Agriculture* of R. P. Wright, Vol. IX, 1910, p. 251.

"In respect to the merits and value of a plough, the Royal Agricultural Society of England drew up the following points to control their awards in their most recent competition:

Price	10
Mechanical properties	20
Simplicity	10
Draught relatively to work done	20
Perfection of work in burying vegetation	25
Efficiency of skim coulter	5
	100

XVII.

Fallowing. The resting of the soil. Soil sickness. Control of soil-bacteria. Soil inoculation. Special bacterial cultures used for increasing fertility. Paring and burning. Heat and antiseptics as soil-improvers.

J. PERCIVAL. **On Soil Inoculation.** — *Agricultural Bacteriology*, London, 1910, p. 201.

The following is an extract from Mr. Percival's book on Bacteriology, on a question that has lately roused much attention in Great Britain:

"The practical utilization of pure cultures of the "nodule-forming" organisms is still in the experimental stage, in spite of the large amount of attention which has been given to the problem. It is quite certain that in certain cases seed inoculation has been very beneficial and remunerative, but exact knowledge of the conditions which ensure an increased yield after such inoculation is still wanting. The evidence seems to point to the conclusion that on much of the cultivated land in Europe the use of "nitragin," or "nitro-bacterine" is quite unnecessary for the growth of good crops of the ordinary leguminous plants, the soil being already well supplied with organisms of the right kind for the adequate infection of the roots of the crop. Failure to obtain increased returns after inoculation seems to occur where the land is supplied with an excess of easily assimilated nitrogenous compounds which check the growth of the nodule organisms, and also on acid soils and those deficient in phosphates and potash.

Inoculation is likely to be effective upon soils poor in nitrogen, especially where leguminous crops have not been grown previously, and also on land which has given meagre crops of this class, with roots devoid of nodules."

W. B. Bottomley. **Some effects of Nitrogen-fixing Bacteria on the growth of Non-Leguminous plants. —** (*Proc. Roy. Soc.* London, Ser. B, 81, 1909, n. B, 548, pp. 287-289; *Centbl. Bakt.* etc. 2; Abt., 25, 1909, No. 5-9, pp. 270-272; Abs. in *Chem. Zentbl*, 1909, II, No. 9, p. 742). *Exper. Stat. Rec.*, vol XXII, No. 3, Febr. 1910 Washington.

The nitrogen-fixing power of Pseudomonas alone and combined with Azotobacter (both obtained from root tubercles of Cycas) was studied in culture experiments and in pot tests with barley, oats, parsnips, and hyacinths. The results as measured by the increase of nitrogen in the culture solution and by the growth of the plants indicated in the author's opinion a decided fixation of nitrogen by the combined cultures.

W. B. Bottomley and A. D. Hall. **Nitrogen-fixing Bacteria and Non-Leguminous Plants.** — *Nat.*, 82, No. 2095, 218-219. London, 1909.

This is a further discussion of the reliability of the conclusions drawn by Professor Bottomley on assimilation of free nitrogen by Pseudomonas in association with Azotobacter.

Prof. Bottomley states that there are four non-leguminous plants possessing root tubercles which contain nitrogen-fixing organisms. In all four a species or variety of Pseudomonas is present, but in Cycas only is Pseudomonas found living outside the cortical cells, in the algal zone, and in Cycas only is Pseudomonas found in association with Azotobacter.

Professor Hall is inclined to think that all differences observed in Professor Bottomley's experiments are within the limits of experimental error.

Experiments with Nitro-bacterine at Wisley. — (*Journal of the Royal Horticultural Society*, Vol. 35, part III, p. 391). *The Gardeners' Chronicle*, No. 3616, p. 248, April 16, 1910.

Trials with nitro-bacterine were carried out at Wisely during the summer of 1909. The plant selected for inoculation was the French Bean, variety Canadian Wonder. A dressing of chalk was applied to the ground, the land was then bastard trenched, but no manure was added. The nitro-bacterine—that is the preparation of the bacterium *Rhizobium leguminosarum* was presented by Prof. Bottomley.

The results indicate that neither the steeping of the seed in nitro-bacterine nor watering the soil therewith, effects any increase in the crop. A comparison of yields from the inoculated and uninoculated plots gave the following average results:

Plots inoculated once, produce	787	grams
Plots inoculated twice, produce	727	»
Plots uninoculated, produce	782	»

Attempts to increase the yield of non-leguminous crops by the use of nitro-bacterines gave similar negative results. The experimental evidence indicates that the nodule bacterium is so widely distributed in the soil of England that inoculation of sown seed takes place inevitably and that the artificial inoculation of seed with cultures of the nodule organism is superflous.

J. Augustus Voelcker. **Inoculation Experiments at Woburn.**— *Journ. of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 362-388.

The field experiments on inoculated lucerne and white clover, begun in 1908, were continued, although those with Argentine lucerne suffered much from fungoid attack and were not continued after the first cutting. The white clover continued quite good.

The inoculation with "nitro-bacterine" was renewed by spreading, on the plots, soil which had been treated with the preparation. This was done on June 3rd, 1909.

The first cutting was taken on August 20th and the weights are given in the following table.

The differences of weight shown in one plot as compared with another are due to previous manuring. As between the inoculated and the not inoculated halves of each plot, there was, as regards the lucerne, a general agreement that the inoculation had not been beneficial.

With the white clover, there was a small gain with the inoculation of the Dutch white clover, as there had been also in 1908. With the Mammoth white clover there was a loss, though the 1908 experiment had not shown any.

Lucerne and white clover; seed inoculated and not inoculated. Green produce per acre (4046 sq. met.), 1909.

	Inoculated					Not inoculated				
	T	cwt	qr.	lb.	kilogr.	T	cwt	qr.	lb.	kilogr.
Argentine Lucerne Plot 1	—	5	1	16	274	1	6	3	24	1368
» » » 2	—	16	0	20	822	2	3	0	16	2189
» » » 3	1	1	2	8	1095	1	6	3	24	1368
» » » 4	—	10	3	4	548	—	13	1	26	684
» » » 5	—	18	3	14	958	1	8	1	7	1437
» » » 6	2	3	0	16	2189	2	13	3	20	2737
» » » 7	2	3	0	16	2189	2	19	1	8	3011
» » » 8	3	15	2	—	3832	5	2	1	24	5200
» » » 9	3	15	2	—	3832	4	11	2	20	4653
» » » 10	2	13	3	20	2737	2	19	1	8	3011
Dutch White Clover . . .	6	10	—	—	6598	5	17	2	—	5964
Mammoth White Clover . .	4	7	2	—	4441	5	5	—	—	5329

R. P. WRIGHT. **Bean-inoculation experiments in Scotland in 1905 and 1906** —(*West of Scot. Agr. Col. Ann. Rpt.*, 9, 1909, pp. 80-98). *E. S. R.*, March, 1910. Washington.

During 1905, 16 experiments were conducted to determine the value of inoculation, but with contradictory results on each of the types of soil used. During 1906 the inoculation trials were discontinued and the scope of the experiments was altered to include the entire subject of manuring. The results with various fertilizers differed so widely that final conclusions are withheld pending further trials.

Inoculation of lucerne in Scotland. — *(Bull. of the West of Scotland Agricultural College*, n. 5). *Nature*, August 1910, p. 211.

Contains an account of experiments on soil inoculation for the lucerne crop. Lucerne is not at present cultivated in Scotland, and the necessary bacteria are presumably not present to any great extent in the soil. Addition of the organism by inoculation has proved successful.

E. J. Russell and H. B. Hutchinson. **The Effect of Partial Sterilisation of Soil on the Production of Plant food.** — *The Journal of Agr. Science*, Vol. III, Pt. II. Oct. 1909, pp. 111-154.

The action on soils of heat and volatile antiseptics like carbon disulphide, toluene, etc., has been studied by several investigators, notably by Koch and Hiltner and Störmer. Darbishire and Russell in a recent publication (*Jour. of Agr. Science*, 1908, vol. II, p. 305) have shown that the property is a general one, holding for all the soils and volatile antiseptics examined and for all the plants excepting those of the leguminous order. Thus, when a soil had been heated to 95° C. it produced two, three, or sometimes four times as much crop as a portion of the soil which had not been heated, whilst treatment with volatile antiseptics, led to an increase in crop varying between 20 and 50 per cent. The treatment had in some way brought about a considerable increase in the amount of plant food (nitrogen, phosphorus, and potassium) obtainable by the plant; such results were obtained not only with fertile soils but also with an exhausted Rothamsted soil.

Several hypotheses have been put forward to account for the increased productiveness: chemical reactions between antiseptic and soil, purely physiological action, etc.

Hiltner and Störmer attribute the action to the changed bacterial flora, they showed that the first effect of the antiseptic is to reduce the number of organisms; but when the conditions again become favourable the survivors multiply with extraordinary rapidity and bring about a more intense production of nitrogenous plant food in the soil. They supposed that a larger amount of atmospheric nitrogen is "fixed" and the complex substances thus formed in the bacterial cells are slowly broken down to yield plant food. Other investigators have also supposed that increased nitrogen-fixation is the main cause of the increased productiveness.

On the other hand, Koch maintains that nitrogen-fixation is decreased by partial sterilisation. Störmer considers that the larger organisms are killed and decomposed by the surviving bacteria, with production of ammonia. The dark green colour of the plants grown on partially sterilised soils has generally been regarded as an indication that the nitrogenous food stuff in the soil has in some way been increased by the treatment.

The authors give in this volume of the Agricultural Science Journal a statement of the experiments made by them in this field and the conclusions to which these experiments lead.

The soil employed in the experiments was taken from an arable field and contained moderate amounts of nitrogen, organic matter, and calcium carbonate. Partial sterilisation was effected either by heating to 98° C. or by addition of 4 per cent of toluene, which at the end of three days was allowed to evaporate by spreading out the soil in a thin layer for as long as necessary. In a third series of experiments the toluene was left in the soil during the whole of the experimental period. A fourth series consisted of untreated soils. A few experiments were also made with soils heated to 125° C., at which temperature all organisms are killed.

After treatment the soils were moistened and kept for definite periods in bottles stopped with cotton-wool at the ordinary laboratory temperature. In these circumstances various changes soon set in; in fact bacteria multiply more rapidly and reach far higher numbers in the partially sterilised than in the untreated soils, from 6 millions to 40 millions per gram. Considerable evidence was obtained that the whole surviving bacterial flora is more active than the original one in effecting the decomposition of nitrogenous organic substances such as peptone etc., and in hydrolising urea; that the comparative inertness of the bacteria in the untreated soil cannot be caused by any bacterial factor; that by toluening or heating the soil this non-bacterial factor, limiting the development of bacteria, is put out of action.

The limiting factor must be biological. Large organisms such as infusoria, amoebae and ciliata were not found in the heated soil, and only small ciliate infusoria were found in the toluened soil, while all these organisms are found in the untreated soil.

The authors therefore conclude that these large organisms (protozoa, etc.) constitute the factor or one of the factors limiting the bacterial activity and therefore the fertility of the untreated soil. Direct evidence of this fact is furnished by inoculating toluened soil, or soil extract, with cultures of large organisms, thus determining the consequent depression in the rate of ammonia formation.

Not only does partial sterilisation kill these destructive and competing organisms and thus make the conditions more favourable for the new bacterial flora, but indirectly increases the food supply, as dissolution of killed protozoa by the bacteria could be observed under the microscope.

So far as plant growth is concerned, in partially sterilised soils this growth is greater and plants contain an increased percentage of nitrogen and phosphoric acid; organic matter in the soil being mode rapidly decomposed with production of a greater amount of ammonia, but no nitrate.

In order to ascertain in what form plants take up their nitrogen from partially sterilised soils two series of experiments were made in special conditions, so that no infection could take place. The percentage of nitrogen in the dry matter of the rye cultivated was higher where no nitrate was formed in the soil, i. e. in the two heated soils and the inoculated toluened soil. Nitrification is therefore not essential to plants, but it may be economical.

B. DYER. **Fertilising effect of Soil Sterilisation.** — *Nature*, vol. 83. March 24, 1910, p. 96.

Some of the large growers of cucumbers, tomatoes, etc. under glass for the London market have for some little time adopted the plan of injecting jets of steam into their soil before planting, not with any view of increasing its fertility, but with the view of destroying slugs, insects, etc. In the experience of some growers, the productivity of the soil after steaming has become so greatly increased that, if anything like the usual quantity of stable manure is mixed with the soil, the plant grow with such rank luxuriance as to spoil their bearing capacity, exhibiting all the symptoms corresponding to an overdose with nitrogen. The growers were unaware of the Rothamsted experiments on heat-sterilisation of soils. The observation appears to afford striking independent confirmation on a practical scale of the indirect fertilising effect of partial sterilisation in killing off the protozoa which normally keep down the numbers of those bacteria that prepare nitrogen-food for plants.

XVIII.

Theories of fertiliser action. Experiments with fertilizers. Experimental fields. General considerations on field experimentation. The effect of manures on soils and on vegetation. Influence of manures on different crops. Manuring in regard to climate.

A. D. Hall. **Fertilisers and Manures.** — J. Murray, London, 1909. Pp. xv-384 and illustr. 9).

" If this book, says the author, is to have any justification for its existence, it will be by helping men to a greater skill and knowledge in the use of their fertilisers and manures. There is no lack of books which give an account of the origin and composition of fertilisers; my object is rather to make the reader understand their mode of action and their relation to particular crops and soils. For it is only by understanding the why and the how that a farmer can properly adjust his manures to his soil and his style of farming; he must to some extent reason the scheme out for himself, he cannot simply be told."

" The object, then, of the scientific man should be to lay down principles which the practical man in his turn must learn to apply to his own conditions; success is only possible when he too does some thinking. Further more, the object of experiments should be to provide knowledge that can be thus applied to other conditions, and an experiment is practical just in so far as it carries out its avowed object, which is to lead men into a sound and fruitful way of thinking on the question at issue.

" It is in this respect—the elucidation of general principles—that the Rothamsted experiments have proved so exceedingly valuable; though initially laid out to test certain definite questions about the nutrition of crops, the answers to which have long since been absorbed into farming practice, the design was so sound and the continuity of the record has been so rigorously maintained that the results now afford an instructive commentary on the whole range of the science of crop production. We have by no means come to the end of the lesson the Rothamsted experiments can teach: every new theory, each extension of our knowledge, finds an unsuspected criticism or an illustration in the records that are still accumulating."

The book, intended for farmers and for the senior students and teachers in agricultural schools, is divided into the following 13 Chapters: Introductory; Fertilisers containing nitrogen; The function and comparative value of nitrogenous manures; Phosphatic manures; The function and use of phosphatic fertilisers; The potassic fertilisers; Farmyard manure; Peruvian guano and other mixed fertilisers; Materials of indirect fertilising value; Theories of fertiliser action; Systems of manuring crops; The valuation and purchase of fertilisers; The conduct of experiments with fertilisers.

Notwithstanding that cases may be quoted where the use of pure culture of nodule-forming bacteria has been of great service, generally on newly reclaimed soils, the author states in Chapter II, that "at the present time we cannot be satisfied that any improved race of bacteria introduced artificially into the soil has managed to persist and get a real footing in face of the enormous natural bacterial flora already existing there."

At Chapter III, we are reminded, that one of the most important effects upon plants of an excess of nitrogen is their increased susceptibility to fungoid attacks of all kinds. Thus, in seasons when rust is prevalent the high nitrogen plots at Rothamsted are markedly the more rusty; the grass plots are also marked by their special rusts; and, again, such a characteristic grass fungus as *Epichloe typhina* is generally common enough on the high nitrogen plots but absent from the others. "But susceptibility to disease brought about by an excess of nitrogen is perhaps most strikingly seen at Rothamsted on the mangold plots, though the mangold is a plant which, as a rule, suffers but little from fungoid attacks. In September, however, the leaves of the mangolds at Rothamsted that receive an excess of nitrogen begin to be attacked by a leaf spot fungus, *Uromyces betae*, which develops rapidly until on the worst plots all the larger leaves turn brown and present a burnt-up appearance, because the spots of destroyed leaf tissue have become so numerous as to run together."

The deflocculating effect of potash salts, is pointed out in Chapter VI, as demonstrated by the appearance of the soil on certain of the experimental plots at Rothamsted, where considerable amounts of potash salts are applied every year.

The percentages of water in Rothamsted soils referred to in Chapter VII, show that the dunged soil, rich in humus, has retained more of the comparatively recent rainfall near the surface, so that the top soil was moister, while the subsoil was drier.

Perhaps one of the more important chapters is Chapter IX, where the action of lime is rightly emphasized.

"It is difficult to exaggerate the improvement that lime effects in the dryness and workability of strong soils, which in many cases would not be fit for arable cultivation had they not been so treated. It has been already mentioned that on the Rothamsted estate the custom of chalking has added from 2 to 5 per cent of carbonate of lime to the surface soil, which is otherwise non-calcareous; but on one of the fields, formerly under experiment, the treatment has never been carried out. This field, Geescroft, formerly carried experimental crops of oats and beans; but during the rainy seasons about 1879 the land lay so persistently wet late in the spring that on several occasions a tilth could not be obtained in time for sowing, and the land had to lie fallow, until at last cultivation was abandoned and the field was allowed to fall down into grass. Even now the herbage is very inferior and shows the wet character of the soil by the prevalence of *Aira cæspitosa;* yet in situation, drainage, and mechanical composition this soil is in no respects different from that of the other Rothamsted fields. The essential factor which has caused all the difference in the character of the two soils is the absence of calcium carbonate from the Geescroft field, which for some reason had escaped the chalking given to the other fields. The physical improvement of a clay soil by lime is not apparent at once but grows from year to year after the application of lime; the flocculating action is really not due to the lime itself but to the soluble calcium bicarbonate which arises from the action of water and carbonic acid upon the calcium carbonate formed from the lime."

In Chapter X, it is stated that, "as it stands at present, Whitney's theory must be regarded as lacking the necessary experimental foundation"; on the other hand, the Rothamsted experiments "have shown that wheat can be grown continuously upon the same land for more than fifty years, and that the yield when proper fertilisers are applied remains as large in the later as in the earlier years of the series; any decline that is taking place is hardly outside the limits of seasonal variation and can easily be accounted for by the difficulties of tillage and the increase of one or two troublesome weeds. Mangolds again show no falling off in yield, though they have now been grown upon the same land for thirty-two years; but with the barley crop, despite the application of fertilisers, there is a distinct secular decline in the yield."

In discussing, in Chapter XI, the application of fertilisers to crops, the author says, that "instead of applying a kind of average manure, the farmer ought to have such an appreciation of manurial principles that he can adopt his fertilisers as economically as possible to his own soil and conditions of farming." "The mixtures sold as "Turnip Manures," "Potato Manures," and so forth, must be in the majority of cases more or less wasteful if they are to be effective everywhere."

In the concluding Chapter, on "The conduct of experiments with fertilisers," the author insists that it is of particular importance that the degree of accuracy which may be expected from a series of field experiments should be realised before any scheme of experimentation is embarked upon. "Nor must it be supposed that by any amount of care the experimental error can be got rid of; there are various ways by which it may be diminished, but in some form, or other it must exist in all work involving measurements, and the only scientific method of dealing with it is to estimate its magnitude and to draw no conclusions from results which are not well outside that magnitude." For example, applying to results drawn from the Rothamsted experiments the method of least squares, the mean error of a single year's result is calculated $\pm$ 10 per cent, and the probable error of the fifty years'mean is only $\pm$ 1.9 per cent.

As to the size and distribution of experimental plots those adopted in the Danish experiments conducted by Dr Sonne upon the relative value of different varieties and management of barley are reported. The plots are about 1/80 acre each (50 sq. metres), and at any one station there are always four plots receiving the same treatment, arranged about the field as follows:

A	F	E	G
B	G	D	F
C	A	C	E
D	B	B	D
E	C	A	C
F	D	G	B
G	E	F	A

The author believes that, considering the care with which field experiments are to be conducted and the large margin of error inherent in their results even under favourable conditions, "they are hardly to be lightly entered upon by the ordinary busy farmer, and that the advice so often given him to work out by experiment the manures best suited to his own farm would really involve a disproportionate amount of work."

" In field experiments, using the author's concluding words, as in all other applications of science to agriculture, the problems involved are so complex, the factors which intervene are so various and unexpected, that the greatest rigour and technical skill are called for in the conduct of the investigation, to be followed by an even greater measure of scientific caution in interpreting the results."

Woburn Experimental Station. Visit of the Royal Agricultural Society.—*The Scotsman*, 16th July, 1910. Edinburgh.

One of the most important of the undertakings carried on by the Royal Agricultural Society of England is the experimental farm at Woburn, Bedfordshire. The ninth Duke of Bedford offered the use of this farm to the Society in 1875, and ever since it has been applied to agricultural investigation.

The farm consists of 140 acres (56.65 hectares), 100 of which (40.46 hectares) are arable land, and the remainder grass. The soil is a light sandy loam, the top soil being about 9 inches (o. m., 23 centimetres) deep, and the subsoil consists of sand. .

At the Rothamsted Experimental Station the top soil is a heavy loam containing many flint stones, the subsoil being a stiff clay resting on chalk. Thus the one may form quite well a complement of the other. This was the view of the R. Agric. Soc. of England in starting the Woburn farm in 1877, which is conducted chiefly, with the intention of finding out in a methodical scientific way what the specific values of various types of plant food may be. The staff is a very competent one. The director is Dr. J. Augustus Voelcker who contributes annually a report of the results obtained to the Society's Journal. Every year a visit of the members of the Society is made to the farm. This year some seventy visitors were present.

One of the features of the farm is the pot-culture station which was instituted in 1897 in consequence of a bequest by Mr. E. H.

Hill. It consists of a completely equipped laboratory, a conservatory and a wired-in space, and is devoted to the examination and analysis of soils and agricultural products. Here also experimental work is carried out in conjunction with the field experiments. The rarer constituents of the soil, their action on plant life, the extermination of weeds and fungoid pests, etc. have been investigated and reported on.

The soil of Woburn is deficient in lime and many interesting experiments in connection with this fact have been made. The original idea of the experiments was to ascertain if the results obtained by Gilbert and Lawes at Rothamsted would be borne out by those at Woburn for 34 years, the manurial constituents being the same from year to year.

In the wheat experiments the crops derived from unmanured land averaged during the 20 years between 1877 and 1896, 14.7 bushels per acre (13.23 hectl. per hectare), during the next ten years, 1897 to 1906, 8.6 bushels per acre (7.74 hl. per hect.), and during 1909 a further drop took place to 7.5 bushels per acre (6.75 hl. per hect.).

Mineral manures alone have had a very poor effect, whilst when applied with nitrogen as nitrate of soda the crops have been nearly doubled. With mineral manures and half the quantity of nitrogen derived from sulphate of ammonia the yield was more than doubled. The continued use of ammonium salts for 20 years gave similar results to those produced by nitrate of soda. After that time the soil had become acid and the crops rapidly dwindled away, the yield being at once restored by the application of lime.

The deteriorated condition of the soil exhibits itself at Woburn in the production of the weed spurrey (*Spergula arvensis*) which however disappears on the application of lime. The quantity of lime used was 2 tons per acre (5 000 kgr. per hect.).

The study of the different nitrogenous manures has been continuous at Woburn. Sulphate of ammonia, nitrate of soda, rape dust and farmyard manure have been compared.

In determinating the value of inexhausted manures recourse is generally had to the tables constructed by Lawes and Gilbert. Experiments were instituted to confirm or if necessary alter the above tables. The exact composition of the cakes and meal fed to the animals on the farm, of the manure obtained and of the resulting produce had to be ascertained, thus entailing a long and interesting work.

The part played by leguminous plants in fertilising the soil has been the subject of many new researches at Woburn, and the results have been of great interest.

Experiments have also been made with some non-leguminous plants, such as rape and mustard, used as green manure and the results have been so good as to raise the doubt that the nodule theory of Hellriegel is not quite perfect.

Besides the above mentioned many other subjects have been investigated at Woburn such as the residual values of top dressings, the laying down of grass lands, the improvement of old pastures, the use of magnesia in potato growing, the growing of lucerne, etc.

J. Augustus Voelcker. **Pot-culture Experiments and on Inoculation of Leguminous Crops, at Woburn, in 1908.**—*Journal of the Roy. Agr. Soc. of England*, Vol. 70, 1909, pp. 388-395).

The work at the Pot-culture Station at Woburn of the Royal Agr. Society of England, in 1908, embraced the following:

1) The influence of lithium and potassium salts on wheat. (Exp. with the Hill's Fund).
2) Green manuring experiments.
3) Experiments on the influence of magnesia in soils.
4) " with fertilisers on fen-soil.
5) " with the acid soil of plot 2[a]-continuous barley.
6) " on the inoculation of leguminous crops.

The influence of Lithium and Potassium salts on wheat.

The salts of lithium used were the chloride, carbonate, sulphate and nitrate, in a quantity supplying the soil with 0.00375 per cent of the metal lithium. Along with this experiment was a similar one with the corresponding potash salts, in quantities to supply the soil in each case with 0.0075 per % of the metal potassium. The seed germinated well.

When the produce was weighed the following results were obtained:

	Corn		Straw	
	Weight	Percentage of untreated	Weight	Percentage cf untreated
	grammes	per cent	grammes	per cent
No treatment.	29.40	100 —	47.92	100 —
Lithium chloride.	19 37	65.90	25.16	52.50
» sulphate.	17.65	60 -	23.79	49.60
» carbonate	14.73	50.30	19.66	41 —
» nitrate	21.82	74.50	31.16	65.10
No treatment.	29.40	100 —	47.92	100 —
Potassium chloride	29.80	101.40	46.95	97.90
» sulphate	29.10	99.01	50.08	104.50
» carbonate	26.56	90.30	43 —	89.70
» nitrate	31.37	106.70	48.14	100.40

From these figures it will be seen that in every case where lithium salts, even in so small a quantity as 0.00375 parts of lithium in 100 parts of soil are present, a harmful influence will be exerted on a wheat crop.

The experiments will be continued with smaller quantities of lithium.

Experiments on the influence of magnesia in soils.

Previous experiments having shown that magnesia applied as such to the soil of Stackyard Field produced very marked results on the wheat crop according as the proportion of magnesia to lime increased, experiments were carried out with a view of ascertaining if this held good with the insoluble forms only, and what would be the effect of magnesia in the form of carbonate, and as dolomite.

The soil of Stackyard Field contains 0.40 % of lime and 0.20 % of magnesia and it had been found that by adding magnesia (Mg O) so as to bring the proportion of this substance in the soil above that of the lime contained, the crop was proportionally diminished, the character of the roots altered and the grain from "soft" or "starchy" changed into "hard" or "glutinous" wheat.

The materials added to the soil in this experiments were:

1) Lime and magnesia.
2) Carbonate of magnesia.
3) Sulphate of magnesia.
4) Dolomite finely ground.
5) Lime from dolomite.

Wheat was sown in November, and came up well in all the sets. The results are given in the following table.

	Corn		Straw	
	Weight	Percentage of untreated	Weight	Percentage of untreated
	Grammes	Per cent.	Grammes	Per cent.
No treatment	30.54	100	52.96	100
Lime and magnesia added. .	41.87	137	64.81	122
Carbonate of „ „ . .	42.83	140	72 —	135
Sulphate of „ „ . .	26.51	86	53.25	100
Dolomite (finely ground) „ . .	34.84	114	59.23	112
Lime from dolomite „ . .	42.59	139	69.88	132

N.B. The soil after mixing containing in each case Ca O 0.80 %. Mg O 0.40 %.

Very striking were the results produced on the grain. The wheat from the untreated and from the ground dolomite sets was found to be almost or entirely "starchy" in character, whilst in every other case where there had been a marked increase in the crop, the grain was decidedly glutinous.

Analyses of the grain gave the following percentages of nitrogen.

	Nitrogen in grain per cent.
No treatment.	1.19
Lime and magnesia	1.58
Carbonate of magnesia	1.33

	Nitrogen in grain per cent.
Sulphate of magnesia	1.33
Dolomite (ground)	1.22
Lime from dolomite	1.36

Experiments on the inoculation of leguminous crops ("Nitro-bacterine").

The crops tried were:

1) Ordinary white clover.
2) Mammoth white clover.
3) Red clover.
4) Lucerne.

The seeds were sown on June 16th, 1908. There was not much difference between the inoculated sets. The weighings of the first cuttings yielded in green produce:

	Not inoculated grammes	Inoculated grammes
Ordinary white clover	211.6	237.1
Mammoth	204.3	227.1
Red clover	211.–	215.6
Lucerne	76.4	72.9

A. D. Hall. **Some Secondary actions of Manures upon the Soil.**—*Journal of the R. Agric. Soc. of England.* Vol. 70, 1909, pp. 12-35.

The Director of the Rothamsted Experimental Station (Lawes Agricultural Trust) investigates the loss of carbonate of lime in cultivated soils caused by the action of fertilizers.

Samples of soils from the Rothamsted plots were taken from one field in 1865, 1881, 1893 and 1894 and from other fields in 1867, 1868 and 1873 so that the effect of thirty years action of the manures can be ascertained.

The following table gives the amounts of carbonate of lime, calculated as pounds per acre (kgr. 1. 123 per hectare), in the surface soil from certain of the plots in the Rothamsted fields at the dates given, while the last column of the table gives the average annual loss deduced from these figures.

TABLE I. — LOSS OF CARBONATE OF LIME FROM ROTHAMSTED SOILS.

Field	Plot	Manuring	Carbonate of lime, lb. per acre		
			Earliest date	1904	Average annualo loss.
Broadbalk 1865. . . .	3	Unmanured	110,500	90,200	800
—	2.b	Dunged	100,400	85,100	590
—	6, 7, 8, 10	Ammonium salts	85,300	61,800	1100
—	9	Nitrate of soda	106,000	92,700	565
Hoos 1881	10	Unmanured	86,800	63,900	(1) 1000
—	1 and 4 A	Ammonium salts	54,300	37,500	775
—	1 and 4 N	Nitrate of soda	59,500	42,500	595
Agdell 1867	—	Unmanured	159,400	117,700	936
Little Hoos 1873 . . .	—	Unmanured	103,000	70,500	1046

(1) Another plot more fairly comparable with the plots which follow lost at the rate of 675 lb. p. acre, corresp. to 756 kgr. per hectare.

Another problem was set up when Dr. Voelcker observed that the soil of the permanent wheat and barley plots at Woburn, which had been receiving ammonium salts for about 20 years, had become actually acid to litmus paper and had rendered the land unable to carry barley without a comparatively light dressing with lime.

It was observed also that one of the Rothamsted fields contained plots which were cut for hay every year and on which the soils had become acid through the application of ammonium salts year after year for a long period.

Half of each of these plots was limed, 2000 lbs per acre having been applied in 1903 and again in 1907.

Table II shows the great increase of crop which has followed the liming.

TABLE II. — EFFECT OF LIME UPON ROTHAMSTED GRASS PLOTS.

Relative yield of hay on the limed portions, the unlimed part being taken as 100.

Plot	Manuring	1903	1904	1905	1906	1907	1908	1909
4/2	400 lbs (1) ammonium salts + superphosphates . . .	124	111	134	118	113	127	237
9	400 lbs ammonium salts + complete minerals . . .	121	110	142	128	106	118	150
11/1	600 (2) ammonium salts + complete minerals . . .	115	103	206	120	167	115	119

(1) 400 lbs per acre = 448 kgs. per hectare.
(2) 600 lbs per acre = 672 kgs. per hectare.

Another example of these secondary actions between fertilizers and the soil which are not immediately apparent is afforded by nitrate of soda.

All farmers upon clay have recognized that the use of nitrate of soda leaves the land very wet and sticky.

Mechanical analyses were made of the soils, and it was surprising to find that the nitrated soils were, contrary to expectation, distinctly and regularly coarser, by the loss of some of their finer particles, instead of having undergone a disintegration accompanied by a greater production of these.

Table III gives the average mechanical analyses of five pairs of plots from the different Rothamsted fields; in each pair there was a plot receiving nitrate of soda and one ammonium salts.

TABLE III. — PERCENTAGES AFTER IGNITION.

Mean of five plots	No sodium nitrate	With sodium nitrate
Fine gravel	2.2	2.1
Coarse sand.	6.1	6.7
Fine sand	18.8	18.8
Silt	29.5	29.9
Fine silt	14 —	13.9
Clay	17.9	15 —

It was clear that there was some substance in the nitrated plots which had brought the soil into a deflocculated condition and this substance could not well be anything else than an alkali. On testing, in fact, the soils from the nitrated plots were found to be slightly alkaline.

TABLE IV. — SHOWS THE QUANTITIES OF CARBONATE OF SODA IN POUNDS PER ACRE (KGS. 1.12 PER HECTARE) IN SOIL OF PLOT 14.

1st depth	2nd depth	3.d depth	4th depth
0 to 9 inches (0 to 228 m/m)	9 to 18 in. (228 to 459 m/m)	18 to 27 in. (459 to 685 m/m)	27 to 36 in. (685 to 914 m/m)
66	37	33	39

SUMMARY.

1) The long continued use of sulphate of ammonia on soils poor in lime results in the soils becoming acid.

2) The acidity is caused by certain micro-fungi in the soil which seize upon the ammonia, setting free sulphuric acid.

3) The infertility of such soils is due to the way all the regular bacterial changes in the soil are suspended by the acidity.

4) The remedy, as may be seen at Woburn, is the use of sufficient lime to keep the soil neutral.

5) From the Rothamsted soils the carbonate of lime is being washed out at the rate of 800 to 1000 lbs per acre (896 to 1120 kgs. per hectare) per annum. The losses increase with the use of sulphate of ammonia and diminish by dung or nitrate of soda.

6) Nitrate of soda, in large quantities, destroys the texture of heavy soils.

7) Some of the nitrate of soda gets converted into carbonate of soda by the action of plants and bacteria; and carbonate of soda, deflocculating the clay particles, destroys the tilth.

8) The best remedies are the use of soot or superphosphates; the best preventive is the use of a mixture of nitrate of soda and sulphate of ammonia instead of either separately.

9) Soluble potash manures and common salt may also injure the tilth of heavy soils through the production of a little soluble

alkali by interaction with carbonate of lime in the soil. The remedy is to apply such manures in the winter or in conjunction with superphosphate.

E. J. RUSSELL. **The nitrogen problem in crop production.** — (*Journ. Roy. Agr. Soc. England*, 69, 1908, Pp. 104-114) *Exper. Stat. Rec.*, Vol. XXII, No. 3, Febr. 1910, Washington.

This article is based mainly upon investigations made at Rothamsted and discusses the sources of nitrogen available to the farmer, including nitrogen compounds in the soil, purchased manures, purchased feeding stuffs, nitrogen fixed by bacteria alone and in symbiosis with leguminous plants, and losses of nitrogen on the farm due to drainage and to bacterial action. The value of a rotation adapted to the maintenance of the nitrogen supply is pointed out.

Some recent Agricultural Field Trials in Great Britain. — *Nature*, Vol, 83, p, 313. London, May 12, 1910.

A Review of the following articles:

" West of Scotland Agricultural College, Reports on experiments; Durham County Council Education Committee, Report of Dairy Investigations; Northumberland Education Committee, Guide to Experiments for 1909; East Sussex Education Committee, Experiments on Meadow Hay; Agricultural Students' Gazette, Experiments on Pasture; Journal of the Department of Agriculture and Technical Instruction for Ireland.

" Field experiments are perhaps the most difficult of all experiments to interpret. The growth of plants is influenced by so many factors—temperature, water supply, food supply, etc.—that small variations in the condition may lead to marked differences is result. The soil is a very complex mixture, and not uncommonly shows some variation even within the limits of a single field. Even if the soil itself is tolerably uniform a slope may introduce irregularities. The influence of a tree or hedge makes itself felt for some distance, while the effect of the previous treatment of the ground if often very great.

" In the experiments studied in the above articles in no case is the experimental error indicated, nor can we find it has been ascertained; indeed, so far as we know, it is only at Rothamsted that the determination is made, and there, where all the conditions are favourable and the workers thoroughly competent, it amounts to 10 %.

"In the Sussex experiments a number of plots were laid out on each of 20 farms, but as the experiments only lasted one year it is impossible to draw any definite conclusion.

"The experiments in Nothumberland have been carried out over several years and they illustrate the value of basic slag in improving poor clay pastures. On the light soils, potash has been found very effective.

"The Cirencester experiments on pasture have been going on for 18 years and show some interesting results, differing in many ways from those obtained at Rothamsted. Thus the plot receiving sodium nitrate alone was poor, tufted, and worse than the plot receiving ammonium sulphate alone. *Ustilago* was most prevalent on the plot receiving kainit alone."

XIX.

Organic fertilisers. — Green manuring. Sea-weeds and other vegetable refuse as manure. Composts. Peat in manuring. — Dung and Urine. Farmyard manure. Night soil. Utilisation of town-sewage. Animal refuse as manure. Guanos. Manure value of cattle-feeds.

EDWARD J. RUSSELL. **The Composition of Seaweed and its Use as Manure.** — *The Journal of the Board of Agriculture,* N. 6, September 1910, p. 460.

The light soils of the Isles of Scilly are very dependent on a supply of organic matter to retain moisture; as much as 50 tons of seaweed per acre is therefore applied for early potatoes, nearly as much for mangolds and other roots, but smaller dressings are put on for corn. A certain amount is also allowed to rot in piles, and is then used for bulb cultivation and general garden purposes.

Fucus serratus is most popular and enjoys the highest reputation, whilst the thick fleshy strands of *Laminaria* are least thought of: indeed, it is considered that they injure the soil if used too freely. The weed is generally gathered between September and March, and is by far the most important fertiliser in the Islands.

In the Isle of Thanet sea-weed is used in several ways. The fresh weed is spread at the rate of ten to fifteen tons per acre over lucerne or sainfoin in the early autumn, and then raked off in spring, just before the crop starts. It is also put on the land at the rate of ten to fifteen tons per acre before ploughing, and is found to be very beneficial to such market-garden crop as cabbage, celery, asparagus, &c., as well as the ordinary farm crops. Some is also thrown into the dung mixen.

However, it cannot be said to be a very important manure at the present time, and is collected only when other work can be left, the reason probably being that cartage is heavy. A load weighs about a ton, and often requires two horses to get it from the shore; the enormous quantities thrown up by high tides when the wind is from the north or north-east making a fringe along the high-water mark which may be three or four feet in thickness, sometimes prove more than the market gardeners and farmers on the coast can profitably deal with.

A considerable amount of seaweed is collected in Scotland, where the right of gathering still sometimes forms part of the covenant with the landlord, and has even been the subject of litigation. It appears to be held in special favour on the south-west coast, where there is a good deal of light soil, and cartage presents no particular difficulties; indeed, it is perhaps the chief manure used for early potatoes on the Ayrshire coast, being applied at the rate of 25 to 30 tons per acre in autumn, and then ploughed in. What is gathered in summer is put on top of the "middens" till wanted. Further up the West coast, and also on some of the islands, seaweed is used by the crofters, but it does not appear to be held in so much favour on the East coast, excepting where it can very readily be obtained.

Seaweed is largely used on the Irish coast and on the French coast. At Mont St. Michel there is a considerable trade in seaweed as manure. It is also of great importance in some of the New England coast districts.

The composition of seaweed shows some variation with the time of cutting. Mr. Toms' analyses of Jersey seaweeds, made at different times of the year, indicate that weed cut in October is poorer than that cut in March or May. His results are:

		Fresh weed		Percentage composition of the dry matter					
		Water	Dry matter	Organic matter	Nitrogen	Ash	Potash	Lime	Phosphoric acid.
		%	%						
Fucus cut	March . . .	77.4	22.6	81.4	1.91	18.6	2.62	1.3	0.36
	May . . .	73.4	26.6	79.5	1.98	20.5	2.26	2.1	0.20
	October . .	76.6	23.4	79.3	1.16	20.7	2.50	1.3	0.85
Laminaria drift	March . . .	87.0	13.0	65.0	3.06	35.0	3.45	1.96	1.29
	May. . . .	78.0	22.0	74.0	1.04	25.6	3.93	1.70	1.70
	October . .	82.0	18.0	81.7	0.96	19.3	2.34	1.65	1.65

British results are summarised as follows, the sea-weed examined being in the wet condition:

	Per Cent.	Average Per Cent.
Water	70 to 80	75
Organic Matter	13 to 20	18
Nitrogen	0.3 to 0.8	0.5
Potash	0.8 to 1.0	1.2
Phosphoric acid . .	0.02 to 0.17	0.09

A considerable amount of water is lost on drying in the air, and if the weed has not been washed by rain in the meantime, its value is increased four, five, or even six fold.

It is difficult to form an estimate of the money value of seaweed to the farmer. The fertilising materials present in 1 ton of seaweed possessing the average composition would cost 8s. to 10s. if purchased from a dealer. This value is arrived at by allowing 12s. for each per cent. of nitrogen, 4s. for each per cent. of potash, and 3s. for each per cent. of phosphoric acid. No account is taken of the sodium, calcium and magnesium salts, which on most soils, but especially light soils, would be distinctly beneficial; nor is any allowance for a possible stimulating effect of the iodides present (1).

(1) In a recent dispute on the value of seaweed at Rosyth, the values assigned by experts to sea-weed varied from 1s. per ton to 9s. 3 1/2 *d.* In the end the arbitrator fixed the value at 4s. 9*d.*

See *North British Agriculturist*, quoted in *Nature*, Aug. 4, 1910, p. 151. Ed.

E. G. Mawbey. **Land Utilisation of Sewage.**— *VIII Internationaler Landwirtschaftlicher Kongress.* Wien, 21-25 Mai 1907, Referate, Sektion V-VII, Band III, Sektion V, Rapport 2/B. Wien, 1907.

The main conclusions arrived at by the author are:

"The trend at the present time in the British Isles is towards artificial treatment of sewage, chiefly by tanks and bacteria beds, because of the many instances where suitable land is not available, or the cost is entirely prohibitive, and because of some prejudice against sewage farms through mismanagement, etc.; also because artificial processes can be more uniformly controlled in all weathers.

"The ruling factors which determine in each case the method of treatment to be adopted are the local conditions such as the situation, levels and nature of available land, its cost and proximity to inhabited areas, the nature of the sewage, and particularly by which method the sewage can be rendered harmless, without nuisance in treatment, at the lowest cost to the community.

"Most soils will purify sewage if the quantity applied is in proportion to the purifying capacity of the land, which, however, in some cases may be too small to justify land treatment alone.

"The best effluents, both chemically and bacteriologically, are obtained from light loamy soils overlying a porous subsoil such as gravel, or coarse gravelly sand.

"The difficulties caused by the heavy clay soil at Leicester have been overcome and satisfactory effluents obtained by the method conceived and adopted of providing a separate and independent system of drainage for each field below, at which the drain effluent can be run on to the surface of the lower land again and again for further treatment, and when sufficiently purified, discharged into the effluent drain close by.

"Low-lying flat clay land would not be so suitable for this treatment.

"Crude sewage can be treated on very light porous land, but there are inevitable and serious drawbacks to this method with all kinds of soil.

"In the author's experience and practice, considerable success has been achieved by the clarification and preliminary purification of sewage by bacterial treatment in tanks and first contact bacteria beds, and then by final purification on old pasture land, from which excellent effluents are obtained and the fouling of the grass by sewage matter avoided.

"Twelve acres of first contact bacteria beds have been constructed at Leicester for this purpose.

"After bacterial clarification, a much greater volume can be efficiently purified per acre of land, and even where complete bacterial purification is adopted, and where the levels of bacteria beds and adjoining land are favourable, the effluent could in some cases with great advantage and some profit be used for irrigating ordinary agricultural land, especially in dry seasons, the organic matter of the sewage having been largely converted into inorganic substances in the best form and condition for the nutriment of crops without fouling them.

"Other advantages of preliminary clarification are the avoidance of large areas of uncropped land for receiving crude sewage; the saving in cultivation expenses; increased income from cropped land; and the avoidance of slimy sludge accumulating on the surface of grass or vegetable crops.

"The extra income derived from the greater produce of sewage-irrigated land is not commensurate with the working expenses, the rent of land and the capital outlay on the sewage disposal works; but it provides a very considerable asset, and in some cases the working expenses are more than covered; consequently, land utilisation of clarified sewage under favourable conditions minimises the cost to communities of the necessary provision of sewage disposal works."

A. H. Valentine. **The Distillation of Sewage Sludge.**—*Journal of the Society of Chemical Industry*, March 15, 1910, p. 244.

The author describes certain laboratory experiments which he had made with the sludge from the Sewage Works at Oldham., with the object of determining: *a*) the character of the products of distillation; *b*) the character of the residuum; and *c*) the conditions for obtaining the most economical results.

The sludge was acidified, roughly dried by evaporation, and broken into pieces of about one inch diameter. These were placed in a flat-bottomed cylindrical steam-jacketed copper vessel with a perforated false bottom; the vessel was capable of holding about 12 lb., the depth of material in the vessel being about one foot. Attached to the coverhead of the vessel was a long referee's gas tube dipping at the bent end into a large vessel of hot water. Superheated steam was passed into the vessel at a temperature of from 160° to 250° centigrade. At the lower temperature grease began to distil over, and was deposited on the surface of the hot water as an exceedingly voluminous snow-like mass. This was periodically scooped off and brought to the liquid condition by boiling up with a drop or two of dilute sulphuric acid. The liquid fatty acid on cooling solidified into a hard compact mass, attached to which on the under side was a layer of "foots." The quantity of "foots" seemed to depend upon various factors, such as the amount of dust in the retort, the temperature of distillation and the rate at which steam is sent through the sludge. In the same way the colour of the fat, which ranges from almost white to a reddish brown, seemed to depend upon these same factors, as well as upon the quantity of acid used in acidifying the sludge. The amount of stearic acid and allied bodies thus obtained varied from 7 to 11 per cent of the original dried material. Determination of the saponification value indicated that the product contained from 88 to 97 $^1/_2$ per cent of stearic acid. Different samples were valued by various grease distillers and soap manufacturers between the limits of £ 12 and £ 20 per ton.

The residue in the retort was found to have lost from 10 to 18 per cent of its original weight. The material burns easily with a long white flame; it is easily friable, and absorbent of water. The percentage of nitrogen closely approximates to the percentage in the original sludge, viz., from 1.7 to 3 per cent. The chemical composition and physical properties of this material indicate that it should have a value as manure. Comparative tests were made on a small scale to determine the difference in weight between vegetables grown in soils with and without the application of this material, the conditions being otherwise comparable. With carrots there was an increase in weight of 15 per cent., with beetroot of 25 per cent, and with potatoes of 18 per cent.

It is pointed out that to get the best yield of grease from sludge it is necessary that the sludge for this purpose should be obtained as far as possible in dry weather; the presence of storm water increases the percentage of useless mineral matter.

The writer suggests that the dry acidified sludge might suitably be distilled in a gas-producer so designed that the upper portion could be subjected to steam distillation alone, while the lower of two exits would take away the gases, formed by the combined action of steam and air at a higher temperature upon the residue from the first stage of the operation.

Such a process would probably work best under suction. The recovery of nitrogen as ammonium sulphate would also be an essential feature of the process.

XX.

Chalking, Marling and Liming. Gypsum as a corrective of soils. Other soil-correctives.

C. A. Stewart. **The Definition of Marl.** — (*Econ. Geol.*, 4, 1909, No. 5, Pp. 485-489). *E. S. R.*, Febr. 1910. Washington.

The various uses which have been made of the term marl are given and the author concludes that in his opinion the term " should be employed in its original sense—as any rock that is valuable as a natural fertilizer (with the exception of the phosphate rocks and such well-defined minerals as gypsum which seem to be separated in general usage)."

J. Hughes. **Value of Chalk as a Dressing for Light Soils.** | *The Journal of Board Agriculture.* July 1910, vol. XVII, N° 4, p. 306.

Observation on the agricultural value of chalk, with special reference to particular kinds of soil requiring lime in a mild form, have recently been made by Mr. John Hughes, Agricultural Analyst for Herefordshire. Chalk is but slightly soluble in cold distilled water—very much less so than caustic lime. It was found that while 1 part of caustic lime dissolves in 833 parts of water, 1 part of chalk only dissolves in 22 222 parts of water—the relative solubility being, therefore, about as 1 to 27. Under soil conditions, however, the solvent is not pure water, but " soil water," which contains various vegetable acids exerting a considerable solvent action on plant foods. It is usual, therefore, to make comparisons by the use in chemical practice of a 2 per cent solution of citric acid, originally suggested by Wagner as a standard solvent for estimating the probable availability of phosphate of lime in basic slag. Such a solution, however, is far stronger than the sap acidity of plants, and in order that an acidity or solvent action less than that possessed by the sap of farm crops should be represented, Mr. Hughes tried a 0.1 per cent solution of citric acid. With such a solution he found that 1 part of caustic lime was dissolved in 809 parts of the solution while 1 part of chalk was dissolved in 984 parts. Comparing the actual lime in quicklime with that in chalk, it appears that in pure cold water caustic lime is about 27 times more soluble than chalk, but that in the 0.1 per cent, solution of citric acid lime is only about twice as soluble as the lime in the form of chalk.

It seems clear, therefore, that if chalk be reduced by grinding to as a fine a condition as caustic lime, it will be sufficient to apply 1 ton per acre of ground chalk instead of 10 cwt per acre of ground lime. The ground chalk would usually be both less costly than ground lime, and more convenient to apply. At the same time it would have a less rapid action in the destruction of vegetable matter in the soil. Mr. Hughes remarks that the value of chalk for all light soils has been too much neglected. The red soils of Worcester and Hereford are, he says, types of soils that would be improved by dressings of finely-ground chalk, which is also suitable for gravel, granite, and sandy soils deficient in vegetable matter as well as in lime. The chalk should be dried and ground finely, distributed evenly, and lightly harrowed in.

J. Augustus Voelcker. **Experiments at Woburn, on the use of Lime.** — *Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 361-388.

The experiments were begun in 1908, in order to test the value of lime in a rotation.

Lime was applied in the one case as lump lime, at the rate of 2 tons per acre (5 025 kg. per hectare) in the other as ground lime in smaller quantity, viz. 10 cwt per acre (1 257 kg. per hectare). The crop of 1908 was barley, and the land which is poor in lime showed the advantage of using lime, the crop being increased by 17 bushels per acre (15.27 hectolitres per hectare) in the first year through the heavier application of lime. Red clover was the crop for 1909 but owing to damage caused by frost, by wood pigeons and by the bad weather during harvest time it was useless to record the weights. A second application of 10 cwt per acre of ground lime was given to one of the plots. Wheat follows in 1910.

J. AUGUSTUS VOELCKER. **Experiments with Magnesia on Wheat, 1909, at Woburn.** — *Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 362-388.

Field experiments begun in 1908. The quantities of magnesia (Mg O) applied for the wheat crop of 1908 were 3 cwt. per acre and 6 cwt. (376 and 753 kgs. per hectare).

The harvest results, as expected, did not show anything marked as regards difference of crop weights, but the produce of each plot was submitted to practical milling and baking tests, and these showed that as the amount of magnesia in the soil was increased the inferiority of the grain was more marked.

These results being considered of much importance, the experiments were continued in 1909. Wheat was sown in 5 plots. Besides superphosphate and sulphate of potash, 1 $^1/_2$ cwt. of magnesia (ground fine) per acre (186 kgs. per hectare) was given as top dressing in November.

Examining the harvest results, the figures of the plots which received the larger quantity of magnesia show the tendency of magnesia to reduce the crop. The quality of the wheat was also poorer.

J. AUGUSTUS VOELCKER. **Experiments with Magnesia on Potatoes.** — (*Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 387-388).

Experiments were made in 1909, at the Woburn experimental station of the R. Agric. Soc. of England, with magnesia in different forms on potatoes. The forms used were:

1) Magnesia (Mg O) at the rates of 3 cwt. and 6 cwt. per acre (376,5 and 753 kgs. per hectare).

2) Carbonate of magnesia 3 and 6 cwt. per acre.

3) Magnesian lime, 6 cwt. per acre.

4) Magnesian limestone, finely ground, 10 cwt. per acre (1255 kg. per hectare).

Magnesian limestone is carbonate of lime and carbonate of magnesia, and the magnesian lime was the same material after burning.

The application were given early in May. The dung, superphosphate and sulphate of potash were given in all cases alike.

During the period of growth the plot that received 6 cwt. of magnesia per acre, looked decidedly inferior to the one that had had 3 cwt.

In every case the produce of the plots to which magnesia had been given in any form fell below that of the "standard" dressing only.

This experiment does not seem to bear ont the conclusions obtained at the farm in 1908 nor those arrived at in Scotland.

The matter requires further enquiry and will be followed up.

XXI.

Special fertilisers. — Nitrates. Ammonium Salts. Lime-cyanamide. — Artificial fixation of free nitrogen. — Phosphatic fertilisers. Bone meal and bone ashes. Mineral phosphates. Superphosphates. Basic slag. etc. — Potassic manures. Stassfurt salts. Wood ashes. — Other substances used in fertilising.

How to use Nitrate of Soda, with a preface by BERNARD DYER. — Notice in *Nature,* Vol. 84, July 14th, 1910, p. 50.

Summaries are given of various field trials with sodium nitrate.

Application of Sulphate of Ammonia on light soils. — (*Mark Lane Express,* 101, 1909. No. 4072, p. 403). *Exper. Stat. Rec.,* Febr. 1910. — Washington.

Reference is made to experiments in which sulphate of ammonia was applied (1) entirely in autumn, (2) one fourth in autumn and three-fourths in spring, (3) all in spring in one application, and (4) in spring in two equal applications, the first just when growth had started and the second 3 weeks later. The crop used was rye, and the experiments extended over 2 years. The soil was well supplied with potash and phosphoric acid.

Spring application gave better results than fall application. Apparently the best results can be expected from 2 applications in the spring, one just at the beginning of growth and the second about 3 weeks later. The soils should in all cases be supplied with an abundance of lime.

GEORGE LUNGE. **Coal Tar and Ammonia.**—(Gurney and Jackson. London, 1909); Abs. *Nature*, August 11, 1910, vol. 84, p. 166.

The volume on coal-tar and ammonia is now in its fourth edition. What enormous changes have come over the industry of tar production, and of the extraction and utilisation of the innumerable substances which enter into its composition, will be evident from even the most superficial examination of the several issues. The rate of progress, indeed, transcends anything to be observed in any other branch of manufacture. Only nine years have elapsed since the third edition made its appearance, but such has been the acccumulation of new material in that interval that practically the whole of the chapters—eleven in number—dealing with coal-tar and its products have had to be revised and in great part rewritten. In this section of the work Dr. Lunge has had the assistance of Dr. Kraemer, of Berlin, an acknowledged authority in this branch of chemical technology.

England is still the great tar-producing country of the world, but her supremacy in this respect is threatened by the United States. Tar is mainly obtained from gas-works, from blast furnaces, and from coke-ovens. In the United Kingdom the annual production at the present time approaches a million tons—obtained by the destructive distillation of about seventeen or eighteen million tons of coal—an amount exceeding that of the whole of Europe put together and probably more than twice the aggregate yield o Germany and France.

J. AUGUSTUS VOELCKER. **Experiments at Woburn with nitrogenous top dressings 1909.** — *Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 381-387.

In 1908 experiments with calcium cyanamide (" nitrolin ") were conducted at the Woburn Farm Experimental station of the Royal Agric. Soc. of England with barley, mangolds and potatoes. In 1909 they were extended to the wheat crop, and nitrate of calcium was included in the enquiry.

The comparison was in each case made with sulphate of ammonia and nitrate of soda, one cwt. per acre (125 kgs. per hectare) of the former being taken as basis, and the relative quantities of the other nitrogenous manures so arranged as to supply the same amount of nitrogen.

The author gives the tables of results of these experiments.

The best wheat crop, both in grain and straw, was obtained from nitrate of soda; sulphate of ammonia and calcium nitrate being practically equal in both corn and straw, while calcium cyanamide, though giving slightly more corn than sulphate of ammonia and calcium nitrate, yielded considerably less straw than either.

JAMES HENDRICK. **New Nitrogenous Manures.** — *Trans. Highl. and Agric. Soc. Scotland*, Vol. XXI, 1909, pp. 122-134.

Until about 1880 the United Kingdom was the greatest consumer of nitrate of soda; since then other countries have so rapidly advanced in the consumption of artificial manures that the United Kingdom is now a comparatively small factor in the market.

Germany comes first. The United States are the next largest consumers and several other countries already are larger consumers than the United Kingdom, so that the consumption of nitrate which has increased from about 200 000 tons to 1 700 000 in the last thirty years, may continue to increase enormously.

This constantly increasing demand for nitrogenous manures causes some anxiety for the future, and new sources have been sought for, the new manures, nitrate of lime and cyanamide have meanwhile been discovered.

In 1908, 25 000 tons of nitrate of lime were manufactured and it is expected that in a few years the production will increase to 100 000 tons. It should contain about 13 % of nitrogen. Three samples analysed by the author contained respectively 12.73, 12.14 and 13.07 %. Whilst commercial nitrate of soda contains about 15.5 %.

The author made some experiments to determine how rapidly nitrate of lime absorbs moisture in comparison of nitrate of soda. Two bags each containing an equal weight of these manures were left in an unheated store during the winter. After 5 weeks the nitrate of lime had become hard and lumpy and after nine weeks it had gained 17 per cent in weight, after which it began to lose weight by liquid running away from it. The nitrate of soda after five weeks had not gained appreciably in weight but had become lumpy. After which it lost very little in weight, but did not become distinctly damp.

When a similar bag of nitrate of lime was covered with a few sacks to protect it from the air, it gained weight much more slowly. Even after 10 weeks, though beginning to get lumpy it was still sowable.

A portion was mixed with dry peat dust in the proportion of 5 of nitrate of lime to 1 of peat, but the gain in weight was more rapid still. After seven weeks this mixture was quite wet, and liquid began to escape from the bag.

When 1 part of nitrate of lime was mixed with 1 part of potash manure salt, 1 $^1/_2$ of bone flour and 1 $^1/_2$ of superphosphate the mixture soon became damp. After 9 weeks it was wet and sticky, and unfit for use.

These experiments show that if nitrate of lime has to be kept for any length of time it will require special packages, and that it will be difficult to use it in mixtures unless used very soon after they are made.

Cyanamide of calcium is formed when nitrogen passes over calcium carbide heated in furnaces to about 1000° C.

Various modifications of the process of Frank and Caro for the manufacture of cyanamide have been devised, among which one, invented by Dr. Polzeniusz, has been employed on a large scale.

According to this process a small quantity of chloride of lime is added to the carbide of lime, and the resulting cyanamide contains some chloride of lime. This addition is said to enable the combination of nitrogen to take place more easily and at a lower temperature.

The first factory that started production of calcium cyanamide on a large scale is situated at Piano d'Orta in the Abruzzi, Italy. It can produce 10 000 tons a year.

Large plants have been erected at other places in Italy. Important factories have been or are being erected in Dalmatia, in France, in Switzerland, in Germany, in Norway, in Japan and in Canada at the Niagara Falls. When completed they will be able to turn out about 200 000 tons of cyanamide per annum, by the Frank & Caro process.

In Germany the Westeregeln works produce cyanamide by the Polzeniusz process.

Hitherto no works of the kind have been erected in Britain, though the West of Scotland would be suitable for this industry.

The British market is now supplied with cyanamide by a large factory, working with the Frank & Caro process, situated on the Hardanger Fjord, Norway, and belonging to an English company. In the same neighbourhood nitrate of lime is also made.

The following table shows analyses of some samples analysed in the author's laboratory:

	Cyanamide Frank and Caro		Cyanamide Polzeniusz	
	Per cent	Per cent	Per cent	Per cent
Calcium cyanamide (Ca CN_2)	48.43	55.42	56.50	49.77
Carbon	13.16	16.15	14.27	12.72
Silica	5.72	4.67	4 —	7.04
Iron oxides	2.52	3.24	3.70	2.75
Calcium chlorides	—	—	6.40	5.18
Lime	29.94	18.80	15.99	21.35
Containing nitrogen	16.95	19.39	19.77	17.42

In Scotland several pot and field experiments have been made with these manures, and the general results seem to indicate that nitrate of lime is an even more active and valuable manure, weight for weight of nitrogen, than nitrate of soda.

A. D. Hall, Director of the Rothamsted Experimental Station. **The New Nitrogenous fertilisers—Calcium Cyanamide, and Nitrate of Lime.** — *The Journal of the Board of Agriculture.*—London, March 1910. Vol. XVI, N. 12, p. 1006.

"In view of the importance of the two new fertilisers containing nitrogen extracted from the atmosphere, calcium cyanamide or nitrolime and nitrate of lime—both of which are now becoming regular articles of commerce, the results of a comparative trial of these manures against sulphate of ammonia and nitrate of soda, made at Rothamsted in 1909, may not be without interest. The experimental plots were situated in Little Hoos field, the soil of which, as of the other Rothamsted fields, is a heavy clay loam containing between 1 and 2 per cent. of carbonate of lime in the surface soil; the land was in poor condition, and had not received dung for many years previously. The land was given a uniform manuring of 336 lb. of superphosphate (376 kgs per hectare) (37 per cent. soluble) per acre, then each plot, except the two control plots, received 50 lb. (56 kgs per hectare) of nitrogen per acre in one of the selected forms—nitrate of soda, nitrate of lime, sulphate of ammonia, and calcium cyanamide.

The crop selected for experiment was barley—Archer's Stiff Straw; but owing to the cold and wet character of the season, the amount of nitrogen applied was too large, despite the poor condition of the soil, so that the plants on all the plots receiving nitrogen became much laid during July. In consequence, the plots had to be cut by the scythe, and the weights of straw are not very trustworthy owing to the difficulty of cutting them uniformly.

The manures were applied on March 8th and ploughed in, but showery weather followed, and it was not possible to sow the barley until April 6th.

The following table gives the details of the yield on the ten plots, there being duplicate plots for each manure:

EXPERIMENTS ON BARLEY WITH NITROGENOUS FERTILISERS, LITTLE HOOS FIELD, ROTHAMSTED, 1909.

Plot	Manuring per acre 336 lb. superphosphate, 50 lb. nitrogen	Quantities p. acre						Particulars of quality		
		Dressed grain	Dressed grain	Offal grain	Total grain	Total straw	Total produce	Weight p. bush. of dressed grain	Proportion of offal to 100 dressed	Proportion of grain to straw as 100
		bush.	lb.	lb.	lb.	lb.	lb.	lb.		
1	Superphosphate alone .	27.69	1495	101	1596	2511	4107	54.0	6.8	63.6
6		29.69	1640	182	1822	2727	4549	55.3	11.1	66.8
2	Superphosphate & nitrate of soda.	44.62	2231	277	2508	3429	5937	50.0	12.4	73.1
7		51.57	2830	316	3146	4334	7480	54.9	11.2	72.6
3	Superphosphate & nitrate of lime.	45.17	2417	364	2781	4806	7587	53.5	15.1	57.9
8		47.14	2595	321	2916	4091	007	55.1	12.4	71.3
4	Superphosphate & sulphate of ammonia.	49.34	2683	280	2963	2943	5906	54.4	10.4	100.7
9		48.82	2673	270	2943	4091	7034	54.8	10.1	71.9
5	Superphosphate & cyanamide.	43.86	2388	182	2570	4469	7039	54.4	7.6	57.5
10		46.48	2545	300	2845	3483	6328	54.8	11.8	81.7

It will be seen that the experimental plots were not numerous enough to enable one to determine in a single season the magnitude of the difference, if any, between the four nitrogenous fertilisers selected for comparative trial.

One sees, however, that if any difference does exist between the effectiveness, nitrogen for nitrogen, of nitrate of soda and nitrate of lime, or of sulphate of ammonia and cyanamide, it will be only a difference of 10 per cent. or less. That being the case, it should be the character of the soil and the relative price of the fertilisers per unit of nitrogen, which should dictate the choice between them. The Rothamsted soil has no special peculiarity and suits any of these fertilisers indifferently, but on other soils —very light sands, heavy clays, soils very short of lime—secondary considerations, which do not come into play in these experiments, will make one or other of these fertilisers the preferable manure".

R. A. Berry. **Reports on experiments with some new nitrogenous manures on oats, hay, potatoes etc.** — (*West of Scot. Agr. Coll. Ann. Rpt.*, 9, 1909, pp. 15-31). *E. S. R.*, March 1910. Washington.

These experiments are a comparison of the value of lime nitrate, basic lime nitrate, and lime nitrogen with nitrate of soda and sulphate of ammonia as sources of nitrogen.

Oats. Eight plats showed no advantage of lime nitrogen over nitrate of soda. Other plats showed very little difference between nitrate of soda and the same amount of nitrogen in lime nitrate. While basic lime nitrate and lime nitrogen gave lower results.

Hay. Nitrate of soda and the same amount of nitrogen in sulphate of ammonia gave about 2 tons 480 lbs. per acre. While lime nitrogen gave only 1 ton 1994 lbs. of hay.

125 lbs. of nitrate of soda gave 1180 lbs. per acre more than the check plat, while the same amount of nitrogen in basic nitrate of lime and nitrate of lime gave 605 and 400 lbs. respectively.

Mangels. The same amount of nitrogen applied in the form of nitrate of soda gave heavier crops than in the form of lime nitrate.

Potatoes. There was a difference in favour of sulphate of ammonia as against lime nitrate.

C. G. T. Morison. **The amount of free lime and the composition of the soluble phosphates in Basic Slag.** — *The Journal of Agricultural Science*, Vol. III, Part 2, October 1909. Rothamsted Experiment Station.

Basic Slag owes its value as a source of phosphoric acid to the fact that it is essentially basic in its character, and can be used on land where an acid manure of the character of superphosphate is not to be recommended.

As no figures were available on the subject it seemed interesting to determine how much of the lime which it contains existed in the free uncombined condition.

The present analyses and Stead's work have fully established that it is not tetracalcium phosphate which supplies the soluble phosphoric acid in basic slag but a body in which the molecular ratio of phosphoric acid to lime is 1 : 5. Of the total lime present in the slag which was 38.62 %, 5.8 was as oxide or carbonate, 27.68 was combined in readily soluble form, leaving 5.17 combined with the remainder of the phosphoric acid. V. F. Kroll in a preliminary note (*Stahl und Eisen* no. 19, May 6th, 1908) says that the principal constituents of basic slag is a compound hitherto unknown consisting of a silico-phosphate of lime and ferrous iron, which would seem to agree with the results obtained in the present paper. The absence of crystals of tetra-calcium phosphate, which were undoubtedly obtained from basin slag by earlier observers and the low percentages of free lime now found to be present in the slag, may be correlated with the increased percentage of phosphoric acid in slags of modern manufacture, less lime being nowadays employed in the dephosphorisation process than formerly.

J. Hendrick. **The Lime in Basic Slag.** — (*Jour. Soc. Chem. Ind.*, 28, 1909, n. 14, pp. 775-778). *E. S. R.*, XXII, Jan. 1910.

Chemical studies of various samples of Thomas slag are reported which "indicate that the basic lime in slag is not only a very variable quantity, but that it consists of lime in various forms of combination. A little of it is free caustic lime. The rest is in combination, such as silicates and basic phosphates. A part of this combined lime is readily liberated, and will probably readily act in the soil as a base. Other portions are only liberated with greater difficulty and slowly. As the conditions are very complex, it is impossible to draw any line and state an exact percentage of basic lime in slag except in terms of a strictly defined method of determining it.

J. Hughues. **Basic slag and potash for chalk land.** — (The Field [*London*], 114, 1909) *E. S. R.*, May 1910.

Chemical examinations of 2 samples of soil from the Sussex chalk downs, one of which had been fertilized with phosphatic slag and potash and the other not so treated, are reported. The principal difference indicated by the analysis was the higher percentage of organic matter in the fertilized soil, and this is thought to explain the fact that this soil was greatly benefited by the application of a fertilizer like slag, containing a large amount of lime, when the soil already contained a high percentage of this constituent.

Manganese as a fertilizer (Mark Lane Express, 100 [1909], n. 4042, p. 305; Phosphate, 18 [1909], n. 886, p. 111). *E. S. R.*, Aug. 1909.

Investigations on this subject by Javillier, Lecarme, and others are referred to, and suggestions are made as to the best method of applying manganese salts as a fertiliser. It is pointed out that the salts should be used in highly diluted form, and to this end it is advisable to mix them in pulverized form with chemicals or barnyard manure in such quantities as to give 8.9 to 35.7 lbs. of manganese per acre (10 to 40 kgs per hectare).

William E. Bear. **Import of manures into Great Britain.** — *Jour. of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 151-163.

Apart from nitrate of soda and guano, most of the manures imported in Great Britain are raw materials for their manufacture. Nearly all the nitrate of soda comes from Chile, though Germany contributes a small quantity; and Peru is the main source of our supply of guano. Of basic slag we import very little, less than 10 000 tons having been received in 1908. Bones for manufacturing arrive from a great many countries, India and Argentina being the only extensive contributors. The greatest shippers of phosphate of lime and rock phosphate to this country are unspecified islands in the Pacific and the United States, followed by Algeria, France, Belgium and Dutch Colonies. Germany is by far the most important contributor of unspecified manures, and particularly potash.

XXII.

Manufacture of fertilisers. — Examination and valuation of fertilisers. — Frauds in the sale of fertilisers. — Trade in fertilisers. — Legislation regarding fertiliser-trade. — Valuation of unexhausted manurial residues in soils.

Board of Agriculture and Fisheries. Methods of analysis of fertilizers and feeding stuffs for 1908. — (*Analyst*, 34, 1909, No. 403, p. 461-468). *E. S. R.*, vol. XXII, March 1910, No. 4. Washington.

This is a description of the methods of analysis of fertilizers and feeding stuffs agreed upon by the Board of Agriculture and Fisheries.

J. Hendrick. **Arsenic in Manures and effect on poultry.** — *Trans. of the Highl. and Agric. Soc. of Scotland*, Ser. V, Vol. XXI, p. 309. Edinburgh, 1909.

It was feared that some fowls were being poisoned by picking over the fields manures with traces of arsenic. The crude vitriol (sulphuric acid) which is used in preparing such manures as superphosphate and sulphate of ammonia generally contains arsenic, sometimes in considerable quantity. It was from the use of such vitriol in preparing brewing sugars that a bad outbreak of arsenic poisoning was caused a few years ago among consumers of the beer prepared from such sugars. It is to be expected that superphosphate and other dissolved manures, and, to a less extent sulphate of ammonia, will contain arsenic. Superphosphate frequently contains a considerable amount of arsenic. It is not likely, however, that this would be a serious source of danger to animals in ordinary circumstances. It has been shown by experiment also that the arsenic does not pass into the plants grown by the help of such manures, so that there is no danger of stock or human beings being poisoned by consuming crops grown by the aid of such arsenic contaminated manures.

Exports from the United Kingdom, for 1908, of Manures and Cattle foods and other products of interest to Agriculture. — *Annual Statement of the Trade of the United Kingdom with Foreign. Countries and Brit. Possessions*, 1908, Vol. I, Table No. 14. London, 1909.

The total exports from the United Kingdom, for the year 1908, of some items interesting Agriculture were as follows:

	Tons	Value £	Value Frs.
Cattle foods	26 893	179 413	4 530 178
Sulphate of Copper . .	71 288	1 593 077	40 225 194
Basic slag	171 138	246 720	6 231 377
Sulphate of ammonia .	234 282	2 763 584	69 682 921
Superphosphates . . .	146 192	366 719	9 259 654

XXIII.

Systems of culture. Rotation of crops. Culture systems in special climatic or soil conditions. Dry-Farming. Irrigation farming. Electro-culture. Action of crops on the soil.

ANDREW HUTCHESON. **Rotation of Crops in Scotland.** — *Trans. of the Highl. and Agric. Soc. of Scotland*, vol. XXI, 5th series, pp. 51-58.

The last half century has witnessed many changes in agricultural practice, but in no direction perhaps has there been more than in the cropping. In many old leases and even in some modern ones long detailed clauses are inserted as to the cropping.

In most leases nowadays the tenant is only bound not to miscrop or deteriorate the land, but to practice good husbandry. Formerly heavy penalties were threatened for any infraction of the prescribed methods, whilst now such questions are reserved to arbitration on the basis of deterioration to the holding.

As regards the sale of produce several severe restrictions were frequent, thus for instance the sale of straw was forbidden.

All such clauses would now seem to be inoperative in view of the Agricultural Holdings Act of 1906 which came into operation on the 1st of January 1909. Clause 3 of that Act reads as follows:

1) Notwithstanding any custom of the country or the provisions of any contract of tenancy or agreement respecting the method of cropping of arable lands, or the disposal of crops, a tenant shall have full right to practice any system of cropping of the arable land on his holding, and to dispose of the produce of his holding, withous incurring any penalty, forfeiture or liability. Provided that he shall previously have made, or, as soon as may be, shall make, suitable and adequate provision to protect the holding from injury or deterioration, which provision shall in the case of disposal of the produce of the holding consist in the return to the holding of the full equivalent manurial value to the holding of all crops sold off or removed from the holding in contravention of the custom, contract or agreement; paragraphs *a*) and *b*) consider some cases in which this subsection does not apply.

2) If the tenant exercises his rights under this section in such a manner as to injure or deteriorate the holding or to be likely to injure or deteriorate the holding, the landlord shall without prejudice to any other remedy which may be open to him, be entitled to recover damages in respect of such injury or deterioration at any time, and, should the case so require, to obtain an injunction, or in Scotland an interdict, restraining the exercise of the rights under this Section in that manner, and the amount of such damages may, in default of agreement, be determined by arbitration.

Rotations on heavy soils. — In the Carse of Gowrie, which is for the most part stiff clay there is generally an eight shift. Bare fallow, wheat, beans, wheat, turnips, barley, grass (cut for hay) and oats. This, however is sometimes varied. At Errol for instance there is a farm of stiff clay with the exception of about 10 acres (4 hectares) of black land. These have been constantly in turnips for twelve years giving always good crops without a trace of disease.

It is not generally known that turnips can be grown on the same field for any lenghth of time with perfect immunity from finger-and-toe (*Plasmodiophora Brassicae*) provided no contaminated dung be used. The intervention of other crops seems to account for this scourge.

The laying down to Timothy is also a very economical way of farming strong soils. Immense crops can be grown, and many keepers of horses prefer Timothy to rye grass where there is a heavy draught. If a division of a farm is kept in timothy for some years where hay is not sold, it provides winter food for the horses and allows the other grass breaks to be depasturised the first year, and this always secures a better pasture in the following years than when hay is cut the first season.

Rotation on "easy" soils and black soils. — Different methods are followed according to the situation and locality. The ordinary six shift: — three years pasture, with oats, turnips, and oats or barley is known to all. In some districts a seven shift is practised: two years grass, oats, potatoes, wheat, turnips, and barley. Then there is also the close six shift: — barley sown out with grass and clover seeds, hay, oats, potatoes, wheat and turnips.

The author speaks next of the *potato growing* to which sometimes the half of the farm is devoted. In order to secure an early and abundant crop, growers sprout their seed in boxes.

In certain districts *catch-crops* are greatly in vogue. One of the most noticeable features in the cropping of land during the last half century is what could be called the want of cropping or the laying of land down to permanent pasture.

A Royal Prize Farm. — *The Farmer and Stock Breeder.* London, July 18, 1910.

The second prize in Class II of the Royal Prize Farm Contest for holdings chiefly arable of not les than 50 acres and under 150 acres exclusive of fell or tidal marsh land, was awarded to Stanley Farm, Ormskirk. The soil is cropped as follows: Potatoes 42 acres, oats 30 acres, wheat 42 acres, clover and ryegrass 18 acres. Of permanent pastures there are 10 acres; gardens, orchards one acre. The stock comprises six milking cows, five heifers, five calves, a bull, ten pigs, six working horses, three colts and a pony. The rotation followed is: potatoes, wheat, oats, then seeds for one or two years. The greater portion of the farm has been marled and all of it has been recently limed.

J. H. Priestley, **Electro-Culture: Overhead Electrical Discharges and Plant Growth.** — *Journal Board of Agriculture.* April 1910, p. 16.

" It is owing to the enterprise and energy of Mr J. D. Newman that trials of the overhead discharge method upon a large scale have been carried out with those new facilities which, through the kind co-operation of Sir Oliver Lodge, F. R. S., and his son, Mr Lionel Lodge, he has been able to test very fully.

" These trials have been made chiefly upon the land of Mr Raymond Bomford at Salford Priors, near Evesham. Mr Bomford's co-operation has been of the greatest value to Mr Newman. During the last year or two, also, a smaller but interesting trial has been made at Bitton, near Bristol, at some nurseries which are the property of Mr George Newman.

" The general assumption underlying the work is evidently that the passage of a small electric current through the plant is beneficial to it, and tends to increase the yield and often to lessen the time in which that yield is usually obtainable.

" Perhaps it would be more correct to say that the assumption is that *an increase* in the slight electric current passing in a plant is beneficial, because it must be remembered that in the ordinary way the atmosphere above a plant is usually at a higher potential than the plant, and as a consequence a slight current is probably leaking away to the ground through the vegetation, and Mr Newman has followed Lemström in usually having his overhead wires charged positively, and, therefore, practically, increasing this current to the earth but not reversing its usual direction.

" That this physiological effect is produced is still a subject open to controversy and at present the most urgent need in connection with this subject is further experimental physiological work to decide the question.

" Mr Priestley's own experiments upon the respiration of electrified plants lead him to attach more importance than is usually done to a possible accelerating action of the current. A study of field experiments shows that often an acceleration is reported, and this acceleration may have a very important bearing upon the yield of the crop.

" This acceleration effect seems to be only one indication of many pointing to a raised vitality in the plant, as evinced by a more active pursuance of its normal physiological functions.

" Thus several experiments point to the fact that the electrified plants give off water more rapidly, and as a consequence may suffer, as compared with their unelectrified fellows, if too strongly electrified during a dry season. This seems the most probable cause of the smaller strawberry crop, accompanied by a much sweeter if, on the average, smaller fruit, from the Evesham fields, in 1908.

" It is well known nowadays that the disease-resisting power of a plant seems largely a function of its vitality, and when grown under unsuitable conditions the less virile plants seem more easily to succumb to the parasitic attack. It is hence, perhaps, worthy of note that on one or two occasions in the cucumber houses at Bitton, electrified houses seem to have shown indication of greater resistance both to the ordinary *Cercospora* spot disease and to other occasional outbreaks of disease. From the nature of the trials, howerer. I fear no very definite statement is possible, and the question is not easily decided by experiments in the laboratory. „

Application of the Method of Overhead electric Discharge.

" A) *In the Open.* — In considering the method of applying the overhead discharge it should be clear that many points in regard to its use are at present not decided, and that any rules followed in regard to times of electrification, strength of current, etc. are of an empirical character.

The system is capable of use upon a large scale, and the Evesham installation charges some twenty acres; similar installations could easily be established to charge a still larger area, and a device which would be quite possible is to charge at, alternate periods in the 24 hours, two different areas of some twenty acres each. The first necessity is a supply of current for the induction coil. A continuous current, any voltage from 10-250 and at about 100-500 watts is necessary; a current at 110 volts and 2-5 amperes is quite satisfactory. If this is not available from some power-station in the neighbourhood it can be generated by means of a dynamo and small oil engine, which can be placed upon any convenient spot upon the farm, and the power may probably also be employed for other purposes. The high-tension generating apparatus needs to be placed in a building — a watertight shed will do — near the area to be electrified, as while it is possible to lead the lower tension current any distance without appareciable loss by leakage, this is not the case with the high-voltage current. The high-tension apparatus can hardly be satisfactorily described in a non-technical article; Sir Oliver Lodge has briefly described it in a paper published privately in 1908, but anyone thinking of adopting the system would need to consult Sir Oliver Lodge, Mr Newman, or other electrical expert, unless he is himself acquainted with the working of the mercury break and high-tension coil, the Lodge electrical valve, etc, while much of the apparatus is protected by patents.

By judicious arrangement the network of wire necessary to charge twenty acres can be carried by some 20 poles. The insulators have to be of a special type to prevent as far as possible leakage down the pole, which is likely to occur in spite of the fact that the charged wire never touches the insulator or pole, but is fastened to it through the agency of yet another insulator and a short piece of wire.

Serious leakage in wet weather and for some hours subsequent to rain can probably never be prevented, but it is certain that, with the devices now adopted by Mr Newman and with a new form of insulator now in use at Evesham, given dry conditions, the discharge takes place from the part of the overhead system intended for the purpose. This discharge area consists simply of a series of thinner wires stretched taut between two of the parallel thick wires. With lower voltage it would probably be necessary to supply downwardly directed points at intervals along the discharge wires, but with this high voltage it is possible without this provision to detect a quite appreciable discharge from the wires when the apparatus is running properly.

It is, of course, very necessary to have some simple method of ascertaining that effective discharge is really occurring.

The arrangement adopted is to have an insulated wire which receives a charge when the overhead wire is giving off electricity, and this charge can be detected quite simply, either by touching the wire with the finger, when a slight sbock is felt as the current passes through one's body to the earth. At night a different method may be adopted; a vacuum tube, which will show a bright glow as the slight current passes, may be used.

Using this method it is possible to test to what extent the wires are distributing the charge over the field, and hence at what distance apart they may be effectively put, a distance that varies with height of crop and of the wires above the ground.

It can also be shown that the treated area will not be sharply delimited from the untreated if growing side by side, for it is found that on wiudy days the discharge is carried considerably further over the crop in the direction in which the wind is blowing.

As it is possible by the method described to detect quite close to the ground an appreciable discharge from a wire raised some 10-16 feet above it. it is clear that this height is preferable, as it permits of all the ordinary operations of cultivation, including harvesting, being carried on without interference and without damage to the overhead system.

Thus Mr Newman tells that, in the three years' work at Evesham, only one wire has been broken.

B) *Under Glass.*—Under these conditions it is possible either (1) to use a smaller and cheaper method of generating electrical discharge, the influence machine, with, however, the attendant disadvantages of smaller output and liability to interruption owing to the unsuitability of most forms of influence machines for continuous running, or (2) to adopt the high-tension system described for work in the open.

Along the first lines ran the early experiments at Mr Newman's nurseries at Bitton, and with remarkably good results on the whole, the occasional failure being probably to be attributed to causes which could easily be controlled.

In applying the other method in use at Evesham to work under glass, several points had to be considered. The main difficulty was the great tendency to leakage under these conditions, and in practice it was never possible to keep up such a high charge on the wires running through the greenhouse, as, with the same apparatus, could be obtained in the open field. At the same time it was quite possible to keep up an effective discharge, Mr Newman and myself testing the point on several occasions by carrying a long test wire into the houses and testing the distribution of the charge.

To avoid leakage where the current entered the house, a pent roof was put up to prevent the water dripping on to the insulators used, and under this pent roof was placed, first a large porous cylinder or perhaps an ebonite tube, and within this a tube of fused silica, some two feet long, through which the charged wire (gutta-percha covered wire) ran. These fused quartz or silica tubes are easily obtainable nowadays, and seem the most satisfactory type of insulator,

Within the house, the wire was simply hooked on to another wire, running the whole length of the house, and supported by ebonite insulators attached to either door by lengths of paraffined string running through holes in an ebonite rod. This single wire was of comparatively small diameter and acted as the discharge wire.

The houses are arranged in groups of five, without walled partitions separating them, and hence it was possible to run the charge from house to house within the same block by simply carrying a wire under the wooden frame supporting the glass roof, the wire being passed through a long cylinder of porous earthenware that was suspended freely from the roof by means of paraffined string.

Under these conditions the discharge was obtained, but from the construction of the houses it is certain that a very large percentage of the charge must be lost.

Thus the hot-water pipes are raised well above the floor, and the base of the plants may be descrived as being in the " shade ,, of these iron pipes as regards effective discharge, as the plants are not raised upon staging above the hot-water pipes. Cucumbers and tomatoes are the crops usually grown, and while the tomatoes may obtain their fair share of the charge, the cucumbers, in their at tempt to obtain lignt, spread their leaves and stems so close to the glass that they run within the protection of uninsulated wires, placed near the roof to afford them support, and to which their tendrils cling. To such extent as they lie behind these wires they must be very much out of the region of discharge, and it does not seem to me surprising that the results for 1908 with cucumbers grown in this manner show very little difference that can be attributed to the current. And yet even in this case the acceleration results are quite striking, as is shown by the table appended ot the cucumbers cut from five of the houses in April, 1908.

Another difficulty that has to be met in installation under glass is the added risk of shock to those working amongst the crops Cultivation under forcing conditions involves almost continuous attention being paid to the plants, and as a consequence arrangements have to be made to allow men to work amongst the crops without the risk of a shock, which would be sufficiently violent to be a considerable inconvenience. This result may be achieved by running the electrical discharge only at night. At Bitton this practice has usually been followed, the wires through the greenhouses being charged at night and an area out of doors electrified during the daytime; unfortunately there are not sufficient physiological data to hand to say whether current applied at such a time is effective or not.

" *Cost of Treatment.* — The practical man will probably desire that this article should include a reference to the cost of this new method of treatment, but that is a subject which I do not feel competent to pursue in any detail.

Presumably any person desirous of installing such an apparatus would first get in touch with some competent firm of electricians, and thus he could soon get some idea of the cost. The Agricultural Electric Discharge Co. would possess all necessary data on these points. From my own experience I am satisfied that an apparatus for greenhouse work, in which the electricity is supplied from a continuously running influence machine, could be installed at a cost of some £50; but the other and more satisfactory method, which is the only one which at present seems to admit of development upon a large scale, would cost considerably more, perhaps some £200 to £300. When once installed the cost of running resolves itself practically into a question of the cost of working an ordinary gas or oil motor, with an occasional need for resting or replacing an overstrained electric valve ".

Results of Large-Scale Electro-culture Experimental Trials.

Bitton, 1905.

(Electricity from an influence machine).

Cucumbers.—Increase 17 per cent.

Strawberries (5 year plants). —Increase 36 p. cent. (1 year plants) —80 per cent. (and many more runners produced).

Broadbeans.—Decrease 15 per cent. Acceleration—some 5 days.

Cabbages (not weighed).—Acceleration—10 days.

Celery.—Increase 2 per cent. Wires used as discharge points not fine enough.

Tomatoes.—No difference.

Gloucester, 1905.

(Electricity from an influence machine).

Beets.—Increase 33 per cent.	Both electrified and control areas watered in dry weather.
Carrots.—Increase 50 p. cent.	

Evesham, 1906.

(High-tension Electricity from Coil and Valves etc.).

Wheat Canadian Red Fife.—Increase 39 per cent.

English Red Queen.—Increase 29 per cent.

Barley (a very irregular crop, owing probably to previous treatment of field).—Increase 5 per cent.

Evesham, 1907.

Wheat Red Fife.—Electrified 41.4 bushels per acre; control 32.0 bushels per acre. Increase 29 per cent.

Mangolds.—Some 18 per cent. increase; but estimation merely by cartloads, and as loads varied, being biggest where crop heaviest, real increase should be greater.

Strawberries.—First complete picking, June 28th. Electrified 56 lb.; control, 33 lb. (Area of electrified is only 56 per cent., size of control area). Final difference, July 10th.—Increase 25 per cent.

Evesham, 1908.

Strawberries.—Acceleration as previously, thus:—Pickings on June 20th and 22nd give electrified 1 318 lb.; control 1 876 lb. (Electrified area 56 per cent. size of control). Final result. Decrease 9 per cent. (July 8th). Dry season.

Wheat.—Electrified (7,68 acres) 32,5 bushels per acre; control (10.2 acres) 26,15 bushels per acre; increase, 24.3 per cent.

Tomatoes.—Variety Bryant's Special (grown to single stem).

	Electrified		Control
	A	B	
Number of plants	483	929	148
Total fruit picked (lb.)	1 390	3 175	358
Lb. per plant	2.9	3.5	2.4
Fruit picked ripe and sound before September 24th. . .	175	333	15

The control area and electrified area A were to all appearances exactly comparable as to situation and soil, while area B had a somewhat better aspect and was occasionally irrigated by the overflow of a pond.

Bitton, 1908.

(High tension Electricity from Coil and Valves etc.).

Cucumbers.

Set of 5 houses		Numbers picked before April 29th
(1) control. . .	2 410 cucumbers	(1) 214 cuc.
(2) " . . .	2 477 "	(1) 343 "
(3) electrified .	2 753 "	(3) 485 "
(4) " .	2 710 "	(4) 487 "
(5) " .	2 729 "	(5) 424 "

XXIV.

Agricultural Seeds. Composition, ripening, vitality and germination of seeds. Examination of seeds. Frauds in the seed-trade. Legislation regarding the sale of seeds and of plants, or of living parts of plants.

Effect of Ammonia on Germination. — *Gardeners' Chronicle,* May 1910, No. 3622. London, p. 349.

During last year tests were made at the Harper Adams' Agricultural College to determine the effect of a solution of ammonia upon the germination of Broad Beans. The seeds were steeped in a 10 % solution of ammonia from 1 to 48 hours, and after washing in water were germinated at 60° F. The tabular results indicate a decided increase in the speed of germination after steeping for 24 hours, the rate diminishing when the seeds were acted upon for shorter or longer periods than this. Whether the ammonia acts as a direct stimulus to growth is however not clear from the records, as the germination of "control" seeds, after steeping in water only for the same time, is not given in the report.

A. J. Brown. **The permeability of the coverings of the seeds of barley.** — (*Proc, Roy. Soc.*, 1909, Ser. B, 81, No. B 546, pp. 82-93, dgm. 1). *E. S. R.* London, Aug. 1909.

The author states that the seeds of the variety of barley known as *Hordeum vulgare cærulescens* owe their color to the presence of a blue pigment in the aleurone cells. This pigment, like litmus, is turned red by acids. Such seeds, when immersed in a dilute solution of sulphuric acid, soon turn a pink color if their coverings are damaged, but if the integument is not injured they will imbibe water, become soft and swollen, and retain their color for a considerable time.

A study was made of the behavior of the seed coats, and the penetrating power of solutions of a number of chemicals was investigated. The investigations are considered as only preliminary, but the general trend of the evidence tends to show that solutions of the solutes which diffuse readily through the seed coverings differ in some essential manner from solutions of nondiffusible solutes. An explanation is offered in which it is stated that "some unrecognized peculiarity in the manner in which the molecules of the two classes of solutes are combined with the molecules of the solvent water may constitute the factor which orders their different behavior with respect to the seed coverings".

Dodder Seeds in Seed Mixtures. — (*Journal of Roy. Agric. Soc.*, vol. 69, 1908). *The Journal of the Board of Agriculture,* February 1910, vol. XVI, No. 11, p. 933. London.

Experiments have been carried out by the Society's Consulting Botanist, to ascertain the danger from dodder seeds present in clover or in ready-made seed mixtures for laying down pastures. Dodder seeds of the two kinds, the larger foreign and the native, were sown with various seeds used in agriculture, red clover, alsike, trefoil, lucerne, timothy, rye grass, cocksfoot, rape, and kale. Both kinds of dodder attached themselves to these very different plants, and the various clovers were more or less rapidly destroyed; little damage was done to the cruciferous plants like rape and kale, and practically none to the grasses. The dodder grew, flowered, and produced seeds on the clovers, while the other plants only provided food for the parasite for a time. The grasses suffered least from the attack, but they supported the dodder plants from twentyone to thirty-four days in a condition vigorous enough to enable them to spread to the neighbouring plants. The presence of dodder seed in seed used for leys is obviously dangerous, and the suggestion that seed containing dodder may safely be used in pasture is incorrect.

W. E. Brenchley and A. D. Hall. **The development of the Grain of Wheat.** — *Rothamsted Experiment Station; The Journal of Agricultural Science,* vol. III, part 2, October 1909, pp. 195-215.

These experiments were made with the purpose to study the process going forward in the latter part of the life of the wheat i. e. the migration of accumulated material from the stem and leaves to the grain, and the progressive changes in the composition of the grain.

A study during 1907 and 1908 of various plots of wheat cut at three day intervals leads to the following general conclusions:

1) The whole plant and with it the nitrogen, ash, and phosphoric acid it contains increases in weight until about a week before it would be regarded as ready to cut. Some increase of dry weight takes place during the last week.

2) In the formation of the grain three stages may be distinguished *a*) a period during which the pericarp is the most prominent feature; *b*) the main period during which the endosperm is filled; *c*) the ripening period characterised by the desiccation of the grain.

3) For the filling of the endosperm each plant possesses as it were a special mould, and continually moves into the grain uniform material cast in that mould, possessing always the same ratio of nitrogenous to non-nitrogenous materials and ash. The character of the mould possessed by each plant is determined by variety, soil, season etc.

4) The main feature of the ripening process is desiccation rather than the setting in of such chemical changes as the conversion of sugars into starch, non-protein into protein, though the latter change also takes place.

5) The maximum dry weight of grain is attained a day or two before the grain would be regarded as ripe by the farmer. Allowing for the fact that the tillered shoots are a little behind the central shoots, no loss of weight in the crop will be incurred by cutting before the corn appears quite ripe, while a number of accidental mechanical losses due to birds, shedding, weather, may thus be avoided. Other experiments have shown that, though there may be no gain, there will be no loss in the quality of the wheat due to such early cutting.

H. S. Reed. **The effect of certain chemical agents upon the transpiration and growth of wheat seedlings.** — (*Bot. Gaz.*, 49, 1910, 2, 81-109). *E. S. R.*, June 1910.

The small amounts of the chemical agents used (lime, sodium phosphate, potassium salts, sodium nitrate, inorganic acids, etc.) had a definite influence upon the correlative transpiration. The effects produced in all cases seemed to be due to the specific action of the ions constituting any given agent. Potassium always showed its inhibiting action on transpiration, regardless of whether it was in combination with chlorine, nitric acid, or sulphuric acid. The stimulating effect of calcium was shown in a similar way.

XXV.

Crops and experimentation connected therewith. — Corn crops and other Food-grains. Root and tuber plants for food and forage. — Grasses and leguminous forage crops. Meadows and Pastures. Hay. Ensilage.

Dr. Marion I. Newbigin. **Evolution and spread of food-plants.** — London, Macmillan and Co. (1910). Rev. *Nature*, August 11, 1910, n. 2128, vol. 84.

Dr. Marion Newbigin tells of the evolution and spread of food-plants with an epical directness and unity of plan. An episode in the development of Transatlantic commercialism—such as the transportation of Smyrna figs to California—becomes in her hands a wonderfully impressive illustration of the working of the scientific spirit.

Stapf Otto. **The History of the Wheats.** — (*Supplement to the Journ. of the Board of Agric.*, vol. XVII, n. 3, London, June 1910. Pp. 71-83).

About the much discussed question of the origin of wheat it is explained, that what is usually understood when we speak of "Wheat" comprises a multitude of races, mostly of economic interest, which fall under one of the three groups of the Soft, the Hard, and the so-called English wheats; or, to use their Latin designations, the *Vulgare*, the *Durum*, and the *Turgidum* Wheats.
To them might be added as less common and economically less important wheats, those of the *Compactum* and *Polonicum* group, popularly known as "Dwarf" and "Polish" wheats. With the exception of the last, all these together form, in the system devised by the prominent agrostologist, Eduard Hackel, the subspecies *tenax* of the species *Triticum sativum*. They are characterised as the name *tenax* indicates, by having spikes with a tough spindle which, when mature, does not break up into joints and grains easily falling out from their husks or glumes. To these

wheats proper are opposed the so-called Spelt wheats. The spindles of these break up into joints at maturity, the grains falling with their husks and being more or less difficult to separate from them. To this group we have to refer, of cultivated wheats—the Spelt proper (*Triticum Spelta*), the Emmer (*Triticum dicoccum*), and the One-grained wheat or Einkorn (*Triticum monococcum*); further, the two wild wheats, *Triticum oegilopiodes* and *Triticum dicoccoides*. The macroscopic characters mentioned are, however, correlated with anatomical differences in the structure of the shell or pericarp of the grain, which still more accentuate the separation of the wheats proper and the Spelt wheats. From this standpoint the Polish wheat, which generally is treated as a distinct species, has to go with the wheats proper. Those are the principal kinds as they present themselves to the practical man without consideration of their taxonomic value. At present they are rather definitive and distinguishable units, whatever their place and relative position in the evolution of the wheats may be. It need only be added that the various Spelt wheats differ more from each other than do the wheats proper. Those ten wheats, however, are not only fairly well definable, but they are also constant in the sense that we cannot turn Soft wheat into Hard wheat, or Spelt into Emmer; nor has it been proved so far that the two wild wheats can be transformed into their assumed cultivated representatives, as we can, for instance, convert the wild carrot into the garden carrot. But too much stress must not be laid upon that, as *Triticum oegilopiodes*, the assumed primitive form of the Einkorn, has not been much experimented with, whilst *Triticum dicoccoides*, the supposed Emmer, was only rediscovered quite recently — having been known before solely from a single herbarium specimen — and is approaching now only its second harvest in the experimental grounds at Poppelsdorf, Bonn. In valuing the affinities of those wheats and tracing their descent, we have therefore to rely on the varying degree of their structural resemblances, the nature of the differentiating characters, the presence or absence of intermediate forms, other than hybrids, and on analogies.

J. G. Stewart. **Report on trials with varieties of wheat.** — (*Edinb. and East of Scot. Coll. Agr. Bul.*, 18, pp. 9). *É. S. R.* vol. XXII, March 1910, N. 4, Washington.

In this variety test of wheats Browick stood first in yield of straw and saleable grain, and White Chaff Squarehead, second.

Ch. E. Saunders. **The inheritance of " strength " in wheat.** — *The Journal of Agricultural Science*, Vol. III, Part 2. October 1909, p. 218.

Polemical.

The problems connected with the subject of strength in wheat will not be solved until a great deal more work of a patient and thorough character has been done. At present it appears that the absence of strength is due to various causes which may perhaps be roughly grouped under two heads, namely, small quantity of gluten, and poor quality of gluten.

These two causes each of which is perhaps complex seem to operate either together or separately, and it would be very singular if one simple rule of inheritance could be found to govern all cases; and even if we seek to dispose of most kinds of wheat in this easy fashion, in what group shall we place those varieties which are quite deficient in strength for several months after threshing, but which, on long keeping ultimately rise to the very highest rank?

A. D. Hall and E. J. Russell. **The Factors Determining the Yield of Wheat.** (Wheat: papers read at Meeting of the British Assoc. for the Adv. of Science at Winnipeg. Aug. 1909). — Supplement to the *Journal of the Board of Agric.*, Vol. XVII, n. 3. London, June 1910, p. 18.

To each type of soil there is a limiting yield beyond which the crop will not go. But the limit is not the same for all varieties; it is not unusual to find that one variety may do much better than another under one set of conditions, but not so well under others. There is still a good deal of work to be done in inquiring into the soil conditions and reducing to precise terms such vague expressions as " a good wheat soil. " For example, on soils not very dissimilar, with the same rainfall and management, a heavy wheat crop will stand in one case, while on the other soil it will invariably go down, and as yet it is impossible to state definitely the factors which thus determine the stiffness of straw in one case and not in another.

In new countries, such as Canada, as wheat is largely a pioneer crop, and as the pioneer cannot control his conditions to anything like the extent that is possible in more developed parts of the country, it is important that wheat should be bred to suit local conditions.

Experiments with Wheat. — *Journal Board of Agriculture*, May 1909, London, p. 150.

" *Continuous Growing of Wheat, 1908* (*Journal of Roy. Agric. Soc.*, vol. 69, 1908). After 30 years' continuous experimenting with wheat and barley (1877-1906) at Woburn, certain changes in the plan of manuring were introduced in 1907, and the effect was expected to be manifested for the first time in 1908. One plot received 5 tons 13 cwt. farmyard manure per acre, this being the equivalent of 100 lb. ammonia per acre, and other plots received various mineral manures. "Square Head's Master" was drilled at the rate of 2 $^1/_4$ bus. per acre. One plot received rape-dust (23 lb. ammonia) on February 21st, and nitrogenous top-dressings were given to various plots in early May and early June. The wheat came into ear by June 19th and most was cut on August 11th, all being carted and stacked by August 26th.

On the whole, the wheat yield was a good one, the unmanured produce being 12 $^1/_2$ bus, per acre, or nearly 2 bus. above the average of the last 10 years. The highest yield (28 $^1/_2$ bus.) was with minerals (superphosphate, 3 cwt. and sulphate of potash $^1/_2$ cwt.) and 2 cwt. per acre (practically) of nitrate of soda; the same minerals and 1 cwt. nitrate of soda yielding 2.3 bus. less. Farmyard manure produced 24.3 bus.; but rape-dust (4 cwt. per acre) only 16.6 bus. The 4 cwt. of rape-dust were apparently not equal in effect to 1 cwt. of nitrate of soda, which supplied the same amount of nitrogen, the latter yielding 23.7 bus.

So far the presence of phosphate appears to be more essential than that of potash, but the evidence is not yet conclusive. Sulphate of ammonia alone gave no crop beyond a little tail corn, but with varying quantities of lime applied some years previously — 5 cwt. in 1905, 2 tons in 1897, and 2 tons in 1905—the crops were respectively 3 bus., 22.9 bus., and 18.7 bus. Where a heavy dressing of sulphate of ammonia was used with minerals, the yield was insignificant where no lime was given. The report states that "it is becoming increasingly clear that heavy dressings of sulphate of ammonia, when continuously applied "will run land out" where lime is deficient, even when mineral manures are applied, and that the true remedy is liming." There are, further, indications that $^1/_2$ ton per acre of lime is not sufficient, but that at least 1 ton per acre should be used."

Wheat Experiments in Staffordshire and Shropshire in 1909. (A report of experiments by the Harper Adams Agricultural College). — Notice in *Nature*, Vol. 84, July 14, 1910, p. 50.

One of the most notable features is the cropping power of Browick gray chaff wheat, recently introduced to the district by the College authorities. Other wheats selected from Fife are also under investigation.

R. B. GREIG. **Oat and Barley Experiments, 1909.** — *Aberdeen and North of Scotland College of Agric.* Leaflet 8. *Experiment St. Record*, May 1910.

Of the 6 varieties of oats tested each averaged per acre more than 50 bu. of 42 lbs. each at the 5 centres at which the tests were conducted. The Highlander and Thousand Dollar varieties proved the earliest. The milling properties of 7 varieties are given, loss of weight from drying, and weight of husks, dust, oatmeal, and meal per quarter being indicated.

In a test of 8 varieties of barley, Danish Archer proved remarkably prolific. All were seeded at the rate of 2 500 000 seeds or from 4 to $4^3/_4$ bu. per acre. This rate of seeding yielded a total weight of from 4 548 to 5 370 lbs. per acre.

R. B. GREIG. **Report on oat and barley experiments, 1909.** — *Aberdeen and North of Scotland College of Agriculture*, Experiments, Leaflet, No. 10.

Several varieties of oats have been studied. The yield obtained from the "Major" variety is noticeable. This variety was obtained in 1904 by Major Smythe of Echt, who sowed a mixture of four varieties of oats, "Waverley", Wide-awake ", "Siberian" and "Thousand dollar", the three last being American or Canadian varieties. From this mixture of varieties one was obtained which, ever since 1904, has shown itself to be very prolific. It is probable that the "Thousand dollar" variety predominated in the mixture, but it is certain that a variety of a constant character both as to high rate of yield and uniform quality, has been obtained.

A comparative study has been made of several varieties of barley; amongst others the *Danish Archer* variety has proved itself to be undoubtedly the most productive during the three years of exerpiments, from 1907 till 1909.

DUNLOP, W. R. **The utilisation of Barley Straw in the Manufacture of Ensilage.** — *The Journal of the Board of Agriculture*, Vol. XVI, N. 4, 298-300. — London, July 1909.

It is a matter of common knowledge to feeders of stock that barley straw is of much less use on the farm than either oat or wheat straw. However, from the results of experiments reported, it is considered probable that the digestibility of barley straw could be greatly increased by fermentation with green stuff under pressure: that is, instead of making ensilage from green-stuff alone, barley straw might be added to the greenstuff and the mixture compressed and allowed to ferment. Even on the small scale of the experiments reported the effect upon the straw was most marked; its characteristic natural resistance is lost, and the various fatty acids and aromatic compounds produced during the fermentation tend to make it very palatable to stock. There is always a risk, however, in working with fermentation of this sort, that it may go too far and putrefaction set in, especially when air is allowed to enter.

The best proportion advised, in which to mix the green and straw is three to one by weight respectively; any green crop may be employed, provided the material is used directly from cut. In the preliminary experiments done, it was found that the material was most suitable for feeding after six weeks. Nevertheless actual trials and comparative feeding experiments are wanted.

Varieties of Oats. (Univ. Coll. of N. Wales, Bangor, Bull. 5, 1909). — *The Journ. of the Board of Agric.* May 1910. Vol. XVII, N° 2, London, pag. 144.

"Twenty-one varieties of oats were grown at Madryn in 1909. The yields were remarkably good, and there was little to choose between a number of the best plots. The first five in yield were Schlandstedter (114 bus. of 42 lbs) Beseler's Prolific (109 bus.) Abundance (108 bus.), Banner (108 bus.) and Wide Awake (106 bus). This experiment has been carried on for seven years and results are given in the report for each year. Over this period there has been little difference between such well-known varieties as Abundance, Newmarket, Wide Awake, Banner, Waverley, and Stable King. Daubeny and the German varieties Beseler's Prolific, Schlandstedter, and Anderbecker, have not been grown so frequently but are comparable to the others. The yellow and black varieties never cropped so well at Madryn as many of the white oats. They did better in the early years of the experiment, when the yields were altogether lower and when the land was presumably in poorer condition. Goldfinder proved a useful yellow variety, provided it was sown early enough to ensure ripening in good time."

R. P. Wright and A. M. M'Alpine. **Report on variety tests of Oats, in Scotland.**—(*West of Scot. Agr. Coll. Ann. Rept.* 9 [1909], pag. 37-77, 127-161-167-193, 199-220) *E. S. R.*, vol. XXII, March 1910, n. 4.—Washington.

Experiments were conducted with uniform station-grown seed on twentieth-acre plats on 147 different farms, during the 5-year period ended with the season of 1906. The average yields of the 3 typical varieties tested were Banner, 66 bus of dressed grain per acre, Potato, 57 bus, and Sandy, 53 bus.

In a test of 27 varieties conducted on 33 different farms, 429 iron frames were used, these frames being bottomless and each enclosing a part of the field in which 32 seed oats were sown at uniform distances and under uniform conditions. "The produce of this miniature acre is intended to show the links of connection between the variety of the oat and the acre yield of the crop." The characters studied were the mortality of the varieties, their tillering power, proportion of mature straws to barren shoots, straw length, straw bore, ear length, and number of spikelets per ear.

Studies based on about 200 samples of oats representing 20 varieties and grown on 17 different farms, indicated that marks of good seed are proper weight per thousand seeds, and assurance that the seeds have come from prolific ears or heads. A study of maximum and minimum weights per thousand kernels of various varieties showed that among those designated as small oats, the average weight per thousand kernels ranged from 21.8 gm. to 23.6 gm. Among the large oats the range was from 25.4 gm. to 31.5 gm. Even for the same variety of oat, however, higher bushel weight was found to be no guide to higher kernel weight, and manurial applications had little effect on the kernel weight. Data are also presented on the proportion of kernel to husk and its relation to milling power.

R. N. Salaman. **Male sterility in Potatoes, a dominant Mendelian Character, with remarks on the shape of the pollen in wild and domestic varieties.** — (*Linnæan Society*, June 16, 1910). *Nature*, vol. 84, London, July 7, 1910, p. 29.

Experiments at Barley near Royston, Herts, during the past four years.

The author points out that " dead " pollen grains, or none, are usually associated with flowers of heliotrope colour.

Effect of a Change of Locality on the Vigour of the Potato plant. (Report on Experiments with potatoes in 1909, by Mr. Stewart, of the Edinburgh and East of Scotland Agricultural College). — Note in *Nature*, Vol. 84. July 14, 1910. p. 50.

The best change of locality is from a later or colder district to one earlier or warmer. Thus in the South East of Scotland it was found advantageous to procure seed from the north, just as in England it is found profitable to procure seed from Scotland or Ireland.

Planting Potatoes. (Lancs. C. C. Agric. Dpt. Bull. n. 10). — *The Journal Board of Agric.*—London. August 1909, p. 403).

This Bulletin gives the results of the experiments with seed potatoes which have been carried on for the four years 1905-8. The two points investigated were the effect of change of seed, and the benefits of boxing and sprouting.

The conclusion arrived at are as follows:

1) Seed potatoes brought from a northern to a southern latitude give a much larger crop than do those brought from a southern to a northern latitude.

2) The yield from Irish-grown seed sprouted, though highly satisfactory, is, on the average, below that from the Scottish-grown seed sprouted. It is evident, however, that Ireland may become, in the near future, a strong competitor with Scotland as a source of seed potatoes for Lancashire, especially if the respective costs of transit are taken into consideration.

3) Seed potatoes obtained from localities within the county fail on the average to produce crops as large as those obtained from Scottish or Irish-grown seed.

4) Seed potatoes obtained early in the year and sprouted before being planted give a larger yield than those obtained late and planted direct (i. e. unsprouted) from bags. It is important to keep the first formed sprouts, as they are the strongest, and appear above ground in the shortest possible time, thus allowing a longer season of growth.

5) The increased yield from seed bought early in the year will repay the extra labour incurred by its early arrival upon the farm and will at the same time allow of a substantial profit, as, on the average, the crop is increased by more than two tons of large tubers per acre by the use of sprouted seed.

R. P. Wright. **Effects of planting sprouted tubers on the yield of the potato crop**. — (*West of Scot. Agr. Col. Ann. Rpt.*, 9, 1909, pp. 101-114). *E. S. R.*, March 1910. Washington.

The object of this experiment was to determine the effect upon yield of sprouting potato tubers before planting. The increase varied with the varieties tested, the later varieties showing a decided increase.

W. Bruce. **Experiments with potatoes, 1906-1908.**—(*Ed. and East of Scotl. Col. Agr. Bul.*, 17, 24). *E. S. R.* Washington, Aug. 1909.

Among the best varieties of potatoes grown were Midlothian Early, Sharpe Express Conquest, Cottar, Dalmeny Acme, Factor, Dalhousie, What's Wanted, and Langworthy. The two varieties last mentioned ranked highest in quality but did not come up to the others in yield. Sets obtained by cutting tubers of market size produced as heavy crops as whole tubers of small size, and furnished a larger proportion of marketable potatoes. Planting 12 in. apart in the row gave better results than planting at wider distances.

Lime nitrogen proved an efficient nitrogenous fertilizer for the crop. The use of 1 cwt. of sulphate of ammonia, 4 cwt. of superphosphate, and 1 cwt. of potash per acre is recommended, either used alone or with a heavy dressing of farm-yard manure.

The use of 5 cwt. of ground lime per acre in connection with a complete fertiliser was not profitable, and the corresponding use of 1 cwt. of carbonate of magnesia has so far not given results that would warrant its general use.

E. Porter and R. C. Gaut. **Summary of experiments on the manuring of potatoes in Lancashire.** — (*County Council Lancaster, Ed. Com., Agr. Dept., Farmer's Bul.*, 13, 25, pl. 1). *E. S. R.*, XXI, August 1909, Washington.

Basing their recommendations on the results of the experiments here described, the authors advise the use of 20 tons of farm-yard manure per acre for potatoes on land in moderately good condition. Where commercial fertilisers are to be used alone, 2.5 cwt. of sulphate of ammonia, 6 cwt. of superphosphate, and 2 cwt. of muriate of potash is recommended. Satisfactory crops of potatoes were grown with the use of commercial fertilisers alone, but the practice is not considered generally good. For the production of the largest and most profitable crops it is advised that 10 tons of farm-yard manure, 1 cwt. of sulphate of ammonia, 4 cwt. of superphosphate, and 1 cwt. of chloride of potash per acre be given.

R. B. Greig. **Effects of the new Nitrogenous manures on potatoes and hay.** — *Aberdeen and North of Scotland College of Agriculture Experiments*, Leaflet, No. 9, 1909.

This is a brief report on the effects of Cyanamide of calcium and Nitrate of lime on potatoes and hay as compared with those obtained by the use of Sulphate of ammonia and Nitrate of soda. The experiments on potatoes were carried on from 1907 to 1909 those on grass lands were only made in 1909.

The results show that Cyanamide of calcium and Nitrate of lime may be used with advantage in the case of potatoes. They can be used when the potatoes are planted, as they do not seem to favour the development of potato-rot (gale) nor to deteriorate the quality or size of the tubercles. Nitrate of lime should be preferred to Cyanamide.

The different nitrogenous manures used for spreading on the field in April 1909 may be classed as follows in order of merit:

Manure	Production in hay Cwts. per acre	kgs. per ha.
Nitrate of soda	49.35	6918
Sulphate of ammonia	48.33	6070
Nitrate of lime	47.35	5947
Cyanamide of calcium	43.48	5461
Without nitrogenous manure (av.)	39.08	4908
Without any manure (average) .	34.81	4372

Manuring the potato crop. — *Mark Lane Express*, London 103, 1910, 4089, p. 137.

The recommendations of various authorities on this subject are summarized, including those based upon recent experiments in Scotland with lime-nitrogen.

R. B. Greig. **Turnip manuring experiments, 1909.**— *Aberdeen and North of Scotland College of Agriculture. Experiments leaflet, n. 11.*

The action on turnips of finely ground mineral phosphate, used in large quantities in the North of Scotland, is studied.

All the patches on which experiments were made were manured alike with sulphate of ammonia and potassic salts. The experiments showed the advisability of using ground phosphates along with stable manure. The following is the yield of the turnips:

Manure	With stable-manure tons.	cwts.	Without stable-manure tons.	cwts.
Superphosphate	23	15	17	10
Ground Algerine phosphate	21	8	16	11
„ Belgian „	21	7	15	4
„ Florida „	20	7	13	14
Without manure (average)	—	—	11	13

R. B. Grieg. **Turnip manuring experiments, 1908.**— (*Aberdeen and North of Scotland Agric. College*, Leaflet 7, p. 6). *Exp. Stat. Record*, May, 1910. Washington.

A mixture of $^6/_7$ cwt. sulphate of ammonia, $5^3/_4$ cwt. superphosphate, and 1 cwt. sulphate of potash produced an increase of 9 tons 15 cwt. of turnips per acre. When the potash was omitted the increase over the check plat was only 5 tons 6 cwt. On omitting the phosphate the increase was 2 tons 4 cwt., and omitting the nitrogen resulted in an increase of 7 tons 10 cwt. The use of superphosphate alone showed an increased yield of 5 tons over the check plat, but of only 1 ton 15 cwt. on plats fertilized with dung. Applications of more than 3 or 4 cwt. of superphosphate appeared to be unprofitable, except as to their residual value. Phosphoric acid in high grade and in low grade slag appeared equally advantageous, except that the low grade slag had an apparent advantage on land deficient in lime.

Varieties of Swedes. (North of Scotland Agric. Coll. Trans., of Student's Assoc. 1909). — *The Journal of the Board of Agriculture.* June 1910. Vol. XVII, N° 3, p. 226.

"It is pointed out in this Report that in spite of the great acreage occupied by the turnip crop in the North of Scotland, little or no data exist to show which are the varieties of turnips and swedes best suited for the various districts. This Association has, therefore, initiated a scheme to test the better-known strains of swedes and turnips. Purple Tops were tested in 1909, Green Tops will be tried this year, and Bronze Tops in 1911."

', Ten varieties of Purple Top swedes were grown on nine farms. The difference between one variety and another on the same farm was often considerable, and indicated that every farmer should discover for himself by experiment the variety most suitable to his circumstances. On the average of the nine centres there was no very great difference between the varieties."

"Nine varieties of swedes and turnips were tested for their power of resisting finger-and-toe. Of the swedes the best was Bruce's Buchan, with 91 per cent of sound bulbs; and of yellow turnips, Climax and Victor Achilles, with 84 per cent of sound bulbs. The trials are being continued."

Manuring of Swedes in Cumberland and Westmoreland. (Farm. School Newton Rigg. Thirteenth Ann. Rept. 1908-1909). — *The Journ. of the Board of Agric.*, May 1910, Vol. XVII, n. 2, London, p. 147.

"The following results were obtained in 1908, which confirm those of former years:

Plot.	Tons	Cwts
1) No manure	7	17
2) $3^1/_2$ cwt. kainit and $7^1/_2$ cwt. superphosphates. . .	29	0
3) 1 cwt. nitrate, 2 cwt. kainit, 6 cwt. slag.	28	11
4) 1 cwt. nitrate, 2 cwt. kainit, 5 cwt. superphosphates	28	7
5) 12 tons dung	25	2
6) 12 tons dung and one-quarter of Plot 4 dressing . .	28	12

"The cost of the artificials used on Plots 2, 3, and 4, was 29s. Evidently as good crops of swedes may be grown with artificials as with farmyard manure, and at a comparatively small outlay. The deciding consideration in good farming as to the extent to which artificials should replace farmyard manure, will be the extent to which the swedes will be consumed by sheep on the land where grown. If all are to be thus disposed of, as is frequently the case on light land, the crop may be grown entirely with artificials; if half the crop only is to be eaten on the ground, then half the dung of Plot 5 and half the artificials of Plot 3 or 4 would be good management. And if all the roots are to be carted off, then the full dressing of dung assisted by a small artificial dressing as with Plot 6 should be applied; so as to leave the land in good condition for the corn and seed-grass crops which are to follow."

Varieties of Mangolds. (*Midland Agric. and Dairy College*, Bull. 3, 1909-1910). — *Journal of the Board of Agriculture*, p. 145, London, 1910.

The following table shows the relative value of three varieties of mangolds.

Variety	Yield in tons per acre.	Dry matter lbs. per acre
Prizewinner	31 ton 8 lb.	5546
Windsor-Globe	29 „	5436
Golden Tankard.	20 „	4579

Manuring of mangolds and swedes. [Results of Field Manurial Demonstration by Wiltshire County Council, 1908-9]. — *The Journal of the Board of Agriculture.* — June 1910. Vol. XVII, n. 3, p. 231.

"Six experiments on the manuring of mangolds and six on the manuring of swedes were carried out at different centres in the county."

"The schemes on which these demonstrations were carried out received the general approval of the Board of Agriculture and Fisheries, and were largely based on the schemes submitted to the Board by the Agricultural Education Association. They appear to have been very carefully carried out, and this report gives the results obtained at each centre, together with full particulars as to the soil, weather, and previous cropping."

"In the case both of the mangold and the swede experiments, there were eight plots at each centre, the area of each plot being eight perches. One plot received no artificial manure; one plot received a complete dressing comprising kainit, superphosphate, and nitrate of soda; three plots received dressings composed of two of these manures; and three plots dressings of each manure alone. The quantities in the mangold experiment were as follows: kainit, 5 5/8 cwt; superphosphate, 6 cwt; and nitrate of soda, 2 3/8 cwt per acre. In the swede experiment, the quantities were: kainit 2 7/8 cwt; superphosphate, 6 cwt; and sulphate of ammonia 7/8 cwt."

"The general tendency of the experiments is in favour of kainit and nitrate of soda, which gave a better result than the complete manure at four out of the six centres and at a smaller cost."

"In the case of the swede experiments, the results at one centre were irregular and produced very little result, owing to the wet season. Taking the average of the other five, the best result was obtained from the complete manure, which gave an increase of nearly 11 tons par acre, or a gain, after deducting the cost of the manure, 87 s. 6 d. per acre. Kainit and superphosphate, and kainit and sulphate of ammonia, gave approximately similar results, with averages of 7 tons 15 cwt, and 7 tons 8 cwt, per acre or gain of 62 s. 8 d. and 64 s. respectively per acre. Superphosphate by itself gave 7 tons 1 cwt, or a gain of 62 s., so that the addition of kainit to this manure had apparently little effect; in fact, at two centres superphosphate alone gave a higher result. In the same way the application of sulphate of ammonia, in addition to the superphophate, produced no further increase. The results of these experiments, therefore, seem to be entirely in favour of a complete dressing."

Manuring of Mangolds. (*Somerset C. C., Rept on Field Trials of Manures*, 1904-1908). — *The Journ. of the Board of Agric.*, May 1910, Vol. XVII, N° 2, London, pag. 145.

"The object of this experiment was to determine whether artificials can be profitably used to supplement the usual dressing of dung. The experiment was conducted in all on thirty-five farms, with a variety of soils, mostly, however, inclined to be heavy. The land usually received from twenty-five loads of dung to the acre, the cultivation and seeding in each case following the usual practice of the particular farm. The artificials applied were nitrate of soda, superphosphate, kainit, and salt, alone and in combination. The plots were one-sixteenth of an acre, ten plots being laid out on each farm."...

"The experience gained from these experiments suggests that the application of artificial manures to mangolds in addition to a good dressing of dung is profitable. Artificials appear to assist in giving the crop a start, particularly in an unfavourable season, and as it is a matter of the greatest importance to secure a regular plant, the use of artificial dressings, in some form or other can for this reason be recommended."

Manuring of Mangolds at Cirencester. — (Roy. Agric. Coll., Cirencester, *Agric. Students' Gazette*, December 1909). *The Journal of the Board of Agriculture*, June 1910, Vol. XVII, N° 3, p. 227.

"All the plots on which this experiment was conducted were dressed with 12 tons per acre of farmyard manure. Eleven different mixtures of artificials were then applied, each plot being in duplicate. The soil varied in depth and texture considerably, and the difference between duplicate plots was in some cases large. Only the produce of $^1/_{80}$ th of an acre was weighed, and errors are likely to have arisen from this cause. All the nitrogenous manures gave an increase, though not always sufficient to show a profit when the cost of the dressing was taken into account. The heaviest crops were given by 3 cwt., of superphosphate and 4 cwt kainit, together with either 1 cwt. sulphate of ammonia, 143 lb nitrate of soda, or 175 lb., nitrate of lime, these amounts containing equivalent quantities of nitrogen. When the roots were valued at 10*s* a ton these three mixtures all showed a profit."

"A second experiment was intended to test the effect of kainit and of nitrogen in four different forms. No farmyard manure was applied but all the plots received 3 cwt. per acre of superphosphate. The plots in this experiment also were very irregular and the area weighed was very small. The general result was to favour the employment of a "complete" manure. Taking the average of the six plots receiving kainit, superphosphate, and nitrogenous manures, against the average of the five plots receiving superphosphate and nitrogenous manures only, there was an increase in yield of $3^1/_2$ tons of roots in favour of the complete mixture."

Experiments of Roots, etc., by the Midland Agricultural and Dairy College. — Notice in *Nature*, Vol. 83, April 14th, London, 1910, p. 199.

Field trials with mangolds, swedes and seeds hay. The trials are made with the aim of discovering the best varieties of the particular crops and the most suitable manures for use in the district.

Produce of Grass and Yield per Acre in Great Britain in 1909. (Statistics affecting British Agricultural Interests). — *Jour. of the R. Agric. Soc. of England*, vol. 70, London, 1909.

Grasses		Acreage Acres	Produce Tons	Average Yield in 1909: cwts per acre	Average Yield in 1909: kgs per hectare
Hay from Clover Sainfoin etc.	England	1 449 286	2 090 595	28.85	3624
	Wales	170 497	192 907	22.63	2842
	Scotland	415 990	652 589	31.38	3941
	Great Britain	2 035 773	2 936 091	28.84	3622
Hay from Permanent Grass	England	4 094 162	4 731 088	23.11	2903
	Wales	529 567	484 687	18.31	2300
	Scotland	152 965	216 585	28.32	3557
	Great Britain	4 776 694	5 432 360	22.75	2857

DOUGLAS A. GILCHRIST. **Trials of Wild White Clover. Clover-Sickness.**—*The Journ. of the Board of Agric.* December, 1909. Vol. XVI, N. 9, Pp. 713-718.

"White or Dutch clover (*Trifolium repens*) has been grown by English farmers since 1764 (1) or earlier. In that year the Society of Arts awarded a premium of £20 to a Wiltshire agriculturist for growing 21 $^1/_4$ cwt. of the seed of this plant, and a similar premium was awarded for the same purpose in the following year. The Society's object was to encourage the growing of the seed in this country, instead of importing it from Holland, as was then the custom. Red, or broad-leaved clover (*Trifolium pratense*) had been in common use in England long before this time, as Walter Blyth in the "English Improver Improved" (third edition, 1652) describes the cultivation of this crop.

(1) *Dossie's Memoirs of Agriculture,* vol. I, p. 58.

From Blyth's account of the growth of red clover in England in the seventeenth century, it appears that at that period of its history its term of growth was three years; it seems quite probable that it has since then gradually become a shorter-lived plant, as it usually does not now last so long.

A difficulty with red clover as now grown, in common with all cultivated leguminous crops, is that land soon becomes "sick" of these crops when they are grown in succession or too frequently. An interesting question that arises is: Does land become "sick" of the wild or native forms of clovers and allied plants?

Gorse, a leguminous plant, continues to grow year after year in its natural habitats without any apparent tendency to gorse-sickness. The leguminous plants, indigenous to districts, evidently continue to grow year after year, with about the same vigour and in the same numbers. Favourite habitats of the leguminous plants, like the Great Orme at Llandudno (on limestone), apparently continue to grow these plants for centuries. Much evidence is accumulating, too, that the continued use of basic slag and other manures which encourage white clover and other natural leguminous herbage, will keep these plants growing healthily for long periods of years. All this indicates that a return to native or wild forms of white and red clovers may have excellent results on clover-sick land.

Wild white clover has now engaged attention for some time. In 1886 the Royal Manchester, Liverpool, and North Lancashire Agricultural Society commenced grass and clover seeds experiments on the late Mr. W. E. Gladstone's Hawarden estate at Broughton Hall, near and Chester, and on Mr. John Roberts's farm at Saltney. The late Mr. Thomas Rigby, of Cheshire, who was such an indefatigable worker in the cause of agriculture, showed the writer these experiments in 1891. In 1886 some small plots had been sown down, (*a*) with grasses only, (*b*) wlth grasses and cultivated white clover, and (*c*) with grasses and wild white clover. Five years later (*a*) had as much white clover present as (*b*), but only a few scattered plants in each case, which were undoubtedly natural to the soil. On the other hand (*c*) had an abundance of clover plants present. It was perfectly evident that wild white clover seed had produced perennial plants, whereas the plants produced from the cultivated or commercial white clover seed had disappeared within a year or two, although they had come up all right after sowing. The wild white clover seed was collected from old and natural pastures in Kent. This produced smaller plants, which spread considerably further than the plants produced from commercial seed.

In 1906 an excellent opportunity presented itself at Cockle Park for testing wild white clover. A small area of the poorest type of boulder clay soil in Tower Hill field had been summer fallowed in 1905, and was sown with wheat in the autumn. In April, 1906, four one-quarter acre plots were marked off and two of them sown with the following seeds (per acre):

	Plot 1	Plot 2
Perennial rye-grass . . .	6 lb.	6 lb.
Italian rye-grass.	6 »	6 »
Cocksfoot	6 »	6 »
Timothy	3 »	3 »
Meadow fescue	8 »	8 »
Red clover	4 »	4 »
Alsike clover.	2 »	2 »
White clover	4 »	4 »
Wild white clover	—	4 »

Plots 1 and 2 had exactly the same seeds' mixtures, except that Plot 2 had, in addition, 4 lb. wild white clover seed. The seeds for Plot 1 cost about 23s. an acre, and as the wild white clover seed for Plot 2 cost 1s. 6d. a pound, the seeds for Plot 2 cost 29s. an acre. These plots have now produced hay for three years with the following results (per acre):

	Weight of hay.	
	Plot 1	Plot 2
1907 . . .	30 $^1/_2$ cwt.	35 cwt.
1908 . . .	18 $^1/_4$ »	28 $^1/_4$ cwt.
1909 . . .	15 $^1/_2$ »	21 $^3/_4$ »
Average .	21 $^1/_2$ »	28 $^1/_2$ »

The aftermath has been grazed every year. White clover, and practically all the clovers, disappeared from Plot 1 after the first year, but now some natural clover plants are spreading on this plot. Plot 2 has always had a thick and close sward of white clover, and this continues to be so. It may be noted that, on this cold clay soil, meadow-fescue seed has failed to produce plants. A striking result is that in Plot 1 the grasses have not been nearly so luxuriant as on Plot 2. This was so even in the first year's hay crop, and is undoubtedly due to the collection of nitrogen from the atmosphere by means of the nodules on the clover roots, and to the stimulating effects of the nitrogen on the grasses.

A further four acres of similar poor clay soil in the same field was sown down a year later with the seeds' mixture of Plot 2, but with cultivated white clover omitted; the seeds being again sown on young wheat, after summer fallow. The resulting hay crops in 1908 and in 1909 have been excellent, and there is now a beautiful sward of white clover. This land received 10 cwt. per acre of high quality basic slag after the wheat crop was removed in 1907, and this has had a remarkable effect in developing the clover plants. The crops of hay (per acre) averaged 32 cwt. in 1908, and 37 cwt. in 1909—very satisfactory crops for this poor clay soil.

The same seeds' mixture was sown 1908, with barley, on about 5 acres of poor clay soil in Upper Brick field. This was also dressed with slag when the barley crop was removed, and the crop of excellent hay produced in 1909 averaged 2 tons per acre.

In 1909 the rotation hay in East Tower Hill field was a considerably lighter crop than this (35 cwt. per acre) though up till February there were good clover plants on this field, all produced from cultivated clover seeds, principally red clover; by May, however, the clover plants had practically disappeared, in common with much of the young clovers throughout Northumberland last spring. This disappearance of clover is, unfortunately, far too common in Northumberland and the North of England, and is probably not due to clover sickness only, but largely to cultivated clovers not being hardy enough to stand the rigorous springs of the North. The experiments already quoted indicate that where these clovers are liable to disappear, the inclusion of a small amount, (say 2 lb. per acre) of wild white clover may be very useful, even in a seeds' mixture for one year.

It may be predicted with confidence that the inclusion of wild white clover seed in a seeds' mixture for laying down land to hay or pasture, especially on strong clay soils, will produce a sward practically immediately, and if this be so the series of years hitherto necessary to accomplish this will to a large extent be bridged over.

A remarkable result is the rapidity with which basic slag has acted where this clover has been sown at Cockle Park. On Lord Londonderry's estate at Wynyard (County Durham), where one of the poorest pastures on a cold boulder clay soil has been drained, dressed with 10 cwt. per acre of high quality slag in November, 1908, and sown with 12 lb. wild white clover seed per acre in April, 1909, there is now a capital sward of white clover where the soil and subsoil left on the surface after draining has been sufficient to give a seed-bed to the clover seeds. Where, however, there is much benty herbage and no loose soil the sown clover has not established itself, although basic slag has greatly developed the clovers and allied plants naturally present in the pasture."

A. N. Mc'Alpine. **Grasses.** — *The Standard Cyclopedia of Modern Agricultural and Rural Economy*, London, 1910.

The object of this article in the Modern Cyclopedia of Agriculture, by the well-known writer on Grasses, is to explain those peculiarities upon which the agricultural value of grasses depends, and also to indicate those points of construction which must be noticed in order to distinguish one species from another when in leaf, when in ear and when in seed.

The various details are considered under the following heads.

I. Distinction between grasses and their allies.
II. Parts of grass plant.
III. Tillering.
IV. Duration of life.
V. Modes of growth.
VI. Height of grasses when in ear.
VII. Natural habitat of grasses.
VIII. Soil for grasses and indicator grasses.
IX. Grass leaves.
X. How to know grasses by their leaves.
XI. Grass ears.
XII. How to know grasses by their ears.
XIII. Grass seeds.
XIV. How to know grasses by their seeds.
XV. Impurities and adulterants of commercial seed.

Mr. William Carruthers, the Botanist. His work from 1871 to 1909. Improving Pastures. — *Journal of the R. Agric. Soc. of England*, vol. 70, 1909, pp. 1-12.

Mr. William Carruthers, who for nearly forty years was consulting Botanist to the R. Agricultural Society of England, has now retired from that post. When he was appointed in 1871 no provision existed in England for the farmers who wished to ascertain the quality of seeds supplied to them or to obtain the advice of a botanist in other matters.

The first investigations made by Mr. Carruthers concerned the quality of the seeds supplied to the farmer for his pastures, which was then most unsatisfactory. Scarcely one sample of meadow fescue examined was free from rye-grass; and the germination was so low that some samples were even below 10 per cent.

In 1882 the Botanical Committee, under whose direction Mr. Carruthers worked, published a recommendation that members of the Society should obtain certain guarantees as to purity and germination of the seeds they purchased. This step had a remarkable effect in improving the quality of seeds. In 1883 two leading firms offered in their catalogues, at ordinary market prices, grass seeds of much higher quality than the Committee suggested. Other seed merchants followed, so that now the guarenteeing of seeds is nearly universal with the leading firms.

The Committee next dealt with forming new and improving old pastures. It had been the practice for the merchants to sell mixtures prepared for different geological formations, in which mixtures the chief ingredients were perennial and Italian rye-grass. These mixtures gave a good crop of grass for a year or two and then would begin to fail.

In dealing with this problem it was important to find out what plants were palatable to the stock.

The grasses which flower and seed in a well fed pasture afford evidence as to the plants which are not palatable; they have been rejected in the grazing. The next step was to find what grasses supplied the largest amount of nutriment and lasted most.

Many experiments were carried on by Mr. Carruthers at the Society's farm at Woburn.

The Committee were greatly aided by the observations and experiments of the late C. De L. F. De Laune, carried on with the assistance of the Society's Botanist, and by the works of Swayne, Curtis, Thornhill and Sinclair. Many worthless and second rate grasses were got rid of and the grasses used were limited to those that were palatable, nutritious and perennial, namely cocksfoot, meadow fescue, foxtail, timothy, one or two meadow grasses (*Poa*) with white and red clover.

An important result of the experiments carried on at Woburn in 1887-8 was to demonstrate the greater value of timothy over rye grass for short lays. The green produce at Woburn for the two years named was at the rate of 6 tons 13 cwt. per acre of timothy, while perennial rye-grass yielded 5 tons 11 1/4 and Italian 5 tons 17 1/4, the same number of germinating seeds per acre being sown in each case. It is also the cheapest good grass in the market.

Supposing ten million plants to be sufficient for an acre the cost per acre would be the following.

	Cost per lb.	Seed for 10 000 000 plants lbs.	Cost per acre
	s. d.		s. d.
Timothy	0. 4 1/2	8	3. 0
Rough stalked meadow grass .	1. 8	5	8. 4
Italian rye-grass	0. 3 3/4	40	12. 6
Perennial rye-grass	0. 3 1/2	46	13. 5

Many contributions by Mr. Carruthers have been published on the weeds of pastures and cultivated lands. The different methods of treating biennial and perennial weeds, and the difficulty of eradicating those with under-ground stems or roots have been pointed out.

R. Stapleton. **On the Flora of certain Cotswold Pastures.** — *Agricultural Students Gazette*, Vol. XV, Part. I. August 1910. Cirencester.

This article draws attention to the flora of certain pastures with a view to forming an opinion of their comparative merit, judged from a purely botanical point of view and not by such criterions as weight of hay and other empirical guides.

The mode of procedure adopted was first to draw up a complete catalogue of the species in a field; secondly, to group the species according to their relative abundance, showing gramineae, leguminosae and non-grass and non-leguminous flora in three separate columns.

This grouping can be conveniently made as follows: Dominant, Subdominant, Abundant, Frequent, Sparse, and Solitary.

Manuring of Seeds Hay (Midland Agric. and Dairy Coll., Repts. on Expts., 1907-908). — *The Journal of the Board of Agriculture.* — London, October 1909, vol. XVI, n. 7, p. 590.

"These trials have now been carried on for five years for the purpose of ascertaining whether this crop can be profitably treated with artificial manures. Plots at a number of farms were dressed with different mixtures of artificials and compared with unmanured plots. The results are considered to show that:

1) The seeds hay crop can be profitably treated with artificial manures, even in a prolific season, and on good land.

2) It is better to apply a complete dressing—i. e., one containing nitrogen, phosphates and potash—rather than an incomplete one.

3) Unit for unit the nitrogen contained in the two manures, sulphate of ammonia and nitrate of soda, is of equal value to this crop. The user's choice should, therefore, be in accordance with the cost per unit.

4) In these trials muriate of potash (potassium chloride) was the only form of potash which gave a profitable return, and then only when applied within the first fourteen days of March.

"The following mixture per acre is recommended as giving the best and most profitable yields: 105 lb. potassium chloride (50 lb. potash) applied within the first fourteen days of March, followed by 130 lb. sulphate of ammonia (25 lb. nitrogen), 216 lb. superphosphate (25 lb. phosphoric acid), applied within the first fourteen days of April".

E. Kinch. **Experiments on Permanent Grass Land, 1910, at Cirencester.** [Royal Agricultural College]. — *Agricultural Students Gazette*, Vol. XV, part I, August 1910.—Cirencester.

Experiments were continued on the 20 plots, each 1/20 acre (202 sq. meters) used the last nineteen years or more (see *Agricultural Students' Gazette* since 1889).

The manures applied to each plot are the same in kind and in amount as in the previous years.

This is the 23d year in succession for the application of the same manures to plots 1 to 14; the 22nd year of the farm-yard manure plots; and the 19th year of the Thomas' basic slag and rape meal.

The unmanured plot gave the very excellent yield of over 25 cwt of hay. All the plots, except the kainit alone, gave a higher yield than the unmanured.

The highest yield was from the plot receiving superphosphate, kainit and nitrate of soda, followed closely by superphosphate kainit and ammonium sulphate, kainit and amm. sulphate, kainit and nitrate of soda, superphosphate and nitrate, and farm-yard manure: all giving over 2 $^1/_4$ tons per acre.

The superphosphate and amm. sulphate, Peruvian guano, and amm. sulphate all gave over 2 tons per acre. Nitrate of soda (alone) gave a slight increase, but its ill effect as compared with amm. sulphate (alone) was more marked than in former years. Phosphates and potash gave an increase of about $^1/_2$ a ton over the unmanured; and in the hay there was a much larger proportion of leguminosae than in some of the plots receiving nitrogen in addition. Basic slag and rape meal improved the quality, but had not much action on the quantity of grass. Peruvian guano improved both quality and quantity.

Buttercups (*Ranunculi*) were less abundant where the complete mineral manures and where kainit, either with nitrate or with ammonium salts were applied.

The average yield per acre of all the plots was 37 $^1/_2$ cwt. of hay, being about 7 $^1/_2$ cwt. more than the average of the whole time of the experiments.

A preliminary botanical examination of the growth in the field gave 50 species of flowering plants.

On the unmanured plot and on those receiving kainit alone and nitrate alone, the number of flowering species was about 30. With kainit and superphosphate the number was reduced to 22; and with kainit, superphosphate and nitrate to 16. There were no buttercups on this last plot, on which 13 of the species were grasses and leguminosae. Cocksfoot (*Dactylis glomerata*) formed a higher percentage than on any other plot; and the miscellaneous herbage was represented only by *Potentilla repens, Cerastium triviale,* and *Galium verum.*

On the unmanured plot *Lathyrus pratensis* was by far the most abundant of the leguminosae; here the ratio of the weight of grasses to leguminosae was very nearly 9 : 1, and of the latter nine tenths was *Lathyrus.*

E. Parke and B. Dyer. **Manuring of Grass land.** (Expts. at Kineton, Warwickshire, 1909). — *The Journal of the Board of Agriculture.* October 1909, Vol. XVI, N. 7. pag. 591.

" Experiments have been carried out at Kineton since 1901 by Mr. Ernest Parke, J. P., with the co-operation of Dr. Bernard Dyer.

When this land was first taken over by Mr. Parke it was in very poor condition owing to long-continued neglect as regards manuring. The fields selected in 1901 for these grass experiments had then been down in grass for about ten years. The soil of both fields consisted of clay containing only a small admixture of sand, and may perhaps be best described as " heavy clay loam. "

On analysis both soils were found to be very poor in available phosphoric acid. The soil of one of the fields (" Upper Hale ") contained a smaller proportion of lime than that of the other (" Five and Three Acres "), and it was accordingly decided to use basic slag as a phosphatic manure for " Upper Hale " and superphosphate for " Five and Three Acres. " Analysis indicated that both soils contained a sufficient quantity of natural potash, but nevertheless portions of the experimental area were marked out for treatment with potash salts. The analytical indications were borne out by the fact that while phosphates have produced a large increase of hay, potash salts have thus far had but a small effect on either of these fields, although in other trials potash salts have proved very valuable in improving both the yield and the composition of the hay.

The results of the first eight years' experiments are summarised below. The natural yield of the land may be seen from the quantity of hay yielded by a portion of each field which has been left continuously unmanured. The yield of the unmanured land is tending to increase slightly but steadily year by year, by reason of the fact that, after hay harvest, the whole of the plots are thrown open to autumn grazing with the rest of the field. Under these conditions the unmanured plots share to some extent the indirect manurial advantage of the consumption by grazing stock of the richer herbage of the manured land. This gradual improvement appears in both fields.

No exact botanical survey has yet been made of the plots, but speaking in general terms, it may be stated that the unmanured land is conspicuous for the poor, wiry nature of its grass and the abundance of plants which in a pasture may be regarded as weeds. On all the manured plots, on the other hand, there is an abundant growth of rich grass. Where phosphates, or phosphates and potash salts, have been continuously applied, without nitrogen, the growth of plants of the clover kind is most conspicuous; while on the plots on which nitrate of soda has been continuously used without phosphates or potash (a mode of manuring which on general principles is not to be recommended), the grasses, as distinguished from clovers, are most prominent. The best herbage, however, in which clovers and grasses appear to flourish with equal vigour and luxuriance, is found on the plots on which both phosphates and nitrate are used every year.

GRASS-LAND: FIVE AND THREE ACRES FIELD, AT KINETON.

Manuring per Acre	Annual Yield of Hay per Acre							
	1908		1909		Eight years Average		Average gain due to Manuring	
	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.
No Manure	0	10 1/2	0	14	0	10 1/2	—	
Superphosphate (3 cwt) . . .	1	8 1/2	1	15 1/2	1	11 1/2	1	1
Superphosphate as above, with Sulphate of potash (1) . . .	1	8 1/2	1	16	1	12 1/2	1	2
Superphosphate as above, with Nitrate of soda (2 cwt. in 1902, 1903, 1904, and 1905; 1 1/2 cwt, in 1906, 1907, 1908 and 1909).	1	14	2	3 1/2	2	1	1	10 1/2
Superphosphate and Nitrate of Soda as above, with Sulphate of Potash (1)	1	14	2	4	2	2	1	11 1/2
Nitrate of Soda without Phosphates or Potash	1	7	1	9	1	12 1/2	1	2

Grass-Land: Upper Hale Field, at Kineton.

(In this field, which is poor in lime compared with the other, Basic Slag is used in place of Superphosphate).

Manuring per Acre	Yield of Hay per Acre							
	1908		1909		Eight years Average		Average gain due to Manuring	
	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.
No Manure	0	12 1/2	0	15	0	13	—	
Basic Slag (8 cwt in 1902; 5 cwt in 1903, 1904, 1905, 1906, 1907, 1908 and 1909). . .	1	10 1/2	1	18	1	15	1	2
Basic Slag as above with Sulphate of Potash (1)	1	11 1/2	2	1 1/2	1	17	1	4
Basic Slag as above with Nitrate of Soda (2 cwt in 1902, 1903, 1904 and 1905; 1 1/2 cwt in 1906, 1907, 1908 and 1909).	1	15 1/2	2	6	2	4	1	11
Basic Slag and Nitrate of Soda as above with Sulphate of Potash (1)	1	16 1/2	2	7	2	5	1	12
Nitrate of Soda without Phosphates or Potash	1	8 1/2	1	15 1/2	1	15 1/2	1	2 1/2

(1) 2 cwt Sulphate of Potash per acre in 1902 and 1 cwt per acre in 1905, 1906, 1907, 1908 and 1909. No Sulphate of Potash in 1903 and 1904.

Manuring of Grass Land. (Harper Adams Agric. Coll., Field Expts, 1908).—*The Journal of the Board of Agriculture.*—London, October 1909. Vol. XVI, n. 7, p. 589.

" The effect of continuous manuring of meadow land which is mown each season is being ascertained on a pasture field laid down many years ago. Ten plots have been dressed each year since 1903, and the crops and the net profit, after deducting cost of manures for 1908, are given and compared with former years. The highest net profit (£. 1 19s. per acre) was given by 3 cwt. superphosphate, and the next (£. 1 1s. 4 d.) by 10 tons farm-yard manure every fourth year, with complete artificials in the intervening years. In the summary of the results for the first four years it was shown that superphosphate, alone or in combination, was essential for an increased crop on this land; this continues to be the case, the effect of superphosphate on the quality of the herbage being very marked.

Experiments on the manuring of meadow hay were also conducted on seven farms in Staffordshire. These trials have now been carried on for from one to ten years, and the results for 1908 and the average for the series of years are given in the report.

XXVI.

Fibre plants. — Sugar producing crops. — Tobacco and other industrial crops. Curing of some special products.

A. D. Hall. **Flax-culture in England.** (*In Agriculture and the Development Grant*). — *The English Review*, April 1910. — London, Chapman & Hall Ltd., p. 132.

"Flax was once a standard crop in the United Kingdom, now the acreage has shrunk to 26 acres in England, though 46 916 acres remain in the North of Ireland. The trade has perished chiefly because the farmer who grew the flax had then to submit it to the "retting" process in order to extract the fibre. Both his facilities and knowledge for doing this were bad, and he turned out an uneven, irregular and discoloured product which was not saleable at remunerative prices. But the farmer ought never in these days of specialism to be called upon to conduct so delicate a process as "retting" really is; his business should be to grow the flax, and there is as yet no proof that the British farmer cannot grow flax profitably. Let the Board of Agriculture or the New Development Commissioners set some one to learn how to conduct the retting process on a large scale and then start it in East Anglia with flax grown by the neighbouring farmers under contract. It would not take many years to demonstrate whether there was enough money in the business to attract the local capitalist."

Cotton Import in the United Kingdom during the 31 weeks ended Aug. 4th, 1910. — *The Board of Trade Journal.* London, No. 715, 1910.

The number of bales of cotton imported into the United Kingdom during the week ended 4th August 1910, was 16 978 and the number imported during the thirty-one weeks ended 4th August was 1 516 954 (including 6000 bales British West Indian, 5418 bales British West African, 9091 bales British East African, and 24 bales foreign East African).

H. Higgins. **Absorption of moisture in cotton.** — (*Journal of Soc. of Chem. Indus.*, Vol. XXVIII, No. 4); *Moniteur Scientif.*, Paris, Avril 1910, p. 252.

Experiments carried out on a great scale by the author confirm the following observations:

1) That cotton tissues that have been completely dried do not absorb—even if exposed for a considerable length of time to the air—the quantity of moisture that they contained originally after having been simply dried in the air.

2) That the drying of cotton impedes the absorption of colouring matters and of humidity.

3) That the absorption of moisture is influenced to a great extent by the substances used as dressing.

4) That there appears to be an analogy between the absorption, on the part of textile fibres, of atmospheric moisture and that of colouring matters in solutions.

Old and New Styles of Baling American Cotton. New bales on view in Manchester. — *Monthly Consular and Trade Reports.* Washington, August 1909, n.° 347, p. 72.

" In transmitting an illustrated clipping from the Manchester Guardian, showing the old and new styles of American cotton baling, Consul Church Howe reports as follows:

It is estimated that the old style of baling costs the cotton trade nearly $15 000 000 (77 250 000 frs.) per annum. A Louisiana packer, who has adopted the compressing and baling of cotton and sent the consignment illustrated, has created a most favorable impression in trade circles in Manchester. It would seem then that the visit of the European spinners to the Atlanta conference in 1906 has resulted in much good being done for the cotton trade in general.

The Manchester Guardian, in its illustrated article, referring to the consignment of the compressed bales, says:

The improvement is so marked that arrangements have been made to have the bales on view at the Manchester Exchange. It is estimated that by the compressing and baling of cotton by the new system not less than £3 250 000 ($15 816 125 equal to about 82 062 500 frs.) will be saved to the cotton trade annually."

Ramie Wool of R. Orr. A New development. — *The Tropical Agriculturist.* Colombo, August 1910, pp. 108-110.

A development in connection with the utilisation of the fibre of Ramie, which gives promise of proving of the greatest moment to planters and agriculturists is the invention of Mr. Robert G. Orr of London, of a means by which Ramie fibre can be so treated upon the fields where it is grown that it becomes an entirely new product, one which is completely different from any material hitherto produced by machinery or chemical process from the fibre-yielding bark of the plant. This is a soft fibre which Mr. Orr terms "Processed Ramie." It can be shipped by the planter to the manufacturer, who can then by simply passing it through a carding machine obtain Ramie "wool," whieh felts and is spinnable at once. This product mixes admirably with cotton, or sheep's wool.

Samples of the material have been shown in London and have been pronounced to be valuable as a wool. Mr. Orr estimates the cost of the treatment of a ton of dried ramie canes by his process would not exceed in India Rs. 5 (8 frs)per ton in addition to that of passing through his scutching machine, which he states would be only small; but he says it would not amount to more than Rs. 7-8 (11 frs 20 c. to 12 frs 80 c.) per ton and it will extract more ramie from the canes than any other process for treating the fibre.

The present and prospective prices of wool emphasise the importance and timeliness of this new method of dealing with ramie, and the invention should prove of great value to many who are engaged in the weaving of woollen cloth mixtures.

A Textile Institute in England, at Manchester. — *Textile World Record,* Vol. XXXIX, No. 3, 306. Boston, June 1910.

About two years ago a number of English textile manufacturers decided to form a Textile Institute, which should render to the textile industry a service similar to that now rendered to their respective trades by the Iron and Steel Institute, the Institute of Mechanical Engineers and other organizations. The English textile trade was sounded and the response was so favorable that the work was continued and an organization perfected. The Institute, in Manchester, is divided into nine sections, each devoted to a department of textile work: Chemical, Cotton, Education, Engineering, Hemps and Jute, Linen, Silk, Woollen, Worsted.

Sir WALTER GILBERT. **Sugar beets in England.** — From *The Times*, April 8, 1910.

" I should like to offer a word of warning lest farmers be misled into the belief that fortune awaits the grower of sugar beets in England.

" It is not to be denied that sugar beet has been successfully grown in this country; but the success achieved has depended entirely upon one particular factor, and that the most uncertain one with which the farmer has to deal—weather.

" In that word lies the whole gist of the matter. Sunshine is the first and indispensable condition for the successful production of any plant from whose root, stem, or fruit it is sought to obtain sugar. Without sunshine success cannot be hoped for; therefore, our climate being what it is, to embark upon sugar beet cultivation as an industry is to court disaster.

" Numerous experiments, some on a large scale, some on a small one, have been made during many years past. Within my own recollection 40 years ago, a gentleman from New Zealand purchased an estate not far from London on which he persevered in growing beet (with the object of converting the sugar into spirit) until he lost a large fortune.

" A similar attempt to grow beet was made more recently at Lavenham, in Suffolk; the result was the same.

" These are merely examples. Some years ago, when the possibilities of growing beet were more before the public than they have been since, factories were established by companies or syndicates in different parts of the country, in some cases to make sugar from beet grown on their own land, in others to make sugar from the roots it was hoped neighboring farmers would grow.

" If any of those companies or syndicates are now in existence, perhaps they will give the public the benefit of their experience. I doubt much if any such remain. I do not wish to dogmatize on the subject. I farm some 2000 acres of land in Essex myself, and if reason can be shown me for believing that sugar beet could be profitably grown I will gladly undertake its cultivation.

"I am aware that improvements have been made in recent years and that thanks to better seed and advanced knowledge of methods of cultivation sugar beet has been grown in England equal in its sugar constituents to the roots grown in France or Germany.

"Dr. Voelcker informs me that from over 14 per cent to 12 per cent of sugar has been obtained from experimentally grown English beet, the proportion of sugar depending upon various facts—namely variety of seed, soil, method of cultivation, and always and above all on the duration of sunshine in any given season.

"The prospects of beet growing may look alluring on paper, but we cannot put aside our climatic disadvantages. If the experiments already made still leave any doubt on the question, I venture to suggest that before farmers are urged to enter upon it as an industry a further series of experiments of a practical nature should be undertaken.

"The Marquis of Denbigh might use his great influence to induce a few competent men in different parts of England to plant, say, four to five acres with beet and continue to grow the root for four or five successive seasons, careful record being kept of the proportion of sugar obtained in each year, these to be compared with the weather records with reference to the duration of sunshine in each summer.

"I do not go into the question whether, if beet can be successfully grown. it would pay the grower. It has always been a mystery to me how the Continental grower, even with his lower standard of living and with assistance in the shape of bounties, can make his crop pay with sugar at normal prices."

CHARLES BATHURST. **Cultivation of Sugar beet in England.** — *Agricultural Students Gazette*, vol. XV, part I, August 1910. — Cirencester.

The old idea that sugar could not be profitably grown in England, owing to the unfavourable climate has now been dispelled.

During the last two years many experiments have been made in Lincolnshire, in Suffolk, in Essex and at Newnham Paddox and they have conclusively proved that sugar beet crops can be grown in England which will bear comparison, as to yield per acre and percentage of sugar, with any raised in other beet growing countries.

Not only was sugar beet successfully grown in the Eastern counties of England last year for exportation to Holland, but Dutch manufacturers are entering into contracts for further supplies and are reported to have undertaken to erect a factory in England if they can be guaranteed that at least 6000 acres in the neighbourhood will be annually put under beet, and that there be no risk of heavy excise duties.

Such a factory, comprising working capital, would involve an outlay of about £130 000 (3 282 500 frs.).

On suitable soil an English crop would average about 18 tons per acre (45 tons per hectare) which at current prices, and deducting cost of production, would leave the cultivator about £7 4 *s.* per acre (450 frs. per hectare).

About 9 tons of sugar beet are required for the manufacture of one ton of sugar. The present price of raw sugar f. o. b. Hamburg is about 14 *s.* per cwt., but this is abnormally high; at an average price of 10 *s.*, and the cost of production at 8 *s.*, the net profit resulting from the manufacture of raw sugar should be about 2 *s.* per cwt. which would give the factory on an annual output of 5000 tons, about £10 000 (252 500 frs.) total net profit. And this without taking into account the residual product, consisting of dried slices of beet, known as *Protos*, which has a high nutritive value as food for cattle. This by-product should add largely to the profits of such a factory.

It is interesting to recall the experiments made in 1899 in various parts of Wilts, Hants, Somerset and Gloucestershire with sugar beets with the view of testing the weight of crop and percentage of saccharose obtainable in the South and West of England.

Out of the 29 experiments, the two most successful ones yielded crops of 20 to 30 tons per acre (50 to 75 tons per hectare) and the percentages of saccharose (from 16 to 18 per cent) were deemed by sugar experts to compare favourably with any results being then obtained on the Continent.

Sugar Beet Production in Great Britain. — *Journal of the Royal Society of Arts.* London, vol. 48, July 29, 1910.

At a meeting of the Sugar Beet Committee, the following resolutions were carried:

1) As it is desirable that all the experiments in sugar beet production should be organised and supervised and the results clas-

sified, this committee trusts that all farmers and bodies who are carrying on experiments should communicate with the secretary.

2) That it is desirable to have experiments on the growth of sugar beet on areas of not less than 20 acres.

3) That the Development Commissioners be requested to make a grant to enable such experiments on the larger scale to be carried out.

4) That a sugar beet committee, which should consider not only the agricultural, but also the industrial and financial aspect of the growth of sugar beet and its utilisation, ought to be formed indipendently of the Chamber of Agriculture.

Growth of sugar beet. (Midland Agric. and Dairy Coll., Repts. on Expts., 1907-08). — *The Journal of the Board of Agriculture.* (London), July 1909, Vol. XVI, no. 4, p. 312.

" Trials were carried out in Lincolnshire in 1906 and 1907 to test the suitability of the district for sugar beet growing. In 1907 the land was prepared in the same way as for mangolds and dressed with 1 cwt. sulphate of ammonia, 3 cwt. superphosphate, $^1/_2$ cwt. sulphate of potash. The seed was sown on the flat, this having been found in 1906 preferable to growing on the ridge. The rows were drilled 12, 15, 18, and 21 inches apart.

Part of the crops was lifted and weighed in October and part in November, in order to find whether the sugar content of the roots increased when approaching maturity. The average yields were:—with 12 in. drills, lifted in October, 15 tons 18 $^3/_4$ cwt.; lifted in November, 17 tons 1 $^3/_4$ cwt.; with 15 in. drills, October 14 tons 13 $^3/_4$ cwt.; November 14 tons 13 cwt.; with 18 in. and 21 in. drills the yields were smaller. The trials, therefore, are regarded as showing that it is most profitable to grow sugar beets in drills as near together as is consistent with convenient cultivation.

On analysis of samples of the roots it was found that in a damp and cold season, like 1907, a considerable advantage is to be gained by delaying the lifting of the roots as long as possible, for in every case the roots lifted in November contained a higher percentage of sugar than those lifted in October. The percentage of sugar was somewhat less with the drills 12 in. apart than with the wider rows, but owing to the larger crop the total yield of sugar per acre was considerably greater ".

J. Ashton. **Sewage into Sugar.** — (*Surveyor*, 37, 1910, No. 943). *E. S. R.*, June, 1910.

A system of sewage irrigation adapted to the production of sugar beets is described.

Production of Hops in England in 1909. (Statistics affecting British agricultural interests). — *Jour. of the R. Agric. Soc. of England*, vol. 70, London, 1909.

Counties	Acreage Acres	Total produce cwt.	Average yield	
			cwts. per acre	kilogs per hectare
Kent	19636	155744	7.93	996
Hants	1414	9444	6.68	839
Hereford	4997	14966	2.99	375
Surrey	544	2344	4.31	541
Sussex	2775	15785	5.69	714
Worcester	3054	16123	5.28	663
Other counties, Glo'ster and Salop	119	78	0.66	83
Total . . .	32539	214484	6.59	828

In 1908 the average yield per acre was 12.10 cwts. corresponding to 1520 kilogs. per hectare.

In England the acreage under Hops is decreasing, as may be seen from the following table given by the "Agric. Statistics of Ireland for 1908," Dublin, 1909, p. XVI.

Area under Hops in England.

Year	Acres	Hectares
1867	64 273	25 966
1871	60 022	24 249
1881	64 943	26 237
1891	56 145	22 683
1901	51 127	20 655
1908	38 921	15 724
1909	32 539	13 146

M. S. R. DUNSTAN. **Cultivation of Hops in England.** — *The Standard Cyclopedia of Modern Agric. and Rural Economy*, edited by R. P. Wright, vol. VII. London, 1910, p. 37.

"The acreage under cultivation is returned in 1807 as 33 218 and (with some fluctuations) there is a rise to 53 816 ac. in 1835, and to 66 703 ac. in 1880; in 1879 we find 71 789 ac. devoted to hops, but in 1905 the average is reduced to 48 967 and to 44 938 ac. in 1907, and it is probable that owing to the depression the acreage will be further reduced to 40 000 ac. in 1908."

There is no agricultural crop which fluctuates in yield so greatly from year to year as hops; in 1879, 71 789 ac. produced 700 000 cwt., which yield was obtained in 1905 from 48 962 ac., whilst the fluctuations in price are equally violent, varying from £2 to £24 per cwt.

The following figures demonstrate some important statistics with regard to the industry:

Acreage and Yield of Hops in England.

	Average annual acreage	Average yield per acre cwts.	Average annual home production cwt.
1888-1897 . . .	56 370	7.76	438 215
1898-1907 . . .	48 841	8.84	434 567

The total annual consumption of hops in England may be taken at about 600 000 cwt....

The hop crop is an expensive one to grow, and there is undoubtedly at the present time considerable overproduction, due to improved systems of cultivation and management, whilst the public taste in beer is changing, both as regards the amount consumed and the quality of the beer. Brewers are using less hops per barrel than formerly, as the following figures will show:

	lb. hops per barrel
1888-91	2.2
1901	2.02
1902	1.97
1906	1.85

The public taste now demands a lighter, brighter, less heavily hopped beer, and the aseptic conditions under which brewing is now carried on, and the smaller quantity of stock ales now brewed, have rendered the use of hops for their preservative effects less essential. The industry is now passing through a phase of severe depression, not only in England, but in Germany and other hop-producing countries. It is probable that the ultimate result will be a smaller acreage confined to the best quality of hop land, and a reduction of the cost of production by the use of improved methods of cultivation and management. "

Experiments with Hops. (Journ. South-Eastern Agric. Coll., No. 17, 1908). — *The Journ. of the Board of Agric.* March. 1910. —London, vol. XVI, No. 12 pag. 1026.

" A paper by Messrs. E. S. Salmon and Arthur Amos gives the results of an investigation into the value of the Male Hop.

" It is shown that it is only when a certain number of the bracteoles of the hops bear seeds that the hops " grow out " properly, and in order for seed to be produced it is absolutely necessary for the flower which grows at the base of each bracteole to be fertilised by pollen dust from a male hop.

" The amount of resins (lupulin) contained in seeded and seedless hops was also investigated and it was found that the effect of fertilisation was to increase the amount of resins.

" A beginning has also been made since 1906 in the breeding of improved varieties. "

Experiments with Hop-Washes. — *The Journal of the Board of Agriculture.* London, February 1910, vol. XVI, No. 11, p. 897. (*Journal of South-Eastern Agric. Coll.*, n. 17, 1908).

From theoretical considerations, a wash made from soft soap alone would be as effectual for killing hop aphis as a mixture of soft soap and quassia containing the same amount of soap, the argument being that the soft soap will kill all it touches, and that the addition of the quassia is therefore unnecessary. The majority of practical hop growers, however, find that the mixture of soap and quassia is more effectual.

In order to test this point, the main part of the College garden at the South-Eastern Agricultural College was washed twice with a horse machine with a wash containing 7 lb. of soft soap only per 100 gallons.

The number of live lice three days after each washing was carefully counted on 100 selected leaves, and for every louse on the leaves washed with soap and quassia there were two lice on the leaves washed with soap alone. After the second and third washings the ratio was still greater, and the results showed that soap and quassia is much more effectual than soap alone as a wash for hop aphis.

A patent paraffin soap wash was also tried in comparison with soap and quassia, but proved very inferior. The value of a solution of soap as an aphicide is due to the fact that the solution is capable of forming a lather, and when hop leaves and aphis are washed with this, it wets them and forms a thin film over their surfaces, and so covers up the breathing pores of the lice, which are, in consequence, suffocated. The piesence of the paraffin in this wash prevented the soap solution from forning a lather, and consequently in this case the soap did not help to kill the aphis.

WALTER ELGAR and JOHN POWELL. **The trials of Hop-drying Plant, 1909.** — *Journ. of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 196-205.

In response to the Society's offer of £100 as a prize for the best hop-drying apparatus, there were four entries.

In the Regulations which were sent to the several competitors features which were considered of special importance were set out as follows:

Efficiency of work.

Adaptability to different kinds of existing oasts (unless the plant is self contained).

Facility of regulating heat and draught, also for cooling.

Time required for drying.

Construction.

Prime cost.

In order that the trials should be as complete as possible, it was arranged that they should be continued throughout the whole period of hop-drying, and during that period each kiln was in the charge of two observers who kept accurate record of all that transpired at each oasting, including such items as quantity and description of fuel and quantity of sulphur used, etc.

After various personal inspections and most carefully going into the figures and details and weighing up the various reports conclusion was that Mr. Shew's plant was the best.

ARTHUR AMOS. **Picking, Drying and Packing Hops.** — *Journal of the Board of Agriculture*, Vol. XVII, No. 2, pp. 89 to 103. London, May 1910.

Time of picking. In average years picking begins about the first week of September. The operation should not last longer than three weeks.

The loss incurred by picking unripe hops is very serious, chiefly because a great deal more of them goes to the hundredweight of dry hops, and then because of the inferior quality; they are said to "cut thin." On the other hand over ripe hops "lose colour."

The author gives the characteristics of ripe hops.

The size of the crop, the presence or absence of disease, and the variety of hops grown have also their influence on the time for picking.

Hop drying is the most difficult and the most important of all the operations connected with hop growing. Careful drying can increase the value even to the extent of 10*s.* per cwt. (25 frs. per 100 kgs). Well dried hops can be kept for two or three years in cold storage without injury.

The open-fire system consists in spreading the hops on a horse-hair cloth stretched over a floor of laths. Below this floor at a distance of from 12 to 14 feet (3 m. 60 to 4 m. 20) is a fire place in which smokeless coal is burnt. The heated air together with the products of combustion pass through the hops and dry them.

The rate of drying depends upon the temperature and upon the rate at which the air passes through the hops. Many oasts are provided with fans to increase the draught.

Temperature of hop drying. At the beginning it should be between 80° F. and 100° F. (26.5° and 37.5° C.). It should rise gradually to 140° F. (60° C.) during the first three hours if the draught is good. If poor, four or five hours must elapse before 140° be reached.

From this point the temperature should be kept steady for about five hours rising to between 150° to 160° F. (65° C. to 71° C.) but not higher.

Finally the temperature should be allowed to fall to about 120° (48 $^1/_2$° C.).

An oasting can usually be dried in from 9 to 12 hours..

The hops picked in the morning are dried as soon as they arrive at the oasts; those picked in the afternoon must be stored in well ventilated places lest they heat.

In order to hasten drying it is usual to turn the hops one or two hours before the finish.

The operation may be considered finished when practically all the strigs are brittle.

Sulphuring. Sulphur is now universally burnt during the drying of hops in England. It improves the appearance of the finished sample. It hastens the drying process, it prevents the formation of a special odour of withered vegetable substance, due probably to some fermentation and, according to some brewers, it increases the keeping qualities of the hops.

Sulphur is usually burnt, in open pans, at the rate of $^1/_2$ lb. to 10 bushels of hops (63 grammes per 100 litres).

Types of oasts. The most common oasts in use are the open-fire kilns in which, as said above, the products of combustion pass through the hops. These necessitate the use of high quality, arsenic-free, anthracite coal.

Another type which has long been used in England is a hot air kiln called the "cockle" in which the products of combustion do not pass through the hops but ascend and circulate in brick flues. In recent years other types of hot air kilns have been introduced. In most of these the products of combustion pass through a maze of iron flues and the most modern kilns are fitted with various apparatus for improving the draught.

Cooling and packing. After the hops have been dried they are allowed to cool partially in the kiln and then for further 8 to 12 hours before they are packed in "pockets" or bags 6 to 7 feet long (1 m. 80 to 2 m. 20) and 2ft. (0 m. 60) in diameter.

Arthur Amos. **The Methods of Picking, Drying, and Packing Hops in Kent.** — *Journ. of the Board of Agric.*, No. 2. *Nature*, Vol. 83, p. 532. London; June 30th, 1910.

Hop production is a highly specialized branch of farming, requiring much more capital per acre than wheat and cattle production, and it includes not only hop growing but also drying. The *oasts*, or drying ovens, are familiar objects to all who have travelled across Kent.

The drying is managed by a skilled workman, who remains in charge during the whole time of hop-picking and even sleeps on the spot so that he may be at hand in case of need.

A good hop-drier is a person of distinction in the village community, and rightly so, since he can by his efforts materially influence the value of that product.

Foreign and Colonial Legislation relating to Hops. — *The Journ. of the Board of Agric.* March 1910, London, vol. XVI, N° 19, p. 1033.

" The Report of the *Select Committee on the Hop Industry* contains certain recommendations whereby Hop growers in England might be supplied with information regarding the industry abroad. It was stated in the House of Commons on the 17th December 1908, that the Board of Agriculture and Fisheries recognised the importance of the subject and that proposals were under consideration with a view to give effect to those recommendations as far as possible. "

" One direction in which action has been taken has been to obtain information as to the legislation relating to the cultivation and marketing of Hops, and a brief statement of the positions in various countries is given below. "

" *Austria.* — The marking of hops is regulated by a law of which a résumé was recently published in the Journal of the Board of Agriculture (vol. XVI, p. 54). There is no special legislation regarding the actual cultivation of the crop. "

" *Belgium.* — The only law dealing with the cultivation and sale of hops is a Decree of 3rd May 1887, which forbids planting or the existence of male hop plants in hop gardens. Male hops are not permitted within a radius of 100 metres, and their eradication by the landowner is compulsory. Local enactments exist in the two principal Belgian hop districts, viz., the communes of Alost and Poperinghe. These regulations refer to the examination of the hops by experts who issue certificates as to origin, quality, etc., and each bale is duly sealed by means of a distinctive label. "

" *Germany.* — There are no Imperial laws or regulations of any kind relating to the cultivation or marketing of the hop crop, but legislation exists in Bavaria, which is the principal district in Germany where hops are produced. Under the terms of a Royal Decree which came into force on the ist July 1862, any person who sells sulphurised hops, either pure or mixed with unsulphurised hops, must expressly declare this nature of the goods to the purchaser, or he must make the fact generally known by affixing to each package a certain sign which is prescribed by law. Infringements are punishable by fines not exceeding 150 marks. The Bavarian legislation does not prescribe the marking of hops according to their place of origin, but in certain districts authority exists to affix to the goods certain seals, which, to a great extent, indicate the origin of the better kinds of Bavarian hops."

"*New Zealand.* — The Government is authorised by the *Produce Exports Act* of 1908 to institute compulsory grading, but the law has not yet been put into operation."

"No legislation exists in France, Russia, the United States of America, Canada, Victoria, or Tasmania."

"As regards the use of Hop substitutes, legislation may be briefly summarised as follows."

"*Germany.* — The use of hop substitutes in the manufacture of beer is prohibited in Bavaria, Würtemberg, Baden, and Alsace-Lorraine."

"*Australia.* — There is no special legislation dealing with the subject, but it is unlawful to import *hop aromas, hop bouquets, hop extracts, hop flavours, hop oil,* and any articles of a like nature, and of any substitutes for, or imitations of any such articles, whether simple or compounded in any manner with other material, and being capable of use in the making of beer, or in any brewing process, or for addition to beer.'"

"*Canada.* — The use of hop substitutes is restricted by the '*Adulteration Act*' of the Dominion which prohibits the addition to potable liquors of articles such as picric acid, strychnine and *Cocculus indicus* which have been employed, or are capable of being employed, as substitutes for hops. The only Provincial law which also contains restrictions is the *Liquor License Act of Ontario.*"

"*Cape Colony.* — The law provides for the flavouring of beer with hops only, and the use of any substitute is illegal."

"No legislation on this subject exists in Natal, the Orange River Colony, the Transvaal, Newfoundland, or in New Zealand."

Trade of Leaf tobacco for cigars in the United Kingdom.— *Monthly Consular and Trade Reports.* Washington, September, 1909. n. 348, p. 128.

Leaf Tobacco not imported, — U. S. Consul S. S. Knabenshue. of Belfast, replying to inquiries as to the importation of cigar leaf tobacco, writes:

There is but one cigar manufactory in Ireland, and that is at Dublin. The popular taste runs to pipes and cigarettes, not only in Ireland, but all over the United Kingdom in which cigar making is confined practically to a few cities, viz.: London, Liverpool, Bristol, Nottingham, and Leicester. The cigar business in the British Isles has declined largely in late years, owing to the increasing taste for cigarette smoking.

The usual way of selling leaf tobacco in the British Isles is through brokers in Liverpool and London. It is there sold by sample, which samples are drawn from each cask of tobacco in bond by independent officials. An exporter of leaf tobacco in the United States can not do better than to get into communication with brokers handling it at Liverpool and London.

Tobacco firms here state that cigar leaf tobacco is not used in the manufacture of cigarettes, they being made from bright Virginia leaf of various qualities. The bulk of the cigars sold in Belfast are of Havana and Key West make".

XXVII.

Horticulture. — The forcing of plants. — Small fruit. — Market Gardening. — Flower-culture as an industry. — Spice, condiment and perfume producing plants. — Essence industry.

W. T. THISELTON-DYER. **National Importance of Horticulture.** — *The Journal of the R. Agr. Soc. of England*, pp. 252-257, London, 1909.

The Horticultural Exhibition at Gloucester was a success.

Horticulture is becoming, indeed has already become, a great national industry to which the land is indispensable. As agriculture becomes more intensive, the dividing line between it and horticulture tends to disappear. The potato is a striking instance of a crop which has been transferred from the garden to the farm. We still, however, import them to the value of two millions. The wealthy will always demand early vegetables, the produce of warmer climates.

But the cheapness of glass will make it possible to compete with them at home.

The Board of Agriculture has repeatedly pointed out the enormous extent to which our consumption of fruit and of even the commonest vegetables is supplied from abroad.

Comparatively little has been done to meet demand, though of late years farmers have competed with market gardeners in the cultivation of greens and cabbages with which they can feed their stock in case of a glut in the market.

Here is a chance for the small holder in country districts if he can be induced to co-operate in marketing his produce.

But fruit cultivation stands in most urgent needs of an impulse. Little progress will be made in the improvement of cider until our farm orchards, the condition of which is mostly deplorable, are treated with more intelligence. At Gloucester there was an instructive competition in fruit-spraying.

The principle which has been adopted in giving prizes for local plantations might with advantage be extended to orchards and fruit gardens. And the more effective management of small holdings, of which there are believed to be some 12 000 in the county of Gloucester alone, would seem to be as much deserving of encouragement as that of farms. Indirectly this would stimulate the activity of the village Flower Shows which are already playing a useful part in rural Education."

WILLIAM E. BEAR. **French gardening in England** — *Trans. of the Highl. and Agric. Soc. of Scotland.* Vol. XXI, Vth Series, 1909, Pp. 106-122.

The establishment of the system of French gardening in England dates from 1905 when a number of Evesham market-gardeners visited the gardens in the neighbourhood of Paris.

They were struck with what they saw, and one of them, Mr. Idiens, engaged at once a French expert and started at Evesham the first French garden in England.

The author describes briefly what French gardening is, namely an improvement on the old system of cultivation on beds, under frames or bell-glasses (*cloches*).

The best account on the Paris system is that read by Mr. Walter F. Giles before the Alton Horticultural Society and which the author summarises briefly.

During the summer stable manure is collected in large heaps to ferment. In making the beds, in November, some fresh manure is added. The beds are somewhat wider than the frames which are about 13 feet by 4 1/4 (4 metres by 1 1/4) and separated from each other by a path about 1 foot (0 m. 30) wide. They are about 9 inches (225 mm.) deep at the back and 7 inches (175 mm.) at the front.

After the manure is put into the frames it is trodden down and covered with 3 or 4 inches (75 to 100 mm.) of good soil which comes to within 4 or 5 inches (100 to 125 mm.) of the glass, so as to prevent the plants from becoming too lanky.

When the temperature has fallen to between 50° and 60° F (10° to 15° C) sowing and planting begin.

It appears that the Paris gardeners are fairly repaid for their work.

It is stated that some of them get average gross returns of about 500 £ per acre (12 625 frs. per hectare) out of which they expect 60 £ per acre (1515 frs. per hectare) net profit, after deducting all expenses and the keep of their families. But it is uncertain whether these figures relate to whole gardens or only to the portions under glass.

Mr. Idiens set apart about 5 acres (2 hectares) of land at Bengeworth near Evesham and in the month of March following the visit to Paris, three quarters of an acre (about 3000 square metres) were already turned into a French garden.

By the spring of 1908 more than half the piece of land was covered with frames and bell glasses. In September of the same year a representative of the "Fruit Grower" (London) visited the garden and published an illustrated report of his visit in that paper of September 17. Four acres (1.6 hectares) were then under work though not all under glass. There were 500 three-light frames and between 9000 and 10 000 bell-glasses. The whole was irrigated by water pumped up from the Avon by a petrol-engine and distributed by underground mains.

Among the few French gardens established in England the A. visited the Westfield garden started by Miss Kingcome. It is an acre and a quarter (half a hectare) in extent. The soil is free-working loam over clay and it slopes to the south. All the conditions are most favourable, but there is no possible protection against the south westerly gales prevailing on the South coast. Another disadvantage is the necessity of carting all the manure from Hastings at the cost of 7 s. 6 d. (9 francs) per ton delivered.

The best directions for starting a French garden in England are those given by Mr. Thomas Smith and published in the four consecutive issues ending with that of November 26 and summarised by the author.

As for the gross returns of a well managed half-an-acre (2023 sq. met) garden Mr. Smith puts them down at 300£ and after the third year when the cost of manure would be reduced, he thinks that the total expenditure, including wages would be about £195 leaving £105 for the working occupier.

This seems a handsome sum for half an acre of land; but it is not much for covering the interest on a capital of over £300 and paying the occupier for arduous work and almost constant attention.

One could take a dairy farm of 40 acres (16 hectares) with the same capital, and probably have as much profit with a tenth of the worry.

Mr. Newsome in his handbook "French Gardening" (F. Steel & Co. London) calculates the first years expenses on one acre when a French expert is employed at £150 per annum and three other men at £1 per week "at least £1600" and puts the return al £600 to £700, After the first year he also thinks that the expense would drop to £200 per acre while the returns would increase.

A. B. S. FRASER. **A French Garden at Withdean, Patcham.** — (*The Country Home*, February, 1910) *Review of Reviews*, March, 1910.

Captain Fraser has sunk some 3000 pounds in the venture, which, he says, is financially a great success. American tools, obtained from France, are used; they are lighter than those used in England. In French gardening a continual moving goes on, from frames to cloches, and from cloches to frames.

T. NEWSOME. **Gold producing soil. French gardening or intensive cultivation on the French system.** — London and Stroud, Frederick Steel & Co. Ltd., 1910, p. 83.

This little book aims at stimulating interest in the much talked of French gardens, to put before the public in a cheap and popular form an outline of what the so-called new method of cultivation is, and to give sufficient details in regard to the apparatus used and its cost so that anyone reading it will be enabled to start the system on a small or large scale.

C. D. McKay. **The French Garden in England.** — A Diary and Manual of Intensive Cultivation. *The Daily Mail.* — London, 1910, pp. VIII-67.

This little book is intended to supply the amateur "French" gardener with the information he requires to start a market garden on the system in vogue in France, more especially in the suburbs round Paris.

In the introduction by W. Beach Thomas, the writer states that the French garden in England has spread since 1908, with a rapidity unparalleled in gardening history. French gardens are now scattered over all the Southern counties; Essex, Middlesex and Hertfordshire are following suit, and a number of experiments are being made to test whether the system will not succeed equally well in the North. Lecturers are going about the country to impart knowledge of the system to gardeners, students and labourers. Within this year the system has been taken up at University College, Reading, the best horticultural school in England; and it is taught at Lady Warwick's College at Bredon's Norton, in Warwickshire. The County Councils have taken up the system which is now taught in reformatory schools, and among institutions which are experimenting is the Church Army.

The largest French garden in England is that of Mr. Harvey at Evesham. His plot, which is equipped with 2000 lights and 4000 bell glasses, has produced a gross revenue of over £600 per acre. From 600 lights Mr. Harvey cut 21 600 lettuces at an average of 2s per doz. Out of same lights 2400 cauliflowers at an average of 4s per doz., and again from the same lights 2400 doz. turnips, and 5000 dozen bunches of carrots at 6d per doz., 3 melons from each light occupied with them at 2s. 6d. each.

P. Elford and S. Heaton. **Practical School gardening.**—(*Oxford, Engl.* 1909, pp. 224, pls. 5, charts. 3, dgms. 7, figs. 77). — *E. S. R.* March, 1910 — Washington.

In this text-book the authors give cultural directions for the different features of garden work, together with a chapter on insects and other pests of the garden, friends of the garden, a calendar of gardening operations, and a nature calendar, and appendixes dealing with the school garden and "discovery" lessons or field trips, meteorological observations, and several useful tables.

Journal of the Royal Horticultural Society, vol. XXXV. — Abs. *Nature*, No. 2131, Vol. 84, Sept. 1st, 1910, p. 271.

The two "Master's lectures" on the adaptation of the plant to the soil, delivered by Mr. A. D. Hall before the Fellows of the Royal Horticultural Society, are published in the Journal of the Society (vol. XXXV, part i). Perhaps the most instructive lessons are based on the reading of crop-distribution maps, from which the author deduces the primary importance of the mechanical composition of the soil.

Following these articles, the Journal contains, amongst the contributions, a paper by Mr. C. C. Hurst on the application of Mendel's laws of heredity to horticulture, an account by Miss E. Armitage of cultivation by the peasants in Madeira, and notes on insect pests in the West Indies by Mr. R. Newstead.

Mr. Hurst quotes from recent experiments by Cambridge workers in connection with the elucidation of the complicated colours of the snapdragon and variation in sweet peas, and discusses the origin of "albino" orchids, which can be explained upon the assumption of two complementary colour factors.

H. de Vries. **The Production of Horticultural Varieties.** — (*Journ. Roy. Hort. Soc.* — London, 35 (1910), n. 3, p. 321-326). Exper. Stat. Rec. June 1910 Washington.

A paper on this subject delivered before the Royal Horticultural Society in which the author describes several cases of experimental production of varieties.

Acreage under different kinds of Small fruit as returned on the 4th June 1909 in Great Britain. — Board of Agriculture and Fisheries. *Agricultural Stat. 1909*, vol. XLIV, part. I, *Acreage and Live Stock Returns of Great Britain.* London, 1910, Cd. 5064, p. 62.

	England	Wales	Scotland	Great Britain
	acres	acres	acres	acres
Strawberries	25 937 1/4	745	3 382 1/2	30 064 3/4
Raspberries	6 614 3/4	31 1/4	2 611 1/4	9 257 1/4
Currants & Gooseberries . . .	24 714 1/4	137 1/4	1 254 1/4	26 105 3/4
Other, including mixed Areas .	20 858 1/4	284 1/4	546 1/2	21 689
Total . . .	78 124 1/2	1 197 3/4	7 794 1/2	87 116 3/4

Cecil H. Hooper. **Small Fruit Growing in Kent.**—*Journal of the Board of Agriculture,* November 1909, p. 628.

" Small fruit, such as raspberries, gooseberries, red and black currants, and also strawberries, are largely grown in nearly all parts of Kent.

Preparation of land for small fruits. — To be successful with small fruits, the soil must be good, well situated, fertile, clean from weeds, and well cultivated. A good working soil is a great asset. For strawberries, raspberries, and bush fruit on arable land, the best practice consists in applying some 30 tons of dung per acre, then ploughing seven inches deep with three or four horses, following each furrow with a heavy brake drawn by two horses to subsoil the ground, stirring it some four or five inches deeper. This is the method followed by some of the best growers, it is almost equivalent to trenching, and costs much less. Steam cultivation to stir the soil may be employed if a large area is to be planted.

The Raspberry. — The raspberry is a plant that responds to heavy manuring. The varieties now most popular for field cultivation in Kent are " Superlative " and " Hornet," which have replaced " Carter's Prolific " and " Norwich Wonder, " the favourites of twenty years ago. The raspberry is propagated from young plants dug up yearly from the side of the parent plant; these suckers or " spawn " are best when taken from young plantations. They should be planted out in land well cleaned, well manured, and deeply worked, the tops being previously cut off to about six inches above the ground line. A common distance for planting is 4ft. 6in. between the rows and 2ft. apart in the row, using one, two, or even three plants to a hole, depending on the strength of the sucker. The planting is done from November to the end of February, avoiding frosty weather, and keeping the roots of the suckers duly protected from frost and drought before planting by carefully bedding them in the soil.

The approximate cost per acre of forming a raspberry plantation, including the first year's cultivation, if everything is well done, will be somewhat as follows:

	£	s.	d.
Forking out weeds	0	5	0
Manuring, ploughing and subsoiling	7	15	0
Heading canes and planting in plough furrow, 4ft. 6in. row, 2ft. apart.	1	0	0
10 000 raspberry plants at from £3—£10, say . . .	5	0	0
Horse and hand hoeing, summer and autumn . . .	2	5	0
Cutting out old canes, filling up blanks, digging or ploughing the following autumn and winter, tipping young canes in March	1	5	0
Rent, rates, and taxes	2	0	0
Total . . .	19	10	0 (1)

As the canes before planting are cut down hard, so as to form strong plants, there is hardly any fruit the first summer, and the second summer the crop is light.

The land is kept clean by horse-hoeing the centres, followed by handhoeing against the plants. The cost during the first year is often reduced by growing a crop such as early potatoesbetween the rows.

The annual cost per acre of cultivating raspberries may be estimated as follows:

	£	s.	d.
(November) Cutting out old and thinning new canes	0	5	0
Tying up the canes cut out	0	2	0
Taking up spawn	0	10	0
Hoeing out	0	6	0
Manuring (with say 1 ton of wool waste)	3	5	6
Ploughing between rows, 7*s.*; digging between canes, 7*s.* (or digging the whote space between the rows by spade, £1 1*s.* 0*d.*)	0	14	0
(March) Heading canes off at about 2ft. 8in. high .	0	2	6
(April) Forking out couch-grass	0	2	0
(April-October) Horse hoeing five times	0	15	0
Hand hoeing, five times	1	10	0
(July and August) Picking, say, 1 1/4 tons, at 1/2*d.* per lb.	5	16	8
Carriage to market in gallon baskets and tubs 1 1/4 tons, at, say, 16*s.* per ton.	1	0	0
Market toll and salesman's charges at 7 1/2 per cent, on £28 15*s.* 0*d.*	2	3	2
Rent, tithe, rates, and taxes	2	10	0
Total cost. . .	19	1	4
Receipt 1 1/4 tons at £23	28	15	0
Balance to cover superintendence, interest on capital for two years during which there is little return and profit	9	13	8

(1) In the original the author puts it down at £20 in round numbers. Ed.

The year's cultivation of the raspberry begins after the picking is finished, the rows are hand-hoed, and as soon as the leaves have fallen the old canes that have borne fruit are cut out near to the ground line, and the new canes are thinned, these thinnings are tied up with string and used by the pickers as fuel. The young plants that have been produced by the parent plant are then dug out. The young plants, or "spawn," as they are called, when taken from young plantations, and of a good variety, may yield a good return, but it is not advisable to allow much spawn to grow, as it takes from the strength of the parent plant, so it is usual to hoe off and destroy most of these shoots unless specially wanted for propagation.

The plantations are usually dunged once in three years, using a truck that is narrow enough to run between the rows without injuring them; if dung is not used, some other manure is probably given each year. It is advantageous for the land to be turned over early in winter to allow the frost to pulverise it. After the winter is over, the canes are headed off to a height at which they are sufficiently strong to hold the weight of the fruit without requiring to be stringed. Between March and October the land is horse-hoed; first with a heavy two-horse hoe, then during the season with one-horse hoes to remove the weeds and form a tilth. If in the early part of the year the land is cloddy, a rib or flat roller is used in the rows. Hand-hoeing is also frequently done in order to keep the land clean and encourage rooting. When the canes are very luxuriant and there is much fruit, it is sometimes advisable to stake and string the rows.

Picking is done chiefly by women and children, some of the latter being excellent pickers. As the fruit should not be crushed, nearly all raspberries are picked without strigs, whether for sending away in gallon baskets or in tubs for the jam factories. The raspberries are conveyed by van or rail during the night and delivered at the jam factory next morning, as the raspberry quickly ferments when in bulk. A few of the handsomest raspberries are sometimes picked with the strigs for punnets in early morning for sale the same day. The yield per acre may be from three-quarters to two tons. The price of raspberries varies considerably from perhaps £15 up to £30 per ton if scarce. Sent in gallon baskets, they fetch probably a penny per lb. more than in tubs.

The best crops are usually from the plantations between three and seven years old, but plantations last ten or fifteen years if the land is suitable.

In order to check weeds and at the same time add vegetable matter to the soil, the author used to sow turnip seed between the rows shortly before picking time, when a good tilth had been obtained by hoeing; this made a good cover crop after picking was over, and gave a useful yield of young turnips.

The Gooseberry. — This fruit is regarded as the hardiest and most regular bearer of British fruits. Before planting, the land is well cleaned, dunged, and deeply worked. The bushes are usually planted about 5ft. apart, or, if large growing kinds, on good soil up to 6ft.

Mr. Fred Neame, of Faversham, has supplied the actual cost per acre of planting four acres in 1906, which is as follows:

Cost per Acre of Planting Gooseberries.

	£	s.	d.
Ploughing	1	0	0
Setting out ground for planting 5 1/4ft. × 5 1/4ft.	0	5	0
Cost of 1 512 two-year old bushes at 9*s.* per 100 with carriage	6	17	6
Planting	0	17	6
Twenty loads of dung at 4*s.*	4	0	0
Carting out and mulching at 1*s.* 1 1/2*d.*	1	2	6
Total	14	2	6

Mangolds were planted between the rows, and this helped to pay the expenses of summer work. The price of 9*s.* per 100 for gooseberries is a very moderate one; 12*s.* is more usual, and sometimes 14*s.* per 100 for market sorts. The second year cultivation will probably cost about £4 per acre, exclusive of rent, including 3*s.* for pruning. The crop the second year may be six half-bushels of green gooseberries. Strawberries are frequently grown with gooseberries for the first four or five years.

The cost of cultivation would be as follows:

Annual Cost of Cultivating Gooseberries.

	£	s.	d.
(November) Pruning	1	5	0
Clearing cuttings	0	5	0
Each alternate year 20 tons dung with cartage, £6 11*s.* 8*d.*; wheeling on and spreading, 10*s.*; = £7 1*s.* 8*d.* Half cost	3	10	10
Digging with fork	1	0	0
(April to September) Hand hoeing four times	1	8	0
Picking 2 tons green gooseberries (or 3 tons ripe)	5	0	0
Packing 187 half bushels at 2*s.* 100 halves	0	3	9
Carriage, 2 tons at 16*s.* (3 tons at 16*s.* £2 8*s.* 0*d.*)	1	12	0
Sale expenses, 4*d.* per half bushel	3	2	4
Rent, rates, and taxes	2	10	0
Cost	19	16	11

	£	s.	d.
Receipt, 2 tons green gooseberries at £12 per ton .	24	0	0
Balance, to cover cost of planting, interest on capital, superintendence, etc.	4	3	1

The system of pruning in commercial plantations in Kent is based on the principle that the younger wood bears the largest and greatest number of berries, also that space between the boughs is necessary for convenience in picking and affording light for the production and development of the fruit. The boughs are not usually spur-pruned though the tips of boughs are shortened and the older boughs cut out so as to keep the bushes with young strong wood. Suckers coming up from the ground or from stems are broken off with the suckering iron, which discourages their growing again, which would happen if pruned by knife. The boughs of the bushes in some plantations spring up direct from the ground, but for convenience in hoeing many growers prefer to have the boughs spring out from a main stem above ground. When making the cuttings for bushes to be grown on a leg, all the buds which would be planted below ground are cut out, and only those to be above ground are left. The disadvantage of being on a leg is that if this main stem is broken the bush is spoilt, whilst if the boughs spring direct from the ground, new growth of strong young boughs is readily obtained.

The usual plan for picking gooseberries is to make the picking as thinnings of the berries, picking the largest and leaving the smaller ones: thus for green gooseberries the bushes may be gone over three times if the crop is good. Ripe gooseberries are usually picked all at one picking.

Green gooseberries travel well, and the package and handling is not troublesome, but ripe gooseberries are very tender, and need care in handling and quick sale. A plantation that will yield two tons green will probably give three tons ripe, but it usually pays best to sell them green; green gooseberries are the first fruit picked when labour is plentiful, whereas the pickers are busy with other fruits when the gooseberries are ripe. The crop in Kent usually varies from about 1 $^1/_2$ up to 3 tons of ripe berries in mature plantations.

Red Currants. — The cost of planting and first year's cultivation of red currants is approximately as follows:

	£	s.	s.
(Autumn) manuring with 20 tons dung at 6*s.* 8*d.* .	6	13	4
Ploughing, twice cultivating, 4 harrowings	2	3	0
Marking out for planting in two directions	0	4	0
(November) 1 743 red currant bushes, at 6*s.* per 100	5	4	7
Digging holes 1 foot square at 5 feet apart, woman carrying bushes, man planting bushes, 1*s.* 8*d.* per 100	1	9	0
(April to September) horse-hoeing four times at 3*s.* . .	0	12	0
Hand hoeing four times at 5*s.*	1	0	0
Rent, rates, taxes, and other expenses	2	10	0
Total . . .	19	15	11

The annual cost of cultivation of red currants per acre is approximately as follows:

	£	s.	d.
(November) pruning	1	2	0
Clearing cuttings	0	5	0
Digging with fork	1	0	0
(April to September) hand-hoeing four times . . .	1	8	0
(August) picking 2 tons of red currants at 6*d.* per 24 lbs.	4	13	4
Packing 187 half-bushels at 2*s.* per 100	0	3	9
Carriage, 16*s.* per ton	1	12	0
Sale expenses, 4*d.* per half-bnshel	3	2	4
Rent, rates, taxes	2	10	0
Cost . . .	15	16	5
Receipt, 2 tons red currants at £10 10*s.*	21	0	0
Profit, to cover cost of planting, superintendence, etc.	5	3	7

Some fourteen years ago the price of red currants was so low as not to pay for picking and carriage, and a great many acres were consequently grubbed; but since then the price has paid expenses, and they have been moderately remunerative. The red currant is almost always grown as a bush on a "leg" or main stem, with four or five branches often forking at a short distance into two. As the fruit buds are formed close against the older wood, the pruning consists in spur-pruning all the young shoots, and shortening the leading shoot, leaving about one-third of its length. The tendency is to grow red currants with longer boughs than formerly, and thereby get more fruit. Red currants are usually planted 4 1/2ft. to 5ft. apart, or perhaps a little wider on very good soil. As with other bush fruits, the land should be well manured before planting, and other crops may be grown for one or two years between the young currant bushes, if care is taken in cultivating and lifting the crop. In order to encourage quick growth the plantation should be frequently hoed.

In pruning the bushes it is important to cut nearly up to the buds to avoid leaving lifeless snags, which harbour the maggots of the Currant Clearwing Fly.

Nuts. — Nut plantations thrive well on the Kentish Rag Rock in the neighbourhood of Maidstone and Wrotham. They are said to commence to be remunerative at about six years old, to be at their best production from about the fifteenth to fiftieth year, to yield on an average 7cwts. or 8cwts. per acre, worth about £30 per ton, and on suitable soil to last sixty years and upwards.

The approximate cost of planting and cultivation are stated by one large grower, viz., Mr. George Smith, of Loddington, near Maidstone, to be as follows:

Nuts with Gooseberries or Currants.

(Cost per Acre of Planting).

	£	s.	d.
Ploughing and harrowing	1	0	0
Setting out land for planting	0	3	0
Digging holes and planting (194 holes, 15 feet apart, 18 inches square) taking out soil 6 inches deep, and loosening the subsoil another foot in depth .	0	15	0
104 four-year old Kentish cob nut trees at 20*s.* per 100	1	18	10
Digging holes, and planting gooseberries or currants at 5 feet apart.	1	0	0
1 548 gooseberries at 12*s.*, currants at 8*s.* per 100, average, say, 10*s.* per 100.	7	14	0
Mulching nut trees with 4 loads dung with labour .	1	4	0
Total . . .	13	14	10

Mature Nut Plantation.

(Cost per Acre of Cultivation).

	£	s.	d.
(November or December) 1 ton shoddy with labour £3, alternate years, half cost	1	10	0
Digging with fork	0	18	0
(December or January) grubbing out spawn at root	0	3	0
(February) pruning at 10*s.* per 100 trees	1	0	0
(March) Canterbury hoeing	0	4	6
(April to September) 3 or 4 hoeings	0	16	0
(September) picking (in 3 pickings) 850 lb. at 2*s.* per 100 lb.	0	17	0
Carriage, say	0	10	0
Commission, 7 1/2 per cent on £14 3*s.* 4*d.*	1	1	3
Rent, tithe, rates, taxes	4	0	0
Cost	10	19	9
Receipt, say, 850lb. at 33*s.* 4*d.* per 100lb	14	3	4
Balance Profit	3	3	7

The foregoing deals with most of the small fruits grown in Kent. The Loganberry, which is now being extensively cultivated, is a recent introduction."

J. C. NEWSHAM. **Strawberry growing in Hampshire.** — *The Journal of the Board of Agriculture.*— London, June 1909, vol. XVI, N° 3, p. 286.

"The development of the strawberry growing industry in this country is becoming more and more extensive, and it is computed that nearly 30 000 acres are at present devoted to this particular form of culture, which in such counties as Kent and Hampshire has, become a well-established and important industry, affording employment to many thousands of men, women, and, in the harwest time, as many children.

In the county of Hampshire, the area devoted to this industry extends from the sea northwards as far as Fareham, Wickham, and Bishop's Waltham. The industry is centred in the district of Botley, Salisbury, Swanwick, and Southampton, and found its origin in this particular part of Hampshire, not as the result of a well-devised plan, arising from the natural adaptability of the soil for the growth of strawberries, but rather as the mere chance issue of a small-holder's enterprise many years ago.

Production in Hampshire. — The number of baskets of fruit despatched during last year from Swanwick Station amounted 874 215, this number representing the output in a comparatively scarce season; as in the previous year, which was considerably more favourable to the setting and ripening of the fruit, the number of baskets despatched from this station amounted to 1 109 714. Large quantities of fruit are also sold to local dealers and to visitors.

Condition of soil. — The adaptability of the soil to the growth of strawberries was a surprise even to those skilled in horticultural matters. The greater portion of the land was unsuitable for farming, and large areas were covered with furze and heather. Much of this heath land is now, however, being gradually acquired and broken up, and where plantations have been made, every sign of strong healthy growth is to be observed. The soil in this district assumes many different characteristics, and may consist of a sandy peat mixed with flints, varying in size from a marble to a hen's egg, while the small quantity of loam originally present has been washed away, giving the surface of the soil the appearance of a bed of flint stones. The greater portion of the subsoil is sand and gravel, but in some districts the gravel does not extend downwards to any appreciable depth. Last autumn the A. noticed a black, peaty soil, originally waterlogged, being surface drained, and in portions of the ground already planted the plants seemed to be thoroughly at home. Expert horticulturists maintain that strawberries require a rich loamy, or, in more familiar language, a "fatty" soil, but soils embodying these characteristics are of very rare occurrence in these districts.

Value of Land. — It is obvious that much of this common land was of little value some thirty or so years ago, but since reports have been circulated as to the large profits to be derived, the price has graduailly increased to such an extent that it is no uncommon occurrence for land in close proximity to a railway station, or so situated as to be productive of early crops, to command a price of £200 per acre, while very ordinary-looking plots are in keen demand at from £100 to £150. Similarly, land may be rented at from £3 to £5 per acre, much of this land having been originally let for arable farming at from 10 s. to £1 per acre.

Farmers who possess moderately large farms are now extensively engaged in this industry, and in such cases the rent of land under strawberries will not exceed £1 per acre, whereas the small holder will be paying up to £5 per acre for similar ground. It may safely be assumed that land has now reached its maximum value in these districts.

Small Holdings. — Many of the larger areas have been divided into small holdings or plots varying in size from five to two acres, or even less; while the fact that one acre of strawberries may realise a profit of £50 is responsible for the general air of respectability and good management presented by these holdings, Among the population composed of strawberry growers, there are no signs of poverty, such as are witnessed in many semi-rural districts. A man can make a moderate living from two acres of land, while in many instances a man, his wife and family are comfortably provided for on a holding of four acres. House accomodation is scarce, as in most instances the houses attached to each holding are either the property of the small holder himself, or are being gradually acquired by him on a system of easy payments, in addition to which, in the majority of cases, he is gradually paying for the freehold of his land.

While £50 is given as the average return per acre, the figure may fall as low as £20, while in a favourable season it may rise to as much as £100. It must not be supposed that strawberry growing is unattended by any risks, and the beginner who is only possessed of a limited capital will find that such influences as, for example, late frosts towards the end of April or in early May spell disaster to his crop, and involve the loss of the greater portion of his capital."

"*Insect Pests.* — Like all other plants which are raised to a high standard of cultivation, strawberries are assailed by a variety of insect pests, among the most prevalent and destructive of which is the wireworm. Where new ground is broken up and not over-deeply trenched, the grubs commence their ravages on newly-formed plantations, and continue to work havoc among the roots so long as the plantations exist. When new plantations immediately succeed old ones, the young plants are often completely destroyed. A good dressing with gaslime at the time of preparing the plantation is the only effectual means of ridding badly infested areas of these pests. The poisonous nature of some of the constituents of this waste product, however, renders it necessary to allow a period of rest of about four months before commencing planting operations.

The Green Rose Chafer (*Cetonia aurata*), locally known as the Rockworm, is of a still more injurious character to the roots of strawberry plants. As a grub it feeds on the roots, while in the perfect state as a beetle it causes considerable injury to the blossoms by piercing a hole just below the flower buds, causing them to become detached from the parent plant.

In some districts very considerable damage has been wrought by the maggots of the Vine Weevil (*Otiorhynchus picipes*). The results of such attacks were especially noticeable in a recent autumn, when plants occupying large areas were completely devoid of root growth and with slight exertion could be pulled out of the ground. The author advised several growers who were suffering from the attacks of these insects to clear the infested area and dress with gaslime, also stimulating the crops with manurial dressings. On completing inquiries later in the year one prominent grower stated that he pulled up all the infested plants and dressed the ground with gas-lime at the rate of 12 tons per acre. The lime was well incorporated with the surface soil, and the ground subsequently received a liberal dressing of slag and kainit before planting in the following year. This treatment was attended with highly satisfactory results. Another grower resolved not to sacrifice all his plants, which were but two years old, and in order to destroy the maggots he dressed the ground between the plants with 1 ton of slag and kainit per acre; after two weeks the dressing wass supplemented with 50 bushels of fresh soot per acre. At a later stage, when the ground was deeply stirred by hoeing, only a few sickly grubs were to be observed where, before dressing, they existed in enormous numbers."

Several plantations have also been infested with the Eelworm, which produces a distorted growth of the stem. As a means of checking the ravages of this pest, dressings of sulphate of ammonia and kainit have proved useful. "Damping off" or mildew is prevalent in some soils on which the growth of foliage becomes rank, but on the lighter gravelly soils fungoid growths are practically unknown."

Strawberry Runner Experiments. National Fruit and Cider Institute, Report, 1908. — *The Journ. of the Board of Agric.*, Vol. XVI, No. 12, p. 1024. London, March 1910.

"Trials of the relative cropping qualities of the 'first' and 'second' runners of strawberry plants were started in 1906. By the term, 'first' runner, is meant the first runner produced from parent plant on a given stem, while the 'second' runner is the next produced on the same stem. The crops for 1907 were small, the plants for the first season not being particularly strong, although, as might be expected the 'first' were the larger. In 1908, the yield was fair, considering the nature of the season; and the plants of the two groups were more even in size and strength. In the two years the total yield for five varieties from the 'first' runners was 713 lb., and from the 'second' runners 607 lb.

"The assertion by some growers that the 'second' runners produce larger crops has thus not been supported by the results for the first two seasons, although possibly the third season's crop may result differently, since the 'second' were originally the more backward plants, and may, therefore, take longer to reach full vigour."

J. A. ALEXANDER. **Spice, Condiment and Perfume producing Plants.** — (*Journ. Roy. Hort. Soc. London*, 35 (1910), N° 3, p. 366-383). Expert. Stat. Rec. June 1910. — Washington.

This paper gives a general account of a large number of plants yielding spices, condiments and perfumes.

New Garden Plants of the Year 1909. — Royal Botanic Gardens, Kew. *Bull. of Miscellaneous Information*, Appendix III, 1910, pp. 57-85. — London, 1910.

Among the new introductions of garden plants recorded during 1909, the Orchidaceae provides, as usual, more species and varieties than any other family, amongst them being *Cirrhopetalum longissimum*, a fine plant introduced from Siam; *Dendrobium Sanderae, D. acuminatum*, both from the Philippines; and *Megaclinium purpureorachis*, from the Congo. China supplies a fair quota of plants, notably *Primula forrestii, P. littoniana, P. Bulleyana*, and *Rhododendron Souliei*, besides sharing with Japan in the supply of species of *Juglans*. The genus *Salix* receives additions from Asia, while Mexico furnishes several species of *Mammillaria*. The Kew introductions include an Encephalartos, *Baikiaea insignis*, a leguminous evergreen tree, and *Strophanthus preussii*, a climbing shrub, all from tropical Africa, also *Euphorbia Ledienii*, from South Africa. Six new species of the fern genus *Nephrolepis* and *Adiantum grossum* are noteworthy. Noteworthy also *Populus Comesiana* from Italy, and amongst Euphorbiacee *Euphorbia Ledienii*.

The Narcissus Culture in Great Britain. — *Bull. des Renseign. Agr.*, No. 7. Paris, 1910.

The culture of bulbs has been introduced in the British Islands with great success and is nowadays one of the most prominent cultures, tons of flowers being exported in the spring to London and other markets.

Lincoln and Cambridgeshire have now large acreages planted with bulbs, some growers having from 20 to 50 acres under narcissus culture.

The soil is almost as well adapted to the onions as the Netherland soils. Deep light soils are the best adapted for narcissus growing.

Fresh manures must not be used, therefore the bulb planting following a potato crop, is generally in use. As a rule bulbs must not be kept long time out of the soil, and planting is done from 5 to 12 cm. deep, according to dimensions of bulbs.

Weeds are carefully removed from the field in the spring. After the leaf fall, bulbs are taken out of the ground and this work is some times done by machine as for potatoes. For bulb production frequent replanting is more necessary than for flower production. The following varieties are recommended for bulbs and flowers under glass:

Golden Spurs, Empereur, L'Incomparable, Sir Watkin, Bicolor Horsefieldii, Imperatrice bicolore, Barri conspicuus, Poeticus ornatus, Bicolor Grandee, Pleasant Eye and Double White.

The expenses per acre in Fens, average of £150 6*s*.; this expense increases in other districts and may be greatly reduced by using horses in preparing the soil instead of hand labor. Bulbs grow in value from 50 to 100 % in a year, from 75 to 100 % in two years. Calculating the flowers produced, from 15 to 20 %. profits must be added to those figures.

Efforts should be made to obtain the flowers at an earlier date by covering the plants with glasses.

D. B. Crane. **The Book of the Sweet Pea.** — *The Bodley Head*, J. Lane, London and New York, 1910, pp. x+136.

In the preface of the book the author says:

"No subject in the whole of the floral world has achieved greater notoriety in recent years than the Sweet Pea (1), the peer

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(1) *Lathyrus odoratus*, Pois de senteur (Ed).

of hardy annuals. Close and persistent attention has been given to the improvement of this flower, by raisers and others, for some years past, and the result of this ungrudging devotion of its enthusiastic admirers is to be seen to-day in numerous beautiful plants, bearing a wonderful display of most charming blossoms.

The Sweet Pea has now such numerous devotees, many of whom have but a faint notion of the possibilities of the flower, that this would appear to be a sufficient justification for the publication of this treatise.

Cultural directions from a comprehensive point of view receive very full consideration and the claims of the Sweet Pea for varied purposes are dealt with in detail, etc.

The book contains a chapter about the pests and diseases of the Sweet Pea, and also some beautiful photographs. Finally the author gives a complete list of Sweet Pea books.

Artificial Aids to Forcing. — *The Gardener's Chronicle*, no 3623, p. 368, London, June 4, 1910.

The principal means used for forcing plants artificially are etherisation, subjection to low temperature, and treatment with hot water. According to a report by Mr Charles Chevalier, of the Brussels International Exhibition, the chief merits of etherisation are that plants thus treated flower two months earlier than is otherwise possible. As to the actual effect produced by ether our knowledge in still incomplete. The prevalent opinion, however, is that it causes a loss of water from the tissues and thus acts by drying the plant. If etherisation is to be practised with success it must be applied early, for example during October or November.

The most important points to bear in mind in the application of ether are that the temperature must not be too low (about 30°—32° F.) and that the plants must be exposed for a fairly long time to the action of the vapour. In the table given by Mr Chevalier 72 hours is cited as a fair time if the preceeding season has been wet, and 60 hours if it has been dry. It may be that certain failures which have been reported in England are traceable to the exposure having been of too short duration. Other anaesthetics which have proved serviceable substitutes for ether are chloroform and carbon tetrachloride.

The origin of the use of artificially obtained low temperatures is due to the initiative of the cultivators of cut flowers at Aalsmeer (Holland). M. P. de Vries, in his report on the "Influence of artificial cold on the forcing of plants", describes experiments made in 1907 on *Syringa, Prunus triloba, Deutzia Limoinei* and *D. gracilis; Magnolia* and *Convallaria.* Large numbers of these, as well as other plants, were placed in a refrigerating chamber on October 31 and maintained for a week at a temperature of from 3°—4° above freezing point.

In this case the drying effect of the low temperature became evident, for the plants gave off so much water vapour as to form a coating of snow on the pipes in the refrigerating chamber, where, evidently, the temperature was lower by several degrees than in the middle of the room.

The advocates of the yet more recent hot water method claim that it is much easier of application and more certain in results than the ether method, which requires an air-tight chamber. Among the plants which have responded to this treatment are Lilaea Forsythia suspensa, and many other species of less horticultural importance. The plants to be treated are plunged in tepid water at a temperature ranging from 85° to 96° F. (30 to 35° C.). The roots are not submerged, but the rest of the plant is kept under the water for periods varying from 6 to 12 hours.

XXVIII.

Arboriculture. Generalities. Pruning, Grafting, etc. Pollination and fruit ripening from a cultural point of view. — Vines, Olives, Citrus-trees, Fruit-trees. — Preservation and preparation of fruit. Canning-industry. — Ornamental-trees and shrubs.

Acreage under Orchards, distinguishing the Kind of Fruit, and the Acreage also accounted for under Small Fruit and Permanent Grass, as returned on the 4th June 1909 in Great Britain. — Board of Agriculture and Fisheries; *Agric. Stat.*, 1909, Vol. XLIV, Part. I; *Acreage and Live Stock returns of Great Britain*, London 1910, Cd. 5064, p. 64.

		England	Wales	Scotland	Great Britain
		acres	acres	acres	acres
Apples (1)		169,296 3/4	3,023 1/4	847 1/4	173,167 1/4
Pears (1)		9,229	72 1/2	173 3/4	9,475 1/4
Cherries (1)		11,415 1/2	35 3/4	23	11,474 1/4
Plums		16,412 1/4	76	289	16,777 1/4
Other including mixed Orchards.		39,303 3/4	287 1/4	850 3/4	40,441 3/4
Total		245,657 1/4	3,494 3/4	2,183 3/4	251,335 3/4
Area also accounted for under.	Small fruit	27,568 1/4	78 1/4	832	28,478 1/2
	Permanent grass	164,568 1/2	2,419 3/4	626 1/4	167,614 1/2

(1) Including Orchards containing more of the tree named than of other kinds.

Fruit growing in the United Kingdom. — *The Gardener's Chronicle*, n. 3613, p. 203. London, March 26, 1910.

No figures are obtainable as to the production of fruit in the United Kingdom. In 1908 there were under fruit cultivation 172 751 acres of Apples, 9,604 acres Pears, 11 868 acres Cherries, 15 683 acres Plums, 28 815 acres Strawberries, 9 323 acres Raspberries, 26 241 acres of Currants and Gooseberries, and 60 892 acres of other kinds. Of this acreage of 335 177 it appears that 27 433 acres of small fruits were grown in the large fruit orchards, leaving a net acreage of 307 744 under fruit cultivation. The industry in this country is growing, and the year 1908 shows an increase of 2 826 acres over the preceeding 12 months. That it is capable of considerable extension in the United Kingdom is shown by the fact that over 4 600 000 cwts of fruit, valued at over £ 3 750 000 were imported into this country in 1908. These figures do not comprise the total imports of fruits, but only of those varieties which are grown also in the United Kingdom.

Acreage of Orchards and Vineyards in the British Empire. *The Gardener's Chronicle*, n. 3611, p. 165. London, March 12, 1910.

	Acres	Hectares
India (1906-7) including vegetable gardens	4 020 136	1 624 135
Ontario (1908)	338 255	136 655
United Kingdom (1907-8)	335 177	135 412
Cape of Good Hope (1908)	72 590	29 326
Quebec (1907)	77 416	31 276
Victoria, Australia (1908-9)	75 105	30 342
Nova Scotia (1907)	54 051	21 837
New South Wales (1908-9)	51 868	20 955
South Australia (1907-8)	41 816	16 894
New Zealand (1908-9)	29 217	11 804
Queensland (1908-9)	25 334	10 235
Tasmania (1908-9)	25 146	10 159
British Columbia (1905)	22 000	8 888
West Australia (1908-9)	18 049	7 292
Natal (1905)	37 590	15 186
Ceylon	1 016 138	410 520
Jamaica	63 029	25 464
Total acreage	6 302 017	2 547 380

E. A. Bunyard. **The Physiology of Pruning.**—*(Journal R. Horticultural Soc.* Vol. 35, Part III, March 1910).—*The Gardeners' Chronicle*, No. 3619 p. 299, London, May 7 1910.

After a short account of the mode of nutrition of the plant by its roots and leaves, the writer considers the origin of the difference between fruit buds and wood buds, and the manner in which pruning may modify their development.

A. J. Manning. **Root-pruning fruit trees.** — *The Board of Agriculture*, Vol. XVI, No. 4, 290-293. London, July 1909.

It is maintained, that fruit-growers should aim at the production of sturdy, well matured shoots only, if quick returns are required, and when trees of even the most vigorous varieties make more than twenty to twenty-four inches of growth in a season, it is a sure indication that they are developing some deep-growing coarse roots. Fruit-trees, therefore, which are producing wood at the expense of fruit, should be pruned sometime between the end of October and the end of November. Trees root-pruned at that time quickly become re-established, and frequently make several inches of new root growth before the ground becomes too cold. If left much later, new growth does not commence till spring, while if operations are begun much earlier the shoots shrivel. Lifting and re-planting should be the method adopted with trees three or four years old; if longer established, root pruning will be most advisable.

W. R. G. Atkins, **Variation of Osmotic pressure in the Sap during the Ripening of some fruits.** (*Proceedings of the Royal Dublin Society*, vol. XII, n. 34). Reviewed *Nature*, August 1910, p. 211.

Following the methods adopted in earlier experiments the osmotic pressures were calculated from the data obtained by measurement of the freezing point of the expressed cell sap. The values so obtained justify the deduction that similar organs of any plant species have approximately equal osmotic pressures. Wide ranges of values may be observed however in similar organs. Thus, tomato fruits gave a value varying from six to nearly eight atmospheres, and greengages a pressure of twenty-nine atmospheres. The variation in pressure recorded for the tomato is connected with the ripening of the fruit, the lower pressure in this case referring to the ripe fruit, and is accounted for by the chemical changes in the cell sap.

A. Kirk. **Grape culture.** — (London and Glasgow, 1909, pp. 75, pls. 19, figs. 36). *E. S. R.*, Febr. 1910. Washington.

A treatise on growing grapes under glass, based upon the author's experience and observations covering a long period of years. The text is well illustrated.

Apples of Great Britain. — *The Journal of the Board of Agriculture*, June 1910, Vol. XVII, N. 3, p. 254.

" The apple is the most important fruit that ripens perfectly in Great Britain, when both its culinary and its table value are taken into account, but, unfortunately, apple orchards have been rather neglected in this country. Considering the general demand for this fruit, it is surprising that even those who have suitable situations and facilities for raising them, have not taken their share in providing our markets with choice apples. The result is that other countries have sought to meet the needs of our population, and a continuous stream of apples arrives from abroad during many months of the year. A perfect system of cold storage enables exporters to send fruit, not only across the Atlantic, but also from Australia.

" The secret of success with the apples sent from Nova Scotia, California, Oregon, and from our own Colonies, is the superior method of grading and packing. Growers in England, on the other hand, often send the fruit to market as it is gathered, small and large together, or, worse still, add the windfalls which they pick up off the ground. These bruised, worm-eaten, defective apples deteriorate the sample and lower the price of the whole. Windfalls should be sold at home at a nominal price or given to pigs, and should never be mixed with better fruit, as they only add to the cost of transit, market and commission charges, without themselves yielding any return. Retailers often prefer barrel or box apples from abroad to those grown at home, because the delivery is so much better. The box or case apples are each packed separately in paper, and thus reach the consumer in prime condition, with extremely little waste. Oregon apples have fetched capital prices during January. February and March this year, the figures ranging from 12s. to 16s. per case of 40 lb. net weight, or, roughly speaking, about 4d. per lb. wholesale; Californian apples hardly come up to the Oregon supply, the price for the corresponding period being from 7s. 6d. to 10s. per case.

"At this time of year the markets are supplied with apples from British Colonies, South Australia and Tasmania taking the lead. Prices vary according to variety, Cox's Orange Pippin fetching 11s. to 14s. per case; Ribstons, Munro's Favourite, Cleopatra, Jonathan, are all of first-rate quality and range from 8s. 6d. to 10s. 6d. or 11s. per case. Sturmer and Scarlet Pearmain, and other kinds, make rather less, say 8s. to 10s. per case."

Pruning Apple Trees. — (*Harper Adams Agric. Coll., Field Experiments, Report,* 1908). *The Jour. of the Board of Agric.*, March 1910, London, Vol. XVI, N. 12, p. 1024.

"Trees that were unpruned were found, both in 1907 and 1908, to form more fruit buds than pruned trees, especially in the case of Cox's Orange Pippin. The average increase in diameter of stem of unpruned trees is less than that of those pruned regularly.

Average diameter in inches at 4 $^1/_2$ feet above ground.

	Unpruned trees	Pruned trees
Cox's Orange Pippin	2.06	2.44
Bismark.	2.25	2.55
Bramley's Seeding	2.42	1.78"

G. Bellettre. **Fruit-packing for England of French products.** — *Les Marchés Anglais des Fruits* Paris, Charles Amat, 1910, p. 39-51.

The panniers generally used for the fruit export to England are round baskets made of osier without covers. They are solid and durable and easily piled, without hurting the fruit, the bottom of the baskets being convexed. Their capacity is of a sieve (36.4 litres) or half-sieve which is generally used and contains 21 pounds (kgs. 9 562) of apples or pears or 24 pounds of other fruits.

The fleins (or flengs or flins) are oval baskets, sometimes rectangular in shape, seldom round, with a handle, and represent an ideal packing for fine fruits, but as they require further packing higher freight results from their use.

Boxes for fruit shipments are of a great number of shapes and dimensions.

Cageots are often used for piling fleins. As accessory packing materials paper, saw-dust, powdered cork and turf are employed.

The packings most be light and resistant, protecting the fruit, and at the same time allowing the air to circulate so as to keep the temperature down. Fruits must be carefully selected and perfectly sound and packed so as to avoid shaking.

Strawberries. Strawberries must be packed in fleins four to six in a cageot. Sorgho fleins must be preferred on account of their low price which permits the loss of the fleins.

Cherries. At the beginning of the season panniers are used; later on, when greater quantities are shipped, cherries are shipped in sieves.

Prunes. The same shipping methods are adopted for prunes.

Peaches. Fancy peaches are shipped in little boxes containing from 8 to 12 peaches each. Common peaches are shipped in sieves and "cageots" of 10 Kg. each and are carefully packed.

Apricots. The same shipping methods are used for apricots.

Pears. Pears are shipped with non returnable packings. Little boxes are used containing from one to two layers of pears. Common pears are shipped in cageots of two or three layers carefully separated.

Tomatoes. Tomatoes are shipped in cageots and panniers.

In Vaucluse panniers of 15 Kg. of tomatoes are used.

Simple Method proposed for Retaining Freshness in Fruit. — *Monthly Consular and Trade Reports*, Washington, March 1909, N. 342, p. 111.

" U. S. Consul Maxwell Blake, of Dunfermline, makes the following report on simple methods used in Great Britain to keep fruit and eggs fresh:

A correspondent in Stirlingshire writes me that he has recently conducted some successful experiments in reference to the packing of fruit for transit, without the aid of refrigeration; his method being simply to pluck the fruit when the sun is high so as to avoid all adhering dampness, and immediately pack in prepared cases containing granulated sugar. Care must be taken that the sugar utilized for the purpose is also quite devoid of moisture and the cases should be so constructed as to be as nearly as possible impervious to atmospheric vapors. Both the sugar and the cases, as may be inferred, should be designed for and admit of constant re-use.

My informant promises that successful results will follow the adoption of this method, although his experiments have been on such a small scale that he is unable to supply me with the fuller details of relative cost and exact structure of case.

L. H. YATES. **Successful Jam making and Fruit bottling.** — (London, 1909, pp. XIV-122). *E. S. R.* Abstr., June 1910. Washington.

Detailed directions are given for making jams and preserves of various sorts, the apparatus used is described and many recipes are included.

Chapters are devoted to storing and packing and to the marketing of stock. The volume as a whole is prepared from the standpoint of fruit preserving as a home industry.

Fruit Bottling. — (*Worcester C. C. Thirteenth Report on Droitwich Experimental Garden,* 1908). *The Journ. of the Board of Agric.*, March 1910, London, Vol. XVI, N. 11, p. 1025.

" Thirty-three varieties of plums were sterilised at various temperatures, and the condition and appearance of the fruit after several months are stated."

WILLIAM E. BEAR. **Fruit imported into Great Britain.** — *Jour. of the R. Agric. Soc. of England,* Vol. 70, 1909, pp. 151-163.

England imported more apples in the five years ended with 1898 than in the five ended in 1908. The quantities sent by the two largest contributors, the United States and Canada, were about the same each for the above periods.

Australia and Tasmania have increased their quantities, while France, Belgium, the Netherlands and Germany have fallen behind their earlier consignments.

France, Germany, and the United States supply the greater part of the pears imported into England. Among them only the United States have made some slight headway. Canadian consignments though small have increased owing to the development of fruit growing in British Columbia.

The comparison of totals for the two quinquennial periods is the same as in the case of apples. It is also the same for plums, of which France is much the greatest contributor.

Apart from apples, by far the most serious foreign competition which British fruit growers have to face is that of the bananas, the imports of which have enormously increased. In 1890 the number of bunches was only 1 287 442; in 1908 it was 6 385 449. The increase is mainly in supplies from Costa Rica and the British West Indies, the latter of which are practically bounty fed by the English Government, by means of a steamship subsidy paid to develope the production of bananas in Jamaica.

G. Bellettre. **The English Fruit Market.** — *Le Marché Anglais des Fruits*, Ed. Ch. Amat, Paris, 1 vol., ill. XIII, p. 232.

This study on the English fruit market and on the cooperation of agriculturists with a view of promoting the exportation of their produce contains valuable information resulting from observations collected in England.

Fruit growers will find in this work trustworthy data on commercial organisation, on transport questions, on the competition of the different countries strüggling for the command of the English market, the most important in the world.

To give an idea of its enormous importance it will be sufficient to mention that in 1908 the quantity of fruit imported into Great Britain not including bananas and deducting re-exports amounted to 757 975 tons worth £ 8 881 040 (222 026 000 frs), while comprising bananas the total value was £ 10 650 290 (266 257 225 frs).

The United Kingdom's chief imports are oranges, apples and bananas, which together represented in 1908 nearly 60 per cent of the total value of the fruit imported. In order of importance the following fruits come next: Lemons, grapes, walnuts, almonds and different nuts, pears, plums and cherries: the value of the imports of the latter has rarely fallen below 5 millions of francs; in certain cases the imports of grapes, almonds and different nuts have exceeded 16 million francs per annum. Among the least important items, currants and gooseberries may be mentioned, of which about 4 millions of francs worth are imported every year. France and Holland export strawberries to the value of 1 250 000 francs; the trade in peaches and apricots is not so considerable.

Other fruit is imported to the extent of 5 to 10 million francs a year.

A great number of countries supply the English market. Oranges are sent from Spain, Turkey in Asia, Italy, the Antilles, the United States and Egypt. Apples from Canada, the United States, the continent and Australia. Bananas from Costa Rica, the Canary Isles, and the Antilles; Grapes from Spain, Portugal, France, Belgium and Holland; Lemons from Sicily and from Portugal. Walnuts, almonds and other nuts from France, Spain and Italy; cherries, gooseberries and currants from France, Belgium, Holland and Germany; apricots and peaches from France and the Cape; Pears from France, Belgium, Holland, United States, Germany, Australia and Canada. Finally plums from France, Belgium, Germany, Holland and the United States.

The Author after mentioning the changes which have taken place in the conditions of the sale of fruit in Paris, illustrates the requirements of the English market, and the lines to be followed by the fruit growers in view of exportation to England.

The third part of the book treats of the cooperation amongst fruit growers who intend to export their produce.

The Statutes of a cooperative association and the railway and steamboat rates of freight etc. are given in the appendix. The book contains besides several maps showing the position of the fruit growing centres in the environs of Paris, the distribution of orchards in Great Britain, the centres of fruit exportation in Holland and in Belgium etc. Numerous engravings represent the packing most commonly used.

G. Bellettre. **The best kinds of fruit for the British market.** (*Le Marché Anglais des Fruits et la cooperation des agriculteurs en vue de l'exportation, preface de M. Bertaux*, p. 29). — Edit. Charles Amat, Paris, S. d. (1910), 1 vol., p. 231.

In a paper *Practical Hints on Fruit Farming* (*Journal of the R. Agricultural Soc. of England*, Vol. LXV of entire Series) bearing the signature of M. James Udale the R. Agricultural Society of England recommends the following varieties:

Pears. — *Lammas and Hessle*, good market kinds for the north and south of England. *Fertility; Conference; Doctor Jules Guyot* (improved Williams Bon chrétien); *Princess*, improved Jersey Louise-Bonne); *Marguerite Marillet* a good grower; *Pitmaston Duchess*, cultivated on a large scale for the market; *Beurré Alexander Lucas; Beurré Clairgeau; Beurré Hardy; Beurré d'Amaulis*, which thrives best in the north of England; *Beurré Capiaumont* and *Hacon's Incomparable* cultivated in the north and in favourable aspects; *Jersey Gratioli* and *Brockworth Park*, an easy grower; *Triomphe de Vienne*, a vigorous variety on favorable soils; *Doyenné du Comice*, probably the choicest pear in existence, together with *Emile d'Heyst, Beurré Superfine*, and *Nouvelle Fulvie*.

Plums. — *Rivers Prolific* one of the carliest varieties, the tree is vigorous, but it does not attain a great size.

Czar, a good market kind; *Early Orléans* is not cultivated to the extent that it was formerly; *Victoria* generally a very productive variety, perhaps the most popular in England; *Belgium Purple*, a good bearer; *Poud's Seedling* the best late plum, good sized and finely coloured; a good many of them are being now planted in England; *Monarch*, of which a good trial has been made and which seems to be a valuable acquisition; *The Diamond*, a market kind, largely cultivated in Kent; *Old Greengage* a variety of greengage enjoying much favour; *Coés Golden Drop* and *Jefferson; The Kentish Bush plum* a tall variety used as a wind-break on the outside of orchards and plantations; *The Damson* formerly a paying variety, now it is not much planted. Occasionally it is still profitable, but during these last years it has not been worth picking. (In 1898 the damsons were left on the trees, prices being very low; while in 1903 they were sold at 20 to 25 shillings per cwt.).

The *Farleigh Damson* is grown chiefly in the south, and *the Prune* in the west and north of England; *Cox's Emperor; Mitchelson's Belle de Septembre; Wyedale*, a good preserving kind thrives in cold places.

Cherries. — *River's Early; Knight's Early Black; Old Black Heart; Elton Heart*, grows well on poor soils; *Frogmore; Early Bigarreau; Keutish Bigarreau; Black Eagle; Napoleon; Tartarian; The New Noble* a variety that will spread widely; *Waterloo*, a late variety that stands rain well; *The Morello* a good variety for espaliers; *The Flemish Red* and *Kentish Red*, useful varieties for preserves, the latter possessing a delicious flavour; *Duke* grown as an espalier or in pots. It is never cultivated in the usual tree form.

Strawberries. — *Royal Sovereign*, the best early variety; *Sir Joseph Paxton; President; Waterloo; Laxton.* It is important to grow varieties that produce handsome fruit with firm flesh which will not be injured by carriage.

English horticultural literature is rich in works on the strawberry which, as is well known, occupies a prominent position among the small fruit of Great Britain.

The English Board of Agriculture has published a book on the best varieties of strawberries, which contains many details that are here quoted. (Walter P. Wright, *Modern strawberry growing; Journal of the Board of Agriculture and Fisheries*, n. 4, Vol. XIV).

Sir Joseph Paxton. This variety was formerly very extensively cultivated in England; it has since slightly lost ground, though its fruit is still much appreciated by the trade on account of its size, handsome appearance and resistance to injury from carriage.

Royal Sovereign. Very valuable variety, the most highly appreciated by the English public. It was created by crossing the Laxton and Bedford; it is earlier than the Sir Joseph Paxton but it ceases bearing sooner; the fruit is conical, laıge-sized, brilliantly coloured and with a firm flesh. It is not only a good field and garden sort but it is also excellent for forcing. In a great number of cases it has superseded, — for pot work, — the old favourites such as *La grosse sucrée, Vicomtesse Héricourt de Thury, President Auguste Nicaise.* No other kind of cultivated plant has so soon conquered a position that can be compared to the one occupied by this splendid variety. Still in its prime it will continue for a long time to render eminent services both in market and in private gardens.

The Laxton. A good variety, early but somewhat less so than the preceding one; it is prolific and produces large sized and handsome fruit of very good flavour.

Bedford Champion. Vigorous variety bearing very large fruit.

The Bedford. Very heavy-bearing variety, the result of a cross between *Dr Hogg* and *Sir Charles Napier.*

Fillbasket. Remarkably productive variety, obtained by crossing. *Royal Sovereign* and *Latest of all.* Well flavoured fruit, much appreciated; its cultivation is extending considerably.

Late varieties. In the market gardens of England there is an increasing tendency to lengthen the strawberry season by means of new late varieties, the older ones being lacking in size and colour. Among these new varieties, the most noticeable are: *Lax-*

ton's Latest; Progress; Givon's Late Prolific, the result of a cross between *Waterloo* and *Latest of all; Waterloo.*

CURRANTS. — Red varieties: *Raby Castle*, especially on poor soils. *Red Dutch; Scotch; West Country Currant* or *American Wonder*, a recently introduced variety.

White: *Versailles, White Dutch*, White currants are chiefly cultivated in gardens.

BLACK CURRANTS. — *Baldwin's*, cultivated in the south of England, *Carter's Champion* much resembling the preceding. *Lées Prolific* a vigorous variety producing large fruit suitable for the table.

GOOSEBERRIES. — *Whinham's Industry;* Howard's *Lancer; Crown Bob; Lancashire Lad; Rifleman; Whitesmith;* commercial varieties suitable for cultivation on a large scale; *Lancashire Prize* suitable for gardens.

RASPBERRIES. — *Carter's Prolific semper Fidelis*, excellent variety for preserves; *Norwich Wonder; Superlative*, perhaps the very best raspberry.

Selling of fruit in Great Britain. Hull is a good distributing centre: present conditions. *Monthly Consular and Trade Reports.* Washington, 1909 November, pag. 95.

" U. S. Consul Walter C. Hamm, at Hull, writes that during August delegations of growers and exporters of fruit from France and Belgium visited that English port to inquire into the market for fruit and the facilities for handling it. The consul mentions the following points for the benefit of American fruit growers:

Two delegations came from France and one from Belgium. The fruit crop in both countries this year is reported to be very large, and producers and dealers are seeking foreign markets for their surplus. They have come to Hull because it is considered the best importing center for fruit in Great Britain, outside of London. Hull has special facilities for receiving fruit from abroad and distributing it over the central and northern half of England. For example, on August 16, one vessel arrived with 12 000 barrels of pears, 6 000 sieves of plums, 6 000 packages of bilberries, cherries, etc.. 14 000 of gages, plums, and pears from the Continent. It is stated that the railroads in southern France are assisting in the sending of these deputations to England in order to aid the exporters in finding a market for their products, and getting their return in freight carriage ".

IMPORT OF FRUIT AND VEGETABLES IN GREAT BRITAIN DURING 1907, 1908 AND 1909.

(United Kingdom Trade and Navigation Returns for 1909. London, 1910).

		Quantities			Values	
	1907	1908	1909	1907	1908	1909
Fruit:				£	£	£
Apples, raw . . . . . . cwt	3 526 232	3 376 579	3 129 646	2 231 327	2 079 703	2 007 911
Apricots and Peaches . »	38 814	30 620	52 724	78 583	60 141	83 443
Bananas, raw . . . bunches	6 232 158	6 385 449	6 238 065	1 771 095	1 769 249	1 752 190
Cherries, raw . . . . cwt	165 412	160 479	185 464	199 489	234 883	210 679
Currants, raw . . . . »	109 130	101 921	131 442	142 245	121 659	151 552
Gooseberries, raw . . . »	45 603	44 518	27 078	25 994	25 529	13 496
Grapes, raw . . . . . »	798 377	673 670	490 003	769 307	728 022	508 111
Lemons . . . . »	882 193	1 045 009	1 037 984	421 599	471 613	475 967
Nuts: Almonds . . . . »	161 947	148 839	162 922	660 604	560 301	710 325
» other nuts . . . »	702 598	752 179	741 374	749 538	768 560	789 798
Oranges . . . . . . »	6 120 185	5 664 041	6 202 271	2 454 569	2 269 731	2 522 491
Pears, raw . . . . . »	500 132	523 029	569 467	478 611	515 924	504 423
Plums, raw . . . . . »	325 761	402 881	486 757	345 720	427 212	474 749
Strawberries, raw . . . »	44 178	33 391	36 829	54 186	45 791	47 877
Unenumerated, raw . . »	538 465	436 947	464 212	339 462	291 325	306 031
Fruit, Dried:						
Currants . . . . . . »	1 188 481	1 297 157	1 052 417	1 392 271	1 464 091	1 114 912
Raisins. . . . . . . »	708 053	759 787	858 982	1 209 576	1 204 074	1 142 969
Vegetables, Raw:						
Onions . . . . »	8 645 048	7 896 109	7 470 775	1 036 231	993 669	1 213 518
Potatoes . . . . . »	8 249 366	7 039 323	4 282 866	2 371 545	1 967 216	1 408 251
Tomatoes . . . . . »	1 135 499	1 160 283	1 161 308	1 020 805	955 985	954 400
Unenumerated . . . »	—	—	—	365 230	371 209	402 739
Flowers, Fresh, value L.	—	—	—	233 641	229 802	244 855

The total value of fresh fruits for 1909 being £10 559 043 (frs 266 615 835), of dried fruits £2 257 881 (frs 57 011 495), of vegetables £3 978 908 (frs 100 467 427).

EXPORTATION FROM GREAT BRITAIN OF BOTTLED FRUITS, JAMS, ETC.
(United Kingdon Trade and Navigation Returns).

	QUANTITIES			VALUES		
	1907	1908	1909	1907	1908	1909
Fruit:						
Lemons (cwt).	27 612	20 457	23 822	14 544	9 915	11 328
Oranges	340 294	248 241	223 709	136 475	100 739	94 514
Fruit, Dried:						
Currants	21 829	22 128	18 467	31 328	27 012	22 378
Raisins.	42 101	14 667	15 727	69 977	26 824	24 209
Jams, preserved fruits & Confectionery (1). . . .	429 742	423 956	477 220	1 081 544	1 092 001	1 242 440
Pickles & Vegetables preserved in Salt or Vinegar gals.	794 762	670 709	801 746	168 433	139 599	166 992
Provisions, Unenumerated .	—	—	—	590 000	582 021	660 558

The total value for 1909 being £2 222 419 (frs 56 116 079).

DUKE OF BEDFORD and SPENCER N. PICKERING. **The Blossoming of Apple trees.**—Twelfth Report of the Woburn Experimental, Fruit Farm. London, 1910, p. 35-51.

The general results may be briefly summarised as follows: Apples which are early in ripening, blossom, on the average, two or three days earlier than late varieties; but this is only a general rule to which there are many exceptions. The character of the fruit (dessert or cooking) has no effect on the relative date of blossoming. The actual date on which blossoming commences has no definite effect on the period over which the coming into blossom of a number of different varieties will extend; this seems to be determined solely by the weather conditions prevailing at the time. Some varieties habitually blossom earlier or later than others, but in the majority of cases such early or late habits are so little marked that, on the average, they exercise only about one third as much influence in determining the order of blossoming as do the weather conditions at the time, so that it is futile to attempt to draw up any precise list of the order of blossoming of a large number of varieties. On the average, the same variety will occupy a place in such a list 2 ½ days different in one season from what it occupies in another,

(1) These figures comprise also confectionery made from sugar without any other ingredients except flavouring and that containing chocolate.

whereas two different varieties selected at randon will occupy in the same year positions differing by 3 $^1/_3$ days. Varieties of apples of foreign origin showed no peculiarities in date of their blossoming.

XXIX.

Forestry. Afforestation and Forest Conservation. Forest trees: Conditions affecting their growth. — Timber. — Preservation of timber. — Forest industries and Special products. Charcoal. Resin. Cork. Tanning materials. Wood distillation. Cellulose paste.

Willow-culture. Basket-work and similar industries.

Forest legislation. Prevention of forest-fires.

Useful wild plants.

Mushrooms and truffles and their culture. Poisonous mushrooms.

Wild animals and their products (furs, skins, ivory, etc.). — Game-protection.

The Woodland Area of Great Britain in 1905. — *The Statesman's year book,* 1910. London, Macmillan, p. 65.

	Coppice	Plantations since 1895	Other woods	Total
	Acres	Acres	Acres	Acres
England	538 123	59 647	1 117 703	1 715 473
Wales	15 733	8 629	159 999	184 361
Scotland	23 015	35 407	809 987	868 409
Great Britain	576 871	103 683	2 087 689	2 768 243

In Ireland in 1908, 301 636 acres were under woods and plantations. In 1908, 904 567 trees were felled, most of the timber being used for mining props, railway sleepers, and packing cases.

Area of land Available for Afforestation. — *Journal Board of Agric.*, April 1909. London, p. 44.

"It appears that the total area (excluding water) of Great Britain according to the latest figures of the Ordnance Survey (revised August 31st 1908) is 56 199 980 acres. Of this, the acreage under crops and grass—i. e., what is usually termed the cultivated area—amounts to 32 211 386 acres. A further area of 2 768 243 acres (as returned in 1905) is woodland, and of the remainder 12 801 974 acres are returned as "mountain and heath land used for grazing."

It will thus be seen that 8 418 377 acres remain unaccounted for in the Agricultural Returns. A very large proportion of this unreturned land is appropriated for urban requirements, while railways, roads, mines, quarries, and other industrial operations absorb in the aggregate a considerable portion of the surface of the country. The extent of land within the boundaries of boroughs and urban authorities in England and Wales, and of Royal, municipal, and police burghs in Scotland, amounts approximately to 4 000 000 acres. Some of this, though probably a small proportion, is included in the Agricultural Returns.

According to a computation made by the Board of Agriculture about 3 537 172 acres of the total surface of Great Britain lie above the 1 500 feet level. Although such part of this elevated land as is used for grazing should properly be returned, it may be assumed that a large part would not be so used. Probably a considerable proportion of the area occupied by deer forests would come within this computed area.

It may be added that, according to a return of 1874 the estimated extent of land subject to common rights in England and Wales was at that time 2 632 772 acres.

In attempting to estimate the extent of so-called "waste land" which might be available for planting, we may deduct in the first instance the land already under woodland and also that which is under cultivation (i. e. returned as under crops and grass). This leaves in round figures 21 000 000 acres. From this we may deduct the land above 1 500 feet and subject to common rights, say, together, 6 000 000 acres. The area of urban districts may also be deducted in a rough calculation of this kind, as, although it comprises a certain amount of land included under other headings, there is, on the other hand, a large aggregate amount of land appropriated by the smaller towns and villages which should properly come under this head. The amount of "waste" area is thus reduced to 11 000 000 acres, which total would include not only absolutely barren and rocky land, but also a large area occupied by railways, roads, quarries, mines, etc. outside urban area. By this process of exhaustion it will be seen that the amount of "waste land" not under crops or woods, not above the 1 500 feet level, not subject to common rights, and not included in urban areas comes to a total appreciably less than the area returned as "mountain and heath land used for grazing." The inference is that a certain proportion of this land (none of which is included in the land under crops or woods) is above the 1 500 feet level, or subject to common rights or included in urban areas.

The manner in which, at the suggestion of the Royal Commission on Coast Erosion and Afforestation, the problem was approached in the inquiry of obtaining an accurate estimation of the amount of waste lands which might be considered suitable for planting was to take the area returned as mountain and heath land used for grazing as representing the extent of available surface which might be utilised for afforestation, and to estimate what proportion of this area in six selected counties (Wiltshire, Suffolk, Derbyshire, Glamorganshire, Lancashire, and Lanarkshire) might be regarded as actually suitable for planting."

The proportion of the mountain and heath land used for grazing which was reported as suitable for planting ranged from *nil* in Wiltshire to 44 per cent in Lanark, and 71 per cent in Suffolk: Taking the six counties as a whole it appears that of the 508 644 acres of the land returned as mountain and heath in 1907, about 33 per cent, may be regarded as suitable for afforestation.

There is no statistical justification for assuming that the "sample" taken by means of this inquiry is representative of the bulk, or, in other words, that the proportion of suitable land found in the six counties can be properly applied to all the remaining counties. Sufficient information has been obtained, however, to indicate that very large deductions must be made from the total area returned as mountain and heath to arrive at a figure which would represent land suitable for planting. The reports seem to suggest that a large part of the land over 1 500 feet is included in the area returned. If it is assumed that out of the 3 537 000 acres above 1 500 feet two millions were included in the returns of mountain and heath land, that area from the afforestation point of view would be reduced to less than 11 million acres."

JOHN FLEMING. **Afforestation in England. When Afforestation Comes.** — *Trans. of the Royal Scottish Arbor. Soc.*, Volume XXXIII, Part II. Edinburgh, July 1910, pp. 124-132.

Various considerations have brought about the necessity of Afforestation in England.

I. The high price to which timber has risen.

II. The extraordinary demand for timber for paper-making;

III. The laudable desire to create some new industry to keep more people on or about the land of the country.

As to what kinds of timber should be cultivated the A. suggests larch and Scotch fir, better than spruce, which is expected to come into use for pulp-making, but for that purpose a wood much freer from knots is necessary. In hardwoods, three varieties are recommended: oak, ash, and the elm. All these trees, as grown in England and central and southern Scotland are far superior in quality to the same timber grown in any other part of the world. Data are given on the movement of timber import from Russia, Sweden, Canada and Finland.

Afforestation of catchment areas. — *The Journal of the Board of Agriculture*, vol. XVI, n. 4, 265-274. — London, July, 1909.

By considering that the supply of water obtained from land forming a "catchment area" is materially affected by the planting of trees, the Departmental Committee on British Forestry was induced in 1902 to recommend that the attention of Corporations and Municipalities should be drawn to the desiderability of planting with trees the catchment areas of their water supply, and in communicating this recommendation to the Local Authorities the opportunity was taken to ascertain some particulars as to the area and character of their catchment areas. Recently the Board of Agriculture and Fisheries have asked the Local Authorities principally concerned for an account of any work in the direction of planting the areas under their control which has since been carried out. The more important results are tabled up as follows:

Corporations and Municipalities	Catchment area		Acres afforested	Trees planted	Average cost per acre		
	Situation	Acreage			£	s.	d.
Leeds Corporation Waterworks	Washburn Valley	11 700	655	Beech, Ash, Oak, Alder, Sycamore, Scotch pine, Spruce. Larch.	11	19	5
Liverpool Corporation Waterworks	Rivington	10 000	408	Beech, Oak, Ash, Sycamore, Spruce.			
	Vyrnwy	23 000	400	Larch; Douglas, Spruce, Silver Fir; Scotch, Corsican, Weymouth, Austrian Pine; Oak, Ash, Sycamore, Beech	6	0	0
Manchester Corporation Waterwork:	Thirlmere	11 000	388	— (*)	6	0	0
Birmingham	Elan Valley	45 562	410 3/4	Larch, Scotch Pine, Spruce.	7	10	11
Torquay Corporation Waterworks	—	2 241	105	Oak, Ash, Larch, Scotch Pine.	5	13	3

(*) According to a scheme of Prof. Fisher, of Oxford University (Quarterly Journal of Foresty, Jan., 1909).

KENNETH MACKENZIE. **Afforestation and local taxation.** — *Transactions of the Royal Scottish Arboricultural Society.* Vol. XXIII, Part I, January 1910, p. 3-7.

Nothing very definite seems to have been stated as to the effect a National Scheme of Afforestation would have upon the incidence of local taxation.

The question is very hard. It seems to the author that it would be more profitable to the community if owners of estates could be encouraged to plant areas in different places, which, under estate management, could be done without disturbing existing sources of valuation to any appreciable extent, rather than to endeavour to afforest in big blocks under a national scheme.

JOHN STIRLING-MOSEWELL. **The Immediate Needs of Forestry in Scotland.** — *Transactions of the R. Scottish Arbt.-Society,* Vol. XXIII, P. II. Edinburgh, July 1910, pp. 121-125.

The steady rise in the price of timber in Scotland justifies some action on the part of the Government.

But it must be remembered that the whole essence of any scheme of sylviculture lies in a proper rotation under which the timber will ripen in order year by year. The whole area intended for forest must be divided, generally speaking, by the number of years fixed for the rotation, something between 80 and 120.

Another preliminary is the provision of what is called a Demonstration Forest. Such an area would not only afford a field for scientific experiments, but would also provide a School for Forestry apprentices. One of the most valuable experiments it can provide will be that of turning bad woodlands into good.

MARTIN MARTIN. **The importance of Forests in Military Defence.** — *Trans. of the R. Scottish Arbor. Soc.*, Vol. XXIII, Part. II. Edinburgh, July 1910, pp. 223-226.

Data are given on Forests in Military Defence and various historical considerations brought to bear on the argument.

The forests form screens within a few years after planting, and increase in obstructive value with the years, being always, and for permanent reasons, obstructions to the advance of hostile armies.

Transactions of the Royal Scottish Arboricultural Society. — (Edinburgh, Printed for the Society, vol. XXIII, part I, January, 1910).

The volume contains the following articles:

1. The Duty of the State as regards Afforestation. By a Correspondent.
2. Afforestation and Local Taxation. By Sir Kenneth Mackenzie, Bart.
3. The Sitka Spruce as a Tree for Hill Planting & General Afforestation (with Plate). By Jonn D. Crozier.
4. The Financial Aspect of Forestry. By Percival Trentham Maw.
5. Afforestation of Catchment Areas.
6. Vegetable Remains from the Site of the Roman Military Station at Newstead, Melrose.
7. Underplanted Larch Plantations at Novar. By William Mackenzie.
8. Continental Notes - Germany (with figures). By B. Ribbentrop, C. I. E.
9. The Timber trade conference. By Geo. U. Macdonald.

10. Continental notes - France. By A. G. Hobart-Hampden, late Indian Forest service.

11. The Forest Nursery Station, Indian Head, Saskatchewan. By Mr Kay, Assistant Nurseryman.

12. Visit to the Forests of Bavaria, 1909. By Sir Andrew N. Agnew Bart.

13. The Thirty-second Annual Excursion, Aug. 1909 (with Plates).

14. The Forestry Exhibition held in the Highland and Agricultural Society's Showyard at Stirling.

W. B. Havelock and Leslie S. Wood. **Plantations Competition 1909.** — *Journ. of the R. Agric. Soc. of England*, Vol. 10, 1909, pp. 258-268.

The following are extracts from the reports of the judges:

"The competition in woodland plantations was instituted by the R. Agr. Soc. of England in conjunction with the Royal English Arbor. Soc. in order to encourage and assist landowners and foresters in the better management of plantations.

"It was considered that as the character of the soil and the elevations varied very considerably in the four competing counties, the classes should be so divided that landowners owning poor and elevated land should not be expected to compete against other owners whose land was of a better character and at lower altitude.

"By visiting estates we did not find in any instance that the woodlands generally were being managed upon any defined well-thought-out scheme; although in many cases we found that the woodland areas throughout the estates were being carefully managed, and these areas were being extended gradually year by year.

"In some cases the woodlands were in the charge of a head forester, but in others they were being managed by the agent, with the general supervision of an estate bailiff, and on more than one estate the landowner himself was personally superintending the woodlands.

"We made inquiries in every case as to the original state of the land, and in the twenty-seven entries, we were informed the trees had been planted on arable land in fifteen cases, in four the land had been grass, and in the remaining eight the land had been either woodland or scrub. It was satisfactory to find that in the great majority of cases the plantations had been formed with trees in a mixture. There were only three examples of what could be termed pure larch, although four or five other plantations were sparsely mixed with deciduous trees.

"Amongst the various trees included in the plantations we found that the deciduous were represented by oak, ash, beech, sycamore, wych-elm, sweet-chestnut, and a few birch here and there. The conifers were chiefly larch, Scots pine, spruce, Douglas fir, Corsican pine, Austrian pine, and a few other varieties in small quantities.

"The average cost of planting amounts to about £7 per acre estimating the value of the trees at 20*s*. per 1000—and that of management and thinning to 20*s*. about per acre.

"The most serious pest we found traces of was the *Argyresthia loevigalella*. In addition to this we found examples of the larch-miner (*Coleophora laricella*), and larch-aphis (*Chermes larici*).

"The only serious fungus was the larch blister (*Peziza Willkommii* [*Dasyscypha calycina*]) although the high altitudes and the generally dry soil were not favourable to its growth."

AUGUSTINE HENRY. **Forestry Exhibition at Gloucester 1909.** — *Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 244-252.

This exhibition was undoubtedly the most important forestry collection ever seen in England.

Great credit is due to the cooperation of the R. English Arboricultural Society in the organisation of this splendid show which comprised no less than 248 separate entries and illustrated admirably the whole field of sylviculture, utilisation of timber and forest protection.

For the first time a gold medal was offered for the best general collection of exhibits in the Forestry section.

Among many interesting things to be seen there were three exhibits illustrating the different rates of growth and varying qualities of the wood of Scots Pine, grown under varied conditions of soil and of climate.

J. NISBET. **The productivity of woodland soil.** — *Science Progress in the Twentieth Century*, No. 15, January 1910, pp. 504-510. London.

The importance of forest humus is maintained, stating that the best method of ensuring a humus favourable to soil productivity is to grow timber-crops in mixed woods consisting of trees suitable to the soil and situation, and capable of protecting the soil against the deteriorating effects of sun and wind, and in such mixed woods the beech has on the Continent been found to possess the most valuable properties regarding the conservation and the increase of soil-productivity. But with the planting of poor waste land, there can be no sufficient supply of nitrogen without humus; and it is also probably due to the want of any admixture of good humus, that pine and spruce are so apt to become liable to fungous root-diseases when planted on fields thrown out of arable land.

Dr. AUGUSTINE HENRY. **The Study of Trees.** — *The Gardener's Chronicle*, N° 3614, p. 220. London, April 2, 1910.

Dr. Augustine Henry, Reader of Forestry at Cambridge University, delivered an interesting lecture on the study of trees at Carpenter's Hall, London. Many European trees occur in pairs of species; there are two species of oaks, two of birches, etc. He pointed out that before man changed the face of the country, there were two great classes of land, alluvial flat, and hilly land, and that one of the pair of species grew in the former and the other in the latter. Of the two varieties of oak the only one that had been planted of late years was *Q. pedunculata,* whereas *Q. sessiliflora* was the better one to plant on dry hilly land, since it had hairs on the leaves which prevented excessive evaporation of water.

A year ago the subject of crossing trees first attracted his attention. In studying the Black Poplars, he found that the tree commonly called the Black Italian poplar was in fact a cross between *Populus nigra,* and *P. Deltoida,* the American species. The Black Italian grows by far the fastest of the three, making as much as 2 cubic feet of timber per year, a fact not to be overlooked by foresters. Its timber is not easily inflammable and would probably pass the tests for fireproof flooring. The astonishing vigour displayed by the "first cross" is displayed in other cases; Dr. Henry referred to "first crosses" of the willow, the oak, and the elm. Trees could probably be produced by "cross fertilisation" that would show in the first cross very vigorous growth, and he instanced the advantage to the forester of a fast-growing Ash or Walnut: how, in the first generation that vigorous growth would be obtained and by sowing seeds of that, forms exhibiting great vigor that would breed true, could be picked out.

See also:

A. Henry. Elm Seedlings showing Mendelian Results. — (*Linnean Society*, April 7, 1910); Notice in *Nature*, vol. 83, April 21, 1910, p. 238.

C. S. Cooper and W. P. Westell. **Trees and Shrubs of the British Isles, Native and Acclimatised.**—(In two volumes; 78 full-page plates by C. F. Newall. London, J. M. Dent & Co., 1909). — Reviewed in *Nature*, Vol. 83, April 28th, 1910, p. 243.

" The number of cultivated species of hardy trees and shrubs now exceeds 3000, and it would be an impossible task to select one-sixth of these for treatment and satisfy everyone."

Percy Groom. **Remarks on the Oecology of Coniferae.** — *Annals of Botany*. London, April 1910, vol. XXIV, n. XCIV, pp. 241-269.

The following extracts of this paper are of interest:

" It is worthy to note that evergreen *Coniferae* have a larger number of serious fungal and insect foes than have dicotylous trees in north-temperate regions. This may be wholly, or only partially, another method of stating the proposition that the Conifers are more readily killed or injured.

" To prove the statement I have drawn up lists of tree-attacking Fungi and insects from the recognized textbooks on the diseases of trees by Hartig, Von Tubeuf, and Judeich and Nitsche.

" I give below a table showing the number of Fungi attacking forest trees, first as given in Hartig's ' Diseases of Trees, ' and thus as enumerating the ones that were so obviously important as to be investigated first, and secondly, as given in Von Tubeuf's ' Diseases of Plants. ' In my lists I originally grouped fungal diseases into four classes:

1) Those fatal to the tree.

2) Those severe, and causing much injury to the living tree.

3) Those that are less severe, and may be merely leaf-diseases from which the tree usually or always recovers.

4) Others, concerning whose precise significance we are not fully informed, but which are probably largely not of first-class importance.

"In the table below, the first two classes are grouped together as severe and the last two as slight; the estimates of the severity or leniency of the diseases are my own.

"The dicotylous trees are infected by 15 severe fungal diseases, of which 11 are limited to them, while the Coniferae are attacked by 25 severe fungal diseases, of which 21 are restricted to them; the remaining 4 affect dicotyledons and Conifers. Of the 15 attacking dicotyledons, 8 are wood-destroying Fungi that do not infect coniferous wood; while of the 25 serious fungal foes of Coniferae only 6 are limited to wood (there are others attacking both wood and cortex). As the Fungi attacking heartwood can hardly be regarded as of first-class severity, if they were excluded from the lists the disparity between dicotyledons and Conifers would be further increased."

Species	Number of parasitic fungal diseases					
	Enumerated by Hartig			Enumerated by Von Tubeuf		
	Severe	Slight	Total	Severe	Slight	Total
Abies pectinata	12	2	14	14-15	3-2	17
Picea excelsa	17-18	4-3	21	19	3	22
Pinus sylvestris	10-11	4-3	14	18-20	6-4	24
Larix decidua	8-9	2-1	10	9 10	2-1	11
Quercus Robur	10-11	3-2	13	10	14	24
Fagus sylvatica	4-5	3-2	7	6	9	15
Betula alba	2	4	6	3	14	17
Carpinus Betulus	1	2	3	2-3	7-6	9
Alnus glutinosa	2-3	4-3	6	1-3	12-10	13
Fraxinus excelsior	1	0	1	1-3	6-4	7

"Similarly, in regard to insect foes, I have drawn up lists of the various insects attacking forest trees in Europe, using as the source of information 'Lehrbuch der Forstinsektenkunde,' by Judeich and Nitsche: the results are given in the columns 2-7 of the succeeding table. These diseases I have ranged into several classes: *a*) severe, and attacking young plants (seed-beds and nurseries, etc.); *b*) slight, and attacking young plants; *c*) severe, and attacking older trees; *d*) slight, and attacking older trees. There is a certain vagueness in the classification because I have had to use my judgement, first, as to whether the disease is severe when it does attack the tree, and secondly, as to whether it is sufficiently common on the tree to be reckoned as a menace; but diseases caused by insects that rarely attack the species I have reckoned as 'slight.' In order to check my estimate I have drawn up the list of insect foes that attack the same species of forest trees and are admittedly of such importance as to be included in the small work on 'Forest Protection' by Fürst; the results are given in column 8 of the same table. The results of both methods of estimating agree in showing the larger number of insects menacing the existence of coniferous species.

NUMBER OF SPECIES OF INSECTS ATTACKING.

Species	Young trees		Old trees		Grand total (young and old)		Number of species of prime importance attacking
	Severe	Total	Severe	Total	Severe	Total	
Abies pectinata . .	3	20	6	27	9	47	16
Picea excelsa. . .	21	64	10	57	31	121	30
Pinus sylvestris . .	33	67	20	67	53	134	32
Larix decidua . .	8	14	7	37	15	51	20
Fraxinus excelsior .	2	2	0	18	2	20	6
Fagus silvatica . .	14	17	8	46	22	63	19
Betula alba . . .	5	13	1	50	6	63	13
Carpinus Betulus .	0	3	0	16	0	19	6
Alnus glutinosa . .	5	6	4	42	9	48	5
Ulmus campestris and U. montana.	0	0	2	37	2	37	6

(The number of slight diseases in obtainable by subtracting the ‘ severe ’ from the ‘ total ’ in the respective cases. The total number of insects listed was 385).

Columns 6 and 8 are worthy of special comparison.

“ Of the insects mentioned here as attacking young trees, 102 species attack the Conifers only, 18 attack the Conifers and dicotyledons, and 15 species attack the dicotyledons only. Thus, on the average, each Conifer has 25.5 exclusive foes or 30 inclusive foes, while each dicotyledon has 2.5 exclusive foes or 5.5 inclusive foes. Similarly, attacking old trees, 121 are confined to the Conifers, 8 damage the Conifers and dicotyledons, while 131 are confined to the dicotyledons. On the average each conifer is attacked by 30.25 exclusive foes or 32.25 inclusive foes, and each dicotyledon by 21.8 exclusive or 23.1 inclusive foes.

“ Thus dicotylous trees (at least in north temperate climes) may owe their victory over Coniferae in the majority of favourable sites largely to their power of resisting or repairing injury caused by sudden hostile influences, including animal and fungal foes. It is possible, too, that in secular changes of climate Coniferae suffered more than dicotyledons, though certain coniferous genera, such as Pinus, betray no signs of inability to secular acclimatization. So far as the chief forest trees are concerned, insect-pollination appears to have played but a small part in aiding the north-temperate dicotyledons.”

The following is the Summary of Mr Groom's paper:

1. The northern evergreen *Coniferae* are architectural xerophytes in which the extensive surface exposed by the evergreen leaves as a whole renders it necessary for the individual leaves to be xeromorphic in form and xerophytic in structure. This type of structure enables these *Coniferae* to live in regions where there is a season of physiological drought, in situations varying from dry dunes to moist forests, and from arctic and alpine situations to tropical sites.

2. The tracheidal structure of the wood of these conifers is well suited to their xerophytic evergreen leaves; and a similar type of wood is apt to occur in north-temperate and austral-temperate dicotyledons that have evergreen xerophytic leaves, as is shown by American species of *Quercus*, *Trochodendron*, and *Drimys*. The tracheidal structure of the wood is not a bar to progress and to the adoption of the deciduous habit, for in the larch a rapid trans-

piration current flows through it and the leaves transpire rapidly. The tracheidal structure of the wood more probably provides the conifer with a safety mechanism that is a defence against extinction.

3. Conifers are more easily deranged and killed by sudden injuries, and are attacked by a larger number of serious fungal and insect foes, than are dicotylous trees. To their greater vulnerability and smaller powers of repairing injuries we may at least partially attribute the defeat and extinction of many Conifers in past ages."

H. CLINTON-BAKER. **Illustrations of Conifers.**—(Hertford, 1909, vol. 1, pp. 75, pls 68). *E. S. R.*, Feb., 1910. Washington.

This work consists of a series of life-size illustrations of the cones and foliage of conifers growing in the British Isles supplemented by analytical keys of the species and by short and concise descriptions of each tree represented.

DAVID STEWART. **Suggested use of "Abies nobilis" for planting up blanks in old and in young woods.** — *Trans. of the R. Scottish Arboric. Society*, Vol. XXIII, Part I, January 1910. Edinburgh.

Though this tree cannot be recommended for general planting, the author thinks that it is one of the most suitable for filling up blanks that may occur in plantations, whether old or young. It is a good shade bearer, and, once established, it is a very rapid grower.

It is liable to suffer from frost in the earlier stages of growth; but if used for the purpose suggested, it would be protected by the surrounding crop.

One advantage gained by using Abies nobilis is that it does not need protection against rabbits.

F. J. PHILLIPS. **A study of Piñon Pine.** — (*Bot. Gaz.*, 48, 1909, n. 3, pp. 216-223). *E. S. R.*, XXI, Dec., 1909.

A brief discussion of the piñon pine (*Pinus edulis*) relative to its general distribution, local occurrence, tolerance and form, wood, fruit, reproduction, and future management.

Seed experiments with Pinus sylvestris. — *The Gardeners' Chronicle.* Sept. 17, 1910, p. 213.

An interesting experiment as yet in its initial stages, is being conducted at Bangor in Wales and in various Continental investigation stations. The experiment in question is designed to test the truth of the common opinion that seed of the Scots Pine obtained from trees grown in Scotland yields the best plants. An account of the results obtained up to the present time is given by Mr Fraser Story in the *Transactions* of the Royal Scottish Arboricultural Society (XXIII, Part II, July, 1910).

For the purposes of the investigation seed was obtained from the following countries: Scotland, France, Prussia (2), Belgium, Bavaria, Russia (2); the Scotch seed being supplied by Mr. J. Grant-Thomson, Granton-on-Spey. Mr. Story finds that of the plants raised from seeds from the above mentioned sources, those from Scotch seed were at the end of two years smaller than any of the others, thus, at Bangor the average height of 2 445 seedlings from Scotch seed was 3 inches, whereas that of 2 520 seedlings raised from Belgian seed was 5 $^1/_4$ inches, and the average height of the seedlings produced by seed derived from the other countries was intermediate between the Scotch and the Belgian seedlings.

At the end of the third year (first year after transplanting, the following averages were observed: Belgian seed 10 $^1/_2$ inches and Scotland 7 inches, and the estimate of the plants was that the Belgians were "much the best," Bavarian "second „ and Scotch "small but good."

Similar, and in some respects more striking, results with respect to rate of growth were obtained in a series of experiments at Chozin (Prussia) where whilst seedlings from Scotch seeds showed a growth of little over 2 inches, the Belgian plants grew to 7 inches.

It remains to be seen, of course, whether the Scotch seedlings will remain inferior in rate of growth to those derived from Belgian seed, or whether it is merely a case of making haste slowly.

HENRY M. CADELL. **Sitka Spruce. On the growth of the Sitka Spruce and other trees in Linlithgowshire and Stirlingshire.** — *Trans. of the R. Scottish Arbor. Soc.*, Vol. XXIII, P. II, pp. 157-167. Edinburgh, July 1910.

"As a tree for hill planting the Sitka Spruce has proved its superiority over larch, Scotch pine, and Norway spruce in a marked degree, its power of resistance against winds, and its general reliability on exposed sites far surpassing those of the other species. It may be added that its virtues are apparently not necessarily confined to its behaviour on hilly sites.

"It is a noble and ornamental tree for a park and will probably produce, on sheltered places with a moist clay soil, more wood than most other conifers, while for shelter belts and where cover is wanted it may prove in certain districts to be the most valuable member of the whole fir tribe."

JOHN D. CROZIER. **The Sitka Spruce as a tree for Hill planting and general Afforestation.** — *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXIII, Part I, pp. 7-16, January 1910, with plate. Edinburgh.

Amongst the many species of coniferous trees of economic importance introduced into Britain from Western-North America and now to be found distributed over the country of an age and in numbers sufficient to test their value for afforestation purposes, none seem capable of producing a growth of timber on high elevations, and moisture-holding soils equal in volume and value to that of the Sitka spruce or Menzies fir (*Picea sitchensis*).

After a study of the habitat of the Sitka spruce over a wide area and under varying conditions of management, the authors gives the following conclusions:

1) The Sitka spruce is suitable for afforesting exposed sites, in humid localities, such as occur in various parts of the Kingdom, and particularly in the Scottish Highlands.

2) Grown in high-forest, it has great productive capacity and yields a high quality of timber.

3) It enjoys practical immunity from attack by insect and by fungoid pests.

These qualities, combined with the great size it attains, tend to make the Sitka spruce in England what it is recognised to be in its native country: "The largest of all the spruces and of great commercial importance."

W. Mackenzie. **Underplanted Larch plantations at Novar in Scotland.** — *Transaction of the Royal Scottish Arboricultural Society*, Vol. XXIII, Part. I, January 1910, p. 35-38.

It is a sylvicultural impossibility in these days to grow a full healthy crop of larch. This has been found to be the case in most parts of Scotland, England, and Ireland. Larch is peculiary susceptible to a fungoid disease, which if given full sway would do an irreparable amount of damage.

Attempts have been made heretofore to fight this disease, with only mediocre success. But the system employed at Novar has been found by the author, so far, to be a satisfactory solution of the difficulty: that is, he anticipates having a fuller crop of larch at the end of the rotation than would otherwise be the case.

The larch is planted pure. When the plantations reach the age of from 12 to 15 years the diseased stems are cut away, and none but the soundest and healthiest are allowed to remain, these usually numbering 350 to 600 per acre, according to the activity of the disease. The cut stems can be utilised down to those 1 $^1/_4$ inch in diameter, which goes to show that an havoc wrought by the disease can be made good to a certain extent. Scots fir at that age is quite useless, whilst all sizes of larch posts find a ready market, which makes larch plantations particularly fitted for planting with an undercrop. No time is lost in stocking the thinned area with an undercrop, 2 years' seedlings being used. The species used are those that can endure the shade of the 350 to 600 larches that have been retained per acre. Areas have been planted with *Abies Menziesii, A. Albertiana, A. grandis, Cupressus Lawsoniana, C. macrocarpa, C. sempervirens, Picea nobilis, P. abies concolor, Thuja gigantea*, spruce, silver fir, Douglas fir and beech.

What revenue may be derived from the wood as a whole can only be conjectured at this stage, but there is no reason to anticipate anything, the author would conclude, but a profitable and satisfactory return.

D. Stewart. **Effects of frost on plants of "Larix europaea" and "Larix leptolepis" compared.** — *Trans. of the Royal Scottish Arbor. Soc.*, Vol. XXIII, Part I, January 1010, Edinburgh.

In the home nursery of an estate in the West Highlands, a plot of seedlings of *Larix europaea* were, during the spring put in side by side with one of *Larix leptolepis*. Both plots were in full growth when the severe frost about the end of April occurred and both suffered severely.

In 1909 they were to be planted out.

Of the European larch, more than 60% were worthless not having been able to recover from the damages caused by the frost.

But nearly all the Japanese larches were good plants having suffered but little permanent damage.

If, as this seems to indicate, the Japanese larch can thus throw off the effect of late spring frosts, it should be the better able to withstand the attack of the larch canker (*Peziza Willkommii*).

W. H. Whellens. **The Japanese Larch versus the European Larch.** — *Trans. of the R. Scottish Arbor. Soc.*, Vol. XXIII, Part I, January 1910. Edinburgh.

On the estate of Greymeg, Scotland, about 2 acres were planted with a mixture of common larch, Scots fir, and Douglas fir, and other 2 acres with Japanese larch, Scots fir, and Douglas fir.

Rabbits did enormous damage in the first four or five years, and the plantation has been filled up many times.

The Japanese larches have quite justified their introduction, for those that the rabbits left are well grown, and at present are entirely free from disease, while the European larches are badly attacked.

Judging from this experience, the author is of the opinion that the Japanese larch should be planted here in preference to the European variety, on soil and in situations suited to it.

C. E. Moss. **British oaks.** — (*Jour. Bot.*, London, 48, 1910; No. 565, pp. 1-8, pl. 1, fig. 1; 566, pp. 33-39) *Exper. Stat. Rec.*, Vol XXII, May 1910, N. 6. Washingon.

The author presents evidence to show that *Quercus robur* and *Q. sessiliflora*, instead of being identical as they are usually considered, differ in botanical structure, habitat, and range.

A. Henry. **Hybridisation of Elms.** — (*Third Annual Report of the Forestry Committee*, Cambridge). *Nature*, Vol. 83, p. 358. London, May 19, 1910.

Interesting studies are being made in the hybridation of elms; astonishing vigour is displayed in certain first crosses of these trees.

R. Zon. **Determining the time of year at which timber was cut.** — (*Forestry Quart.*, 7, 1909, No. 4, pp. 402-409, pl. 1; *E. S. R.*, March 1910. Washington).

The author points out the greater economic value of wood cut in winter over that cut in summer, and reviews our present knowledge relative to methods of determining the time of year at which timber was cut. Particular attention is given to the microscopical method of distinguishing summer and winter wood, worked out by Rashevsky, from which method it seems possible to determine, from the appearance of the last wood layer, whether the tree was cut in spring, summer, or during the dormant period of the year.

R. H. Rew. **Importation of Wood and Timber in Great Britain in 1909.** — (*Agricultural Statistics*, 1909, Vol. XLIV, p. III). *Board of Agriculture and Fisheries*. London, 1010 (Cd 5268), p. 199.

The total quantities and values of the chief kinds of wood and timber imported during the past six years are shown and the quantities of unmanufactured timber received from each country since 1905 are shown in a new table.

Unmanufactured timber is divided into the four categories: 1) hewn, 2) sawn or split, 3) staves, and 4) furniture woods and hardwood, and the total value of the timber in these categories in 1909 was over £23 000 000. In 1906 the value exceeded £27 000 000. The principal item in this total is that of sawn or split wood, the imports of which last year amounted to over 5 700 000 loads valued at nearly £15 500 000 consisting mainly of fir from Russia, Sweden, Canada, the United States, and Norway. The imports of hewn wood and timber amounted, in 1909, to more than 3 400 000 loads of the value of nearly £5 800 000, of which two-thirds were pit wood or props largely from Russia and France. About two-thirds of the oak imported was from the United States. The total value of the imports of manufactures of wood was about £2 000 000 annually.

QUANTITIES AND VALUE OF WOOD AND TIMBER IMPORTED INTO THE UNITED KINGDOM IN 1909.

Description	Quantities 1909—Loads	Values 1909—£
Hewn:		
Fir, other than Pit Props or Pit Wood .	553 993	1 177 864
Oak.	156 540	961 563
Teak	33 857	540 109
Pit Props or Pit Wood	2 627 633	2 929 640
Unenumerated	56 038	174 662
Sawn or *Split:*		
Fir	5 564 787	14 815 499
Unenumerated	157 114	654 125
Staves, of all dimensions.	126 339	546 187
Furniture Woods and *Hardwoods:*	Tons	
Mahogany.	76 202	609 352
Unenumerated	196 702	1 182 578
Wood, Manufactures of:		
Furniture, Cabinet ware, House frames, Fittings, and Joiners' work	—	576 723
Other sorts, including Wood ware and Wood turnery	—	1 477 535
		25 645 837

EDWARD KINCH. **Composition of Saw-dust.** — (*Agricultural Students' Gazette*. Cirencester, Pt. V). *Nature*, Vol. 83, April 14, 1910, p. 199.

Sawdust in some districts is used as litter for cattle. Professor Kinch has examined a number of samples, determining the nitrogen and mineral matter. The folloving figures refer to the dry substance:

	Niirogen.	Mineral matter.
Oak.	0.155	0.29
Elm.	0.27	1.38
Ash	0.29	0.68
Spruce.	0.14	0.71
Larch	0.18	0.25
Red pine	0.30	0.33

In its ordinary state sawdust contains about 10% of water, in which case the mean nitrogen content is about 0.2%.

C. N. Forrest. **Preservatives for wood paving blocks.** — *Engin. Rec.*, 61, 1910, No. 16, pp. 531-532.

The author presents data to show that tar is a better waterproofing agent than creosote, and will remain in the blocks for a long period of time.

Tar is also being adopted in lieu of creosote oil for wood paving blocks because it is a cheaper preservative.

Euphorbia latex for preventing corrosion. — *Agricultural Newspaper*, Vol. IX, No. 203, Febr. 5th, 1910.

The latex of Euphorbia can be used for preserving iron and wood.

Applied as a varnish it is a good protection against rust. Pieces of wood steeped in latex and left in a termite's nest were not attacked at all, and even the *Teredo navalis* does not touch piles and timbers thus treated.

Acetone, a product of Wood-distillation: increasing demand in Great Britain. — *Monthly Consular and Trade Reports*, Washington, February 1909, n. 341, p. 151.

U. S. Consul Maxwell Blake, of Dunfermline, writes that approximately 1 500 tons of acetone, valued at about half a million dollars (francs 2 590 000), are annually consumed in Great Britain. practically all of which is imported from the United States.

There seems to be but one company manufacturing this article in Great Britain. By far the larger percentage of this import is utilized as the solvent ingredient of smokeless powder, gun cotton, and mine explosives; but it is also employed in the making of chloroform, for the preparation of photographic sensitive plates, and as a valuable constituent of certain dyes.

Up to the present time all efforts on the part of the British Government, as well as of various private chemical concerns in Great Britain, have utterly failed to provide acetone in quantities sufficient to supply the commercial demand for it. It is now stated, however, that a simplified method of wood distillation lately discovered and put in practice by a certain French chemist, has gone far toward successfully cheapening its production, it being now successfully manufactured as a by-product of charcoal. In consequence of this Great Britain expects to look more to France than formerly as a source of supply for this product. A technical description of this new French method of wood distillation, which is also likely to be soon imitated by British manufacturers of this product, can easily be procured."

W. G. Smith. **Synopsis of the British "Basidiomycetes."** — (London, 1908, pp. 531, pls. 5, figs. 145) *E. S. R.*, XXI, Dec. 1909.

The publication is designed as a handbook for the study in the field of the larger British fungi, and a descriptive catalogue is given of the drawings and specimens in the department of botany of the British Museum. More than 2 000 species are described, including those growing in the open air and those constantly appearing in greenhouses and in gardens. The term Basidiomycetes is used in the same sense as it was employed by Debary, and includes all mushroom-like fungi, the forms growing on stumps and trees, puff balls, etc., but not the rust fungi which are included by Brefeld.

Cultivated and Poisonous Mushrooms.—(Guide to Mr. Worthington Smith's Drawings of Field and Cultivated Mushrooms and Poisonous or Worthless Fungi often mistaken for Mushrooms, Exhibited in the Department of Botany, British Museum (Natural History) London, Printed by Order of the Trustees of the British Museum, Natural History, 1910). *Nature*, September 22, 1910, p. 361.

The pamphlet issuing from the British Museum (Natural History) is valuable both as a scientific exposition by one of our most eminent fungologists and also as an authoritative guide for the use of those interested in mushroom cultivation.

Edible and Poisonous Varieties of Fungi. — *Board of Agriculture and Fisheries.* London, 1910, pp. 28+col. pls. 25.

To assist identification there are published 25 coloured illustrations of certain species of fungi which are more or less commonly found in Great Britain, together with brief descriptions.

The species described are:

Edible Fungi. — Common Mushroom (*Agaricus campestris*), Horse Mushroom (*Agaricus arvensis*), Tufted Mushroom (*Agaricus elvensis*), Bleeding Agaric (*Agaricus hoemorhoidarius*), Shaggy Caps (*Coprinus comatus*), Warty Caps (*Amanita rubescens*), The Parasol Mushroom (*Lepiota procera*), Sheathed Agaric (*Amanitopsis vaginata*), Scaly Agaric (*Lepiota rachodes*), Chocolate Agaric (*Lepiota emplastra*), Blewits (*Tricholoma personatum*), Funnel Mushroom (*Clitocybe maxima*), Amethyst Agaric (*Tricholoma nudum*), Horn-of-Plenty (*Craterellus cornucopioides*), Great Puff-ball (*Lycoperdon giganteum*), Edible Boletus (*Boletus edulis*), The Common Morel (*Morchella esculenta*).

Poisonous Varieties of Fungi. — Bulbous Agaric (*Amanita mappa*), Warted Agaric (*Amanita pantherina*), The Death Cap (*Amanita phalloides*), Fly Agaric (*Amanita muscaria*), Shield Agaric (*Lepiota clypeolaria*), Glutinous Agaric (*Volvaria gloiocephala*), Verdigris Agaric (*Stropharia aeruginosa*), Purple Agaric (*Cortinarius purpurescens*).

F. L. STEVENS and HALL. **Variation of Fungi due to environment.**—(Bot. Gaz., 48 (1909), No. 1, pp. 1-30, figs. 37) *E. S. R.*, XXI Dec. 1909.

Attention is called to the variation found in studies of fungi made during the past few years, and attempts were made to analyze the cause of the variations to the end that the factor of environmental variation may be more clearly recognized as a problem in mycology. The effect of density of colonies, density of mycelium, chemical relations, light relation, and several unknown factors are discussed at length, and the variability in spore measurements due to various factors is shown by means of diagrams.

The authors state that the bearing of these facts on mycological taxonomy is apparent, and that the tendency to variation should be recognized in making studies of many fungi. They believe that many fungi should be studied in cultures, under suitable standard conditions, in order to determine some of their more important taxonomic characters.

A. H. R. BULLER. **Researches on Fungi.**—London, New York, Bombay and Calcutta, 1909, pp. VI+287, pp. 83. Reviewed in *E. S. R.*, XXII May 1910.

Part I of this work includes investigations of the production, discharge, and dispersal of the spores of the Hymenomycetes treated botanically and physically. Part II is a similar treatment of the

Ascomycetes. The following is a summary of a few of the more important results obtained:

The spores of the *Hymenomycetes* are very adhesive when freshly liberated. Paraphyses are useful as spacial agents. Direct sunlight injures the vitality of the dry spores of certain species. Spores falling from a fruit body suspended in a closed beaker can be seen in clouds or individually without magnification by using a concentrated beam of light. Fruit bodies of corky or leathery consistency are xerophytic, for when revived after drying, they resume the function of discharging spores; the spores liberated are viable.

The four spores on each basidium are forcibly and successively discharged. Each spore is shot out horizontally from its sterigma to a distance of about 0.1 mm., with an initial velocity of 40 cm. per second, but is rapidly checked by the resistance of the air, in consequence of which the spores describe a sharp curve called the "sporabola" and then fall vertically to the ground if in still air. The specific gravity of certain species ranges from 1.02 to 1.21. The falling spores are claimed to be electrically charged.

W. W. Ford. **The distribution of poisons in the Amanitas.** — (*Jour. Pharmacol. and expt. Ther.*, 1, 1909, N. 2, pp. 275-287; *E. S. R.*, XXI, Dec, 1909).

The author claims to have developed a method for the isolation and purification of poisons in Amanitas, particularly of hemolysin, and he gives the results of studies with a number of species in which the presence or absence of the poisonous substances amanita hemolysin, amanita toxin, and muscarine was determined. As a result of his experiments, which were carried on with rabbits and guinea pigs, he found *Amanita phalloides, A. virosa, A. spreta, A. porphyria, A. strobiliformis, A. radicata, A. chlorinosma*, and *A. muscaria* definitely poisonous and to be avoided, while *A. rubescens* and *A. russuloides* are considered as probably free from toxic properties.

Studies made of *A. frostiana*, a species that is closely associated with *A. muscaria*, showed that an aqueous extract was hemolytic in moderate degree, but that all the plants were free from resistant toxin and muscarine. It is thought that this species can not be as closely related to *A. muscaria* as its botanical characteristics would suggest. On account of its close resemblance to the fly agaric the author states it should be scrupulously avoided.

" Nearly 20 species of Amanitas have now been examined by the methods which have been worked out for the demonstration of the 3 most important poisons in fungi, muscarine, hemolysins, and toxins. By the use of these methods, a small amount of material, even 1 or 2 plants, can be analyzed and the properties of the species established."

T. W. Sanders. **Mushrooms and their cultivation.** — *A Handbook for Amateurs dealing with the Culture of Mushrooms in the Open-air, also in Sheds, Cellars, Greenhouses,* etc., and the best methods of Cooking them; including a Description of other Edible Fungi. Pp. 80+fgs. 28. London, 1909.

The author writes in the " Foreword ": " This Handbook has been written to meet the requirements of amateur gardeners who need guidance as to the various methods of growing mushrooms for home consumption. Our aim has been to supply information in as concise and lucid a manner as possible on the culture of the mushroom on ridges or beds in the open air, in boxes and tubs in cellars, etc.; under greenhouse staging; in old hotbeds or in frames; also in pastures. No pains have been spared to make every phase of the art plain and easy to understand in order that even the merest novice may follow with hope of certain success.

" To render the volume of still greater value to the amateur we have not only instructed him how to grow mushrooms, but also how to cook them in various appetising ways.

" We know there are many country readers who in summer and autumn come across a great number of fungi growing in woodland, upland, and mead, but are unaware of the fact that a large proportion of them are edible. The popular notion is that every fungus, except the true mushroom, is a " toadstool ", and poisonous withal. Is is true that a large number of fungi are highly poisonous, but this fact should not deter the reader from studying the various fungi that come under his observation, and gradually finding out those which are edible and those that are not.

To assist the country reader, therefore, to determine those that are safe to eat, we have supplied a chapter giving a brief description of the edible kinds, accompanied, as far as possible, with illustrations of them ".

We give, out of this useful little book, the following extracts regarding the possible application of law in regard to protection of field-culture of mushrooms, and some notes on truffles in England.

"To protect mushrooms grown in fields from thieves, and to secure a conviction in case of the latter being caught gathering them, place a board up in the field containing the following notice: "Mushrooms Cultivated Here". Salt should be occasionally strewn over the field and spawn inserted, then there will be ample justification for stating that mushrooms are cultivated, and anyone caught gathering them may be prosecuted for theft, as well as trespass. In the event of no notice being exhibited in a field in which mushrooms are grown naturally, the only remedy against a person gathering them is a prosecution for trespass."

The truffle (*Tuber aestivum*) is described as "an underground fungus of a blackish-brown colour, and with a warty skin. It grows chiefly in the Wiltshire, Hampshire, and Kentish downs, and can only be found by dogs or swine specially trained for the purpose. They ascertain by the scent the presence of the fungi beneath, and in this way only can the Truffle be discovered. The Truffle has a peculiar and delicious flavour, which is highly appreciated by gourmets. It is said that the flavour is most pronounced if the truffles are cooked when quite fresh. Truffles are more abundant in the south of France than here; or, at any rate, thay are sought for and found in larger quantities than in England. Dried truffles cost from 15s. to 20s. per pound in London. Attempts have been made to cultivate the truffle, but without success.

The mushrooms chiefly eaten in England are reported as the common mushroom, *Agaricus campestris;* the Champignon or Scot's Bonnet, *Marasmius oreades;* the Horse Mushroom, *Agaricus arvensis;* the Giant Puffball, *Lycoperdon giganteum;* the maned Agaric, *Coprinus comatus;* the Plum Mushroom, *Agaricus prunulus;* and a few others, but the first is stated to be the only species grown artificially.

XXX.

Rubber plants and industry. Camphor, Gums, and other special products, partly spontaneous, partly produced by culture.

Experiments with "Eucommia ulmoides," near Norwich. — (*Third Annual Report of the Forestry Committee*, Cambridge). Nature, Vol. 83, p. 358. London, May 19, 1910.

The *Eucommia ulmoides* is a tree which was discovered in the mountains of Central China; it is perfectly hardy and grows fast in England. Its bark produces 5% of rubber, the quality of which however is still a matter of doubt, as only minute quantities have been tested (1).

The World's production and Consumption of Rubber. — *Monthly Consular and Trade Reports*, 1909, Nov., 350. Washington, Gvt Print. Office, p. 214.

Horace Lee Washington (U. S. Consul in Liverpool) furnishes the following information concerning the present and prospective production and consumption of rubber:

The importance of the rubber industry to Great Britain is indicated by the value of its imports and exports. The imports of crude rubber into the United Kingdom in 1908 amounted to $40 682 698 (209 515 894 frs), of which $27 850 730 (143 431 259 frs) worth was reexported. An article in the *Liverpool Post and Mercuny*, of August 23, 1909, deals with the consumption of rubber, wherein the United States holds such a dominant place, and is in part as follows:

Recent developments in the rubber trade were undreamt of not so many years ago. At the time we speak of no one anticipated that fine hard-cure Para rubber would advance to $2,05 per pound

(1) *Eucommia ulmoides*, Oliver, a Magnoliacea of China. By some given as a producer of gutta-percha. See Kew's Bull. of Miscell. Inform. 1901, pp. 89-94. Just. Bot. Jahresb. XXX Jahrg. (1902). 1903. (Ed.).

yet that was the price touched recently. Prior to the developments which have brought the manufacture of motor cars and taxicabs to its present stage, the world's demands for rubber were met largely by South America, and particularly by the Brazils, where the rubber was obtained in its wild state. The requirements for tires have, of course, grown with the progress of the motor and taxicab industry, and are now enormous.

It is recognized by close observers of the situation that the future of the rubber market depends mainly upon the continuance of the demand from the United States, a country which has been buying very freely for some time. The motor-car industry in the United States is expanding to a remarkable degree, it is reported that the Americans contemplate putting 50 000 cabs on the streets of the principal cities of the United States; and when it is stated that each cab will require five tires to begin with, the significance of this enterprise will at once be grasped. An illustration of the advance of the industry in the United Kingdom is found at our own doors. Only five cabs were available for hire in Glasgow when this form of locomotion was first started in the city; now there are forty.

Fine Para rubber fell during the financial crisis in the United States—to be exact in February of last year—to 66 cents (3 frs 40 c.), the lowest price which statistics show was ever obtained for the material. The price recently was about $2,03 (10 frs 50 c.) per pound, after touching $2,05 last week, but new crop Para for October November delivery is at a discount of 25 cents per pound. While so much depends upon the American demand, it is just possible that even should this cease, prices may not fall either so soon or to such an extent as expected, because it is well known that manufacturers are not carrying large stocks, and must come into the market sooner or later.

The total arrivals in Europe during the 1908-9 season (July to June) amounted to 35 840 tons, and in the United States to 33 342, while the deliveries in Europe were 38 546, and in the United States 33 443 tons. The stocks in Europe were 2 944 tons, and in the United States 810 tons. The world's total production was 70 587 tons, consumption 71 989 tons, and the visible supply 5 024 tons.

PHILIP SCHIDROWITZ. **The India-Rubber Industry.** — *Journ. of the Soc. of Chem. Industry,* May 16th, 1910, p. 531.

The Industry in the United Kingdom. — The following figures will give a general idea of the importance of the rubber industry in the United Kingdom:

IMPORTS OF RUBBER (1908).

From	Quantity cwt.	Value £
Brazil	300 032	5 331 842
Peru	29 622	518 885
French Colonies	58 159	553 615
Other Foreign Countries	112 085	831 819
(Total Foreign)	499 898	7 236 161
British Possessions	75 168	1 135 044
Total 1908 (*)	575 066	8 371 205
do in 1907	667 294	10 834 759

(*) The year 1908, owing to the American financial crisis, was an abnormal year; the totals for the preceding year are therefore also given.

Of the total imports, rather more than one half are re-exported, the average figures for the past five years being:

1) EXPORTS OF RAW-RUBBER.

	Quantity cwt.	Value £
Average imports, 1904-908	587 781	9 302 990
Average re-exports, 1904-908	334 129	5 858 488
Balance retained for consumption	253 652	3 444 502

2) MANUFACTURED GOODS.

	Exports (1909) Value £	Imports (1908) Value £
Miscellaneous goods	1 576 000	482 644
Boots and shoes	205 668	123 381
Waterproofed goods	295 184	6 825
Rubber covered cables, other than telegraph and telephone cables	289 342	103 230
Telegraph and telephone cables	744 140	125 087
Total.	3 110 334	841 167

(*) This does not include inferior grade (very resinous) rubbers, such as *Pontianac* or *Jelutong*. The annual production of these is probably some 20 000 to 30 000 tons, the United States alone importing some 12 000 tons annually.

There are no published figures on which an estimate of the value of the manufactured articles consumed in the home trade can be based with any certainty, but it may be safely placed at not less than ten millions sterling, assuming normal rubber prices.

C. SIMMONDS. **Substitutes for Rubber.** — *Nature*, March 17, 1910, Vol. 83, N. 2107, p. 72.

" Of the composite rubbers (or " artificial rubbers, " as they are sometimes called), one preparation, which has been made in quantity, and is said to be excellent for many purposes, has for its basis Guayule rubber incorporated with certain gums. Another such article is compounded of natural rubber and some other substance of vegetable origin; probably a latex or gum, reputed to contain the same chemical elements as rubber and in much the same proportion. Such articles are of course, only partially " substitutes " for rubber, and their cost rises with that of the latter ingredient. Moreover, if any very large demand for them arose, there is always the possibility that the supply of gums and latices would become insufficient, and the advantage of lower cost would thus tend to disappear.

" Coming now to true synthetic rubber; a question often asked is whether there exists any probability of such an article being manufactured and displacing natural rubber, either wholly or to any large extent. Will rubber plantations go the way of madder fields and indigo cultivation? Well, the future is on the knees of the gods. In the face of the precedents just mentioned, to say nothing of others, he would be a bold man who would venture to say that even the best quality of rubber may not some day be made on a commercial scale from cheaper materials such as beet sugar and calcium carbide. But the day is not yet. There are beginnings; there are clear indications of the direction in which to proceed; there is distinct progress to note. But there is still some distance to go, and the end of the journey may not be even in sight.

India-rubber chemically is essentially a polymerised terpene. An article patented some time ago, and named " turpentine rubber " appears to foreshadow a synthesis of true rubber. Turpentine is a mixture of terpenes, and the article in question was to be obtained by passing turpentine through a hot tube, and treating the resulting vapours with hydrochloric acid. The result is a solid condensation-product; and the idea at the base of the process appears to be the production of polymerised terpenes having some of the elastic properties of rubber.

A more promising, because a more scientific way, is that outlined in Heinemann's patent N. 21 772 of 1907. Here a true synthesis is attempted. It is based upon the well known fact that rubber is probably a polymer of the semi-terpene isoprene. The first step is the production of the unsaturated hydrocarbon divinyl, $CH_2 : CH.CH : CH_2$. This is obtained by passing mixed acetylene and ethylene gases through a heated tube. With methyl chloride, divinyl yields isoprene (methyl divinyl, $CH_2 : C(CH_3). CH : CH_2$); and the isoprene on treatment with strong hydrocloric acid is converted, by a union of molecules, into a substance closely resembling caoutchouc, if not identical with it. The raw materials, so to speak, are thus acetylene, ethylene, and methyl chloride, which are them selves obtained by any of the ordinary methods, e. g. from calcium carbide, alcohol, and beet sugar residues respectively."

XXXI.

Weeds and Diseases of plants. — Noxious weeds and their prevention. — Vegetable parasites. — Parasitic and saprophytic Fungi. Conditions affecting parasitism. — Bacteria and plant diseases. — Resistance of plants to disease.

Law and Custom in regard to Noxions Weeds in English Farming. The Agricultural Legislation of 1909. *Journal of the Royal Lancashire Agricultural Society*, 1910, p. 62.

The following is an extract from an article of Mr. T. C. Jackson on the Agricultural Legislation of 1909:

It may be worth while to consider for a moment the position of the English farmer in regard to noxious weeds. We may consider the farmers' position from two points of view, viz: — his relationship in the matter of weeds to his landlord and secondly to his neighbour.

As far as his landlord is concerned, a yearly tenant is not responsible for permissive waste. Thistles and charlock grow naturally, and if the yearly tenant merely failed to cut them down and stop their growth, it would be very difficult for his landlord, if not impossible, to hold him responsible according to the English common law for permitting waste upon the holding.

Besides the common law, however, custom must be taken into account; for it is well known that the custom of the country still plays an important part in the relationship of landlord and tenant. Unless a statute or a written agreement forbids, the custom of the country will prevail. Now universally throughout England we may observe that the possession of foul land at the expiration of a tenancy is a just and proper item which either the landlord or the in-coming tenant may advance as an act of dilapidation and claim damages therefore. What effect in practice the possibility of such a counterclaim may have upon a bad tenant, it is difficult to say. The tenant who was utterly heedless as to the condition in which he left the holding would probably be one who had no claim to compensation for unexhausted improvements to advance, and who, perhaps, was more or less in an insolvent condition and for whom therefore a counterclaim for dilapidation or an action for damages in regard to the condition of the holding would have no terrors.

Finally, there is the written agreement to be considered. During the last two years many new written agreements have been entered into between landlords and tenants as a result of the new condition obtaining under the Agricultural Holdings Act 1908. What those conditions are have been previously discussed in the 1907 and 1909 editions of this Journal.

We may observe, however, that many of these fresh agreements have contained a clause wherein the tenants undertake to cut or destroy thistles, docks or other noxious weeds twice per annum, before the same have flowered, and to remove them from the holding.

Where a tenant has entered into such a written covenant, he will of course be responsible to his landlord if he fails to carry out his agreement in this respect."

JOHN PERCIVAL. "**Couch**" **or** "**Twitch.**" — *The Journ. of the Board of Agriculture,* Vol. XVI, N.° 4, pp. 279-282. London, July 1909.

The terms "couch," "twitch," "scutch," and "whickens" are often applied by farmers in a general sense to several perennial grass-like weeds which creep on or below the surface of the soil.

The three species of grass usually known by the name "couch" are:

1) True "Couch" or "Twitch" (*Agropyron repens*, Beauv.; *Triticum repens*, L.).

2) Black "Twitch" or common Bent grass (*Agrostis vulgaris*, With.).

3) Onion "Couch" (*Arrhenatherum avenaceum*, Beauv.; var. *bulbosum*, Lindl.).

These are among the most troublesome of all weeds of arable land, and when once established a great deal of expense must be incurred before the land is again clean enough for the growth of paying crops.

Remedies. — 1) As all these pests are spread by means of their seeds which are easily blown about, every effort should be made to prevent flowering, and great care should be taken to procure grass-seeds and seed-corn free from those belonging to these weeds.

2) Hedgerows must be kept clear of these pests, for from plants growing there seeds are disseminated. Moreover, if the hedge-rows contain couch of any kind, it will grow out into the head-lands, and the first harrowing spreads pieces of rhizomes or the small "bulbs" of onion couch further into the field, and year by year the weeds extend.

3) Where the couch has become established, repeated ploughing, grubbing, and harrowing during the summer are the only means of dealing with it. The land should be ploughed at first with a shallow furrow, and as much as possible of the weed collected by harrowing when the soil is in just the right state of dryness to leave the roots and creeping stems of the weeds easily. After gathering together, it should be burnt in heaps and the ashes spread over the land. The passage of a roller over the land greatly assists the harrows and cultivators to shake off the soil from the couch and allow of its collection in unbroken lengths.

Care should be taken not to grub or harrow in wet weather, especially on the heavier kinds of land, or much mischief will be done. When wet: the clods are cut or roughly broken by implements into irregular lumps rather than pulverised, and the creeping stems are severed into short lengths too small to be effectively gathered by any implement. A similar state of things also arises when the land is too dry. There is a time in the drying of ploughed land when the soil readily falls into a fine, crumbly powder, and leaves the roots and rhizomes of weeds clean, and it pays to examine the soil carefully from this point of view before attempting to drag out weeds from it.

4) After cleaning in the manner just indicated, the land should be sown with mangolds or other root crops, or with beans, and the horse-hoe with grubbing tines should be kept at work between the rows as long as possible. Rape, vetches, or other similar crops which will grow luxuriantly and smother any weeds may also be grown with advantage.

5) In some cases isolated patches of couch may be forked or dug out and carried off the land.

P. Gedwort Foulkes. **Destruction of Thistles.** — *Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 422-423.

On few subjects is there so much divergence of opinion among farmers as on the thistle (*Carduus arvensis*).

Prof. G. Foulkes has during the last three years carried out experiments on the extermination of this pest at the Harper-Adams Agric. College.

Il 1907 trial plots were laid out on a grass field on which the common creeping thistle was very plentiful. It had been regularly grazed with mixed stock.

The plots were treated as follows during the first two years:

Plot. 1. Thistles cut three times in the season, and dressed with 4 cwt. (200 kilos) common salt after each cutting (cut. June 10, July 9, and 17).
„ 1-A. Thistles cut three times, not salted.
„ 2. Thistles cut once in season and dressed with 4 cwt. salt at time of cutting.
„ 2-A. Thistles cut once, not salted.
„ 3. Not cut., but headed with stick to prevented seeding, and dressed with 4 cwt. salt at same time.
„ 3-A. Not cut., but headed.
„ 4. Cut once and sprayed with sulphate of copper.
„ 4-A. Uncut., but headed with stick and sprayed with sulphate of copper.

In 1909 the use of sulphate of copper was discontinued and plots 3-A and 4-A were cut three times while in plots 1 and 1-A there were pratically no thistles present for the third cutting.

It is well to emphasise the fact that it was the *creeping thistle* that was under treatment.

Leaflet n. 166 published by the Board of Agriculture clearly brings out the difference in habit of growth between this pest and other thistles infesting grass land.

Professor Foulkes remarks: that the conclusions that may be drawn from the trials are that by checking the growth of the thistle above ground in the early summer the development of the underground stem is hindered. Each cutting further weakens the vigour of the plant. By the time of the third cutting in the second season there is very little left to deal with.

By 1909 the treatment on plots 1 and 1-A had pratically cleared the plots.

The cutting is best done when the plants are from 4 to 6 inches (10 to 15 centimetres) above ground.

Another feature noticed was that the herbage on the plots which were cut frequently was much more abundant and freely grazed, whereas on such plots as 3, 3-A, and 4-A there was practically nothing consumed by the stock.

Salt and sulphate of copper seem to have little if any effect upon the thistle.

G. Massee. **Diseases of Cultivated Plants and Trees.** — London, 1910, p. 602.

This new work supersedes the author's "Text-book of Plant Diseases," third edition, now out of print.

The aim of the author is to enable those who are concerned with the cultivation of plants and trees to determine the nature of diseases caused by parasites, and to apply the most approved curative and preventive methods. The work is more than an accurate compilation from the latest authorities, it is the out-come of long-continued, personal investigation.

The author states, "that the most important of remediable and preventive measures combined is cleanliness. Unless this fact is constantly kept in view, and practised, no amount of spraying or other modern method of dealing with disease will produce the desired result. Just now spraying is the order of the day, and under certain conditions is productive of much good; at the same time spraying alone may be overdone, whereas when used in combination with other measures the success is greater and the cost less. Hundreds of people know, to their cost, that repeated sprayings do not always prevent Apple Scab. Why? Because, they do not remove the dead twigs on which the fungus winters. It is sometimes argued that this is impracticable, which is simply nonsense. The same is true of most of common diseases, the cultivator is led to believe by the manufacturer of spraying apparatus and of various preparations warranted to cure every thing, and frequently supported by expert opinion, that his salvation depends on spraying alone! Notwithstanding such persuasion and advice, the cultivator will find it to his advantage to remove the primary cause of disease whenever practicable rather than allow it to remain, and endeavour by means of spraying alone, to keep it under subjection. Diseased branches, fruit, etc., should be removed—in fact, as far as practicable, all diseased material should be destroyed. Unfortunately it is not always possible to do so, as when potatoes attacked by black scab or turnips suffering from finger-and-toe rot in the ground. In such cases the land should be sterilised by the use of quick-lime or gas lime.

" Much has been written of late respecting the great advantage derived from certain fungi parasitic on insects. Such statements are perfectly true; myriads of destructive insects are destroyed by such means. This has happened in the past, and will continue in the future. The one thing to refrain from is that of investing money in any scheme having for its object the extermination of injurious insects through the agency of fungi. Any such investment, will be regretted."

C. K. Bancroft. **Researches on the life history of Parasitic Fungi.** — *Annals of Botany*, Vol. XXIV, No. XCIV, pp. 359-371. London, April 10.

Cladosporium herbarum is shown to be connected with another conidial form belonging to the form-genus *Hormodendron*, commonly regarded as saprophytic, which as a parasite causes disease of the green foliage of many species of plants (cabbages, cucumbers, melons, althea, etc.). The disease takes the form of large irregular holes in the lamina of the leaf, and is favoured by damp summers.

The A. investigates the appearance and course of the disease and gives an account of the experiments carried out with it and draws the conclusion that the life-cycle of the fungus embraces the two conidial forms: *Hormodendron* and *Cladosporium*.

G. Massee. **Evolution of parasitism in Fungi.** — (*Linnean Society*, London, Feb. 17, 1910); *Nature*, Vol. 83, March 3, 1910, p. 29.

Parasitism is mainly the outcome of opportunity and the fact that fungi present all stages of parasitism, and that a saprophytic fungus can be educated to become a parasite, proves that parasitism is an acquired habit. Incipient or imperfectly evolved parasites promptly kill the host, and consequently curtail the period of their own existence as *Pythium De Baryanum*. A higher stage of parasitism is reached by many of the rusts and smuts, *Ustilago Avenae*, etc., where the host is attacked as a seedling, and is stimulated to an unusual condition of growth throughout its normal period of growth.' More advanced parasites show a tendency to arrest the production of spores and Conidia, and to perpetuate themselves by perennial mycelium located in some perennial vegetative portion of the host (root, tubers, etc.), or in the seed. On the most highly evolved parasites reproductive bodies are entirely arrested, and the parasite is perpetuated by hibernating mycelium only.

M. C. Potter. **Bacteria in their relation to Plant Pathology.** — (*British Mycological Society*); *Nature*, vol. 84, July 7, 1910, p. 18).

Presidential address by Prof. Potter to the British Mycological Society.

At least ten plant diseases are considered as caused by bacteria:
The pear-blight (*Bacillus amylovorus*);
Yellow disease of Hyacinth (*Pseudomonas Hyacinthi*);
Canker of the olive (*Bacillus Oleae*);
Corn-blight (*B. Zeae*);
Potato wet-rot (*B. solaniperda*);
Soft rot of hyacinth (*B. hyacinthi-septicus*);
Bacteriosis of the vine (*B. uvae*);
Cucurbit Wilt (*B. tracheiphilus*);
Brown rot of Crucitera (*Pseudomonas campestris*);
Potato and tomato disease (*Bacillus solanacearum*).

G. J. Atkinson. **Some fungus parasites of algae.**—(*Bot. Gaz.*, 48, 1909, No. 5, 321-338); *E. S. R.*, June 1910, Washington.

Descriptions are given of a number of new species of fungi found to occur on *Spirogyra* and other algae.

William Carruthers. **Bromus racemosus L. and Oats. On some diseases of Crops.** — (*Annual Report For 1909 of the Consulting Botanist; Jour. of the R. Agr. Soc. of England,* Vol. 70, pp, 353-355. London, 1909).

"Two cases of the appearance of smooth brome grass (*Bromus racemosus* Linn.) in Winter oats have been reported on. The strange notion that this grass is a reverting of the cultivated oats to its original form is still entertained by not a few farmers.

Specimens of "British Queen" potatoes which were being germinated had the sprouts covered with something white looking like hoar frost. This was found to be due to the spores of a *Fusarium* which had attacked and was destroying the young sprouts.

In Staffordshire a field of potatoes was so badly attacked in July by *Macrosporium Solani* that nothing could be done to save the crop.

C. C. Cornwall. **Influence of Cropping on Resistance to Finger-and-Toe.** (Notes on Agric. and Poultry Expts. in 1905 and 1906). — *The Journal of Board of Agriculture,* Vol. XVI, N° 10. London, January 1910, p. 857.

For several years experiments were conducted with lime and other substances, the results showing that while heavy applications of lime were beneficial, the treatment was expensive. In addition, where these heavy dressing (6 tons per acre) had been used mangolds and oats could not be grown successfully for some time. This suggested that oats and mangolds, which appeared, like finger-and-toe, to be favoured by acidity of the soil, would, if grown continuously so reduce the acidity as to free the land from finger-and-toe. To test this point a field on which previous to 1902 the turnip crop was entirely destroyed by the disease was cropped with oats in 1902, mangolds in 1903, and oats in 1904 and 1905. In 1906 a number of varieties of swedes, not claimed to be disease-resisting, were drilled with 10 cwt. of basic slag per acre, and all produced a sound healthy crop. A few yards of land in the gateway, that had not been properly cropped and cultivated still produced a badly diseased crop. It is, however, to be noted that previous to 1902, experiments had been conducted on a portion of this field with various substances, more especially lime, and it is conceivable that the action of these substances is traceable in the results obtained in 1906.

It was noticed that about 20 per cent of the charlock in the swede crop was affected by finger and toe, while the swedes were comparatively free. The charlock appeared, therefore, to be more susceptible, and it is clearly of importance to keep such land free from it, in order to prevent it from perpetuating the disease."

SIBYL LONGMAN. **The Dry-rot of Potatoes.** — (*Journ. Linn. Soc.* London, Bot. 30, 1909, N° 270, pp. 120-129, pl. 1); *E. S. R.*, Febr. 1910.

Investigations have been carried on to determine whether the fungus of dry rot of potatoes (*Fusarium Solani*) is capable of inducing disease in the growing potato plant, and whether the dry rot can be induced in potato tubers directly by inoculation with spores, as it is commonly supposed dry rot usually follows wet rot.

As a result of the study, the author has reached the conclusion that *F. Solani* is not only a true parasite of the resting tuber but also is capable of attacking the growing potato plant. In regard to the second question, there appears to be no time relation between an outbreak of dry rot and one of wet rot, and it is shown that dry rot may be induced by inoculating healthy potato tubers with cultures of the dry-rot fungus.

Experiments were made to determine the possibility of disinfecting the potato tubers by heating, but it was found that this was impracticable, as the death temperature of the fungus is higher than that of the potato.

Internal Brown rot or Sprain of Potatoes. — (*Journ. Bd. Agr.*, 16, 1909, N. 8, pp. 647-648); *E. S. R.*, March. 1910, Vol. XXII, N. 4, Washington.

A description is given of the internal brown rot or sprain of potatoes, the precise nature of which is obscure. In some specimens mycelium was found in the tissue of the brown spots, and under proper conditions the winter rot caused by *Nectria Solani* always developed. In other cases no mycelium could be found, nor did any fungus develop even under favorable conditions.

Tubers showing this disease were planted, and every tuber produced showed the presence of small spots, indicating that the disease is transmitted from seed tubers to the following crop. Where there were no signs of winter rot on the tubers planted the sets produced a perfectly clean crop.

G. M. **Potato diseases.** — (*New Bulletin; The Gardener's Chronicle*, n. 3608, p. 122). London, Feb. 19, 1910.

The number of reports issued during 1909 exceeded in number those issued during any previous year. Amongst diseases of potatoes a noticeable feature was the great extension of " Corky Scab," caused by *Spongospora Solani.* On the other hand " Dry Scab " recorded during 1908, was not received at Kew during the past season. A series of experiments on the " greening " of potatos was conducted and results published in the *Journal of the Board of Agriculture*, vol. XVI, p. 177. An investigation of the fungi causing discolouration on chilled beef from Argentina has also been made. A considerable amount of diseased material from the Colonies and outside sources has been submitted to Kew during the past year, including *Diplodia cacaoicola*, Henn., the cause of a disease which is a source of serious injury to Cacao in the West Indies.

Some Potato-diseases. — (*Journ. Board of Agr.*, 1909, N. 8, p. 642-646, pl. 1); *E. S. R.*, Washington, March 1910.

During an investigation of the prevalence of the wart disease of potatoes (*Chrysophlyctis endobiotica*) in Great Britain, a number of other diseases were observed to be widely distributed, and brief notes are given on them preliminary to a full report of the investigation. The diseases described are corky scab (*Spongospora scabies*), root rot (*Rhizoctonia violacea*), leaf blotch (*Sporidesmium Solani varians*), blakleg or stem rot (*Bacillus phytophthorus*), and a disease due to *Hypochnus Solani.*

The spread of Wart disease (Black scab) of Potatoes. — *The Gardener's Chronicle*, no 3600, p. 137, London, Feb. 26, 1910.

Inspectors of the Board of Agriculture report that in 1909 Wart disease, *Oedomyces leproides* occurred in, and was almost confined to, an area including Lancashire (south of the Ribble) Cheshire, Shropshire (North of Shrewsbury) Staffordshire and certain parishes in Warwickshire and Worcesteshire, adjoining Birmingham. From this centre the disease was traced, spreading somewhat irregularly in southerly and westerly directions. So far, few field crops have been affected even within the central area of infection. There, and also in the outlying districts, the disease is confined mainly to allotments and gardens.

E. Riehm. **The Wart disease of the Potato in England.** — (*Contbl. Bact*, etc.; 24, 1909, 8-12, 208-213); abs. *Exper. Stat. Rec.*, Vol. XXII, June 1910.

Referring to the potato wart disease, the author discusses the identity of *Chrysophlyctis endobiotica* with *Œdomyces leproides*, and concludes that the two are not identical. The entrance of the zoospores into the host plant has not been observed, but plasmodia were found in the diseased tissues. The fungus belongs to the Olpidiaceæ group. It is claimed that the resting sporangia can live for at least 6 years in the soil. The disease is spread by means of the soil and seed potatoes. The remedies are gas lime, quicklime and sulphur applied to the soil. The article closes with a bibliography of the disease.

Edwin F. Smith. **Tomato and Potato Bacteriosis.** — *The Journ. of the Board of Agriculture*, July 1910, vol. XVII, no 4, p. 297, London.

This disease has been known for some time in the United States, where it has been carefully studied by Dr. Erwin F. Smith. The organism concerned is called *Bacillus solanacearum*, E. F. Smith. Potatoes, tomatoes, and egg-plants are attacked, sometimes on a large scale, in America. In this country it was first observed in 1902. (*Jour. Bd. Agric.*, IX, p. 308) in small quantity of potatoes grown in the North of England and in Scotland.

During the present season the same disease has attacked tomatoes to a somewhat serious extent, examples having been received at Kew from two localities, where it is stated to be present in an epidemic condition.

In the case of potatoes, Dr. Smith has shown that the rapid spread of the disease is caused by insects of various kinds, feeding alternately on diseased and healthy plants. The numerous isolated patches of disease on the fruit and leaves of the tomatoes examined at Kew support this view. To prevent this the plants should be sprayed with Bordeaux mixture containing an insecticide, which would answer the double purpose of warding off insects and preventing the appearance of *Phytophthora infestans*, *Cladosporium fulvum*, etc.

Bacteria have occurred abundantly in the substance of partly ripe tomatoes; hence, owing to the difficulty experienced in thoroughly removing the glairy coating from the seed, it is highly probable that bacteria would become locked up in this substance as it dried round the seed, and on being released during germination would endanger the crop. Seed, obtained from fruit grown in an infected area should not be used.

Potato tubers showing the slightest trace of an internal brown ring should not be used for " sets; " in fact, potatoes from an infected district should be avoided.

Soil that has produced a diseased crop should be treated with gas-lime or with superphosphate of lime.

Wart disease of Potatoes. — *The Gardeners' Chronicle.* Sept. 17, 1910, p. 217.

A pamphlet issued by the Harper-Adams Agricultural College, Newport, Salop, gives an account of experiments made with the object of testing the effect of fungicides on plants affected by Wart disease (Black scab), and of determining which varieties of the Potato are most resistant to the attack of the fungus (*Chytridium endobioticum*, Percival) responsible for Wart disease. After describing the symptoms—now well known—of black scab, a brief account is given of the modes by which the fungus spreads from one place to another. The agents responsible for the distribution of the spores are animals, manure, and *seed.* Thus it has been demonstrated that pigs and poultry straying from infected gardens may carry the spores and thus spread the disease. Again, manure from animals fed on diseased tubers contains the resting spores, and if used on fresh soil may give rise to infection. In particular, seed tubers from diseased Potato crops are responsible for the dissemination of the disease. In Shropshire, black scab is confined practically to gardens and allotments on light soils, and occurs mainly in the north and east of the county. No fungicide of the many tried in the course of the investigation has been found to have a decidedly beneficial effect in reducing the disease, though a summer dressing of copper sulphate destroys the motile spores liberated during that period. More definite results have been obtained from the testing of relatively immune varieties, and it is recommended, in consequence, to grow Southern Queen and Southern Star as earlies with Conquest for the main crop. Of late varieties, Abundance, Langworthy, and Peacemaker showed a superiority with respect to resistance over the other varieties which were tested. Those interested in the subject are recommended to apply to the college for a copy of the pamphlet, which, we understand, will be sent to applicants free of charge.

W. J. Z. **Black stripe in Tomatoes**. — *Gard. Chron.*, XVLIII, 3rd, p. 197. London, Sept. 10, 1910.

This disease is reported as usually making its appearance when the plants are 2 feet to 3 feet in height. A black streak appears in the stems here and there, and, if not immediately checked, the disease spreads through an entire house with great rapidity, completely spoiling the plants, if not killing them outright.

Black stripe enters deeply into the tissues, as will be seen on cutting a section of the stem; growth appears to cease, and the cells shrivel in the affected parts. The disease quickly spreads to the fruit and leaves, which become deformed and covered with a network of black lines, growth becomes weak, and the flowers, which are not already set, fall off.

It is stated most prevalent in houses in which Tomatoes have been cultivated year after year, especially if the plants are grossly fed and inclined to grow rank.

The author has tried several good fungicides, also dusting, and vaporising with flowers of sulphur (the latter, by the way, is excellent for mildew), but all these remedies had little or no effect on black stripe. Excessive sun-heat is the only remedy found effeetual in checking it. The house is closed about noon on a bright day, allowing the temperature to rise to 115° or 120° Fahr. and the author has never known this remedy to fail.

On one occasion last season, the disease made its appearance during a spell of dull weather, and several days elapsed before a bright day appeared, and then only a temperature of 103° Fahr. was obtained, which had practically no effect.

Several days later, a temperature of 120° Fahr. was reached, and the result could be seen almost immediately. The disease was cured, and all the affected plants commenced to grow again, although the old scars remained; but these soon became healed, like wounds on the trunk of an actively growing tree.

The temperature necessary to eradicate the disease appears to be about 115° Fahr. Care should be taken that the roots are sufficiently moist, as such high temperatures cause excessive transpiration, and, if the roots are at all dry, burning results. The foliage should not be thinned excessively before shutting up the house, and if some of the more exposed fruits are slightly shaded from the direct rays of the sun, it is an advantage, as the author has occasionally had a fruit, here and there, scalded.

British tomato houses are not shaded in any way, and the thermometers from which the above temperatures taken were more or less in the direct rays of the sun. The houses are not opened until the following morning, to allow the temperature to fall gradually, as a sudden change to colder conditions might have serious effects.

American Gooseberry Mildew.—*Journal of the Board of Agriculture*, May 1909, n. 2, p. 117.

A description is given of the Gooseberry disease. The following extracts are of special interest to the general reader:

The disease known as American Gooseberry Mildew, *Sphaerotheca Mors-uvae*, Berk., is of a very serious character. It has greatly increased the cost of the cultivation of gooseberries wherever it has appeared, and in some cases it has rendered gooseberry-growing impossible.

This fungus is much more injurious to gooseberry bushes than the allied European Gooseberry Mildew, *Microsphaera Grossulariae*, Lév., as it not only attacks the leaves, but also extends to the shoots and fruit, stunting the latter and rendering it unsaleable.

Only occasionally the English mildew assumes a virulent form and attacks the fruit.

Precautions to be observed by Growers.—Although there are many affected gardens in certain districts of England, and although infection may doubtless be conveyed by wind, birds, insects, and other means which are outside a grower's control, it does not follow that it is useless to take precautions against infection. Even in Worcestershire, where the disease has longest been known to exist, by far the greater number of gardens are free, and of those infected a comparatively small number are badly attacked.

Again, as has already been stated, the disease does not always spread rapidly, and in many of the cases in which it has suddenly appeared all over a plantation there has been reason to suspect that the plantation had been affected for some time without attracting attention. On the other hand, in many of the cases in which the mildew has been discovered early, and prompt action has been taken, disease has not spread throughout the plantation.

When the disease is neglected and allowed to spread all over a garden, the cost of treating it is heavy, and in many of the worst cases it pays the owner better to grub up the plantation than to attempt to cure the affected bushes. It is quite clear, therefore, that it is worth a fruit-growers' while to take precautions to prevent infection, and to prevent disease from spreading if his garden should unfortunately become infected.

Fruit-growers are recommended to observe the following precautions:

1) Plants should not be purchased from nurserymen or dealers unless a guarantee is given that they are free from American Gooseberry Mildew.—Young shoots should be cut back before being planted and the prunings burned.

2) So many cases have been found in which disease has begun on bushes close to the packing sheds or other places near which "empties" have been stored, that baskets, barrels, sacks, etc., which may recently have been in a diseased garden should be treated with suspicion. Empties sent by salesmen for carrying fruit of any kind to market should not be taken direct into gooseberry plantations. They should first be disinfected. Baskets may be disinfected by dipping them in boiling water or in a solution of 1 lb. bluestone (copper sulphate) to 20 gallons of water; sacks may be scalded. Even if disinfected, packages should not be taken into fruit plantations until actually required. As already stated,

the summer spores of mildew do not live long, and every day's delay in bringing baskets near gooseberry bushes makes the risk of infection less.

3) Labourers who have been working in a garden in which the disease exists in its summer stage should not be set to work in a clean gooseberry plantation for a week at least unless means have been taken to disinfect their clothing.

4) Growers should make a practice of searching their plantations for traces of disease at frequent intervals, especially in the months of July, August, and September. Young leaves which are attacked generally curl upwards and show a white under surface covered with mildew. Pickers should be told to report at once any cases of mould on the berries. As indicated above, outbreaks of disease in plantations in which mildew has not previously appeared are very often found near packing-sheds, so that special care should be taken in examining bushes near the places where gooseberries, plums, etc. have been got ready for market.

5) As disease may appear at any time between May and November, fruit-growers should keep on their premises a few pounds of liver of sulphur. This substance, when freshly made up, as explained below, is the best spraying material for summer use. A good quality should be procurable at 6d. per lb. It must be kept in an air-tight tin or a corked bottle, for if exposed to air it quickly loses its value. A spraying pump should also be kept in readiness. The ordinary knapsack sprayer costing about 35s. would serve for ordinary plantations, or a hand-pump of the syringe pattern costing 7s. 6d. to 15s. might be used in small gardens.

Treatment of a First Outbreak.—Assuming that a watchful fruit-grower discovers the disease as soon as it gets into his plantation, he should at once remove and destroy the affected berries or shoots; they may be collected in an iron bucket and burned, or dipped into a "steep" made by dissolving 1 lb. liver of sulphur or 1 lb. bluestone in 10 gallons of water. A spraying mixture should then be made up of 1 oz. liver of sulphur to 2 gallons of water, and the affected bush and surrounding bushes should be throughly sprayed.

Treatment of Diseased Plantation—By adopting the line of treatment indicated above, the chances of stamping out the disease are good; but if from neglect or any other cause a garden has become generally infected with disease, a different procedure will be required.

Two methods may be adopted in treating the summer stage: (1) spraying, and (2) removal of the diseased tips. The first remedy is the best in the early part of the season, up to about the end of July, while the second is the more effective from the middle of August onwards.

Brooks and Bartlett. **Two new Gooseberry Diseases.** — (*Annales Mycologici,* Vol. VIII, N. 2, 1910); *The Gardeners' Chronicle,* June 25, 1910, p. 428. London.

The authors describe two diseases of gooseberries which have killed off large numbers of bushes in Cambridgeshire. The heaviest cropping kinds, such as Winham's Industry and Keepsake are most frequently attacked, and as many as 20 per cent of the bushes are affected in some plantations. The general characters of the two diseases are very similar. One of the diseases is due to the common fungus, *Botrytis cinerea;* the other disease is apparently caused by *Cytosporina Ribis* a species which has been considered hitherto a saprophyte.

In regard to remedial measures, the immediate destruction by fire of all affected bushes as soon as the disease is discovered is recommended, so that the formation of the sclerotia of the fungus and the subsequent distribution of the conidia may be prevented. The present practice of leaving dead and dying bushes in the plantations for some time ensures the continuation and propagation of the disease.

T. F. Brooke and A. W. Bartlett. Abs: *Nature,* No. 2135, Vol. 84, p. 402. Sept. 29th, 1910.

An investigation into the causes underlying a serious loss of gooseberry bushes in Cambridgeshire is recorded by the authors in *Annales Mycologici* (Vol. VII, No. 2). Two fungi fell under suspicion, but definite proof in the shape of infection experiments was only obtained for *Botrytis cinerea,* although good reason is adduced for finding a second cause of disease in *Cytosporina Ribis.* The diseases are not in any way connected and distinct macroscopic and microscopic characters are defined for each fungus; further, it is noted that in no case were both fungi discovered on the same plant.

Strawberry Leaf-Spot.—*The Journal of the Board of Agriculture,* September 1910, No 6, p. 476.

Both cultivated and wild strawberries are often severely injured by a fungus called *Sphaerella Fragariae,* Tul., better known in this country as *Ramularia Tulasnei,* Rab., a conidian form of the *Sphaerella,* and for a long time the only known condition of the fungus. The foliage is the part attacked, and the symptoms are unmistakable. Small reddish-brown spots appear on the leaves; these often encroach on each other and form irregular patches. By degrees the centre of each patch assumes an ashy-grey or whitish colour, bounded by a reddish border, which becomes bright red later in the season. This peculiar arrangement of a whitish spot bounded by a red ring has given origin to the local name of " Birds' Eye Spot " in some parts of the country.

The central whitish portion of the patch soon becomes studded with minute tufts of the conidial condition or Ramularia condition of the fungus. These continue to infect healthy leaves throughout the season. When the infected leaves begin to languish the conidial condition is followed by the higher or Sphaërella condition of the fungus, the spores of which remain on the dead leaves until the following spring when they are liberated and infect the young leaves.

This pest is everywhere present in this country, and is also well known on the Continent and in the United States. None of the cultivated varieties escape the disease, but some are more severely attacked than others. The variety called " Royal Sovereign " is especially susceptible to the disease. When the injury is severe the crop of fruit is much reduced both in quantity and in quality; the plants are also weakened for the following season.

If spraying is commenced at a sufficiently early stage (in fact, where the disease has previously existed spraying should commence when the leaves are quite young) an epidemic may be prevented. The plants should be sprayed with a solution of potassium sulphide (liver of sulphur) in the proportion of one ounce to three gallons of water. This treatment will also arrest the possible appearance of Strawbery Mildew *Sphaerotheca Humuli,* Burr. Spraying should be continued at intervals until the flowers begin to open.

The following method of combating the disease has proved highly satisfactory when strawberry beds are badly rusted. The beds should bë mown soon after the fruit is gathered, covering the dry leaves with a sprinkling of straw or dry litter and burning them. This may seem harsh treatment for the plants, but every one who has tried burning over a strawberry bed has been surprised by the vigorous and healthy appearance of the new foliage.

Leaf disease of celery.—*Board of Agricultural and Fisheries*, Leaflet No. 238, illustrated. London, May 1910.

"Celery leaf spot" caused by *Phyllosticta Apii*, Halsted, was first observed in the United States in 1891 and since then has repeatedly proved to be a destructive parasite on celery. The disease which attacks the leaf is readily distinguished from the other celery leaf parasites by the presence of one or more large blotches on a leaf, which at first are dull brown, then paler, dry, and studded with numerous black points or perithecia, each containing numerous spores. When these are ripe they infect the soil endangering the following crops. Numerous spores are also conveyed to adjoining leaves thus spreading the disease with great rapidity during damp dull weather.

A second celery leaf disease, caused by *Septoria Petroselini*, Desm. has long been known. It studs the leaf with numerous, irregularly angular brown spots, each bearing a few very minute black perithecia, containing myriads of very slender needle-shaped spores. When it attacks celery an epidemic usually results owing to the rapid production and dispersal of spores.

Preventive measures. Both diseases yield to the same treatment, provided it be commenced at an early stage. On the first appearance of the disease the plants should be sprayed with Bordeaux mixture of:

sulphate of copper, 10 lbs.	4,54	kgs.
quicklime 5 lbs.	2,27	»
water 100 galls	454 —	»

Three applications at intervals of a week usually prove sufficient to check the parasite.

E. J. Schwartz. **A New Parasitic Disease of the Juncaceae, Preliminary notice.**—*Annals of Botany*. London, January 1910, Vol. XXIV, N. 93, p. 236.

"The root of various species of *Juncus* are subject to the attack of a Mycetozoan parasite, which the author proposes to call '*Soro-*

sphaera Junci' as being allied to *S. Veronicae.* The terminal stages in the life-histories of both these Fungi are strikingly similar, the wedgeshaped spores being collected into spherical balls, the *sorospheres*, although in the case of *S. Junci* many of these balls are of elliptical shape, and often merely loosely aggregated masses of spores fill the root-cells. The stages of nuclear division in both parasites are also similar. In old infected roots the cortical cells contain the nucleated amoebae of the parasite, and in some the nuclei may be seen collecting in masses previous to spore-formation. The infection of the root takes place by the entry of an amoeba into a root-hair and thence into the cortex of the root. The roots show no hypertrophy. This Fungus is in no way related to the *Entorrhiza*, which has been described by Weber in Bot. Zeitschr. 1884, as being the cause of tubercle-formation in the roots of *Juncus bufonius.* The latter is doubtless one of the Ustilagineae; its young spores are binucleate, and it infects the root by means of conidia which push their way down the root-hairs. I hope shortly to publish in detail an investigation into the life-history of *Sorosphaera Junci.*"

Shot-hole Fungus. (Cercospora circumscripta Sacc.).—*The Journal of the Board of Agriculture*, London, June 1910, vol. XVII, N° 3, p. 211.

This parasite attacks the leaves of the peach, almond, cherry, apricot, and nectarine. Less frequently the leaves of the plum and of other rosaceous trees are injured.

Appearance of the Disease. — The first indication of the disease is the presence of small pale-green, translucent spots scattered over the blade of the leaf. These spots gradually become more cleardy defined, and increase in size up to a diameter rarely exceding one-sixth of an inch. When the patches commence to turn yellow, the fungus bursts through the epidermis of both sides of the leaf, in the form of very minute dark-coloured, hairlike tufts or threads which bear the minute spores at their tips. At this stage the diseased patches become dry and brown and drop out, leaving circular holes, suggesting the idea of the leaf having been riddled with small shot; hence the popular name of "shot hole fungus."

Remedies. — Peach foliage suffers most from the "shot-hole" disease in this country. In this case the disease is difficult to check, as on account of the very tender nature of the leaves, Bordeaux mixture cannot be applied.

Dr. W. M. Scott, of the U. S. Dept. of Agric., has found that a fungicide, known as "self-boiled lime-sulphur mixture," can be used on peach foliage without injury. The proportions for a mixture ready for use are: 8 lbs. lime, 8 lbs. sulphur, 50 gallons of water. The following is the method of preparation:

The mixture can best be prepared in rather large quantities— say 20 pounds, or even 40 pounds, at a time—so as to get enough heat to produce a violent boiling for a few minutes. Place the lime in a barrel and pour on enough water (about 3 gallons to 20 pounds) to start it slaking and to keep the sulphur off the bottom of the barrel. Then add the sulphur, which should first be worked through a sieve to break up the lumps, and finally enough water to slake the lime into a paste. Considerable stirring is necessary to prevent caking on the bottom. After the violent boiling which accompanies the slaking of the lime is over, the mixture should he diluted ready for spraying, and at least enough cold water added to stop the cooking. Five to fifteen minutes are required for the process, according to whether the lime is quick-acting or sluggish. The intense heat seems to break up particles of sulphur into about the physical condition of precipitated sulphur, and the violent boiling makes a good mechanical mixture of the lime and sulphur. Only a small percentage of the sulphur — enough to improve the adhesiveness of the mixture — goes into solution, but if the hot mass is allowed to stand as a thick paste the sulphur continues to unite with the lime, and at the end of thirty or forty minutes enough of the reddish liquid is produced to burn peach foliage, and even apple foliage in some cases. Hence the necessity for cooling the mixture as soon as the lime is well slaked. The finely divided sulphur in mechanical mixture with the lime is depended upon for the fungicidal action rather than the sulphides in solution, the latter being harmful to foliage except in very dilute form.

The mixture should be strained through a sieve of 20 meshes to the inch (25,4 m/m) in order to remove the coarse particles of lime, but all the sulphur should be worked through the strainer.

The amount of water required to make the best mixture depends largely upon the lime. Some grades of lime respond quickly and take a large quantity of water, while others heat slowly and are easily "drowned" if too much water is added at once. Hot water may be used to good advantage in preparing the mixture with sluggish lime, but with quick-acting lime hot water is not necessary, and is likely to bring too much of the sulphur into solution. If desired, the mixture may be kept for a week or more without deterioration, but should be thoroughly stirred before using.

In applying the self-boiled lime-sulphur mixture, the spraying outfit should be equipped with a good agitator. The mixture settles to the bottom of the tank, and unless kept thoroughly agitated cannot be evenly applied.

Spraying should be commenced early in the season, when the foliage is about half-grown and repeated as necessity demands.

If the soil be dug over during the winter, material capable of infecting the foliage in the spring would be buried.

F. T. Brooks. **The cause of the Cherry-leaf scorch disease.** *The development of "Gnomonia erythrostoma" is the cause of the Cherry-leaf scorch disease.* — (*Cambridge - Philosophical Society*, June 6). *Nature*, vol. 84, n. 2124, p. 63. London, July 14, 1910.

The present investigation concerns an examination of the life-history of this fungus from the cytological standpoint, very little work on the Pyrenomycetes having hitherto, been done from this point of view.

E. S. Salmon. **A Canker of Apple trees caused by the Brown Rot Fungus.** — *The Gardener's Chronicle*, n. 3621, May 21, 1910.

The Fungus *Sclerotinia fructigena*—in its conidial or Monilia stage—has long been known as the cause of the *Brown Rot* disease of the fruit of the Apple, Pear, Cherry, Plum and Peach. It is also well-known that the spawn (mycelium) of this fungus can invade and kill the wood of the Cherry, Plum and Peach, and it is not uncommon to find on these trees (when Brown Rot has been prevalent on their fruit) a *dying back* of the branches from this cause.

Under certain circumstances the present fungus is able to cause an injury to the wood of the Apple, a fact which does not seem to have been recorded. This injury does not, as a rule, result in the death of the entire shoot, as in the case of the Cherry, Plum and Peach, but is localised and takes the form of canker. This canker would seem only to occur on certain varieties of apples, notably the Worcester Pearmain, the Ecklinville Seedling, and Beauty of Bath.

The surest remedy is to collect and burn any apples as soon as they show signs of rotting and not allow them to decay and affix themselves to the branches. A spraying of the tree in winter with a solution of copper sulphate (1 lb. dissolved in 25 gallons of water) and with Bordeaux mixture (4 lbs quickline, 4 lbs copper sulphate, 50 gallons water) just before the flower-buds open, and again directly the bloom has set, has proved most efficacious in dealing with Brown Rot on Plums and Cherries and this treatment should be employed for those varieties of Apple, such as Ecklinville Seedling, which are susceptible to this disease.

DUKE OF BEDFORD and U. SPENCER PICKERING. **Silver-leaf Disease.** — *Twelfth Report of the Woburn Experimental Fruit Farm*, pp. 1-35. London, 1910.

The present report deals chiefly with the description of experiments on the disease known as silver-leaf, which attacks many different sorts of trees, but more especially plums and other stone fruits.

It is confirmed that the disease is connected to a fungus known as *Stereum purpureum*.

Inoculation, susceptibility and treatment experiments are reported.

Leaf shedding in Conifers due to "Botrytis cinerea." — *Board of Agricultural and Fisheries*. Leaflet N. 234 illustrated. London, May, 1910.

This disease is caused by *Botrytis cinerea* Pers. and is well known in this country and on the continent. It has been recorded on Firs, Spruces, Larches, Junipers etc.

Young nursery stock suffers most, but the youngest shoots of very old trees are also attacked.

The first indication of disease is a yellowing of the leaves, which finally turn brown and die, but do not always fall, being held by a tuft of brown cob-web like mycelium: The shoots are often twisted or turned downwards.

The diseased leaves and shoots that fall to the ground contain in their tissues the mycelium of the fungus which produces minute black *sclerotiae*. In spring when the young leaves, appear these sclerotia produce myriads of spores and new infections result.

The spores can infect directly young leaves, but the bark of two-year-old seedlings can only be entered by some wound.

Preventive measures:

1) Perfect cleanliness in the seed bed. Weeds should not be left to die on the ground.

2) Stable manure imperfectly buried in the soil can also spread the disease.

3) Damp low lying situations should be avoided for nursery purposes.

4) Spraying with the following solution will check the progress of the disease:

Sulphate of copper, 11 lb	(kgs 5)
Carbonate of copper, 16 lb.	(„ 7 25)
Permanganate of potash, 1 lb	(„ 0 45)
Solft soap, 3 lb	(„ 1 35)
Rain water, 100 gals	(lits 454)

The ground also within, and for some distance around, the affected patch should be thoroughly wetted.

5) All diseased seedlings to be collected and burned.

A. W. Borthwick. **Peziza Willkommii on larches.** — (*Notes R. Bot. Gard.*, No. 21, pp. 23-26, Pl. I, Edinburgh, 1909); *Exp. Stat. Rec.*, May 1910.

This is a discussion of efforts to find exotic species of larch that are resistant to the European larch canker (*Peziza Willkommii*). Two species were tried, Japanese larch (*Larix leptolepis*) and a western larch (*L. occidentalis*), but neither proved to be immune from the attacks of the fungus.

A. W. Borthwich. **Peziza Willkommii on Larix occidentalis Nutt. and Larix leptolepis Gord.** — (*Notes from the Royal Bot. Garden.* Edinburgh, XXI, Aug. 1909, pp. 23-26, 1 Plate). *Botanisches Centralblatt*, Band 114, Nr. 8, Jenn 1910, p. 191.

Occurrence of larch canker in *Larix leptolepis*, a species often supposed to be immune, and also in 5 year old seedlings of the rare and little-known *Larix occidentalis*.

A. W. Borthwick. **Frost canker of "Picea sitchensis".**—(*Notes Roy. Bot. Gard.* Edinburgh, 1909, No. 20, pp. 263-265, pl. I); *E. S. R.* Washington, May, 1910.

The Menzies or Sitka spruce, which is extensively grown in parts of England on account of its value as timber, is dying in large quantities from a form of canker, young trees being the worst sufferers.

The first symptom of the attack is a change in the foliage from dark green to pale yellow. Next the leader loses its leaves, turns dark red in color, and its buds or branches are arrested in growth. The needles are retained on the older parts and if the trees are not killed outright an attempt is made to replace the leader by a side branch. The stem in many cases was found to be cankered. The canker at first is a small flattened area from which exudes a thin, bluish white resin. Later the bark splits, exposing the wood, and the tree attempts to cover this by a callus formation. Fructifications of an Ascomycete are invariably present and may be the cause of the disease, but an anatomical examination of the tissues leaves little doubt that frost is the primary cause. A severe frost of 10 to 15° occurring in May is supposed to have caused the injury.

Other conifers have also been attacked in a similar manner.

A. W. Borthwick. **A new disease of Picea.**—(*Notes R. Bot. Garden.*, No. 20, pp. 259-261, Pl. I, Edinburgh, 1909); *Exp. St. Record*, May 1910.

A brief account is given of a new disease of Picea, which attacks the buds of the trees, sometimes stopping their further growth, but if only one side of the bud is attacked, producing a twisted shoot. The diseased buds are encased in a dense black sheath, thickly dotted with the fruit bodies of the fungus, which is described as a new species, *Cucurbitaria Piceæ* n. sp.

C. E. C. Fischer. **The biology of Armillaria mucida.**—(*Ann. Bot.*, 23, No. 92, pp. 515-585, pls. 2. London, 1909); *E. S. R.*, March 1910. Washington.

A study was made of this fungus, which is said to be common wherever beech trees occur, in order to trace its life history, investigate its action on the wood, and determine preventive and remedial measures.

The fungus was found to grow saprophytically on various substances, but all attempts to infect living beech wood failed and no proof could be obtained to indicate that it is strictly parasitic in its growth. It was found to excrete enzyms which liquefied gelatin, dissolved starch, and reduced lignin to cellulose. Its decomposition products contained neither tannin nor oil.

Among the remedial and preventive measures for the control of this fungus the author recommends the treatment of the wounds on trees with an antiseptic, and the removal and destruction of the diseased parts before the sporophores reach maturity.

XXXII.

Animal and Insect pests. — Rats, field-mice, and other vermin. — Insect-life. — Insects noxious to crops, to cattle, to man, and to special products. Other harmful inferior animal organisms.

D. SHARP. **The Zoological Record.**—(*Zoological Rec.*, 44, 1907, pp. XII-1521; 45, 1908, pp. XII-1395); *E. S. R.*, June 1910, Washington.

These volumes contain the usual classified bibliographies covering the literature relating to all branches of zoology.

FRANCES PITT. **Field mice and their natural enemies.**—(*Country Life* (London) 26 (1909), no. 673, pp. 737, 739, figs. 4). — *E. S. R.* Vol. XXII, no. 4, March, 1910, Washington.

Hawks, owls, foxes, stoats, weasels, and hedgehogs are mentioned as important enemies of field mice.

G. Dalgliesh. **Yellow-necked Field-mouse (Mus flavicollis).** — *Nature,* August 1910, n. 2128, vol. 84, pag. 180.

The difficult, if not indeed unanswerable, question as to the limitations of species and races is again raised by Mr G. Dalgliesh in the case of the yellow-necked field-mouse. In this instance the writer maintains that this mouse ought to be regarded as specifically distinct from the ordinary long-tailed field-mouse (*Mus sylvaticus*) under the name of *M. flavicollis,* basing his arguments, not only on the physical differences between the two forms, but likewise on their distribution and their divergence in habits and disposition. It may be remarked in this connection that naturalists are by no means in accord as to the proper name for the yellow-necked form.

Lionel E. Adams. **Moles and Molehills.** — *Nature,* vol. 83, March 10, 1910, p. 37.

Some interesting notes are given on the construction of molehills. The senses of smell and hearing must be very acute to enable the mole to locate a pheasant's or partridge's nest above his run. That this is the case is testified by two gamekeepers in different parts of the country, both of whom state that the nests are often entered from below and the eggs eaten.

Boelter W. R. **The Rat Problem.** — London, 1909, pp. VII-165 & pls. 2, figs 75.

The object of this book is to present the case against the rat so completely as to place beyond doubt the passing of a British Rat Law on the lines of the Danish Rat Law.

The main conclusions arrived at by the author are as follows:

1) The brown rat (like the black rat) is not an indigenous animal, but invaded Great Britain in 1732 having been brought on ships from India.

2) It has disturbed the conditions existing previous to its arrival by:

a) Exterminating the black rat, and,

b) Becoming a national pest.

3) Five factors have contributed to make the rat a nation nal pest:

a) Its physical and mental faculties.

b) Its tremendous fecundity.

c) The increase in the human population (hence more shelter and more food stores).

d) The killing, by gamekeepers, of the rat's natural enemies — the weasel, the owl, and the kestrel.

e) The total absence of cooperation in the methods chosen by man to exterminate the rat.

4) As a result of these factors operating in favour of the rat, there are to-day, in Great Britain 40 000 000 rats, which do every year a damage amounting at least to £15 000 000.

5) In addition, the rat is guilty of being the chief agent in the spread of trichinosis (by acting as host to the trichina), and of the bubonic plague (by acting as conveyor of the plague flea).

6) The destruction of rats becomes, therefore, a matter of national importance.

7) There is no ideal method for destroying rats. In this war of man v. rat any method is good as long as it kills rats, and is used persistently and in co-operation with similar efforts made everywhere else.

8) Nothing but a national campaign, waged with all the weapons available, can bring about the destruction of the brown rat, but this co-operation can be effected only by the State.

9) The State already undertakes, through the Port Medical Officers of the Local Government Board, the destruction of rats for hygienic reasons, and, through the Board of Agriculture, the destruction of injurious insects. The destruction of rats for economic reasons is therefore only the natural development of the present duties of the State.

10) A short Act, based upon the Danish Rat Law, making it compulsory for county councils and municipal authorities to destroy rats, would probably effect the practical extermination of the rat in this country in ten years.

11) An annual expenditure of £50 000 would probably result in saving the greater part of the enormous loss inflicted by rats.

12) This annual grant should be expended partly on premiums — from 1d. to 2d. for each dead rat handed in partly for experiments, on a large scale, with such bacteriological preparations as may be selected on the grounds of harmlessness to other animals, high efficiency, and easy application.

13) Such Rat Law should contain a clause protecting, during

the five years following the passing of the Act, or for a longer period, all weasels, owls, and kestrels.

14) Pending the passing of such law, public spirit should support the scheme of the Incorporated Society for the Destruction of Vermin of a National Rat-killing Competition, hy means of clubs which it is intended to create by the offer of £300 in prizes.

Interesting is the statement reported by the secretary of an important agricultural society, that the loss to farmers alone should be put at one millions pounds sterling per day!

The Appendix gives the text of the principal rat laws. There is added an abundant Bibliography.

W. R. Boelter. **Draft of the English Rat Laws** [An Act to Provide for the Destruction of Rats]. — *The Rat Problem.* — John Bale. London, 1909, p. 160.

The following draft is proposed in the book of Mr Boelter, in imitation of the Danish law for the destruction of rats.

Be it enacted by the King's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

Local Authorities to Execute Act.—1) Where the local authority are informed by any person that any place or area within their jurisdiction is a rat-infested place or area, it shall be the duty of such local authority to enquire into the truth of such information, and if it is found to be true, to take such measures as may be deemed advisable for the destruction of the rats in such area.

Local Authority may Appoint Officers.—2) For the purpose of carrying out this Act the local authority may, with the consent of the Local Government Board, appoint any person or persons whose duty it shall be to destroy the rats found in the area of the local authority. The local authority may also, with the consent of the Local Government Board, pay any person proving to the satisfaction of the local authority that he has killed rats within its area such sum as the said local authority shall from time to time direct.

Power for Local Government Board to carry out Act.—3) If the local authority decline or neglect to carry on the duty imposed upon them by Section I of this Act, the Local Government Board may at any time, if they think fit, on any evidence satisfactory to them, declare any area to be a rat-infested area, and may give the local authority twenty-eight days' notice in which to take effectual measures for the destruction of the rats in such area. And in case the local authority still declines or neglects to carry out its duty it shall be lawful for the Local Government Board to take such steps as it may deem advisable to carry out the duty imposed upon the local authority by Section I of this Act.

Repayment of Money expended by Local Government.—4) All sums expended by the Local Government Board in the carrying out of such duty shall be refunded by the local authority.

Power of Entry by Officers of Local Authority.—5) A sanitary inspector or an inspector of nuisances, or an officer appointed by the local authority for the purpose of destroying rats, may, without a warrant, enter any place or area suspected of being a rat-infested area or place, and any person who obstructs him in the execution of his duties shall be liable to a fine not exceeding £5.

Damage to Buildings.—6) The local authority shall not be liable for any damage done to buildings or other property caused by any of its officers in the execution of their duty unless it can be shown to the satisfaction of a Stipendiary Magistrate, or two Justices of the Peace, or a County Court Judge that such damage was unnecessary. And any owner of such buildings or other property, and also the local authority, shall have a right to appeal from the decisions of any Stipendiary Magistrate or two Justices of the Peace to a Court of Quarter Sessions, and from the decision of a County Court Judge to the King's Bench Division of the High Court of Justice.

Interpretation.—7) The words "place or area" include dwelling-houses, out-houses, factories, warehouses, docks, wharves, railway stations and buildings attached thereto, stables, sewers, fields, gardens, and stacks of wood, hay, and corn.

The words "local authority" mean County Councils, City Councils, Borough Councils, Urban District Councils, and District Councils.

8) (i.) This Act may be cited as the Destruction of Rats Act.

(ii.) This Act shall come into operation on the 1st day of October, 1909.

G. M. Young. **Report on the use of Virus for Extermination of Rats.** — *Aberdeen and No. of Scot. Col. Agr. Bul.*, 12, pp. 10); *E. S. R.*, Febr. 1910. Washington.

Tests were made of 3 commercial products claimed to be pathogenic in rats, namely, Danysz bacillus, Liverpool virus bacillus, and the bacillus of Ratin (Nos. 1 and 2), the 3 preparations being used in localities at considerable distances from each other.

From the reports received the following conclusions have been drawn: Each product was successful in killing rats. There was no suggestion of any being harmful to other animals, except in one instance, where one product was thought to be fatal to hens, but of this direct proof was lacking. The comparative cost for the extended areas used in this test was, per 100 acres, for the Liverpool virus £ 1, for the Ratin virus £2 5s., and for the Danysz virus £1 10s.

J. Danysz. **Some Reflections regarding the Free use of Bacteriological Cultures for the Destruction of Rats and Mice.** — (*Brit. Med. Jour.*, 1909, n. 2508, pp. 209-10). — *E. S. R.*, Aug. 1909.

The author here considers the possible source of danger to man from the use in the destruction of rodents and other small mammals of certain microbic cultures that belong to the *Salmonella* or *Bacillus enteritidis* group.

According to the most recent investigations two types are to be distinguished among these bacilli, first, those to which belong the bacillus of Loeffler, that of hog cholera, and that of psittacosis, all apparently identical with *B. paratyphus B.*, and second, those to which belong the bacilli of the viruses of Danysz, Issatschenko, Neumann, and Dunbar, which seem to be identical with the *B. enteritidis* of Gaertner. While the microbes of the *Salmonella* group are extremely widespread in nature and are frequently found in cases of poisoning through food, it is considered as far from being proved that they are active agents in these occurrences. Such cases are considered as probably due to ptomaines, etc.

It is concluded that " microbic cultures which have been handled for more than 10 years by more than a million individuals, and which have been scattered broadcast on bread or grain in many parts of the world and placed within reach of domestic or other animals without causing any serious accident, can not reasonably be considered dangerous.

BAINBRIDGE. F. A. **On the Paratyphoyd and food-poisoning Bacilli, and on the Nature and Efficiency of certain Rat Viruses.**—*(Jour. Path. and Bact.* 13 (1909), no. 4, 443-466) *E. S. R.* XXI, Aug., 1909.

"The viruses examined owe their potency to one or other of two bacilli which are indistinguishable from *B. aertryck* or *B. enteritidis* respectively.

"Under the conditions of the experiments, namely, the provision for the rats of abundant space, food, and shelter, the destructive power of the viruses was inconstant, the death-rate in different experiments varying from 20 to 50 per cent.

"Experiments made with phosphorus paste under similar conditions caused a higher and more uniform mortality than did any of the viruses, the death-rate varying from 61 to 67 per cent.

"There is reason to believe that a certain proportion of the rats fed on the virus become immune, and would therefore be unlikely to succumb to a second infection.

"The statements of the entire innocence of the viruses for man require justification."

A bibliography of 28 titles is appended.

C. MORLEY. **The Ichneumons of Great Britain.** — (Plymouth, 1907, Vol. 2, pp. XVI-351, pl. 1, figs. 22; 1908, Vol. 3, pp. XVI-328, pl. 1, fgs. 14); *E. S. R.*, Febr. 1910. Washington.

A descriptive account of the families, genera, and species indigenous to the British Islands, together with notes as to the classification, localities, habitats, hosts, etc.

In the first volume, the *Ichneumonidæ* are considered; in the second volume the *Cryptinæ* are taken up, 41 genera and 317 species being recorded, of which 2 genera and 7 species are new to science; and in the third volume the *Pimplinæ* are considered, 39 genera and 211 species being recorded, of which 1 genus and 8 species are new to science.

G. H. F. NUTTALL. **The Ixodoidea or Ticks.**—*(Journ. R. Inst. Publ. Health,* 16, 1908, No. 7, pp. 385-403, figs. 20); abs. *E. S. R.*, XXI, Aug. 1909.

In this, the first Harben lecture, the author discusses the ticks, their life history, habits, and rôle in disease transmission.

In the second Harben lecture, Dr. Nuttall considers the spirochetes, their disease production, and conveyance by ticks and bugs.

In the third of the Harden lectures a general account is given of the diseases produced by *Piroplasma*, their correlation with the *Ixodoidea*, life cycle, etc.

August Forel. **The Senses of Insects, translated by Macleod Yearsley.**—(Methuen & Co., London, p. XV 324).

The translator thus writes in the Preface.

" The translation of Dr. Forel's, *Senses of Insects*, has been a labour of love. His work is but little known in this country save to a few physiologists, and to those entomologists who have turned their attention to the physiology of insects. By them it is fully appreciated. The work contains, however, so many interesting experimental details, exhibits such a wide field of painstaking investigation, such sound logic, and so liberal and open-minded a treatment of the subject, that I feel sure it only requires translation to find a considerable audience in the United Kingdom. „

W. T. M. Forbes. **On certain Pieris caterpillars.**—(*Psyche*, 16 (1909) no. 4, pp. 69-73, figs. 9). — *E. S. R.* Vol. XXII. no. 4, March, 1910 — Washington.

Breeding notes on *Pieris daplidice*, *P. brassicæ*, and *P. rapæ* are given.

W. E. Collinge. **The rôle of Collembola in economie entomology.**—(*Jour. Econ. Biol.*, 4 (1909), n. 3, pp. 83-86, fig. 1. *E. S. R.* March, 1910 — Washington.

It is concluded that probably all *Collembola* are more or less injurious to plant life. A list is given of 13 species which are distinctly injurious.

The *Collembola* (spring-tails) are a group of apterous insects, all of small size. They have a forked tail bent under the abdomen which enables them to proceed in a series of « skips » several species feed upon vegetation and do considerable damage.

F. Balfour-Browne. **The Life History of the Agrionid Dragon fly.** — (*Proc. Zool. Soc.*, London, 1909, II. pp. 253-285, pls. 2. chart. 1); *E. S. R.*, March 1910, Washington.

In these studies nymphs were first fed upon *Paramœcia* which they ate readily. As they grew the *Paramœcia* were replaced by daphnids, of which they caught and demolished large specimens. The daphnids are said to have served as food all through the nymph stage after the protozoa became insufficient.

A bibliography of 23 titles relating to the biology of the *Odonata* is appended.

W. F. Rankine. **The Wasp-Pest.** — *The Gardeners' Chronicle*, July 16, 1910, p. 39.

There is very little to be urged in defence of the common Wasp. Certainly it acts as a pollinating agent, and also, at certain seasons, is responsible for the removal of certain insect pests. When the Wasp-queens are providing food for their first batch of maggots they prey widely upon many forms of larvae.

The real trouble comes in Autumn, when the broods hatch, and the Wasps attack ripening fruits.

Benzoline is very effective in destroying the nests. Soak the nests and give fire.

Cotton wool, soaked with a solution of Potassium Cyanide, and put in the burrows, is a method useful for destroying Wasps.

Cecil Warburton. **Annual Report for 1909 of the Zoologist.** — *Journal of the R. Agr. Soc. of England*, Vol. 70, 1909, pp. 355-361.

Corn crops.—A remarkable feature of the season was the extensive failure of the oat crop chiefly due to the frit fly (*Oscinus frit*) though eel-worm disease ("tulip root" - *Tylenchus devastatrix*) was also prevalent and the "leather jacket" grubs (*Tipulae*) did considerable harm.

The difficulty with corn pests is that when their presence is observed the harm is almost always already done, and it may be said that remedial measures as a rule are impossible, and only preventive measures remain. The first point in connexion with these is to ascertain the whereabouts of the pest when the crop is carried, whether it is removed with this or left behind in the stubble. The Hessian fly (*Cecidomyia destructor*) for instance is to a great extent carried away in the straw. The Frit fly on the contrary remains in the stubble. The only way to destroy them completely would be to plough in deeply in June, which should be done in case of a very bad attack, where the chances are small of having a crop worth reaping. Finally early sowing is recommended whereever possible as it is the late sown crops which suffer most.

Root crops.—The root crop pests presented few points of interest. "Leather jacket," the grub of the crane fly (*Tipula olearacea*) was the most frequently complained of. See Journal for 1908, page 327, for an account of it. There were cases of damage by root-maggots (*Anthomyia*), Mangold fily (*A. Betae* or *Pegomya Betae*); Turnip gall-weevil (*Ceuthorhynchus sulcicollis*) and millipedes. Mangolds appeared to be the crop which suffered most.

An unusual circumstance was an attack on a beet crop by the garden chafer (*Phyllopertha horticola*), frequent in gardens, but which the A. had not previously met upon a farm crop.

Other farm and garden crops.—Most of the pests complained of were *Aphis* of various species.

The pea-thrips did less harm than in the preceding year. Usually it does most mischief in particularly dry weather. See observations given in the Zoologist's Report for 1908. In every case of attack the eggs were found inside the stamen sheath of the flowers. As before, "topping" the peas as soon as the disease was noticed had a decidedly beneficial effect. In one case many Chalcid flies (*Chalcididae*) were observed, they were probably destroying the thrips grubs.

In the North of England in June some asparagus beds were suffering from an apparently quite new pest, a "surface caterpillar" identified as the larva of the *Agrotis praecox* whose natural food is the dwarf willow. Various expedients were tried, but only the admittance of chickens to the asparagus beds was successful. Trap lamps are, as a rule, not advisable for in some cases they are positively harmful, by capturing more useful insects than injurious ones. In the present instance however their use seems applicable, as these moths belong to a group strongly attracted by light.

In September some hop cones were sent for examination with the complaint that much damage was being done by the "strig maggot," evidently the grub of a small fly of the same group as the pear-midge (*Cecidomydae*). The "strig" is the central stem of the cone. These maggots have the power of "skipping" and can thus distribute themselves over a fairly wide area. It seems to be a wet season pest.

The maggots leave the cones in September, falling to the ground to bury themselves. As, so long as they are within the cone, they are invulnerable, the one chance of destroying them is to treat the soil in some way which shall kill the grubs. One correspondent believed he had obtained much benefit by admitting sheep to a badly infested hop garden and allowing them to tread down the ground thoroughly.

Forest tree pests.—Many applications for advice have had reference to forest-tree pests, including larch-bug. *Lithocolletis* on Holm oak (*Quercus Ilex*), *Pemphigus bursarius* on poplars, a saw-fly (*Tenthredinidae*) on hawthorn, and a leaf miner (*Phytomyza Ilicis*) on holly. Wintermoth (*Cheimatobia brunata*) on ornamental trees, and very frequently the beech-scale (*Cryptococcus Fagi*). An ordinary paraffin emulsion was generally effective against this pest and the wash advocated by Mr. Gillanders proved very efficacious. It is composed of half a gallon (2 litres) of soft water, 1 lb. (kg. 0,454) of soft soap, 1 lb. of common soap, a handful of sulphur, 1 pint (57 centilitres) of paraffin and about the same quantity of turpentine. It is applied with a brush about May when the larvae are hatching out.

Fruit pests.—The inquiries relating to fruit pests did not present any features of especial interest.

The list comprised many aphis attacks, some cases of "big-bud," pear leaf blister mite, saw-flies, goat moth (*Cossus*) and the fruit-tree bark beetle (*Scolytus rugulosus*) and a few of "red-spider" (*Bryobia*).

Parasitic diseases of animals.—Cases were reported of the following:

"Gapes" (*Syngamus trachealis*) in pheasants. Intetsinal worm (*Sclerostomum hypostomum*) in sheep, and warble-fly (*Oestridae*).

Besides these several creatures living in water were sent for identification. In most cases they were innocuous, among these may be mentioned the "Hair worm" (*Gordius*).

Miscellanea.—It is not so generally known as it should be that the wasp-grubs are exclusively reared on insect food. Taking the whole life of a wasp, far more insects are devoured than fruit foods and if it should prove that most of the insects fed to the grubs were injurious, it would follow that wasps do a considerable amount of good.

The A. examined many worker wasps holding insects in their jaws and never found a useful insect as prey, but in the majority of cases they were positively injurious.

H. F. Fryer. **"Hylemyia coarctata," a Destructive Wheat Pest.** — (*Ent. Ma. Mg.*, 2, 20, 1909, 234, 134-135); abst. *E. S. R.*, XXI, Dec. 1909.

The larvæ of this fly are said to have seriously injured young wheat in England by feeding in the stem. The damage caused seems to have been generally attributed to wireworms.

Leather Jackets. — *The Journal of Board of Agriculture*, December 1909, No. 9, p. 763.

"The Board of Agriculture and Fisheries are informed that the Lancashire Farmers' Association are taking steps to induce their members to adopt cultural methods for reducing the numbers of the larvae or grubs of Daddy long-legs, or Crane Fly, and the Board desire to bring this information to the notice of all farmers in the north-west and north of England and the south-west of Scotland, in which districts these grubs, known as Leather Jackets, have wrought great injury in recent years, more especially to the oat crop.

"The methods recommended are as follows: — Clover leys which are to be sown with cereals to be closely cropped and a dressing of gas lime applied. The land to be skimmed and the cultivator used several times, so that the grubs not destroyed by the lime will be brought to the surface and picked up by birds. The autumn sown land to be well harrowed and well rolled with the Cambridge roller in spring, and a dressing of one or two cwt. of nitrate of soda applied per acre. A leaflet on the subject can also be obtained from the Board of Agriculture, London, free on application."

F. V. Theobald. **The Insect and Allied Pests of the Hop.** — *The Journ. of the Board of Agric.*, Vol. XVI, Nos. 89, 90, 355-371, 617-628. London, October and November 1909.

It is stated that the hop is not subject to the attack of very many insects and allied creatures. Forty-two species only of true insects or hexapods have been found feeding on the hop in Britain, but of these only seven are reported of any general importance, namely three wireworms (*Elateridae*: *Agriotes lineatus* L., *A. sputator* L., *A. obscurus* L.); the hop aphis (*Phorodon Humuli*, Schuk), by far the most general and persistent enemy of hops, in 1882 the damage done was said to amount to £1 750 000 and over £200 000 was spent in labour; either quassia and soft soap or nicotine and soft soap are the best remedies, for they in no way harm the foliage; the strig maggot (*Diplosis Humuli*, nov. sp.), very prominent during 1909; the clay-coloured weevil (*Othiorhynchus picipes*, Curtis); the hop jumper or frog-fly (*Euacanthus interruptus*, L.). Only one acarid occurs in sufficient numbers to do any harm, namely the red spider (*Tetranychus Altheae*). One very important hop pest is the eelworm (*Heterodera Schachtii* A. Schur.), causing "nettle head." It is probable also that the *common eelworm* (*Tylenchus devastator*, Kühn) plays some important part in the *dying back* of hops. It must take years of patient research, it is assumed before the part they play can be definitely settled. In all cases of *Tylenchus* attack in hops which the author has observed in recent years the fungus *Fusoma parasitica* has been present and it is a question whether the latter is the direct cause of disease or whether the eelworm makes the plant susceptible to this fungus. With the insect and acarid enemies of the hop, growers can deal, but with eelworm attack they are quite unable to stem the rapid tide of disease that is reported now flowing. Science, it is stated, can do nothing until much more is known of the bionomics of these minute nematode worms.

However, The methods of prevention and treatment suggested are the following: 1) The application of lime, for it has been noticed that this and other eelworm attacks are most frequent in soils deficient in lime, and that an application of it to infected soil has proved of benefit; 2) the use of sulphate of potash at the rate of from 2 to 3 cwt. per acre, this undoubtedly affects the parasites in the soils, not only just around the affected hill, but also around those near it; 3) collection of the parasites by means of "trap" plants, the young plants may then be dragged up and destroyed, a second sowing should be made at once and treated in the same way. It appears that buckwheat attracts the eelworm.

F. V. Theobald. **The Insect and other Allied Pests of Orchard, Bush, and Hothouse Fruits.** — Wye, 1909, pp. xvi-559, figs 328; *E. S. R.*, XXI, Dec. 1909.

This book is said to be written solely with the object of placing before fruit growers, gardeners, and amateurs an account of the insects, mites, and worms which attack and cause disease among fruit trees, bushes, etc., both in the open and under glass. The author considers in consecutive order the insects injurious to the apple, apricot, cherry, currants, damson, fig. goosberry, loganberry (1), nuts, peach, pear, plum, pineapple, quince, raspberry, strawberry, and grape. Accounts of some insects which might become pests in the country owing to importation, beneficial insects, and washes and fumigants used as insecticides and acaricides, together with other data, are appended.

Dr. R. Stewart MacDougall. **The Yellow horned or Plum Fruit Sawfly, Hoplocampa fulvicornis - Klug.** — *The Journal Board of Agric.*, August 1909, n. 5, p. 385.

There is no doubt that the Plum Sawfly, which has been recorded from different parts of the country, is a very dangerous enemy of the different varieties of plum, and efforts should be made to restrict the damage and to prevent the spread of the insect. As regards destructive measures, the Plum Sawfly is most vulnerable in its larval stage before it has left the plum and in the cocoon stage in the soil.

Hoplocampa fulvicornis is an insect well known in Continental literature along with its close ally the Apple Sawfly (*Hoplocampa testudinea*) (see Leaflet n. 205).

Remedial measures:

1) In the Continental literature it is suggested that the trees should be sprayed just before the opening of the flower-buds with a liquid which will be distasteful to the sawfly and will prevent egg-laying. Some such sprays are named, but no record is given as to the value of this mode of treatment.

2) Collect and burn the infested fruits before they fall, so as to prevent a new brood of Sawflies. Infested fruit can be recognised by the hole, blocked, it may be, with adhering excrement or a drop of gum.

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(1) The Loganberry is a valuable hybrid produced at Santa Cruz, California, in 1881, by Judge I. H. Logan, from a seed of the Aughinbaugh blackberry, accidentally fertilized from an adjacent raspberry, supposed to be the old Red Antwerp. The Aughinbaugh is a pistillate variety of *Rubus vitifolius*, the extremely variable wild blackberry of California (Bailey's, *Cyclop. Hort.*).

(*Ed.*)

3) Shake infested fruits off the higher trees—they fall easily—and collect and burn them.

4) Collect at once and burn any fruits that have fallen and are lying under the trees, before the larvae leave them.

5) As the cocoons lie in the soil from summer to the next year, the soil below trees that were infested should be dug and worked, the turned-up layers being beaten.

The Pear Leaf Blister Mite *(Thriophyes pury)*. — (*The Journal of the Board of Agriculutre*, pp. 123-126. London, May 1910.

The Pear leaf blister mite is spreading in England, doing great injury and attacking other *Rosaceae*, the leaves of which it destroys. After the leaves have fallen it is advisable to water the trees with an emulsion of petroleum to which caustic soda is added, or else with a mixture made by dissolving in 10 gallons of water, 3 lbs. of lime, 3 lbs of flower of sulphur, 1 lb of caustic soda, and 1 lb of soap.

F. V. THEOBALD. **The Apple Sucker and its Treatment. —** (*Irish Gard. 4* (1909) no. 37, pp. 34-35, figs. 8). — *E. S. R.* Febr. 1910 — Washington.

An account of the biology of *Psylla Mali* and the methods of combating it.

R. S. MACDOUGALL. **The Genus "Chermes" in its Relation to Forestry.** — (*Journ. of the Board of Agric.*, Vol. XVI, No. 6, Sept. 1909, pp. 441-453, Pls. 2, fig. 1, Dgms. 3).

A brief account of the species of *Chermes* occurring in Great Britain.

The genus *Chermes* confines its attacks to coniferae. The complete life history of a species may take two years. Two different species of conifer being made use of. One, the primary host, is typically the spruce, the other the secondary or intermediate host is a *Larix, Pinus* or *Abies*. The foundresses on the primary host give rise to galls. The other generations do not form any. In the two years cycle there are five different generations. The three chief forms in the cycle are *a*) wingless virgin females, *b*) winged virgin females, *c*) males and females.

In certain species the life cycle is completed in one year on only one host, a spruce, a wingless generation alternates with a winged, and only females are known. Exceptionally a species is found only on larch.

The A. gives the life history of *Chermes viridis* Ratz, *Ch. Abietis* Kalt, *Ch. strobilobius* Chol., *Ch. lapponicus* Chol. and others, illustrating some of them by diagrams and by illustrations of the insects and of their eggs. He next treats of the damage done to the various trees and of the treatment recommended and gives the formulae of successful sprays.

John Macrae. **An Attack by the Weevil Strophosomus Coryli in a Fir Plantation.**—*Trans. R. Scottish Arbor. Soc.*, Vol. XXIII, P. II, pp. 185-186. Edinburgh, July 1910.

In Scotland in a mixed plantation of Douglas fir, Japanese larch and Scotch fir, the foliage of the alternate rows of Scotch fir was much damaged by a weevil, *Strophosomus Coryli.*

As a remedy handpicking from the plant was suggested.

H. H. Brindely. **Notes on the Procession of "*Arethocampa pinivora.*"** — *Cambridge Philosophical Society*, June 6, 1910; *Nature*, Vol. 84, July 14th, 1910, p. 62.

The caterpillar of this Eupterotid moth infests the pines of the Landes. The caterpillars march in single file from the nest-tree over the sand on fine days in late March and early April, ending the last day's procession by burrowing for pupation.

G. C. Champion. **A Buprestid and other Coleoptera on Pines injured by Heath fires in Northwestern Surrey.** — (*Ent. Mo. Mag.*, 2. ser., 20, 1909, n. 239, pp. 247-251); *E. S. R.*, vol. XXII, n. 4. Washington, March 1910.

Melanophila acuminata, Criocephalus ferus, and other Coleoptera found on or beneath pines (*Pinus sylvestris*) injured by heath and brush fires are noted.

Memorandum on the large Larch Sawfly "*Nematus Erichsonii Hart*" published by the "Board of Agriculture and Fisheries." — *The Journ. of the Board of Agric.*, May 1910, Vol. XVII, n. 2, p. 150. London.

The following *Memorandum* was issued in April in order to distribute information as to the Large Larch Sawfly:

"In recent years the larch plantations of Great Britain have been visited by a pest which has already caused great losses in certain places and threatens to inflict serious injury on British Forestry. The Large Larch Sawfly is known to have done much damage in Denmark about sixty years ago, and in more recent times has devastated the larch forests of North America. How long it has been present in Great Britain is not known, but its presence was not officially confirmed till 1906, when it was reported from Cumberland. It has since been found over a large area in Wales, a wide district in the north of England, and a very considerable area of the south of Scotland. It probably exists in other parts of the Kingdom. There is reason to believe that up to the present the general attack is but slight, but in the spots where the prevalence of the pest is greatest many thousands of trees have been killed. Nor is it likely that the plague will go no further. There are evident signs that it has spread in recent years, and it is recorded that in the United States and in Canada it did not stop till 50 to 100 per cent of the matured larch over vast areas was destroyed, with the loss of many billions of feet of timber. The seiious nature of this prospect has led the Board to place the Sawfly among the dangerous insects scheduled under the Destructive Insects and Pests Order, the presence of which on any plantation must at once be reported to the Board. The y are also engaged on an investigation of the extent to which it prevails in this country in the hope of discovering some preventive or remedial measures. Every occupier of any premises on which the insect is found, is bound therefore to report the discovery under a penalty of ten pounds, but few cases have been reported, chiefly on account of the inability of most persons engaged in forestry to identify the pest, or recognise the symptoms of an attack. The Sawfly remains in its larval state for only a few weeks of the year, and for some part of that time it is very small and consequently, easily overlooked. The appearance of an attacked tree, however, is such that for a much longer period the characteristics can be distinguished by an expert. In spite, however, of this extension of time it is not possible for the Board's Inspectors to examine every larch plantation in Great Britain, and the Board feel it incumbent on them to ask for the assistance of every person interested in forestry in tracing the presence of the infestation.

"The search may be conducted in two ways:

1) The actual insect may be looked for as (1) egg embedded

in the shoots of the tree, (2) caterpillar feeding on the green needles, (3), cocoons lying in the ground or among the long grass, (4) adult on the wing.

2) The larch trees may be examined for signs of Sawfly attack, even though no insect can be found.

" The caterpillars or larvae of the Large Larch Sawfly may be first looked for towards the middle and end of June. In 1909 the first seen were not discovered till July 4th, but they were evidently some days old and the season was rather late. They appear in considerable number on the lower branches of the larch, generally towards the terminal shoots in which the eggs are laid. As they grow older they advance towards the stem, and eventually may be found wherever there are any needles. Larvae begin to spin up their coccons in July. In 1909 the last caterpillar was seen on August 31st, but in other years they might be found later.

" When very small they are not easily noticed but they grow rapidly, and when full grown are about three-quarters of an inch long, with round *black* heads, three pair of black thoracic legs, and seven pairs of abdominal legs of a greyish green, the same colour as the rest of the body.

" The caterpillars feed at first in clusters, but afterwards they separate in search of food. They assume various characteristic positions, a common one being with their " tail end " curled round the shoot on which they are feeding. When disturbed they erect the hind segments of the body over the front ones. The larvae of the Large Larch Sawfly can be distinguished from other larvae that may be found on the larch by the following characters:

Moth caterpillars	*Nematus Erichsonii*
Legs never more than sixteen. If they are geometer caterpillars they progress by a looping or spanning movement characteristic of this family.	The caterpillars have twenty legs. The mode of progression in continuous.
Other Sawflies:	
The *Nematus Laricis*, or Small Larch Sawflly caterpillar has a brown head, is grass green or greenish brown in colour. It is full grown in July.	Has a black bead, and body is greyish green. Feeds and grows till the end of August.

" The larvae leave the trees when full fed and spin cocoons in which they live till the spring when they pupate. The cocoons may be looked for under the affected tree not only near the trunk but also over the whole surface covered by the crown of the tree. The cocoons are found in the soil under the moss and litter that usually cover the ground under larch trees and this must be turned back when the cocoons are being hunted for. These are dark brown and cylindrical with rounded ends, and about half an inch long.

" The adult Sawfly on emerging from the coccon, after the pupal stage is over, is in general appearance black, with glassy wings. The female flies at once to the lower branches of the tree, to lay her eggs, but apparently much of the life of the insect in this stage is spent on the wing and round the upper branches. It can therefore easily be overlooked and is difficult to identify at any distance. The Large Larch Sawfly is nearly twice as long as the Small Larch Sawfly and can be distinguished from the latter which is quite black by the red segments of the abdomen.

" Larch plantations that are suspected of having been attacked should also be examined with the object of discovering traces of infestation. This work may be carried out from the middle of June to the end of November. The symptoms to be looked for are as follows: In June and July a search should be made on the terminal shoots of the branches for signs of eggs, which are laid alternately in two rows. The number is usually about twenty, but as many as forty have been found. The easiest sign, however, to notice, is the distortion of the current year's shoots, which often curl up when eggs have been laid in them. A closer examination will generally reveal the incisions made by the Sawfly's ovipositor on the concave side of the curled shoot. The slits where the eggs have been laid resemble small eyes, less than one-tenth inch in diameter. A little later, in July and August, the needles should be examined for signs of feeding. The young caterpillars do not eat the whole needle but bite pieces out of the edges of it At a later date when the caterpillars are more fully grown, and separate in search of food the whole rosette of needles will be eaten or only a stump left. In August and September these defoliated dwarf shoots may sprout again, and present almost the same appearance as they did in May, except of course that the growth is irregular. These indications are to be found in varying intensity on all trees that have been attacked, but in the case of a serious infestation the tree presents a brown and withered appearance which is noticeable hundreds of yards away, and after a little practice the more seriously affected trees can be picked out at a distance. When the attack is very serious and prolonged the trees die and there is then no difficulty in realising the damage done.

" Nearly all these manifestations are shown in the articles on the Sawfly which were written for the *Journal of the Board of Agriculture* by Dr. Mac Dougall and Dr. Hewitt, and in Leaflet 186."

JOHN MACRAE. **The Large Larch Saw-Fly.** — *Trans. of R. Scottish Arbor. Soc.*, Vol. XXIII, PS. II, pp. 186-177. Edinburgh, July 1910.

The *Nematus Erichsonii*, Hart. (Saw-fly) is more widely spread in the British area than was formerly believed.

As a remedy the natural enemies of the insect, should be encouraged, especially voles, various insect-eating birds, and especially an ichneumon fly (*Mesolejus aulicus*).

EDWARD T. CONNOLD. **British Oak Galls, illustrated with 68 full-page plates, 21 insects and 17 small drawings.** — (London, Adlard and Son, 1908, p. v., p. XVIII-169, with 68 plates).

The British Oak is the abode of a vast concourse of dependents. Nearly five hundred different species of insects, and other creatures, find their needs amply supplied, mainly by the leaves. Of this number about two hundred are either parasites living upon the larvae of fifty-four species of *Cynipidae* which produce galls, or they are inquilines obtaining their nourishment from the tissues of the galls. The Oak is therefore of great importance to insect life.

The object of this volume is to describe and illustrate, in some measure, galls produced by the *Cynipidae* and other causes of galls on the Oak. The insects, with their parasites and other occupants of the galls, have been fully described by various writers; several pages will, however, be devoted to a few interesting and unique features of the *Cynipidae.*

G. H. Carpenter. **The warble flies.** — (*Dept. Agr. and Tech. Instr. Ireland Jour.*, 9, 1909, No. 3, p. 465-476, pl. 1, fig. 1); *E. S. R.*, vol. XXII, No. 4, March 1910. — Washington.

Further results in continuation of investigations previously noted (*E. S. R.*, 20, p. 582, 857) are reported.

While muzzling experiments conducted with calves during 1907-8 seemed to support rather strongly the theory of the maggot's entrance by the mouth, those carried on during 1908-9 tend to confirm the results of 1906-7 in favor of the theory that they enter through the skin. In the spring of 1908, 132 of the 194 cattle used in the previous experiments were still on the farm and had been left throughout the summer of 1907 without any kind of dressing or protection against the attacks of the fly. From these cattle 586 maggots were squeezed out, an average of 4.44 per beast, and a reduction of 58.8 per cent, which is believed to have been largely due to this treatment. It was found that yearlings were far more benefited during the spring of 1907 than either the cows or calves.

A maggot which emerged from the skin May 13, pupated and emerged as an adult (*Hypoderma bovis*) 40 days later. A second maggot of this species which emerged from the skin May 30 appeared as an adult in 31 days, as did also a maggot of *H. lineata*, which emerged from the host on May 24. The gullets of a number of heifers and bullocks 2 or 3 years old were examined. "In many of these maggots were found, and in most cases they were embedded in the connective tissue of the submucous coat, whith the axis of the maggot lying along the direction of the gullet. In some the head of the maggot was directed upward, in others downward; most were near the stomach, but some were near the pharynx, as if they were wandering to and fro in the submucous coat for a period of several weeks. One was found lying in the cavity of the gullet, but no trace of perforation of the mucous coat could be detected. The effect of the maggot on the submucous tissues is to cause a small amount of yellow discoloration due to the formation of pus."

Ticks and Redwater in Cattle. — *Board of Agriculture and Fisheries*, Leaflet n. 237. London, May 1910.

Redwater is due to the entrance into the blood of a microscopical protozoal parasite, *Pyroplasma bigeminum*. It appears to belong to the same class of disease as Texas Fever.

In Texas Fever the carriers of infection from one animal to another were the progeny of female ticks.

The British Ticks belong to two varieties: *Haemaphysalis punctata* and *Ixodes ricinus.*

March to June and October to November are the two periods of the year in which the adult forms, apparently the most dangerous, are most prevalent. It is at these times of the year thja Redwater is mcst frequently met with.

The disease obtained its name because sometimes the affected animals passed red urine.

The death-rate from Redwater in England is not high, but the disease may cause the animals to fall off very much in condition and in milch cows it causes a great diminution of the milk yield.

For preventing losses from Redwater one of the three following methods may be adopted:

1) Preventive inoculation.
2) Eradication of the ticks from the pastures.
3) Purification of the ticks without destroying them.

For the eradication of ticks, sheep (which are not susceptible to Redwater) can be put in large numbers on the pastures to act as "tick collectors" and subsequently dipped to kill the ticks, through unfortunately none of the dipping materials commonly used have a particularly destructive effect on ticks.

The purification of the ticks may be obtained by keeping cattle off the pastures for some time. Probably 14 months would be required to ensure purification. The process may be hastened by heavily stocking the pastures with sheep.

C. Gordon Hewitt. **House Flies and Disease.** — (*Nature*, vol. 84, pp. 73-75. London, July 21, 1910).

The belief that the house-fly is an agent for the spread of disease was entertained as early as the seventeenth century, and in 1871 Lord Avebury regarded the fly as "a winged sponge" spreading contagion. In 1886 Tizzoni and Cattani obtained the cholera spirillum from flies caught in cholera wards, the same year Hoffman found tubercle bacilli in the excreta of flies and in 1888 Celli showed that the typhoid bacillus passes in a virulent condition through the digestive tract of the fly. The excessive mortality which occurred from typhoid in the Spanish-American war attracted attention to the relationship of flies to this disease and later in the South African war the same conditions were present and enteric fever raged; these conditions are well known now; open latrines, frequented by incipient cases of enteric, swarmed with myriads of flies who also haunted the mess tents, defiling the food, and in many cases distinguishable by the lime which they bore on their appendages from the latrines.

One of the most important and convincing experiments is that of Gussow, who obtained 30 colonies comprising 6 species of bacteria, and 6 colonies comprising 4 species of fungi, from a single fly caught in a living room and allowed to walk over a culture plate of agar-agar. Flies captured near excremental products generally carry putrefactive bacteria. Hamilton recovered *B. typhosus* five times in 18 experiments from flies caught in two undrained privies and in the room of an enteric fever patient.

The habits of these insects are perfectly suited to the dissemination of pathogenic bacteria; they seek all kind of excrementous and decaying matter for the purpose of depositing their eggs, and fly with perfect freedom on milk, sugar, etc., which form excellent mediums for the deposition of the bacteria they have become contaminated with.

Of all substances flies prefer horse-manure for depositing their eggs. The most important factor which affects the number and potential danger of flies is temperature. During the hot months of July, August and September, flies are most abundant and it is significant that in years when the temperature is high there is almost always a high mortality from typhoid fever during the third quarter of the year, as also from infantile diarrhea. Morgan has discovered a bacillus present in a large percentage of cases of the latter disease, which has been isolated from flies captured in infected houses.

The fly problem may be attacked and solved in cities and towns providing the authorities will take the necessary steps. Stable refuse should not be left exposed for more than 6 or 7 days in the summer, but should be removed from the vicinity of dwellings, treated with chloride of lime and kept in a closed, flyproof chamber.

Though the common house-fly usually constitutes from 90 to 98 % of the fly population of houses certain other species are also found to occur. The blood-sucking fly which is frequently mistaken for an ordinary fly is found in houses in the spring and autumn. Not infrequently inflammatory swellings are caused by the bite of one of these flies and they may cause malignant pustule by the mechanical transference of the *Bacillus anthracis.*

R. Stewart MacDougall. **The Common House-fly (Musca domestica).** — *Trans. High. and Agric. Soc. Scotland,* vol. XXI, pp. 135-174.

Although several species of fly are found in our houses, this is by far the commonest.

Dangers due to the Housefly. — Domesticated animals are plagued by these flies when the flies are present in great numbers; but it is as a menace to the health of human beings that we would denounce the house-fly and argue for a campaign against it.

That danger may attend the presence of the house-fly is clear from much evidence that these insects can and do carry infection to milk and comestibles. It is not pleasant to reflect that these house-flies may have come directly from filth or garbage, and that germs of disease attached to their hairs or voided in their excrement can be deposited on meat, or confectionery, or fruit, or eatables generally, or be washed off into milk, where the germs may multiply and be the cause of disease.

Such infective matter carried to milk—that not uncommon grave of flies—can in the summer-time, when flies are abundant, be responsible for the prevalence of summer diarrhoea in children, so baneful in result. A high percentage of the deaths of children from infantile diarrhoea is due to infection conveyed by house-flies.

The spread of typhoid fever has in well authenticated cases been proved to be due to the carriage of the bacillus of typhoid by house-flies. The bacillus of comsumption can also be carried by the fly, not only externally attached to hairs on its body but also internally, the bacilli after being voided not having lost their virulence.

Experimentally, too, it has been shown that where flies were fed on cultures of the cholera germ, the germs were found up to four days later in the intestines of the flies and in their excrement. The germ of anthrax may also be carried.

Protective Measures. — Protect exposed comestibles by means of gauze.

Do away with exposed heaps of stable manure, and arrange that such manure be in closed receptacles.

Howard found that chloride of lime applied to manure piles destroyed the maggots. He recommends the regular cleaning out of stables, and each time that a day or two's accumulation is added to the pile a shovelful of chloride of lime should be thrown over it. Paraffin sprinkled over the refuse kills the grubs.

The winner of a £400 (10 000 frs.) prize offered by the Paris newspaper, 'Le Matin,' for the best description and mode of fighting the house-fly, recommended the use of the thick residuum left behind after the distillation of crude shale (schist) oil. This shale oil was stirred up with its own volume of water. Two litres of the oil would serve to dress a square metre of cesspool or dung. In connection with dung-heaps, the author declares that excellent results will be obtained by mixing the oil with soil and scattering layers of this at intervals during the summer over the dung-heap. Fowls take the larvae greedily.

F. P. Jepson. **The Breeding of the Common House Fly (Musca domestica) during the Winter Months.** —*Journ. Econ. Biol.*, 4, 1909, N. 3, pp. 78-82; *E. S. R.*, March 1910. Washington.

A paper read before the Association of Economic Biologists at Oxford, July 13, 1909.

Sis Rubert W. Boyce. **Mosquito or Man.** — *The Conquest of the Tropical World*, pp. XIII + 280 50 illus. London, John Murray, 1910. Pp. XVI + 280.

See XLVI in the present volume.
First edition, October 1909; Second edition, February 1910.

XXXIII.

Antiparasitic and Insecticide preparations. Spraying: contrivances and implements for combating parasites and pests. — Frauds in the sale of such preparations and measures for controlling their trade. — Legislation regarding the sale of insecticides and similar preparations. — Legislation regarding plant diseases and pests. Legislation against weeds. — Protection of plants against wanton destruction.

The Duke of Bedford and S. N. Pickering. **Fungicides, General Remarks. Copper Fungicides Classified. Previous Work on Fungicidal action. Previous Work in Bordeaux injury. The Question of Solvent Excretions. Absorption of Copper by the Leaf. Experiments on Scorching and Fungicidal Action.** — *Eleventh Report of the Woburn Experimental Fruit Farm*, 1910, pp. 1-190; See also previous studies; Pickering, *Jour. Agr. Science*, October 1909, and *Journ. Chem. Soc. Trans*, 1907, 91, 1988.

In the introductory part of this publication the Authors state plainly that " any attempt to reduce the present report into the form of a popular treatise, adapted for the reading of the average fruit grower, would be a failure, for it deals with the nature and action of copper fungicides, a subject which can not be investigated without dipping somewhat deeply into a number of intricate chemical questions." Therefore keeping in mind that the practical outcome of such scientific investigation work, is the part particularly interesting to the greater number of fruitgrowers and farmers all over the world, special attention will be paid to the practical conclusions, since it is only by means of the present researches of Prof. Pickering that the character of the substance constituting the familiar Bordeaux mixture has been elucidated.

The chemistry of all the changes, copper compounds undergo when in use, will, in the proper form, be appreciated in the Authors' original report.

The reaction between copper sulphate and lime is shown to yield four basic sulphates:

1) 4 Cu O, SO_3 (or 10 Cu O, 2.5 SO_3).
2) 5 Cu O, SO_3 (or 10 Cu O, 2 SO_3).
3) 10 Cu O, SO_3.
4) 10 Cu O, SO_3. 3 Ca O, and two other compounds.
5) Cu O, 2 Ca O (or 10 Cu O, 20 Ca O), (existence doubtful).
6) Cu O, 3 Ca O.

The conditions of the formation of each of these basic sulphates were investigated, and a series of the corresponding Bordeaux mixtures prepared.

The properties of the sulphates were studied and in particular their decomposition under the influence of water and carbonic acid in presence of calcium sulphate or of organic matter, these being the conditions on the leaf surface.

The next problem was to ascertain the function of Bordeaux mixture and so to settle which was the most useful of the possible basic sulphates. These salts are insoluble and have to be converted into soluble substance before they can exert a fungicidal action. No evidence could be obtained that the plant leaf or the spore excreted anything that could dissolve an insoluble substance, but it was shown that the carbonic acid of the air decomposes these basic sulphates, liberating the copper sulphate, which constitutes the active part of the mixture. It acts in two ways. It directly poisons the fungus cell developing from the spore. Some of the copper sulphate gets into the leaf, displacing a certain amont of iron and entering into a remarkable combination not yet investigated, which seems so long as it persists to afford the leaf immunity against fungal attacks, etc.

The object of the fungicide is to furnish a steady supply of copper sulphate and therefore the reaction yielding the lowest basic sulphate 1), now known as the Woburn Bordeaux (though it has been in use in Italy for many years) is to be considered the most efficient of the series. In the reaction yielding the basic sulphate 4), owing to the excess of lime having to be disposed of first, there will be a delay in the liberation of the copper sulphate.

The fact that in Bordeaux mixture 1) (Woburn Bordeaux) no such delay exists any more than with 3), that it contains no gritty particles of lime to clog the spraying nozzles, that it must be 2 $^1/_2$ times more effective, or 2 $^1/_2$ times more economical than the ordinary mixture, institutes strong arguments in its favour. The latter argument, however, has now been found to have been much understated, for direct determinations of the copper sulphate recoverable from these mixtures by the action of carbon dioxide, prove the existence of secondary reactions, which greatly increase the above mentioned proportion. In the case of reaction 4), the ordinary Bordeaux mixture, a secondary reaction sets in between the calcium carbonate and the copper sulphate which further reduces its efficiency.

The Soda Bordeaux, a mixture of copper sulphate and sodium carbonate has been suggested as a substitute for ordinary Bordeaux, as being less likely to scorch the foliage.

The reaction requires the addition of 1.84 parts of the crystallised carbonate (ordinary washing soda) to one part of the crystallised sulphate; but the mixture on standing becomes altered and nearly all the copper remaining in solution, changes into carbonate $2\ Cu\ 2,\ C\ o_2,\ H_2\ o$, which is malachite. This change is not prevented in practice but only delayed and only 0.001 to 0.002 of the copper remains in solution and this amount is probably too small to have an appreciable fungicidal action.

The action of soluble copper compounds on foliage was investigated by immerging leaves in the solutions. In the case ot compounds which are insoluble to start with, the leaves had to be wetted with them and then exposed to the action of the air.

A further investigation of the action of various copper compounds on foliage was made by spraying them on growing trees.

Numerous series of experiments made in these ways with the various Bordeaux compounds, gave values which agreed remarkably well with the conclusions drawn as to their relative efficiency from the study of their chemical composition and behaviour alluded to above.

This is of special importance with reference to the Bordeaux paste, which has already come into extensive use as a cheap and labour-saving substitute for the ordinary mixture. So far as reports received up to the present are concerned, its effect seems to be satisfactory, and to be equal to that of the ordinary freshly prepared Bordeaux mixture.

The Woburn Bordeaux requires 1 ounce of copper sulphate, $6\ ^3/_4$ pints of lime water and $4\ ^1/_2$ gallons of water.—Sulphate of copper gr. 28.35. Lime water, l. 3.83. Water, l. 29.53.

Messrs W. Voss of Slengall Road Millwall E. who have been working on the subject with the Author's assistance, have succeeded in preparing a paste which, when diluted with water, reproduces a mixture which is practically identical both chemically and physically with the freshly-made Woburn Bordeaux except that it contains no excess of lime. "The paste itself is not likely to be made by growers, and it would not be fair on Messrs. Voss who have devoted much labour to the perfection of it, that we should give details as to how the many difficulties met with in preparing it satisfactorily have been overcome." (Of this important publication an Abstract is given in *Nature*, Vol. 83, March 3 1910, p. 13).

Effect of carbon bisulphide on Wireworms. — (*Journal of South-Eastern Agric. Coll.*, No. 17, 1908); *The Journ. of the Board of Agric.*, Vol. XVI, No. 11, p. 936. London, February 1910.

The usual practice in hop gardens, where wireworms are troublesome, is to trap them with pieces of mangold placed at the side of each hill. This is a somewhat expensive operation and may cost about five shillings per acre annually, so it was determined to try an injection of carbon bisulphide.

Two rows in the College garden were selected (S. E. College of Agriculture at Wye), and the hills in one row were treated by injecting two ounces of carbon bisulphide into each, at four points about two feet away from each hill. The hills in the other row were left untreated.

The hills in each row were trapped with mangold in the usual way, and after about three weeks the traps were pulled out and the wireworms carefully counted.

In eighty hills in the row treated with bisulphide there were 336 wireworms, whilst in eighty hills in the untreated row there were 362 wireworms. This result shows that the injection of carbon bisulphide is of very little use for wireworm in hops.

E. S. Salmon, Mycologist to the South-Eastern Agricultural College, Wye, Kent. **A Lime-sulphur Wash for use on Foliage.** — *The Journal of the Board of Agric.*, Vol. XVII, No. 3, p. 185. London, June 1910.

A summer wash for use against certain fungus diseases of plants can be prepared by boiling lime and sulphur together.

This wash, unlike "flowers of sulphur" and the "liver of sulphur" solution, is not readily washed off by rain. Some experiments which have recently been carried out show that this lime-sulphur wash is efficacious against "powdery mildew," and the experience lately obtained in other countries indicates that in certain cases the wash may be useful in combating attacks of apple "scab" or "black spot."

Experimental work. — The experiments carried out in connection with "powdery mildew" were briefly as follows. In one set of experiments young hop-plants affected with the well-known hop "mould" or mildew (*Sphaerotheca Humuli*) were treated in the following manner. A considerable number of leaves were chosen which bore patches of the mildew in a powdery and actively growing condition; each leaf was then divided by a line down its midrib into two halves. Each half of these selected leaves bore from one to four patches of mildew. One half of each leaf was painted over with the lime-sulphur wash, while the other leaf — which served as a "control" or check — was either left untreated or was painted over with pure water. In every case the patches of mildew on the treated half of the leaf were killed — the spawn (mycelium) of the mildew drying up, but not changing colour; on the other half of the leaf the mildew continued to increase rapidly. Further, no fresh infection took place on the treated half of any of the leaves, although spores (conidia) must have constantly been blown there from the powdery patches on the untreated part of the leaf. In one series of experiments investigations were made with regard to this point. Healthy young hop-plants were chosen, and one half of some of the leaves was treated with the lime-sulphur wash. Spores (conidia) of the hop-mildew were then sown on both the treated and untreated halves of each leaf. In no case did any infection take place on the treated part of the leaves, while (under the condition of the experiment) the untreated half of the leaves became virulently infected, and after fourteen days bore numerous powdery patches of "mould."

In another series of experiments a number of young hop-plants which were all beginning to be infested with hop "mould," were divided into two sets of equal numbers, each set being so far as the eye could judge, equally affected with the mildew. In each experiment one set of plants was well sprayed with the lime-sulphur wash — using a Vermorel nozzle on an "Eclair étamé" knapsack. A fine misty spray was obtained and the leaves of the treated plants appeared, when the spray had dried on them, as though uniformly dusted over with a fine, whitish, closely-adhering dust. The same result was obtained as in the first experiments mentioned above, i. e., the "mould" died away on the sprayed leaves, and, in those cases where the sprayed plants stood apart from the unsprayed plants the "mould" did not appear on the fresh growth. During the time of the experiment the "mould" continued to increase on the unsprayed plants, and the fresh leaves of these, as they expanded became infested.

In many of the above experiments frequent and heavy showers of rain fell on the sprayed leaves, but did not wash off the spray owing to its closely-adhering nature.

Preparation of the Wash. — The lime-sulphur wash used in the above experiments may be made first in a very concentrated form by boiling together the following quantities of lime and sulphur:

Quicklime (in lumps) . . .	50 lbs.
Flowers of sulphur	100 "
Water	50 gallons.

This formula, as well as the method of making and diluting the wash which is described below, is that recommended in Bulletin No. 92 of the Pennsylvania State College Agricultural Experiment Station.

Some form of heating apparatus is necessary, such as a copper. Iron or zinc coppers are suitable, but copper ones must not be used.

Place 10 gallons of water in the copper, and start the fire. Add the 50 lbs. of quicklime. When the slaking is well started, add the 100 lbs. of sulphur gradually, and mix until a thin even paste is formed, taking care to break up all the lumps of sulphur as far as possible. If too thick, a little more water can be added. When thoroughly mixed, add water up to the 50 gallon mark (using a measuring stick). Boil for one hour, adding water when necessary to keep it at the same level.

The wash thus prepared will be an orange-red liquid, consisting of a solution of sulphides and polysulphides of calcium, together with small amounts of other sulphur compounds. There will also be a small amount of insoluble lime and sulphur.

Strain through butter-muslin, and store at once where air cannot reach the liquid. This concentrated wash can be kept, until wanted for use, stored in completely filled and corked stone jars or in barrels. If in barrels the surface of the fluid must be protected from the air by a layer of oil (mineral).

Before use as a spray on the foliage of plants the concentrated wash obtained as above requires to be diluted. The amount of dilution which is necessary in order to avoid "scorching," varies with the character of the foliage or plant to be sprayed, and can only be ascertained by experiment. In the experiments described above, a lime-sulphur wash having a specific gravity of 1.01 was used; this is obtained by adding from about 20 to 23 gallons of water to every gallon of the concentrated wash — according to the specific gravity of the latter, which will vary slightly. When diluted, the wash must be used at once. Hydrometers with a specially prepared scale and directions for use can be obtained, price 3*s.* 6*d.* each; by means of one of these instruments the specific gravity of the concentrated or diluted wash can instantly be ascertained. Under the conditions in the experiments described above a lime-sulphur wash of the specific gravity 1.01 produced no "scorching" on the leaves of the hop, gooseberry, or apple. On the young, tender foliage of roses in the Greenhouse, "scorching" resulted with a wash of this strength; in such cases the wash should be used at half strength. It is possible that under certain weather conditions this weaker strength will be necessary for the hop, gooseberry, and apple also in order to avoid "scorching" the foliage. In all cases the lime-sulphur wash should be first used on an experimental scale, the specific gravity of the diluted wash (or the number of gallons of water added to each gallon of the concentrated wash) being carefully noted. A few plants should be sprayed with a wash having the specific gravity 1.01; and then, if necessary, further dilution with water should be made.

In the boiling together of the lime and sulphur a chemical reaction takes place, bringing about the solution of the lime and sulphur. The best proportions of lime and sulphur to use are believed to be those given above.

After application to the leaves, the wash is acted upon at once by the atmosphere, with the result that sulphur is almost instantaneously deposited. The sulphur thus deposited is in an excessively fine state of division — the particles being many hundred times finer than those of "flowers of sulphur" — and in consequence adheres, in the form of a whitish powder, so intimately to the surface of the leaf that rain will not wash it off. If sprayed leaves, when once the spray is dry, are placed under running water from a tap, it will be found that the whitish powder consisting of sulphur is not washed off.

The diluted lime-sulphur wash, which is a perfectly clear liquid, should be applied with a nozzle throwing a very fine "misty" spray. The same type of nozzle which is suitable for the application of Bordeaux mixture (see this Journal for January last) is suitable for the lime-sulphur wash. The receptacle of the spraying machine must be wooden or iron (galvanised iron or tin); a copper knapsack sprayer must not be used, as the wash acts chemically on this metal. Knapsack sprayers which are tinned over can be obtained. According to the results of experiments recently carried out in the United States, certain arsenical washes can be added to the lime-sulphur wash.

M. C. Potter. **On a Method of checking Parasitic Diseases in Plants.** — *Journ. of Agr. Science*, Vol. III, Pl. 1, pp. 102-107, Dec. 1909. Cambridge.

In the study of the action of bacteria in pathogenic relation to the higher plants various types of bacterial diseases have been established.

One large class comprises those in which the bacteria invade the cells of the parenchyma, producing a rapid degeneration of the cell and its contents and complete destruction of the tissues. To this group belongs the "White rot" of the turnip, caused by *Pseudomonas destructans* (Potter). This bacterium secretes an enzyme (cytase) which acts on cellulose, swelling and disintegrating the cell walls; while at the same time producing a toxin fatal to the protoplasm of its host cell. Its action extends rapidly from cell to cell, the entire parenchymatous tissue becomes speedily reduced to a watery pulp.

Pseudomonas destructans, both when growing upon the turnip and also in a nutrient solution produces a substance, toxic to the living plant cell, which retains this property after boiling; the cytase on the contrary being destroyed by the high temperature.

The toxine thus separated from the cytose is toxic to the *Pseudomonas* and this has been demonstrated on turnips cut in halves and artificially inoculated with pure culture of *P. destructans*, and then treated with the toxin.

In the treated halves the decaying areas did not increase and the disease was completely arrested, whilst the untreated halves gradually became completely rotten.

This toxic solution prepared from the turnip is not necessarily toxic to other micro-organism. *Penicillium glaucum*, *Bacillus subtilis* and *Proteus vulgaris* flourished when sown upon it even in concentrated solutions.

Similar experiments attended by similar results were made with oranges and lemons affected by *Penicillium italicum* and *P. olivaceum*.

Laurel Leaves as an Insecticide. — *The Gardeners, Chronicle*, No. 3618, p. 382. London, April 30, 1910.

Pot-plants have been freed of aphis by placing the plant in a box with crushed laurel leaves, when, after 10 minutes, the aphides appear to be all dead. The insecticidal action of the laurel leaves is due to the fact that they contain a glucoside which, when the leaf is injured, is acted on by a ferment contained in the leaf, and, decomposing, gives off the excessively poisonous gas, hydrocyanic acid. If the laurel leaves are placed in a basin and a drop or two of chloroform added the gas is liberated more quickly and the insects sucumb to it sooner. This treatment is handy when an occasional pot requires insecticidal treatment.

J. Augustus Voelcker. **Potato-spraying Experiments 1909.** — *Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 362-388.

At the Woburn Experimental Station of the R. Agric. Soc. of England potatoes were grown in 1909.

The " sets " were planted in May, 12 tons per acre (30 146 kgs. per hectare) of farmyard manure having been previously applied.

At the close of June, no " potato disease " had as yet shown itself; upon a portion of the field some experiments with different kinds of " spraying mixtures " were carried out.

The applications consisted of:

1) the ordinary Bordeaux mixture (sulphate of copper and lime);

2) Woburn " Paste " introduced by Mr. Pickering, of the Woburn Experimental Fruit Farm;

3) Strawsonite.

On the unsprayed portion a plot was left as it was, and on a second portion. when disease began to appear at the end of July the " tops " of the potatoes were cut off altogether.

Disease was very prevalent throughout the crop and the results of the applications were remarkable. See table:

POTATO SPRAYING EXPERIMENTS 1909.
PRODUCE OF TUBERS PER ACRE.

Plot	Treatment	Ware	Seed	Small	Diseased	Total produce	
		T. c. q. lb.	c. q. lb.	c. q. lb.	c. q. lb.	T. c. q. lb.	Kgs. p. hect.
1	Not sprayed. Tops left on.	3 5 0 17	35 1 21	22 0 23	5 1 21	6 8 0 26	16 105
2	» » Tops cut off.	5 6 0 20	34 0 8	22 2 20	18 - -	9 0 3 20	22 726
3	Sprayed with « Bordeaux » mixture	6 7 0 23	34 3 12	7 1 13	29 2 10	9 19 0 2	25 000
4	Sprayed with « Woburn Paste »	6 1 1 18	37 0 17	8 3 6	18 0 21	9 5 2 6	23 300
5	Sprayed with «Strawsonite»	6 11 1 ·5	30 0 14	20 1 15	21 2 6	10 3 1 12	25 542

It is noticeable that the simple device of cutting off the top of the plants as soon as the disease appeared had the result of considerably increasing the yield of sound tubers and of total produce. How such an increase could have taken place in view of the larger quantity of diseased tubers is hard to explain, and it seems to open up interesting considerations.

MONTAGU M. TAYLOR, GEO E. CHAMPION. **Trials of Fruit Tree Spraying Machines at Gloucester 1909.** — *Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 193-195.

These trials were held in the orchaids of Mr. Martin Chant at Hucclecote, on June 17 and 18. Four power machines and twenty-six hand machines were entered for competition.

Among the first Messrs. Weeks and Son entered a 5 HP. oil engine driving three-throw plunger pumps. The engine and pumps were mounted on a four wheeled frame. This machine supplied the nozzles of eight lengths of hose pipe at once, delivering 930 gallons per hour and doing good work with the different mixtures used. This machine was classed the first.

The next in order of merit was Messrs. Drake and Fletcher's 3 HP. two cylinder petrol engine and a set of two-throw plunger pumps mounted on a four wheeled trolley and delivering 600 gals. per hour.

The other two were: a 5 HP. and a 3 HP. both petrol engines.

The twenty-six hand power machines were, after the exhaustive trials on the first day, reduced to eight, and of these the first place was taken by Messrs. Weeks and Son's machine consisting of a 35 gallon wooden container mounted on side wheels with a gun metal pump fitted with ball valves. The second place fell to Messrs. Drake and Fletcher's machine consisting of an oval shaped barrel of 18 gals. capacity mounted on a barrow frame with ball valve pump.

The others also were very good machines.

Some knapsack machines were also entered, a form not intended to be included under the regulations.

Of the nozzles used in the trials, the large "Seneca" pattern was found the best for lime and salt spraying; and for the Bordeaux mixture Messrs. Weeks and Son's "Multispray," the "Mistry" and the "W. E. K." did the best work. As a general purpose nozzle Messrs, Drake and Fletcher's adjustable "Mistifier" was very satisfactory.

THEOBALD. **Spraying against Apple Sucker** (1). — *Journal of South-Eastern Agric. Coll.*, No. 17, Wye, 1908; *The Jurnal of the Board of Agric.*, Vol. XVI, No. 11, p. 935. London, February 1910.

The life history of the Apple Sucker is given by Mr. Theobald, together with a description of various experiments and trials with the lime and salt wash. Experiments were carried out at Wye in 1907 and 1908 to find a cheap sticking medium to make the lime adhere more firmly to the bark, but no very satisfactory results were obtained.

Mr. Theobald gives the following summary of conclusions as regards this wash: — Lime and salt wash (1 $^1/_2$ cwt. fresh lime, 40 lbs. salt, to 100 gallons of water) prevents the hatching of large numbers of the apple suckers, its effect varying according to the thickness put on the trees, the thoroughness of the application, and the extent to which it has dried before rain comes. No ingredient yet known prevents to any great extent the flaking-off of the lime on smooth wood. Waterglass or paraffin to some extent causes it to hold slightly better. Up to 40 lbs. of salt may be used

(1) *Psylla mali.* Ed.

to 100 gallons of water, but more than that amount may damage the buds of some varieties. As much lime as possible should be used so as to make a thick coating.

KENNETH G. FURLEY. **Spraying for Apple Sucker.** — *The Jour. of the Board of Agric.*, Vol. XVI, No. 11, p. 934, Febr. 1910. London.

In the winter of 1906-07, a number of washes used were tried on seven plantations in Worcestershire, against the eggs of the Apple Sucker, *Psylla Mali.* The principal washes used were:— Lime and salt wash; strong paraffin emulsion; lime, sulphur, and caustic soda wash. In addition, six other washes were used, including medium and weak strengths of paraffin emulsion, Mr. Spencer U. Pickering's paraffin and soda wash, and a lime and paraffin wash. It was also thought advisable to try the ordinary caustic alkali wash, which was at one time thought to have an injurious effect on the eggs, in order to settle once for all that in this respect it is useless, and consequently it is a waste of money to apply it. The double strength of caustic soda was used as well.

The spraying was done in October, November and March, in order to find which month was most suitable, should any of the washes prove successful. The only wash that was found to have any appreciable effect on the ova was the lime and salt wash. In 1907-08 this was again tried, and also VI Fluid, a proprietary fluid advertised to destroy the eggs of Apple Sucker. The latter did not prove successful. The lime and salt wash was made according to the following formula: — Best selected white lime (freshly burnt) 1 $^1/_2$ cwt., agricultural salt 30 lbs., water 100 gallons. The lime is first slaked and should be well stirred until all lumps disappear, when the salt is added. In order to prevent the coating flaking off the trees when dry, several "fixatives" were added to the wash. Of these waterglass at the rate of about 5 lbs. per 100 gallons was the most effective, but also the most expensive. Powdered alum. 3-4 lbs. per 100 gallons, and a few pounds of soft soap and of paraffin-soap jelly were also found to be more effective than most of the fixatives used. The lime and salt wash was again very efficacious in most cases, although in the first year of application the infestation was often only reduced. It was found necessary to apply it thickly, and the best results were obtained when spraying was done as late as possible up to the time when the buds began to burst.

Winter Washing of Fruit Trees. — *The Journal of the Board of Agriculture*, Vol. XVI, N. 10, p. 832. London, January 1910.

"A neglected orchard not only harbours during the winter all manner of insect enemies which commence their ravages in spring, but forms a nursery or breeding-ground from which other orchards are infested with noxious insects. The first step, therefore, is to destroy these pests as far as possible, and for this purpose winter washing is practised."

Some formulae for winter washes are given.

Protection of Timber against White Ants. — Abs: *Nature*, vol. 84, n. 2133, September 15, 1910, p. 342. London.

A Note on the protection of timber against white ants appears in the Transactions of the Royal Scottish Arboricultural Society (vol. XXIII, part II). Three processes are described, of which one is a contrivance for destroying white ants by pumping a poisonous smoke through their galleries, while the others are timber-treatment measures. Details of the Powel process are not disclosed, but *blue oil* is the specific which apparently has received recognition at the War Office.

Report by T. H. Middleton on Destructive Insects and Pests, in application of the Destructive Insects and Pests Acts, during 1908. — *The Journal of the Board of Agriculture*, vol. XVI, No. 10, London, January 1910, p. 845, Cd. 4934.

One of the early steps taken under this Act was the passing of an Order designed to some extent to protect the country against the introduction of new pests by requiring the occupier of any premises on which certain pests are discovered to report the fact to the Board. The pests selected include five insects and four fungi, which are among the most serious enemies of plants abroad. Of these, the Vine Louse or *Phylloxera*, the San José Scale, the Mediterranean Fruit Fly, the Colorado Beetle, Black Knot, and White Root Rot are not known to exist in this country, though some of them do occur occasionally. On the other hand, the Large Larch Sawfly, Black Scab of Potatoes, and American Gooseberry Mildew are, unfortunatly, prevalent. Each of these pests is dealt with in the Report, and the action taken in regard to them is described.

As regards Wart Disease, after detailing its life-history and referring to its prevalence in the country, Mr. Middleton observes that the disease has as yet received so little study that it is not possible to say much about the best means for eradicating it or preventing its spread. Cases of the disease have been found in Ireland, and there the Government required the destruction of all the potatoes and prohibited the planting of potatoes on the infected spot for a number of years. It is to be hoped that the remedy will be successful, but it is clearly one which could not possibly be applied in Great Britain owing to the number of infected gardens and the difficulty not only of detecting disease, except at harvest time, but of enforcing the prohibition for a period long enough to ensure the disappearance of the infection. The remedy must to a certain extent depend on the grower, and he can always ensure the desired result by planting some other crop. But owing to the want of accurate knowledge of the life history of the fungus, it is clear that carefully conducted experiments must be carried out on a proprer scientific plan before the cultivator can be offered the sound and pratical advice he so badly needs. A number of observations by growers have been made, and these afford a base for subsequent experiment. The observations resolve themselves into two classes: (1) on the fungicides used as remedies for disease either as curatives or preventives, and (2) on the varieties of potatoes most liable and least liable to attack.

The remedies tried were (1) flowers of sulphur, (2) soot, and (3) lime, all of which were reported to have met wih some succes in 1908 (*).

Both in pot and garden experiments sulphur has been found to keep the disease in check, even if it has not prevented it. The best and most economical way to use sulphur is first to dust the sets, preferably when stored in the autumn, and then to sprinkle them freely with flowers of sulphur as they lie in the drills before covering up. Before the plants are earthed up the soil should be dusted with sulphur, to prevent the disease from attacking the haulms, at the ground surface. Soot has been sprinkled on the sets as they lay in the drills with some success, and two cases are known where freshly slaked lime sprinkled as described above has

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(*) In the field experiments of 1909 none of these remedies were effective.

checked the disease. Gas lime, on the other hand, laid on in the winter is said to have been ineffectual. Kainit, quicklime, and salt, applied to the ground in the winter, have not proved of any value, and trenching the ground to the depth of 2 ½ to 3 ft. has also proved of no avail. Evidence as to the susceptibility of the different varieties of potatoes is more definite. The variety named Snowdrop is usually, possibly always, immune. Maincrop, Lang-Worthy, Conquest, and Golden Wonder are not attacked. All varieties belonging to the Up-to-date class take the disease very readily and very badly. With the object of arriving at some trustworthy information the Board arranged for two classes of experiments to be carried out during 1909. Experimetal plots were secured in Lancashire, Cheshire, Shropshire, and Breconshire, and planted with seventeen selected varieties of potatoes; while another class of experiment has been arranged to test the effects of possible remedies. Further, in order to test the use of sulphur, a number of cottagers and allotment holders have been supplied with a few pounds of sulphur for the treatment of their gardens.

The next subject touched upon is the American Gooseberry Mildew, and it appears that the number of gardens scheduled as infected with this disease increased from 692 in 1907-8 to 2,442 up to the 15th April, 1909. The disease, however, dit not spread very widely beyond the areas attacked in the previous year, except in one district, viz.. Kent, where it assumed considerable proportions. The counties infected were Gloucester, Worcester, Hereford, Warwick, Shropshire, Leicester, Derby, Northampton, Norfolk, Isle of Ely, Holland Division of Lincoln, Cambridge, Huntingdon, Kent, Essex, Surrey, Sussex, and Middlesex.

After dealing with the problems connected with administration, Mr. Middleton goes on to discuss the economics of the disease under the headings soil and situation, effect of manuring, susceptibility of different varieties, sources of infection and remedies, and it is pointed out that the experience hitherto gained in combating American Gooseberry Mildew may be summed up in the following suggestions and hints for gooseberry growers.

1) When American Gooseberry Mildew appears in a garden it must not be assumed that the plantation is ruined.

2) Neither must it be assumed that mildew is not dangerous and may remain untreated.

3) The disease should be dealt with at once as recommended in the Board's leaflet (The leaflet will be sent post free to all applicants to the Board of Agriculture and Fisheries, London).

4) The local Inspector or the Board's Inspector should be consulted as to the best way of dealing with severe outbreaks.

5) Spraying with liver of sulphur in June and July will check the spread of the mildew and will help to secure healthy shoots for next season.

6) When young wood has been formed, it should be protected by spraying with Bordeaux mixture. Bordeaux may be used instead of liver of sulphur as soon as the berries have been picked. It is to be preferred to liver of sulphur for use in August and September.

7) Diseased tips should be removed as soon as active growth has ceased. The earlier they are removed the better, provided that the season is sufficiently advanced to ensure that the buds on the shortened shoot do not begin to grow.

8) The bushes should be carefully pruned during the winter months; plants that have become too dense should be thinned and the last traces of disease removed.

Among other pests dealt with in the Report are the Felted Beech Coccus, the Pigmy Mangold Beetle, a new Tomato disease, and various "Scabs" of potatoes. The Report also refers to the inquiries into Bee Disease in the Isle of Wight, and into the Food of Birds.

Destructive Insects and Pests Order of 1910. — *The Journal of the Board of Agriculture.* June 1910, vol. XVII, n. 3, pag. 233.

The Board of Agriculture and Fisheries, by virtue and in exercise of the powers vested in them under the Destructive Insects and Pests Acts, 1877 and 1907, do order, and it is hereby ordered, as follows:

Notification of Discovery of Insect or Pest. — I. 1.—The occupier of any premises on which an insect or pest mentioned in the Schedule to this Order exists, shall forthwith notify the fact, with particulars of the time and place of discovery, to the officer appointed by the Local Authority to receive such notices, or, if no such officer has been appointed, to the Board; and, where practicable, a specimen of the insect or pest shall accompany the notice.

2.—An officer of a Local Authority who receives a notice under this Article shall forthwith report the fact to the Local Authority.

3.—The Local Authority on receiving in any manner notice of the existence or apparent existence of an insect or pest mentioned in the Schedule to this Order shall forthwith transmit the information to the Board and take such steps as may be necessary to determine to what extent the insect or pest exists."

Powers of Entry. — II. An Inspector or other officer appointed in that behalf by the Local Authority, and any Inspector of the Board may, upon production if so required of his appointment or authority, enter any premises on which he has reason to believe that an insect or pest mentioned in the Schedule to this Order exists or has recently existed, and examine any plant, fruit, crop, seeds, tubers, bulbs, layers or cuttings on such premises."

Action to be taken by Local Authority. — III. 1. — An Inspector or other officer of the Local Authority or of the Board, acting under their direction, may at any time and from time to time by a notice served on an occupier of premises on which an insect or pest mentioned in the Schedule hereto exists or recently has existed, require him to adopt such measures for prevention of the spread of the insect or pest as are specified in the notice.

2.—Where a Local Authority have consented to pay compensation for such destruction, the notice under this Article may require the occupier of premises on which an insect or pest mentioned in the Schedule hereto exists or recently has existed, to destroy by burning or other effective method all or any of the plants, fruit or crops on the premises, and the Local Authority shall pay compensation for such destruction subject and according to the provisions in that behalf of the Destructive Insects and Pests Acts, 1877 and 1907.

3.—A notice under this Article may prescribe the time within which the adoption of any measure thereby prescribed shall be completed.

4.—An occupier may appeal to the Board against a notice, served on him under this Article by an Inspector or other officer of the Local Authority, and the Board may, after consultation with the Local Authority, cancel the notice or modify its requirements in such manner as the Board think fit.

5.—For the purposes of this Order a notice shall be deemed to be served on a person if it is delivered to him personally or left for him at his last known place of abode or business, or sent through the post in a letter addressed to him there, and a notice or other document purporting to be signed by an Inspector or other officer of a Local Authority or of the Board, shall be *prima facie* evidence that it was signed by him acting under the directions of the Local Authority of the Board as the case may be."

Penalty on Sale or Use for Planting of Diseased Seeds, &c. — IV. Every person who shall knowingly use, or sell for use, for planting any plant, seed, tuber, bulb, layer or cutting attacked by an insect or pest mentioned in the Schedule to this Order, or any seed, tuber, bulb, layer or cutting which has been derived from a plant so attacked and is capable of spreading the insect or pest, shall be liable on conviction to a penalty not exceeding ten pounds.

Prohibition of Sale of Specimens. — V. It shall not be lawful, except with the written permission of the Board, to import, sell, or offer for sale, a living specimen of any insect or pest mentioned in the Schedule to this Order.

Penalties. — VI. Every person shall be liable on conviction to a penalty not exceeding ten pounds who —

1.—Knowingly fails to give such notification as is required by Article I of this Order; or

2.—Fails to adopt such measures for prevention of the spread of the disease as are specified in a notice served on him under this Order; or

3.—Wilfully obstructs or impedes any Inspector or other officer when acting under this Order; or

4.—Imports, sells or offers for sale an insect or pest in contravention of this Order.

Notification of Order. — VII. This Order shall be published by the Local Authority in accordance with any direction given by the Board.

Revocation of Order. — VIII. The Destructive Insects and Pests Order of 1908 is hereby revoked.

Execution of the Order. — IX. Each Local Authority shall carry into effect this Order within their District, and shall appoint such Inspectors or other officers for that purpose as may be necessary.

Definitions. — X. In this Order —

"The Board" means the Board of Agricultore and Fisheries;

"Local Authority" means a local authority hawing power to execute and enforce the Diseases of Animals Act, 1894; and "District" means the area in which the Local Authority has such power to act.

Application of the Order. — XI. This Order shall apply to Great Britain.

Short Title. — "XII. This order may be cited as the *Destructive Insects and Pests Order of 1910.*

In witness whereof the Board of Agriculture and Fisheries have hereunto set their Official Seal this third day of May, nineteen hundred and ten.

T. H. MIDDLETON *Assistant-Secretary.*

***

SCHEDULE.

INSECTS AND PESTS TO WHICH THIS ORDER APPLIES.

The Vine Louse (*Phylloxera vastatrix*, Planchon).
The San José Scale (*Aspidiotus perniciosus*, Comstock).
The Mediterranean Fruit Fly (*Ceratitis capitata*, Wiedemann).
The Colorado Beetle (*Doryphora decemlineata*, Say).
The Large Larch Sawfly (*Nematus Erichsonii*, Hartig).
The Potato Moth (*Lita solanella*, Boisduval).
The Gipsy Moth (*Liparis* (*Ocneria*) *dispar*, Linné).
The Brown Tail Moth (*Euproctis chrysorrhoea*, Linné).
The Nun Moth (*Liparis monacha*, Linné).
The Cherry Fly (*Rhagoletis Cerasi*, Linné).
The Narcissus Fly (*Merodon equestris*, Fabricius).
Black Knot (*Plowrightia morbosa*, Saccardo).
Wart Disease or Black Scab of Potatoes (*Synchytrium endobioticum*, Percival).
Tomato Leaf Spot (*Septoria Lycopersici*, Spegazzini).
Melon or Cucumber Canker (*Mycosphaerella citrullina*, Grossenbacher).
American Pear Blight (*Micrococcus amylovorus*, Burrill).

American Gooseberry Mildew (Chapel Fields Allotments). Order of 1910. — (*Order of the Board of Agriculture and Fisheries.* June 1910).

The Board of Agriculture and Fisheries, by virtue and in exercise of the powers vested in them under the Destructive Insects and Pests Acts 1877 and 1907, do order, and it is hereby ordered as follows:

Application of the Order.— 1) This Order shall apply to the allotments known as the Chapel Fields Allotments in the parish of Somersham in the county of Huntingdon.

Definitions.— 2) In this Order:

"The Board" means the Board of Agriculture and Fisheries.

"An allotment" means an allotment to which this Order applies.

"Disease" means the disease affecting gooseberry and currant bushes which is known as *Sphaerotheca Mors-uvae* or American Gooseberry Mildew; and "diseased" means affected with disease.

"Article" means Article of this Order.

Removal of Gooseberries from an Allotment.— 3) Gooseberries shall not be removed from an allotment except with a permit signed by an Inspector of the Board authorising the removal, which permit shall be attached to the sieve or other receptacle containing the gooseberries in such manner as to be seen readily.

Precautions in Picking Gooseberries on an allotment. — 4) The occupier of an allotment shall take such steps as are necessary to secure compliance with the conditions of this Article and to carry out such other precautions against the spread of Disease from his allotment as an Inspector of the Board may think necessary, and require him to carry out; provided that an Inspector of the Board may in writing exempt an allotment from the operation of this Article or any condition therein contained.

Conditions.— *a*) Whenever fruit is picked one picker shall be sent in advance of the others who shall pick all diseased gooseberries and drop them into a can containing a suitable quantity of paraffin. The diseased gooseberries shall subsequently be burnt.

b) All pickers shall be girt with aprons or other suitable protection in such a way that the disease cannot be conveyed to their clothes, and these aprons or other protection shall be dipped in boiling water before being taken to any other garden and also at the close of each day.

c) The pickers shall collect the gooseberries in baskets or bags and carry them to some convenient part of the allotment where the gooseberries shall be emptied out on a sheet and again examined. Diseased gooseberries shall be at once destroyed. Sound gooseberries may then be placed in the receptacle in which they are to be removed from the allotment.

a) No sieve or other receptacle in which gooseberries are to be removed from the allotment shall be brought into the allotment among the bushes.

e) The baskets in which the gooseberries are gathered by the pickers shall be disinfected by dipping in boiling water at such times as may be required by the Inspector and shall not be taken to any other garden until so disinfected.

Offences.— 5) Every person shall be liable on convinction to a penalty not exceeding ten pounds, who:

1) removes any gooseberries in contravention of this Order: or

2) fails to adopt such measures for prevention of the spread of the disease as are specified in article 4.

Commencement.— 6) This Order shall come into operation on the tenth day of June, nineteen hundred and ten.

Short Title.— 7) This Order may be cited as the *American Gooseberry Mildew (Chapel Fields Allotments) Order of 1910.*

Importation of Currant Bushes into Great Britain. — *Journal Board of Agric.*, April 1909, p. 63. London.

" The importation of currant bushes into Great Britain is now sanctioned by the American Gooseberry Mildew (prohibition of importation of Bushes) Amendment Order of 1908 (N. 2), provided that a licence of the Board of Agriculture and Fisheries granted under that Order is produced at the point of landing, Such licences are issued on certain conditions, which require the following requirements to be carried out.

I. Requirements to be carried out by the exporter:

a) The bushes are to be cleansed of all earth before being packed up.

b) The bushes are to be firmly and suitably packed in such a way that they cannot come in contact with any other bushes on the journey; but in order that they may be inspected at the port of landing by the Custom House Officer to see if the package contains contraband goods, they must be packed in such a way that one end of the package can be opened and, after the contents have been examined, be closed up again. The package should bear a label to show where it should be opened. It is suggested that the following words should be used: " Open here for Customs examination ". It is preferable that the words should be in English.

c) The name and address of the sender should be put on the address label as well as that of the consignee, and the words " Currant Bushes only " should be clearly written or printed on the label, thus:—

Currant Bushes Only.—From M. Brun et Cie. Pépiniéristes, Orléans (France).—To Messrs Brown & Co. Nurserymen, Reading, (England).

d) No other plants should be included in the package.

e) The bushes should not be despatched till the sender is satisfied that a licence has been issued.

II. Requirements to be carried out by the importer:—

a) A guarantee should be procured from the exporter that the bushes are free from American Gooseberry Mildew, Black Currant Mite, and other disease.

b) A letter should be written to the Board of Agriculture and Fisheries, 4 Whitehall Place, S. W., applying for a licence to import currant bushes. The letter should state:—

1) The kind of bush to be imported, i. e. whether red, black, and so forth.

2) The approximate number to be landed (an outside number should be given).

3) The proposed date of landing.

4) The proposed port of landing (one or more ports may be given, but the number should not exceed three).

5) The name and address of the exporter.

6) The name and address of the person or firm on whose premises the bushes are to be planted.

7) The address of the place where the bushes are to be permanently planted. This address should be full, so that the place can easily be found by an inspector visiting the district.

8) An assurance that the guarantee of freedom from disease referred to above has been obtained.

9) If the writer is not the person on whose premises the bushes are to be planted, a written undertaking to observe the conditions of the licence as described in this memorandum must be forwarded with the application.

10) The address to which the licence is to be sent should be given.

c) When the licence is received, the sender should be instructed to despatch the bushes, The licence should be sent either to him to be forwarded with the package or to the Collector of Customs at the port where the bushes are to be landed. The bushes cannot be landed until the licence has been produced.

d) The Collector should be asked to initial the licence to show that the bushes are landed, and the licence should then be returned to the Board,

e) The bushes should be sent direct to their destination, and on their arrival planted as soon as possible. The Board should be informed of their arrival.

f) The bushes must be shown to any Officer of the Board or Local Authority who requires to see them.

If the bushes are to be consigned to Ireland, the sanction of the Department of Agriculture and Technical Instruction for Ireland must also be obtained ".

Poisons and Pharmacy Act, 1908. — *The Journal of the Board of Agriculture*, vol. XVI, n. 2, pp. 146-149. London, May, 1909.

The attention of sellers of insecticides, fungicides, sheep dips, and weed-killers, which are poisonous by reason of their containing arsenic, tobacco, or the alkaloids of tobacco, is drawn to the provisions of the Poisons and Pharmacy Act, 1908 (8 Edw. 7, c. 55), with respect to the sale of such preparations by persons duly licensed by the Local Authority: i. e. the council of any municipal borough in England having a population of more than 10 000 according to the last published census for the time being, the town council of any Royal parliamentary or police burgh in Scotland, and, as respects any other place, the Council of the county.

Provisions as to the Sale of Poisonous Substances to be used exclusively in Agriculture or Horticulture.—Section 2 of the new Act provides that " so much of the Pharmacy Act, 1868, as makes it an offence for any person to sell or keep open shop for the sale of poisons, unless he is a duly registered pharmaceutical chemist or chemist and druggist, and conforms to regulations made under Section 1 of that Act, shall not apply in the case of poisonous substances to be used exclusively in agriculture or horticulture for the destruction of insects, fungi, or bacteria, or as sheep dips or weed killers which are poisonous by reason of their containing arsenic, tobacco, or the alkaloids of tobacco, if the person so selling or keeping open shop is duly licensed for the purpose under this section by a local authority, and conforms to any regulations as to the keeping, transporting, and selling of poisons made under this section," but the section is not to exempt any person so licensed from the requirements of any other provision of the Pharmacy Act, 1868, or of the Arsenic Act, 1851, relating to poisons.

Finally, the Regulations, dated the 2nd day, of April, 1909, are reported.

XXXIV.

Animal physiology, chiefly in regard to nutrition, growth and fattening. Animal Chemistry. — Feeding and fattening experiments. — Breeding and Selection.

Prof. G. C. Bourne. **Animal Chemism: Enzymes and Hormones.** The British Association at Sheffield, Section D., Zoology. — Abs. *Nature*, No. 2134, September 22, 1910, p. 382.

The following is an extract from this important address:

" It is, perhaps, too sweeping a generalisation to assert that the life of any given animal is the expression of the sum of the activities of the enzymes contained in it, but it seems well established that the activities of cells are, if not wholly, at all events largely, the result of the actions of the various kinds of enzymes held in combination by their living protoplasm. These enzymes are highly susceptible to the influence of physical and chemical media, and it is because of this susceptibility that the organism responds to changes in the environment as is clearly illustrated in a particular case by Tower's experiments on the production of colour changes in potato-beetles. Bayliss and Starling have shown that in lower animals, protozoa and sponges, in which no nervous system has been developed, the response of the organism to the environment is effected by purely chemical means. In protozoa, because of their small size, the question of coadaptation of function hardly comes into question ; but in sponges, many of which are of large size, the mechanism of coadaptation must also be almost exclusively chemical. Thus we learn that the simplest and, by inference, the phyletically oldest mechanism of reaction and coordination is a chemical mechanism.

" In higher animals the necessity for rapid reaction to external and internal stimuli has led to the development of a central and peripheral nervous system, and as we ascend the scale of organisation this assumes a greater and greater importance as a coordinating bond between the various organs and tissues of the body.

But the more primitive chemical bond persists, and is scarcely diminished in importance, but only over-shadowed, by the more easily recognisable reactions due to the working of the nervous system. In higher animals we may recognise special chemical means whereby chemical coadaptations are established and maintained at a normal level or in certain circumstances altered. These are the internal secretions produced by sundry organs, whether by typical secretory glands (in which case the internal secretion is something additional and different from the external secretion), or by the so-called ductless glands, such as the thyroid, the thymus, the adrenal bodies, or by organs which cannot strictly be called glands, namely, the ovaries and testes. All these produce chemical substances which, passing into the blood or lymph, are distributed through the system, and have the peculiar property of regulating or exciting the specific functions of other organs. Not, however, of all the organs, for the different internal secretions are more or less limited and local in their effects, one affecting the activity of this and another the activity of that kind of tissue or organ. Starling proposed the name hormones for the internal secretions because of their excitatory properties (ὁρμάω), to stir up, to excite).

" Hormones have been studied chiefly from the point of view of their stimulating effect on the metabolism of various organs. From the morphologist's point of view, interest chiefly attaches to the possibility of their regulating and promoting the production of form. It might be expected that they should be efficient agents in regulating form, for, if changes in structure are the result of the activities of groups of cells, and the activities of cells are the results of the activities of the enzymes which they contain, and if the activities of the enzymes are regulated by the hormones, it follows that the last-named must be the ultimate agents in the production of form. It is difficult to obtain distinct evidence of this agency but in some cases, at least, the evidence is sufficiently clear.

" I will confine myself to the effects of the hormones produced by the testes and ovaries. These have been proved to be intimately connected with the development of secondary sexual characters, such, for instance, as the characteristic shape and size of the horns of the bull; the comb, wattles, spurs, plumage colour in poultry; the swelling on the index finger of the male frog; the shape and size of the abdominal segments of crabs. These are essentially morphological characters, the results of increased local activity of cell-growth and differentiation. As they are attributable to the stimulating effect of the hormone produced by the male organ in each species, they afford at least one good instance of the production of a specific change of form as the result of an internal chemical stimulus. We get here a hint as to the nature of the chemical mechanism which excites and correlates form and function in higher organisms, and from what has just been said, we perceive that this is the most primitive of all the animal mechanisms. I submit that this is a step towards forming a clear and concrete idea of the inner nature of the organism. There is one point and that a very important one, upon which we are by no means clear. We do not know how far the hormones themselves are liable to change, whether by the action of external conditions or by the reciprocal action of the activities of the organs to which they are related. It is at least conceivable that agencies which produce chemical disturbances in the circulating fluids may alter the chemical constitution of the hormones, and thus produce far-reaching effects. The pathology of the thyroid gland gives some ground for belief that such changes may be produced by the action of external conditions. But however this may be, the line of reasoning that we have followed raises the expectation that a chemical bond must exist between the functionally active organs of the body and the germ-cells. For if, in the absence of a specialised nervous system, the only possible regulating and coadapting mechanism is a chemical mechanism, and if the specific activities ot a cell are dependent on the enzymes which it holds in combination, the germ-cells of any given animal must be the depository of a stock of enzymes sufficient to insure the due succession of all its developmental stages as well as of its adult structure and functions. And as the number of blastomeres increases, and the need for coordination of form and function arises, before ever the rudiments of a nervous system are differentiated, it is necessary to assume that there is also a stock of appropriate hormones to supply the chemical nexus between the different parts of the embryo. The only alternative is to suppose that they are synthesised as required in the course of development . . . . .

It would seem, therefore, that there is some theoretical justification for the inheritance of induced modifications, provided that these are of such a kind as to react chemically on the enzymes contained in the germ-cells."

. . . . .

A. D. HALL. **Review on the Progress of the Chemistry of Animal Nutrition during 1909.** — *Annual Report of the Progress of Chemistry for 1909. Issued by the Chemical Society,* Vol. IV. London 1910, p. 198.

" In this subject work continues to be very active on the part of the pure physiologists; eventually their work will be applied to agricultural problems, but until the whole question of protein hydrolysis and re-formation in the body has been cleared up no great advance is likely to be made in the feeding of animals on scientific principles.

The evidence as to the specific character of the proteins of each animal that had already been obtained from the experiments of Miss Willcock and Hopkins (*Ann. Report,* 1907, 276) has been strengthened by further work reported this year. V. Enriques, (*Zeitsch. physiol. Chem.,* 1909, 60, 105; *A.,* ii, 594) experimenting with rats, found that nitrogen equilibrium could not be maintained when zein was the only nitrogen compound fed, although the loss of body-nitrogen was less than on an entirely nitrogen-free diet. Gliadin, which contains tryptophan but not lysine, maintains nitrogen equilibrium, and can even lead to storage of nitrogen. E. Abderhalden (*Ibid.* 61, 194; *A.,* ii, 327, 817) also fed dogs on the cleavage products of casein from which the tryptophan had been removed. Thereupon they lost body-nitrogen, but the equilibrium was maintained when either the unaltered cleavage products were fed or tryptophan was separately added. While all these papers point to the necessity of the tryptophan group in building up the proteins contained in the organism, they go further, and show that no complete understanding of the peculiarities of animal nutrition is possible until we have a full record of the syntheses of both animal and vegetable proteins. On this latter point Osborne, Leavenworth, and Brantlecht (*Amer. J. Physiol.,* 1908, 23, 180; *A.,* i, 72) rather abandon the hope of determining the monoamino-acids accurately, and would differentiate the proteins by separating the hexone bases, which can be obtained quantitatively. They give results for about twenty-four vegetable proteins; histidine was present in all to the extent of about 2.5 per cent, lysine was absent from the gliadins but present in the proteins from leguminous seeds. Arginine varied from 1 to 14 per cent., being least in oil seeds, but most abundant in cereals.

" The discussion continues of the part played by non-protein nitrogen compounds in nutrition. Morgen, Beger, and Westhausser (*Landw. Versuchs-Stat.*, 1909, 71, 1) fed milch cows on diets in which the non-protein compounds of malt, extract of grass, asparagine, ammonium acetate and tartrate were compared with protein. The authors conclude that the conversion of these substances into digestible proteins in the intestine by the action of bacteria can hardly be regarded as proved. Although of much less value than proteins, they will do some of the work of the latter bodies, not so much by enabling the proteins to be better utilised, as by themselves carrying out some of their functions, although they are probably not converted into materials available for the making of meat or flesh. W. Thaer (*Ibid.* 70, 413; *A.*, ii, 608) fed sheep with hay and various quantities of protein, asparagine, molasses, etc., and found that the nitrogen of the molasses was but little utilised, the asparagine somewhat more so. The inorganic elements of nutrition have attracted more attention than usual, especially the phosphorus compounds. Hart, McCollum, and Fuller (*Amer. J. Physiol.*, 1909, 23, 246; *A.*, ii, 161) find that animals become unhealthy when the phosphorus in the ration falls below a certain limit; increased amounts result in larger skeletal growth. Nuclein, lecithin, and phytin gave no better results than inorganic phosphates, although there was no evidence of synthesis in the body of organic from inorganic phosphorus compound. E. Koch (*St. Petersb. Med. Woch.*, 1906, 400; *A.*, ii, 162) on the contrary, found that inorganic and non-protein phosphorus compounds are not utilised in repairing phosphorus waste, except, perhaps when phosphorus starvation was setting in. From the practical point of view, H. Ingle (*J. Agric. Sci.* 1909, 3, 22) shows that most of the foods, such as oat hay, mealies, and bran, used for horses in South Africa are deficient in lime rather than in phosphoric acid, and possess a very low Ca O, P_2O_5 ratio. The author connects this badly balanced diet with the prevalence of a disease, osteoperosis, characterised by an exceptional weakening of the bones, which causes considerable mortality in parts of the colony. Ingle recommends the use of leguminous fodders, such as lucerne hay, to provide a great amount of lime in the diet, instead of the bone meal which is often employed, because in the latter the lime is already combined with phosphoric acid. Certain pastures and particular parts of the country have always been famous for raising horses with good bone, but there has been no scientific investigation of the causes."

HERBERT INGLE. **Cattle feeding Experiments in Britain. A Review of over 200 Trials made in the years 1833-1908.** — Trans. of the *Highl. and Agric. Soc. of Scotland*, Vol. XXI, 1909, pp. 196-254.

Large numbers of experiments on the feeding of cattle have been made in this country during the past fifty or sixty years. Generally the object in view has been a comparison of the effects of certain food stuffs. Sometimes equal weights of the foods have been considered, other times equal money values, while only recently has much attention been paid to the chemical composition of the rations.

In the present paper an attempt has been made to reduce the results to a uniform basis as far as possible.

The important points to bring out were:

1) The average daily ration.

2) The rate of increase in live weight.

3) The quantity of digestible matter in the ration.

4) Its albuminoid ratio.

5) The amount of digestible matter consumed per 1 lb. of increase in live weight.

The element of cost has been neglected owing to the fluctuations in the prices of commodities.

The figures in the tables given are the result of considerable labour, for in many of the original papers the data are somewhat involved.

The various columns give:

I. The name of the experimenter.

II. The date of the trial.

III. The publication in which the results appeared (1).

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(1) The following is a list of the publications containing the official reports on the experiments reviewed.

A) *Trans. of the Highl. and Agric Soc. of Scotland.*
B) *Journ. of the R. Agric. Soc. of England.*
C) *Journ. of the Board of Agric. and Fisheries.*
D) *Reports of the Univ. Coll. of N. Wales.* Bangor.
E) *Reports of the W. of Scotl. Agric. Coll.*
F) *Reports of the Aberd. and N. of Scotl. Coll. of Agriculture.*
G) *Reports of the Durham Coll. of Sc. issued in connection with the Co. Council of Northumberland.*
H) *Reports of the Agric. Dept. of Cambridge Univ.*
I) *Reports of the Agric. Dept. of Leeds Univ.*
J) *Reports of the Agric. Dept, of the Univ. of Wales, Aberystwith.*
K) *Reports of the Edinbg and E. of Scotl. Coll. of Agriculture.*
L) *Guide to Experiments by the Agric. Dept. of Cambridge Univ.*

IV. The number of animals in each lot, together with age, sex, and breed when known.

V. The duration of the experiment in days.

VI. The average total gain in live weight per head, in pounds.

VII. The average daily gain in live weight per head, in pounds.

VIII. The average daily ration.

IX. The total digestible albuminoids present in the daily ration.

X. The starch equivalent of the digestible fat, carbohydrates, amides, and fibre in the daily ration.

XI. The total digestible matter in the daily ration per 1000 lbs. live weight.

XII. The total digestible albuminoids received per day, per 1000 lbs. live weight.

XIII. The starch equivalent of the digestible fat, carbohydrates, amides, and fibre received per day per 1000 lbs. live weight.

XIV. The albuminoid ratio of the ration.

XV. The weight, in lbs., of digestible matter consumed per 1 lb. of increase in live-weight, followed by the sum of the digestible albuminoids and starch equivalent of the fat, amides, carbohydrates, and fibre in that matter.

XVI. The average live-weight of the animals per head during the experiment.

A few words of explanation as to how the figures have been arrived at are given.

Average Daily Increase in Live-weight per head. — This varies from 3.13 lb. (Lot. 77) to 0.28 lb. (Lot. 87), the average of all the lots is 1.083 lb.

The greatest increase (Lot. 77) was obtained with six Shorthorns in 1889-90, during a period of 110 days, the ration used corresponding to a supply of 12.3 lbs .digestible matter per 1000 lbs. live-weight per day, and having an albuminoid ratio of 1: 4.25, while the next highest (2.99 lbs.) was obtained with four Shorthorn bullocks in 1870-1 during 98 days, the ration used corresponding to 15.7 of digestible matter per 1000 lbs. live weight and having an albuminoid ratio of 1: 19.9 (Lot. 26).

Influence of breed. — In many cases the breed of the animals is stated in the original papers.

This is indicated, when obtainable in the large Table.

Taking the cases where all the animals in a lot are of the same breed or variety the following gives a summary:

Breed	Number of lots	Average daily gain per head
Shorthorn	39	2.08
Hereford	40	1.793
Irish cross-breds	26	1 96
Galloway	20	1.52
Welsh	14	1.86
" Blue-greys "	12	1.50
Aberdeen-Angus	4	1.86
Norfolk-Polled	3	1.82
Ayrshire	2	1.57
	160	

The average gain of all the 160 lots was 1.828 lbs. per day per head.

Taking the aggregate amounts of digestible albuminoids, and the starch equivalents of the digestible fat, carbohydrates, fibre and amides in the food consumed for each pound of increase, a better criterion of feeding capacity is obtained.

The results expressed in this way are as follows:

Breed	Number of lots	Food constituents consumed for 1 lb. increase
		lb.
Shorthorn	39	8.533
Hereford	40	9.74 (*)
Irish cross-breds	24	10.32
Galloway	20	10.185
Welsh	14	10.257
" Blue-greys "	12	8.858
Aberdeen-Angus	4	8.375
Norfolk-Polled	3	10.50
Ayrshire	2	10.20
	158	

(*) If the very abnormal Lot n. 87 be excluded, the mean for the 39 lots of Herefords is only 8.636 lbs.

It would appear from the above table that for utilising the food supplied the greatest aptitude is shown by the Aberdeen-Angus (The number of experiments, however, is not large enough to be conclusive on this point) followed by the Shorthorn, Hereford, "Bluegrey," Galloway, Ayr, Welsh, Irish crosses, and Norfolk Polled, in the order given. Too much reliance, however, should not be attached to this conclusion, as the conditions of feeding etc. have been so varied.

Remarks on some of the Foodstuffs used. — In studying the tables it appears:

I. That, as a rule—with a few exceptions,—the quantity of digestible matter supplied per day has been larger in the recent experiments than in the earlier ones.

II. That beans which were formerly often used have in recent experiments been rarely used. In the Table, beans or bean-meal have entered into the rations of 28 lots. The average gain of these lots was 1.935 lbs. per day. (The average of all being 1.803 lbs.) but the average of food consumed per 1 lb. of increase was 9.368 lbs. (The average of all being 9 lbs.) Perhaps this indicates that beans are palatable and enable the animals to eat largely, but are not very economical.

Superiority of Leguminous fodders.

III. The success of rations in which clover-hay enters in considerable quantity.

The good effects of clover hay is doubtless partly due to its high content of albuminoids, but in the writer's opinion it is probably connected with the nature and amount of its ash constituents. He has recently called attention to the importance of the relative proportions of lime and phosphoric acid in the food of animals, especially with reference to bone development and nutrition (1), and has shown that a diet composed wholly of cereals furnishes a large excess of phosphoric acid as compared with lime, and to this circumstance he attributes the prevalence of certain bone diseases among horses and mules fed entirely upon oat hay or oat hay and maize.

Now in almost all seeds, oil cakes etc. the phosphoric acid greatly exceeds the lime in amount, while in the straw of wheat, barley, and oats there is only a slight preponderance of lime.

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(1) Vide *Journal of Comparative, Pathology and Therapeutics*, March 1907.

In potatoes and mangolds according to Warrington the phosphoric acid exceeds the lime, though of swedes and turnips the reverse is said. Rations consisting of oil cakes, cereal grains and straw, and roots will thus contain more phosphoric acid than lime, which condition does not favour bone development or nutrition.

Leguminous fodders contain an overwhelming excess of lime over phosphoric acid and it is probable that for this reason the inclusion of clover hay in feeding rations must have a beneficial effect upon growth and development (1).

Common cotton cake. — The figures for the 26 lots receiving 3 lbs. or more daily of this food are 1.850 and 9.942 lbs. respectively. Summarising:

3 lb. or more of	Number of lots	Average daily gain	Average weight of digestible matter per 1 lb. increase
		lb.	lb.
Linseed cake	49	1.873	9.086
Decorticated cotton cake	51	1.846	9.235
Common cotton cake.	26	1.850	9.942

Influence of housing. — Several of the trials were made to compare the rate of increase of cattle kept in stalls, loose-boxes, or open sheds and yards.

The results are not entirely consistent, but the general indications appears that more food per day is consumed when the animals have exercise and abundance of fresh air, they make a greater daily gain in weight, and each pound af increase is obtained with about the same consumption of digestible matter.

Influence of cooking food. — Several trials were intended to determine whether cooking the food was advantageous. In some cases it was apparently economical but the general conclusion arrived at was that it did not pay.

Suggested Ration for fattening cattle. — From careful consideration of the mass of material here collected, the writer would sug-

(1) Vide *The Mineral constituents of Food*: *Jour. of Agric. Science.* Dec. 1908.

gest as a daily ration, likely to give good results, some such mixture as the following.

The figures being suitable for an animal of about 1000 lbs. live weight.

Linseed cake	lbs.	3	kilogs.	1.363
Decorticated cotton cake.	»	3	»	1.363
Clover hay chaff. . . .	»	10	»	4.545
Maize or barley meal. .	»	2	»	0.908
Oat straw chaffed . . .	»	5	»	2.272
Roots	»	40	»	18.180

This would provide about:

2.55 lbs.	(kilogs. 1.157)	digestible	proteids
0.99 »	(» 0.450)	»	fat
11.58 »	(» 5.257)	»	carbohydrates, fibre and amides.

THE SOY BEAN. **Feeding Experiments with Soy Bean Cake.** — *The Journ. of the Board of Agriculture*, December 1909, Vol. XVI, N. 9.

" Up to the present very few experiments on systematic lines have been made with this cake, though it has been extensively used for feeding purposes by farmers.

One experiment, reported by Professor Gilchrist, of Armstrong College, was carried out at the Cumberland and Westmorland Farm School, and was intended to test the comparative feeding value of soy bean cake and decorticated cotton cake. *Three cows and three heifers, after their first calf*, were selected in February, 1909. They were all at an early stage of their lactation period, and as the milk naturally declined in quantity as the trial progressed, it was decided to feed soy bean cake during the first and last three weeks and decorticated cotton cake during the middle six weeks. Each cow received daily 49 lb. swedes or 42 lb. mangolds, 14 lb. hay, 7 lb. oat straw, 4 lb. crushed oats, and 4 lb. soy bean cake or 4 lb. decorticated cotton cake.

As regards milk production, there was a slight advantage in favour of the soy bean cake, but it was so small that the two cakes were considered to be equal in this respect. Both foods also gave similar results as regards the fat content of the milk. The cows gained rather more in weight while they were receiving the soy bean cake than they did on the decorticated cotton cake.

An experiment on similar lines was conducted at the Royal Agricultural College, Cirencester. Six cows were selected from the College herd, and divided into two lots of three each, care being taken that the age, period of lactation, and quantities of milk per day were as nearly equal as possible. The cows were turned out to grass on April 5th, and the experiment lasted from April 12th to May 9th. The daily rations were 35 lb. pulped mangolds, 6-8 lb. chaff, 2 lb. ground oats, 1 lb. bran, and a small allowance of hay. Lot I. received, in addition, 4 lb. soy bean cake, and Lot II. 4 lb. decorticated cotton cake; the bean cake contained 6 per cent. of oil and 40 per cent. of albuminoids and cost £6 10s. per ton.; while the cotton cake contained 8 per cent. of oil and 34 per cent. of albuminoids, and cost £7 10s. per ton.

The yield of milk appeared to be little affected by the kind of cake used. The percentage of butter-fat in the case of the bean cake remained almost constant, a slight increase, if anything, being noticed: with the decorticated cotton cake the percentage of butter-fat had a tendency to fall.

The butter produced by the bean cake was of a soft, oily nature and quickly churned, but it yielded well. It was, however, of a decidedly paler colour and somewhat inferior flavour as compared with that from cotton cake. The butter produced by the decorticated cotton cake was hard, and took a longer time to churn. The yield, however, was not so good as from the bean cake. No difference in laxative effect or otherwise was observed in the two cakes."

G. ARCHDALL REID. **The Laws of Heredity, with a diagrammatic representation by Prof. H. H. Turner**. Pp. xi+548. London, Methuen & Co. Ltd., 1910, price 21*s*.—Reviewed in *Nature*, vol. 84, July 7, 1910, by W. T. Thiselton-Dyer.

"Dr. Archdall Reid thinks, and no doubt rightly, that 'the main reason against a full acceptance of the Darwinian doctrine' is 'the retrogression of useless parts and organs.' His solution of this difficult problem is one of the most novel and interesting things in his book, and will probably be subjected to most criticism. Thirty two yearlings, costing 51520 guineas, only produced two winners. From this and similar cases he draws the inference that retrogression preponderates over progression.

"The instability of prize-bred domesticated races requires careful scrutiny. The late Duke of Devonshire pointed out to Lankester that race-horses are bred for speed, and not for 'points.' The conclusion that I draw from Sir Walter Gilby's facts is that breeders have not yet succeeded in fixing this particular quality. But Shorthorns, which are bred for points, have reached a high degree of stability; if they had not, no one would give a thousand guineas for a bull. The purchase of a possible race-horse is confessedly a gamble."

"The chapter on Mendel's laws is altogether admirable. It is probably the most luminous account of them which has been published.

"Disease and immunity are admirably discussed. Races become tolerant through selection working on germinal variation. Protoplasm learns to neutralise toxins. Twenty years ago I ventured with bated breath to hint the possibility of its education. The result is that the microbe and not the sword is the ultimate 'Empire builder'; and subject races will either absorb or expel their conquerors. The argument is extended to alcohol and narcotics. All races who win their freedom from vicious indulgence must first be slaves to it."

A. B. Bruce. **Mendelism, and its application to Stockbreeding.** — *The Journal of Board of Agriculture*, vol XVII, n. 4, p. 284. July 1910.

"Signs are not wanting that the researches in the science of heredity associated with the name of Mendel are awakening the interest of practical men. The appointment of the leading expert in Mendelian research to the Directorship of the Innes Institute at Merton suggests that horticulturists, at any rate, anticipate that practical results are likely to follow the application of the new methods to garden plants. That agriculturists, too, are not behindhand in recognising the value of the new science, as applied to the plants of the farm, is shown by the recent appointment of Professor Biffen as Botanist to the Royal Agricultural Society of England. Professor Biffen's success in producing new and valuable varieties of wheat is now a matter of common knowledge.

The value of Mendelian methods, when applied to the production of new varieties of plants, is both theoretically and practically beyond dispute, but the application of these methods to the breeding of animals stands on another and different footing; results of economic importance have not been achieved so far, and it is still doubtful, theoretically, whether the new methods are applicable to the problems in which practical men are interested. Stockbreeders, as a rule, have not, up to the present, devoted much attention to the matter, and it would seem that the mathematical aspect, which finds a place even in professedly popular accounts of the theory, is an obstacle which, to some minds, proves insurmountable. If, however, the *facts* established by the Mendelian school, be dissociated from the theories which have been framed to explain them, there is nothing in the new science that the ordinary reader need have any difficulty in comprehending.

In the first place, to clear the path, it is necessary to point out that Mendelian methods and discoveries are concerned with, and confined to, the inheritance of distinct and mutually exclusive characters only. For example, a flower is either coloured or white; colour and whiteness are an example of such characters. Thus the Mendelian can predict what will happen when, say, a white breed of rabbit is mated with a coloured one; he cannot predict the result of mating a large animal with a small one; he can foretell the colour of the eyes of the children of two blue-eyed parents; he is ignorant of the law determining their height. Confining our attention, then to the inheritance of sharply defined characters, of which colour will serve as a type, the root principle of Mendelism may be simply stated. It is that many, if not all, such characters behave as distinct units in inheritance, and *may* be present (or absent) in the off-spring, *dissociated from the other characters present in either of the parents*, in accordance with certain definite numerical laws. For example, a child may have the blue eyes of its father but all its other colour characters from its brown-eyed mother, moreover, the Mendelian law enables us to affirm that the blue-eyed child has no dark-eyed character in its "blood," even though its mother had dark eyes; in other words, the offspring of this blue-eyed child, if mated with another blue-eyed individual, will never show any "reversion" to dark eyes. It cannot, however, be asserted that the offspring of two dark-eyed parents will all have dark eyes, for it is a fact that, whereas the blue eye is always "pure," in the sense that it breeds true, the dark eye, on the other hand, is sometimes pure and sometimes impure, the "impurity" consisting in the fact that the blue-eyed character is sometimes latent and likely to appear in the offspring. In Mendelian terminology, dark eye is "dominant" to the "recessive" light eye. It must be clearly understood that dominance is not an essential of the Mendelian law; the root idea is that certain characters are independent units, the transmission of these units from parent to offspring being entirely independent of the inheritance of other units which may distinguish the parent individual.

It is clear that we have here an entirely novel conception of heredity. The ideas hitherto prevalent, if capable of definition at all, are associated with the use of the word "blood" in connection with heredity. It is assumed that, as the child is of the same blood as its parent, it carries, in its constitution—it may be latently—something of all the characters of the parents, and this something may appear at any time, by hazard, in the descendants of that child. The Mendelian conception, on the other hand, is that the factor on which any one of the characters of an individual depends may be replaced by some other factor in the child, and that the first factor, once having disappeared from the "blood" will not reapper until introduced from the outside by mating with another individual which carries the missing factor—whether patent or latent —in its "blood."

This idea may be stated in another way. The Mendelian regards the individual as a mosaic, the pieces of which are partly apparent and partly concealed; the child is a mosaic of pieces derived partly from one parent and partly from the other: if a piece, A, of one parent is replaced by another, B, in the child, A will not appear in the descendants of that child unless it is reintroduced from outside by marriage. The popular idea, on the other hand, is that the characters of the parent are inextricably blended, or fused together, or, as it were, dissolved in the blood, and that, consequently, the child carries some portion of *all* the characters of the parent, and thus trasmits them to future generations, their appearance on the surface being possible at any time through the working of the mysterious principle of reversion.

To give an example of the application of these principles to concrete instances, we cannot do better than describe an experiment carried out by Professor Wood at Cambridge, which formed the subject of an interesting lecture recently delivered by him to the Farmer's Club in London. The distinguishing points of the Dorset and Suffolk breeds of sheep are well known; briefly, the Suffolk is black-faced and hornless, while the Dorset is white-faced and horned. Now, if the two characters, face colour and horns follow Mendelian laws, it should be possible to produce a sheep having the white face of the Dorset combined with the absence of horns characteristic of the Suffolk, and, moreover, one which will breed true to this novel combination. Further, the desired result should be attainable by breeding two generations only. And so it proved; for, by breeding together the first crosses between Dorsets and Suffolks, there was obtained a ram having all the points of the Suffolk except that, instead of having a black, it had a white face. It is clear, therefore that the something, whatever it may be, that causes the blackness of the Suffolk is inherited independently of the other characters, and can be replaced by the something which produces whiteness, just as we can pick out one piece of a mosaic and replace it by one of another colour without disturbing the remainder of the picture. The method adopted to secure this rearrangement of the mosaic is simply to interbreed the first crosses between individuals containing the pieces we want, knowing that the offspring of the union, if sufficiently numerous, will include the new combination we are in search of. „

R. I. Pocock. **On the colours of Horses, Zebras and Tapirs.** — (*Ann. and Mag. Nat. Hist.* (London) 8, ser., 4 (1909), no. 23, pp. 404, 415). — *E. S. R.* March, 1910 — Washington.

This contains a discussion of the nomenclature of colors and color patterns in Equidæ and other large mammals. Various theories which account for the causation and inheritance of albinism, dappling, and the zebroid pattern are reviewed. The author thinks that the Equidæ are descended from dark colored animals patterned with white spots, running into longitudinal lines originally and in a late state of evolution becoming arranged in transverse bars over the neck and body. If this theory is true, then the white spots of dapple-grey horses represent phylogenetically the white spots of a tapiroid progenitor, a stage antecedent to the vertical zebroid bands hitherto regarded as the most primitive pattern extant in the Equidæ.

J. C. Ewart. **The possible Ancestors of the Horses living under domestication.** — (*Science*, n. ser. 30 (1909), No. 763, 219-223; *Proc. Roy. Soc.*, ser. B, 81 (1909), No. B 549, 392-397); abs. *E. S. R.*, XXI, Dec. 1909.

These are abstracts of a paper presented before the Royal Society, London.

The anatomical differences of 6 species, the possible ancestors of the domestic horse, are briefly described. Three of these species, which have been found in the Pliocene deposits, are *Equus sivalensis*, the oldest true horse known to science, found in the Siwalik deposits of northern India, *E. stenonis* of Europe and Northern Africa and *E. gracilis* (*Asinus fossilis* of Owen), also found in Europe and Africa. The three principal Pleistocene types are *E. nomadicus*, *E. fossilis*, and *E. robustus*. Some relationships between these species and the modern breeds are briefly noted.

I. B. Wood. **The Inheritance of Horns and Face colour in Sheep.** — *The Journal of Agricultural Science*, vol. III, part II, Pp. 145-155, October 1909.

This article setting forth the results whith have been obtained up to the present by the experiments on the inheritance of horns and face colour in sheep (described in a preliminary note published four years ago in the *Journal of Agricultural Science*, vol. I, p. 364) is not a final pronouncement and indicates the kind of difficulties which anyone who proposes to work on Mendelian lines with large animals must be prepared to face.

The parental types which were used in the crossing, were the Dorset Horn and the Suffolk. The Dorset Horn breed has a pure white face and legs. Both sexes have large horns, those of the male being larger and more spiral than those of the female. The Suffolk breed has a pure black face, its head is quite bare of wool, and both sexes are normally free from horns.

The experiment was begun in the autumn of 1903 by crossing a Dorset Horn ram with 30 Suffolk ewes.

The reciprocal cross was made the next year by crossing a Suffolk ram with 20 Dorset ewes. Description is given of the first cross F_1; of the second generation F_2 in which the F_1 ram described was mated with 28 F_1 ewes, and of the horned F_2 ram which was mated with 6 pure Dorset ewes, with hornless Hampshire ewes and with F_2 ewes. The hornless F_2 ewes were tested by mating them with the F_2 hornless ram already proved to be pure hornless. Two horned ewes which appeared in the second generation have been tested by mating them with a Dorset horned ram; figures are given of the progeny of the speckled faced F_2 ram mated with F_1 ewes. From these experiments the following conclusions can be given:

1) As far as the characters under observation are concerned

it is immaterial which way the cross is made. Reciprocally bred first crosses are identical.

2) The inheritance of horns is closely connected with sex. Large horns are dominant in the male, recessive in the female.

3) The meaning of scurs is not yet settled.

4) A horned ram may be either pure horned or heterozigous.

5) A hornless ram must be pure hornless.

6) A horned ewe must be pure horned.

7) A hornless ewe may be either pure hornless or heterozigous.

8) The occasional occurrence of scurs in Suffolks is probably explained by the dominance of the hornless condition in the female.

9) There is no dominance of white face over black or *vice-versa.* Pure white and black faces segregate in the second generation.

10) Woolly and bare heads appear to be a pair of characters which blend in the first cross but segregate again in later generations.

11) A number of striking instances of recombination have been observed.

12) The slowness and lack of certainty in testing the females and the complicated nature of what might have been hoped to be simple characters, are the principal difficulties of experimental breeding with large animals.

The experimental work of the Agricultural Department of the University of Cambridge has been transferred from Impington to Gravel Hill, where it is proposed to begin a new series of sheep breeding experiments on somewhat different lines, bearing more directly on points of economic importance such as would be likely to appeal to the butcher, the dealer or the wool merchant, but experiments on these lines are hardly likely to turn out less complicated than horns or face colour.

P. McConnell. **Live stock: Breeding and Management.** — *London and New York*, p. 112, pl. 1, figs 15.

This contains a short descriptlon of the principles and methods of live stock farming, of each breed worthy of note, and of the directions in which further improvement may be expected.

XXXV.

Cattle-foods: Composition and feeding value. — Frauds in the sale of feeds. — Legislation regarding cattle-foods. — Housing and hygiene of domesticated animals.

J. Augustus Voelcker. **Examination of Feed-stuffs. Annual Report for 1909 of the Consulting Chemist.** —*Journal of the R. Agric. Soc. of England,* Vol. 70, 1909, pp. 339-352.

The Author notes with satisfaction that the practice of gross adulteration of offals has now been put an end to.

Several cases of adulteration of this kind have been followed by prosecutions under the Fertilisers and Feeding Stuffs Act in different parts of the country, and heavy penalties against the principal offenders were obtained. The R. Agric. Soc. took a very prominent part in urging on these prosecutions.

Of new materials the one that has come prominently into use is Soya bean cake and it bids fair largely to take the place of other feeding materials.

The report contains much interesting information and research on the chemistry of several food stuffs, manures, waters etc. among which deserve to be mentioned the examination of numerous samples of linseed cake for the possible presence of substances capable of developing prussic acid. Only in one instance did the author find this to occur.

The cattle showed an unwillingness to take the cake, which had a distinctly bitter taste and yielded 0.22 °/₀ of prussic acid.

Alfred Smetham. **Java Beans and other Feeding Stuffs that may produce Prussic Acid. Some new Feeding Stuffs and their relative Value as Cattle Foods.** — Liverpool, 1909, p. 11.

"*Java Beans.* — In 1905 beans from Java were imported into the United Kingdom in considerable quantities, but directly they were put into consumption complaints of injury to and death of stock poured in from all sides. Investigation by Messrs Tatlock & Thomson, of Glasgow, revealed the fact that these beans, which closely resembled the beans of *Phaseolus lunatus*, a plant grown in Mauritius, Burma and elsewhere, yielded on steeping with water notable quantities of Prussic Acid, and there can be no doubt that the conclusion of these chemists, confirmed in many cases by other analysts, the author included, that the deaths must be referred to Prussic Acid poisoning was correct. The fact that the beans of *Phaseolus lunatus* at times developed poisonous properties had been well recognised for a long time, and the matter had been investigated at the Imperial Institute by Prof. Dunstan, who, on examining the beans from Mauritius, discovered that the Prussic Acid did not actually exist in the beans, but that under suitable conditions the beans were capable of yielding Prussic Acid, the original of which was traced to a glucoside, to which the name *Phaseolunatin* was given, and a ferment which was able to decompose the glucoside with formation of Prussic Acid.

The fact that Java Beans may be deadly poisonous caused chemists generally to investigate a number of other beans and seeds to ascertain whether they possessed cyanogenetic properties similar to Java Beans, and the results obtained have been most interesting and instructive.

It has long been known that Tapioca root produced Prussic Acid, and when taken in an untreated condition was poisonous; but it was not generally known that a large number of seeds in common use possessed similar properties, although to a less marked extent.

All the beans from Java which were examined yielded Prussic acid when steeped in water at a suitable temperature, the quantities found ranging from 0.012 per cent. to 0.137 per cent. Taking the highest quantity (0.137 per cent.) the Prussic Acid capable of being yielded by 10 lbs. of the beans is 95 grains, and as one grain of Prussic Acid is regarded as a fatal dose in man it is evident that when the conditions are favourable to the production of the full amount of Prussic Acid such beans would prove highly poisonous.

The beans from Mauritius examined by Dunstan, Henry and Auld yielded amounts of Prussic Acid varying from 0.041 per cent. to 0.088 per cent., while the beans from Burma varied from 0.004 per cent. to 0.024 per cent. for the pale brown with purple spots, and nil to 0.027 per cent. for the cream white beans.

Beans obtained from France and Madagascar and *Haricot* and *Butter* beans obtained in the United Kingdom yielded practically no Prussic Acid.

The *Red Rangoon* or *Burma Beans* yielded small quantities of Prussic Acid, but most of the samples of *White Rangoon Beans* examined have yielded at most only small quantities. As there do not seem to be any cases of poisoning from the use of Burma Beans, it is to be presumed that the quantities of Pru ssic Acid produced in the ordinary course of feeding are insufficient to have any marked toxic effects.

A curious fact has been noted with regard to the cultivation of the wild seeds of *Phaseolus lunatus.* In the wild state the seeds are purple and very poisonous, but on cultivation the colour is gradually modified, until at last the seeds become white, and with the change of colour the poisonous character of the seeds disappears.

As far back as 1888, it was shown by Jorissen and Hains that ground Linseed in contact with water yielded Prussic Acid; but in view of the fact that Linseed, both in the ground state and pressed into cake, had been used largely as cattle food with highly satisfactory results, the discovery was regarded as having more of a scientific interest than practical bearing.

In the light of his researches at the Imperial Institute on Java and other Beans, Prof. Dunstan has investigated the cause of the production of Prussic Acid in Linseed, and finds that it is brought about by the interaction of a glucoside and ferment identical with the cyanogenetic glucoside and ferment of the beans of *Phaseolus lunatus.* From two samples of Linseed Cake he was able to produce 0.035 per cent. and 0.041 per cent. of Prussic Acid, and he points out that these quantities are about 50 per cent. greater than those obtained from Burma Beans. He suggests, however, that the heat to which the Linseed is raised in the manufacture of the cake destroys the ferment and thus prevents the immediate production of Prussic Acid, and it is to this that he attributes the practical absence of poisoning among cattle. The fact that the quantities of Prussic Acid mentioned above were produced in quantities which might prove fatal, but it would only be by long soaking in cold or tepid wather that the production would take place. In practice the cake is usually fed dry, and in that case the enzyme which produces the poison would be destroyed, or if used for calf feeding it is mixed to a gruel with boiling or hot water, which would have a similar effect in the destruction of the ferment. In a case which came under the author's observation in which suspicion fell upon Linseed Cake as the cause of death in calves fed upon it, he was able to obtain Prussic Acid equal to 0.017 per cent. or 1.19 grains per lb. As this quantity was only about half that found by Prof. Dunstan, and by Dr. Bernard Dyer, who has examined a large number of samples of Linseed Cake from different sources, and by the A. also, he was unable, in the absence of further details than were placed at his disposal, to refer the deaths to the particular sample of Linseed Cake; but it seems that if Linseed or Linseed Cake Meal is used in the preparation of a calf meal, and is mixed into a gruel with water which does not approach the boiling point, and is allowed to stand for a considerable time before use, a grave danger will be run. From time to time cases of death in calves fed upon calf meals containing Linseed have been brought to the Author's notice, but he has not been able to associate the deaths with the use of the calf meal. In the light, however, of our present knowledge Mr Smetham would not be surprised to learn that, in some of the cases at all events, the deaths were due to Prussic Acid poisoning, brought about by the improper preparation of the gruel from the calf meal."

ALFRED SMETHAM. **Chinese and Burma Decorticated Cotton Cake. West African Cotton Cake. Some New Feeding Stuffs and their Relative Value as Cattle Foods.** — (Liverpool, 1909, p. 7).

" *Cotton Seed Cakes, Decorticated and Undecorticated.*

Until recently the bulk of the Decorticated Cotton Cake and Meal imported into Great Britain has come from North and South America, but recently there have been shipments from China. Those that have come under the Author's observation have been in a fairly fresh condition, and promise, if the supply is maintained, to become a useful addition to the rapidly increasing feeding materials at the disposal of the farmer. As will be seen from the following analyses, which may be taken as typical of the present imports, these samples compare favourably in composition with the American article:

Composition of Chinese Decorticated Cottonseed Cake and Meal.

	Water	Oil	Albuminoids	Carbohydrates	Woody Fibre	Ash.	Sand.	« Food Units »
Shanghai Meal .	9. 80	12. 60	40. 88	25. 15	5. 02	6. 55	0. 10	158
» » .	9. 60	13 03	41. 12	23. 32	6. 38	6. 55	0. 05	158
Decorticated Cake	12 60	5. 20	37. 88	25.94	12. 23	6. 15	0. 20	133
» «	12. 80	9. 47	39. 88	24. 87	6. 53	6. 45	0. 25	152
» »	11. 05	6. 70	36. 25	26. 40	13. 05	6. 55	0. 25	134
» »	12. 95	7. 87	37. 00	24. 73	11. 10	6. 35	0. 20	137
» »	11. 70	9. 40	41. 38	23. 00	7. 12	6. 70	0. 15	150

In addition to the Decorticated Cotton Cake and Meal there seems a probability of a trade springing up in the Undecorticated — or whole seed — Cake. The samples which have come under Mr Smetham's observation have been, for the most part, in a sound condition, and the composition is such that, if they can be imported at a profit, they should prove a valuable acquisition to the farmer. The following analyses indicate the character of the present deliveries:

Composition of Chinese Undecorticated Cotton Cake.

	Water	Oil	Albuminoids	Carbohydrates	Woody Fibre	Ash.	Sand.	« Food Units »
Undecorticated Cake	10. 45	5. 10	28. 25	81. 55	19. 10	5. 55	0. 20	114
» »	10. 15	5. 97	29. 63	28. 88	19. 47	5. 90	0. 40	118
» »	9. 85	8. 60	30. 88	28. 19	17. 08	5. 40	0. 10	127

The relatively high percentage of albuminoids, compared with Undecorticated Cakes from other sources, is particularly noticeable in those cakes which the Author analysed.

" At present the trade in Burma does not seem to be highly organized, and often the description of the goods is very faulty, as will be seen from the following analyses of some recently imported parcels:

COMPOSITION OF BURMA COTTON SEED CAKE.

	Water	Oil	Albuminoids	Carbohydrates	Woody Fibre	Ash.	Sand.	« Food Units »
Decorticated Cake .	12. 30	10. 27	40. 84	23. 57	6. 47	6. 55	1. 05	151
Undecorticated Cake	9. 50	4. 00	17. 00	38. 06	27. 29	4. 15	0. 35	90
» »	9. 80	5. 03	23. 38	32. 04	23. 30	6. 45	1. 75	103
» »	10. 50	4. 57	18. 62	33. 33	27. 33	5. 65	1. 30	91
Decorticated Cake .	9. 30	6.47	24. 63	31. 77	20. 73	7. 10	1. 80	109
Decorticated Cake .	8. 60	10. 10	38. 38	27. 37	8. 45	7. 10	0. 90	148
Undecorticated Cake	9. 70	9. 57	32. 62	27. 79	12. 97	7. 35	1. 60	133
Decorticated Cake .	11.65	10. 06	41. 44	23. 52	6. 83	6. 50	0. 95	152

Another new source of Cotton Seed Cake, which at present is in its infancy, but which it is hoped and expected will in the near future attain considerable proportions, is that produced in Africa. Persistent and successful efforts have been made to grow Cotton in the Colonies, and it is to be hoped that incidentally this endeavour will benefit the British agriculturalist by adding to the sources of supply of concentrated feeding stuffs. At present many of the samples of African Cotton Cake imported are very "woolly;" but with more experience and improvements in manufacture a marked change for the better may reasonably be anticipated. The following analyses show the composition of some recent shipments.

COMPOSITION OF WEST AFRICAN COTTON CAKE.

	Water	Oil	Albuminoids	Carbohydrates	Woody Fibre	Ash.	Sand.	« Food Units »
Cotton Seed Cake .	10. 35	7. 03	23. 75	24. 31	30. 56	4. 00	0. 15	101
» » » (delinted)	10. 40	6. 73	23. 00	26. 47	29. 50	3. 90	0. 15	101
Cotton Seed Cake .	10. 30	6. 47	23. 25	27. 45	28. 68	3. 85	0. 30	102
» » » .	11. 15	3. 67	24. 25	26. 40	29. 03	5. 50	1.05	96
» » » .	9. 45	7. 83	22. 75	24. 49	31. 48	4. 00	0. 25	101
» » » .	9. 20	7. 53	22. 63	29. 32	27. 67	3. 65	0. 20	105

Alleged Poisoning of Cattle by Soy-bean Meal. — (*Mark Lane Express*, 103 (1910), n. 4090, pp. 169-171: *Vet. Rec.*, 22 (1910), N° 1127, pp. 545-549); *E. S. R.* June 1910.

Twenty-five out of 52 cows near Edinburgh, Scotland, which had been fed 1 lb. of soy-bean meal per day (distributed over 2 feeds) are reported to have died from poisoning thought to have been due to hydrocyanic acid from the meal. A suit against the firm from whom the meal was purchased, is under way.

Nutritive Value of Straw. — *Agr. Gaz.* London, May 1910, p. 469.

Insilage of the pulp of beets with chaffed straw increases the nutritive value of the latter, while in the fermentation of the straw some chemical actions take place which increase its assimilability,

H. Gamble. **Foodstuffs and their Deterioration.** — *Vet. Jour.*, 65 1909, N° 411, pp. 439-452 fig. 1; abs. *E. S. R.*, XXI, Dec. 1909.

These are notes on the deterioration of feeds due to bacteria, fungi, animal parasites, and other causes. Experiments are reported on growing pure cultures of bacteria and molds found in linseed cake, cotton cake, and maize.

XXXVI.

Special Stock-breeding. — Horses. Cattle. Sheep and Goats. — Swine. Other higher domesticated animals. — Meat production and connected industries. — Production of Wool. Trade of Wool. — Some special products of domesticated animals.

Robert Wallace. **Riding Horses, Carriage Horses and Ponies.** Board of Agriculture and Fisheries. *British Breeds of Live Stock.*—London, 1910, p. 1-137.

The following are some extracts from this important official publication in the part regarding Horses.

The Race Horse or English Thoroughbred, with the solitary exception of the Arab, has been the fountain head at one time or another of all that stands for quality among the light-legged horses in this country. It has been bred without stain of alien blood for considerably more than 100 years, and subjected to the most rigorous system of selection for strength and staying power by the test of performance on the turf.

The Ideal Hunter.—The ideal Hunter is a strong-boned Thoroughbred, 16 to 17 hands high, sound in wind and limb, full of substance and quality, good at the withers, with long sloping shoulders, short in the back, well coupled and strong at the loins, with powerful, long, level hind quarters, which enable the animal to get the hind legs well under him in jumping; muscular thighs and big clean hocks with a prominent vein below them.

It is most important that a Hunter should have been got by a stayer, possess plenty of pluck and staying power, and take a keen interest in the sport, in vying with his neighbours as to who shall be first in at the death; also that he shall be always ready to feed after the hardest run and lie down to take his well-earned rest.

Cross-bred Hunters.—A great many good Hunters are not clean-bred. A good cross-bred Hunter of the weight-carrying type can be produced by two Thoroughbred crosses on a light-legged undersized Clydesdale or Suffolk Punch mare; such animals are often good with hounds, but rough and angular in the hind quarters and generally wanting in finished quality. A Cleveland Bay or a good clean but strong-boned mare of nondescript ancestry may also breed a good Hunter by a Thoroughbred horse, but the risk of a misfit in the latter case is greater than when hunter-breeding, which is a lottery at the best, is practised with mares of a suitable stamp, whose pedigrees, if not complete, are known to be in a preponderating degree Thoroughbred of the right sort with plenty of bone and size.

Associations and Public Bodies for the Improvement of the Breed.—There are several public bodies which exist for the promotion of the interests of light horses in this country, of which the Hunter is the principal type. The Royal Commission on Horse-Breeding, which receives a Parliamentary grant amounting to £ 5100 per annum, represents State assistance for the encouragement of horse-breeding in Great Britain, while private breeders are associated in The Hunters' Improvement Society, established about 1875, and in the Brood Mare Society, dating from 1903.

The Royal Commission on Horse-Breeding gives King's premiums of about £150 to sound, selected Thoroughbred stallions which are allocated to certain specified districts throughout the country, and stand at the moderate fee of £2 for each mare. About 60 per cent. of foals are left. For the benefit of the War Office and the Remount Department, a record has been kept of all breeders who have had mares served by the premium stallions since 1888.

Similar work is done in Ireland under the Royal Dublin Society, which issues a *Register of Thoroughbred Stallions* for service under a horse-breeding scheme formulated in 1892, and revised in 1905.

The Hunters' Improvement Society exists "to improve the breed and promote the breeding of Hunters and other horses used for riding or driving, and for military purposes." It receives a grant of nearly £500 a year from the Royal Commission on Horse-Breeding, and spends about £ 4000 a year in the numerous directions in which it operates.

The Brood Mare Society "obtains (free from hereditary disease) strong hunter-bred mares by gift or purchase, and lends them to farmers and others on certain conditions, the object being to keep good brood mares in the country, and restrict their wholesale exportation and the consequent deterioration in the breed of horses in the United Kingdom."

The Hackney is believed to have sprung from a foundation stock of Norwegian horses landed by the Norse invaders in Norfolk and Yorkshire. The very high and free action, both before and behind, is a distinguishing feature of the breed. The ancestors of both the Hackney and the Thoroughbred of the present day have been freely crossed by imported horses from the same foreign stocks, but they have been bred for different objects and in different environments. It is to the original native mares, in each case, that the trotting habit of the one and the galloping habit of the other are due.

The Hackney horse of to-day is a powerfully-built, shortlegged, big, broad horse, with an intelligent head, neat neck, strong, level back, powerful loins, and as perfect shoulders as can be produced; good feet, flat-boned legs, and a height of from 15·2 to 15·3$^{1}/_{2}$ hands. Hackney-bred carriage horses of 17 hands high can be obtained.

The Cleveland Bay is the oldest type of the large-size carriage horse, and has existed probably without much variation in the North and East Ridings of Yorkshire for more than 200 years. Hays traces its origin to Yorkshire cart mares, descended from the old English Black Horse or War Horse, and from a Barb stallion, which latter introduced the universal bay colour, and the dark dorsal stripe characteristic of the breed.

Value for Crossing.—The extraordinary robustness of the constitution of the breed is a valuable asset in a Cleveland brood mare. These mares will produce upstanding carriage horses if crossed with a Hackney stallion, while a cross with a big-boned Thoroughbred will produce a weight-carrying Hunter, both of which crosses often sell for very high prices.

The Yorkshire Coach-Horse is an off-shoot of the Cleveland Bay, but it has been recognised as a distinct variety for over 100 years. *The Yorkshire Coach-Horse Stud Book,* 1887, says of the type:—"It cannot be claimed for the Yorkshire Coach-Horse that he is a pure-bred animal, but that, on the contrary, by the judicious crossing of large-sized good-coloured mares with stallions, altogether or nearly Thoroughbred, a class of horses has been produced suited to the wants and circumstances of the times. By universal consent, the colour should be bay or brown, with black eyes, mane and tail, abundant but not curly, the height from 16 hands to 16 hands 2 inches, with fine head, sloping shoulders, strong loins, and lengthy quarters, high-stepping action, good sound feet, flat legs, and abundance of bone and muscle."

The Yorkshire Coach-Horse in some respects often strongly resembles the Cleveland Bay, but he is taller and shows more style and quality—the head is more refined and the crest more developed; his action is also freer, as well as higher.

Ponies vary considerably in size, but their general characteristics are their hardiness of constitution, their longevity, surefootedness, activity and strength.

They are much more intelligent, cunning, tricky and knowing than large horses, and, when accustomed from youth to children and grown-up people, they develop a more intimate acquaintance and friendship with human beings than is the case with other horses.

The shoulders are generally steep and the withers low and broad, so that the saddle is liable to move forward out of its natural position.

The Polo Pony Society.—The Polo Pony Society was started in 1893, and one of its first acts was to complete the *Polo Pony Stud Book* "for the improvement and encouragement of the breeding of high class Riding Ponies." It possesses a Board of Inspection of 100 judges distributed over the United Kingdom. Entry can only be made of animals under 14·2 hands that are leading prize winners or have passed the inspection of one of the judges, which implies that they possess merit and are free from hereditary disease.

One chief difficulty in breeding Polo Ponies is keeping down the height to the prescribed limit. This makes drafts of mares from the various Mountain and Fell ponies of the country invaluable as foundation stock. Few have been bred with sufficient care to enable them to be entered in the Stud Book, but, by breeding from the best specimens of stallions that occur within the various breeds, a better class of animal will be produced in another generation among such ponies as the following:—Welsh, Dartmoor, Exmoor, New Forest, and Scotch West Highland. So trying are the conditions under which these ponies are reared in their natural habitats that the introduction of refined blood by way of improvement would so soften and otherwise weaken the constitution that the progeny would either die out or become degenerated. This was recognised as a prominent inducement for the admission of the various indigenous mountain breeds for registration, each in its own division, in the *Polo Pony Stud Book*, and by registering such of them as are likely to breed riding ponies, and, by periodically going back to this fountain head of all ponies, it is hoped to regulate the size of our high-class riding ponies to the desired limit, and at the same time to infuse into their blood the hardiness of constitution, and endurance combined with a fiery yet even temper, which are so pre-eminently characteristic of the British native breeds.

The Welsh Pony is one of the tallest and one of the best of the Mountain breeds. A good many types exist owing to the introduction of alien blood of different sorts, and a great many of the mares are too tall for producing Polo Ponies by a Thoroughbred or Arab stallion; but it has been truly said of the animals in a pure state, when they rarely exceed 12 to 12·2 hands, that "the indomitable pluck, endurance and good temper of the Welsh pony, together with his substance and dash, will be found an invaluable cross for the Throughbred and Eastern-bred ponies."

The New Forest Pony is another breed which possesses the advantage of an Association devoted solely to its improvement. It takes its name from the New Forest, a Crown property of 70 000 acres in extent which was laid out as a Royal forest by William the Conqueror. It is believed that horses have there found a home for an extended period, although the type has been subjected to change by the recent introduction of Thoroughbred and Arab blood. The large proportion of greys, many of them flea-bitten, among a great variety of colours, is traced to the latter origin. There are not many duns, and but few piebalds left.

Dartmoor Ponies have been highly appreciated from time immemorial, but, like moorland and mountain ponies generally, they have suffered from want of attention in breeding, and have been left to Nature.

The Exmoor Pony is on the average about 12 hands in height, and it should never be above 13 hands, although the natural pasture is better than that of Dartmoor.

The Shetland or Sheltie from the Shetland Isles is one of the oldest breeds of ponies extant, quite different in appearance from the other breeds of ponies in the country. It is extremely well proportioned and finished, and resembles a well-shaped miniature Clydesdale with good characteristic action. The smallest specimen on record is reputed to have been only 26 inches high. The average height is 40 inches, but (with the object of keeping down the size) no pony of more than 32 inches can be entered in the Shetland Pony Stud Book.

Black, bay, and brown are the favourite colours, but mouse colours are most common. Grey, cream, chestnut and piebald are also seen. There is an excellent demand for registered Shetlands in America and Canada, and a good market at home for handsome good movers. Inferior-looking specimens make excellent mine ponies. Their short stature is there of special advantage. Their surefootedness, intelligence and good-nature make them ideal companions for children, and their docile temperament and tractable disposition, which are remarkable in comparison with ponies of any other British breed, adapt them admirably for either the coal pit or the lawn nursery.

Heavy Draught or Farm-Horses.—British Work Horses are usually classified as belonging to three distinct breeds,—the Clydesdale, the Shire and the Suffolk Punch, although the two first-named have at least one common ancestor in the old English War Horse—alternatively called the Great Horse, the Strong Horse, and the old English Black Horse. In many points the two breeds are so similar that they may fairly be regarded as merely distinct strains of one and the same breed.

The Clydesdale.—It is now generally admitted that the Upper Ward of Lanarkshire, in the Dale of Clyde, has long been renowned for powerful farm horses, and that the superior size and strength were at least partially due to the capacity of the soil to support large-framed animals, some at least of which were imported from England.

Special Characteristics of the Clydesdale.—Bay and brown are the commonest colours; black and grey (which becomes white with age) comes next, and more rarely, chestnut and roan, with very frequently a silver hair through the darkest coat, a white blaze and one or more white feet. The height averages, for mares about 16 hands, and for stallions 16·2, few exceeding 17 hands.

The breed is famous among draft horses for unsurpassed activity, strength, and cleanness of bone, freedom and general perfection of knee and hock action at the walk and in the trot; length, strength, and slope of pastern to 45°; gaiety of carriage; fineness of skin; silkiness, straightness and length of the hairy fringe down the back sinews before and behind; general beauty of symmetry, with a tendency in some members of the breed to shortness in the back-ribs and consequent lightness in the barrel; good sloping shoulders and short muscular loins and back, which last frequently looks hollow because of the height of the powerful well-fleshed withers and noble chest. In action the hocks move closely together, especially in the mare, and the hind toes turn slightly outwards, but not sufficiently to throw out the stifle joint. Wideness at the hocks, more common with stallions than mares, implies weakness of the loins and tends to grow worse with age or after a period of service; the joints of the limbs should be large and clear, and the large round feet substantial, smooth, shortened at the toes and well arched below, without any trace of thinness or flatness.

THE SHIRE HORSE.—*Points in which the Shire differs from the Clydesdale.*—The best types of Shire horses differ little in points from Clydesdales except in their greater massiveness (which gives them a great advantage in money value) and their lack of finished quality, especially seen in the heavier head and coarser legs and feet. As the shoulders are not so well laid back, a great many of the breed are deficient in the splendid action for which the Clydesdale is noted. The objects striven for are the same in both, although in some particulars the one strain has got a little ahead of the other, and *vice versâ;* "size, soundness and substance" are wanted, with "good feet, good legs, good walking action and a robust constitution."

THE SUFFOLK PUNCH.—The Suffolk Punch was named from its native County and from the thick-set body and short legs of the early form of the present breed, which has during the process of its evolution gained a height approaching that of the modern Clydesdale. Its most conspicuous points of difference from the Shire and Clydesdale are its chestnut colour and its freedom from the abundance of long hair on the legs. The absence of long hair makes the Suffolk Punch look too heavy for its limbs, but the bone is of good, hard quality and stands the test of hard work. The breed is also famous for fruitfulness and longevity—one mare on record having bred till she was 37 years old— and for a docile but courageous disposition and even-tempered willingness to work.

History of the Breed.—The revised historical notice issued by the Society in 1902 carries the improvement of this ancient breed, of Norman and Old-English descent, back to 1764, when Andrew Blake introduced Farmer (174) and advertised him as a Lincolnshire trotting stallion.

The breed is also notable for the power of doing well on little food, working long hours without a meal; and of continuing to work to a greater age than any other draft breed. The latter quality it probably acquired or strengthened by a Thoroughbred connection which it had in Barber's Procter (58), who was "the son of Winter's Storm, a trotting horse of great substance, son of Gooch's Bloodhorse, brother to "Thunderbolt.".....

The Board of Agriculture and Fisheries publishes the following list of Horse-Breeding Societies in Great Britain, with indications regarding Horse Shows, Sales and recent prices:

List of Breeding Societies of Horses		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Cleveland Bay .	Cleveland Bay Horse Society of Great Britain and Ireland. Secretary: Thomas Curry, Field House, Marton, Yorkshire.	Shows:—Royal Agricultural Society, Yorkshire Agricultural Society, Cleveland, Stokesley, Hinderwell and Egton.	Stallions: From £100 to £200. Mares: From £50 to £100. There are no fixed public sales.
Clydesdale. . .	Clydesdale Horse Society of the United Kingdom. Secretary: A. Mac Neilage, 93, Hope Street, Glasgow.	Sales at Perth, Elgin, Lanark, Ayr, Carlisle and Wigton (Cumberland). Shows:—Royal Agricultural Society, Highland and Agricultural Society, Glasgow, Edinburgh, Aberdeen, Kilmarnock and Ayr.	At a recent Joint Sale held at Perth, 59 head averaged £40 9*s.* 8*d.*, and at Seaham Harbour 45 head (of which 26 were foals) averaged £37 4*s.* 1*d.* At certain other sales in 1909, 21 head (of which 19 were stallions) averaged £102 2*s.*; 22 head of mares and fillies averaged £97 5*s.* 4*d.*; 11 mares and fillies averaged £55 2*s.*; and 41 mares and foals averaged £50 3*s.* 1*d.* A large export trade was done in 1909, chiefly to Canada.
Hackney . . .	Hackney Horse Society. Secretary: Frank F. Euren, 12, Hanover Square, London, W.	Annual London Hackney Show at the Royal Agricultural Hall, London.	No record is obtainable of the prices at the Annual London Hackney Show, but at various Annual Stud Sales in 1909 the average price varied from £57 to £95 per head.

List of Breeding Societies of Horses		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Hunters and Polo Ponies.	Hunters' Improvement Society and Polo and Riding Pony Society. Secretary: A. B. Charlton, 12, Hanover Square, W.	Sales by auction are held in London, York, Leicester and other towns.	For useful Hunters, from 40 to 100 guineas. For good Hunters, from 100 to 300 guineas. For Polo Ponies, prices similar to the above. At private sales the average prices of Polo Ponies ranged from 75 guineas to 100 guineas. At an unreserved sale of Polo Ponies held in 1908, 14 Saddle Ponies averaged 77 guineas, and 43 head of Young Stock averaged $32^{1}/_{2}$ guineas.
New Forest Ponies	New Forest Ponies Association. Hon. Secretary: Thos. Stobold, Harrow Farm, Bransgore Christchurch.	An Annual Show is held at Lyndhurst, Hants. Sales are held at Brockenhurst, Lymington, Ringwood and Lyndhurst.	Information as to average price is not available.
Shetland Ponies.	Shetland Pony Stud Book Society. Secretary: R. W. Walker, 3, Golden Square, Aberdeen.	Shows:—Highland and Agricultural Society, Royal Agricultural Society, Royal Northern Agricultural Society, Lerwick Agricultural Association, Tunbridge Wells Show, Polo Pony Show.	The average price for stallions, mares, colts, fillies and foals obtained at the Joint Annual Sale held in Fife in 1909 was £23 2*s.* 7*d.* In Shetland good mares can be bought for £20. Non-pedigree mares for £10 to £12.

List of Breeding Societies of Horses		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Shire	Shire Horse Society. Secretary: J. Sloughgrove, 12, Hanover Square, London, W.	Shire Horse Society's Show at the Royal Agricultural Hall, London; sales are also held at Crewe, Wrexham, Derby and Peterborough.	The average price obtained for 153 horses at the Society's Show at the Royal Agricultural Hall, in 1909, was £113 2*s.* per head. Detailed prices were as follows:— Highest Price. £ *s.* — Average Price. £ *s.* 9 Stallions, 1 year old 136 10 — 77 0 27 » 2 » » 420 0 — 134 19 24 » 3 » » 273 0 — 128 16 12 » 4 » » 866 5 — 152 3 8 » over 4 » » 231 0 — 114 17 9 Fillies 1 » » 89 5 — 59 1 14 Mares 2 » » 315 0 — 102 2 14 » 3 » » 462 0 — 105 2 4 » 4 » » 231 0 — 130 4 28 » over 4 » » 220 10 — 104 10 4 Geldings . . . . 78 15 — 64 12
Suffolk	Suffolk Horse Society. Secretary: Frederick Smith, Woodbridge, Suffolk.	Annual Sale at Ipswich. Shows:—Woodbridge Spring Show, Suffolk Agricultural Show, Essex Agricultural Show, and Royal Agricultural Show.	Estimated average prices for sound animals:—Foals, 25 guineas; Mares and Fillies, 65 guineas; Geldings, 53 guineas; Stallions, 100 guineas.

List of Breeding Societies of Horses		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Welsh Pony . .	Welsh Pony and Cob Society. Secretary: John R. Bache, Stud Farm, Knighton, Radnorshire.	Shows:—Royal Agricultural Society Show, Polo Pony Show, London Spring Show and various shows throughout Wales and at Wrexham and Crewe.	From £50 to £100 is obtained for small male animals and from £40 for females.
Yorkshire Coach	Yorkshire Coach Horse Society. Secretary: Frederick Walker, 3, Blake Street, York.	Shows:—Royal Agricultural Society, Yorkshire Agricultural Society, Malton, Escrick, Whitby, Pocklington and Stokesley.	These horses are now in the hands of comparatively few owners; there are no public sales so that no record of prices is available.

The General purpose Horse. — *Mark Lane Express*, London, January, 1910.

Writing on the breeding of horses in England the Author expresses the opinion that the tendency to specialise has been carried to an excess in the United Kingdom. The result is that a type of horse is bred which is only adapted to a very limited sphere of utility.

The Traffic in Decrepit Horses to the Continent. — *The Farmer and Stockbreeder.* London, April 1910.

The Author studies the traffic in decrepit horses between England and the Continent, more especially the Antwerp market, and enquires into the causes of the bad usage to which these animals are subjected. He proposes that a remedy be found in concerted action between England and Belgium.

Exportation of Horses to Belgium or the Netherlands. — *The Farmer and Stockbreeder.* London, April 25, 1910.

The Board of Agriculture and Fisheries have issued an Order for the rigorous application of the Exportation of Horses Order of 1898.

Before being shipped these must be visited by a veterinary surgeon whenever the authorities shall deem it necessary in order to prevent cruelty to old horses and losses in the horse trade with Belgium and Holland.

H. W. Percy. **Sulphur Poisoning in Horses.** — *Exper. Stat, Rec.*, vol. XXII, May 1910, N° 6. Washington.

An account of poisoning of horses by sulphur. The Author considers sulphur very poisonous if given in quantities larger than 8 oz.

Robert Wallace. **Beef Breeds of Cattle.** [Board of Agriculture and Fisheries. *British*].—*Breeds of Live Stock.*—London, 1910, p. 1-137.

The following are some extracts from this important official publication in the part regarding Cattle:

The Shorthorn. (1)—*Origin of the Shorthorn.*—The Shorthorn, sometimes referred to as "the one cosmopolitan breed," is descended from the old North-East of England cattle, which were known by tradition to exist in the four adjoining counties of Northumberland, Durham, York and Lincoln, before it centred, with Darlington as its capital, in the counties of Durham and York. Between these counties flows the River Tees, and thus "Teeswater" was one of the early names of the breed, which was also known as the "Holderness," "Yorkshire" and "Durham." After the designation of Shorthorn had been universally adopted in Great Britain, the name Durham lingered in North America, and it is still in common use in France and Argentina. The traditional Shorthorn possessed dual-purpose qualities of conspicuous merit, and it is believed to have had a crossbred ancestry as a result of mating, over 200 years ago, imported bulls of superior type from Holland and Denmark with cows of an earlier English breed.

Weight.—The ancestral breed was longer in the limbs, heavier, coarser, and slower in coming to maturity than the modern Shorthorn. Shorthorn cows of the flesh-producing type probably average when in prime breeding form, about 1 400 lb., while in full flesh they run up to 1 800 lb., and a few even to 2 000 lb. Old bulls when fat may scale 2 800 lb.; but a good average, and preferable, weight is about 2 000 lb.

Early Exportation to America.—For a number of years before this time numerous importations of good Shorthorns had been made into America, and many prices rising into four figures in dollars had been realised by the importers. The first attempt at an establishment of an American pedigree registry or herd book was locally made by L. F. Allan, of Black Rock, N. Y., in 1846. The second volume, extending to the whole country, appeared in 1855, and the publication remained a private enterprise until purchased in 1883 by the American Shorthorn Breeders' Association.

The highest Shorthorn prices were reached in 1873, when, at New York Mills dispersal sale, five animals realised \$25 000 (£5 210) or above. The 8th Duchess of Geneva was knocked down at \$40 600 (£8 460) but a misunderstanding was got over by the

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(1) See *History of Shorthorn Cattle.* Edited by James Sinclair, London—Vinton and Co, Ltd., 1907; *Farm Live Stock of Great Britain,* by Robert Wallace, Edinburgh—Oliver and Boyd, 1907; and *Shorthorn Cattle,* by Alvin H. Sanders, Chicago—Sanders Publishing Company, 1901.

payment of $30 600 (£6 375), the price at which her daughter, 1st Duchess of Oneida, had been sold. 10th Duchess of Geneva was, like the other two cattle, purchased to go to England, at the record price of $35 000 (£7 292). The average for 109 animals was $3 504 ($730), and of these 17 bulls averaged $1 836 (£382), and 92 females $3 813 (£794).

" *Shorthorn Herd Books.*—In the Coates' Shorthorn Herd Book,—which is the record of the United Kingdom—" no bull is eligible for insertion unless it has five crosses, and no cow unless it has four crosses, of Shorthorn blood, which are, or are eligible to be, inserted in the Herd Book."

In France, the last sire in the pedigree must have been born in 1830, or before it, to enable an animal to be entered.

For the Herd Books of Canada and the United States, " the pedigrees of imported animals shall themselves trace and all their crosses to an animal that was either entered or was eligible for entry in Vol. 40 of Coates's Herd Book." Until about five years ago the Volume was No. 20.

For the Argentine Herd Book pedigrees " trace in an unbroken succession of named dams and registered sires to a *named* dam born in or before 1850. In the event of the date of birth of the last named dam being unknown it is then required that her sire shall have been born in or before 1845. No break must occur in the pedigree, such as an unregistered sire or an unnamed dam, or the 'son of' a registered bull, when he himself has not been entered, unless a dam above such break can be proved to have been born in or before 1850.—SINCLAIR. "

THE NON-PEDIGREE SHORTHORN.—*Derived from the same ancestry as the Pedigree Shorthorn.*—The non-pedigree Shorthorn is the direct descendant of the original cattle of the North-east of England which were found on sale in the local markets in that part of the country from week to week during the life-time of the Collings, of the elder Booths and of Bates. It was from these common cattle of Shorthorn type that Thomas Booth and the early Scotch breeders selected the cows with which they mated their improved bulls in the process of forming the comparatively modern pedigree Shorthorn. The common cattle benefited considerably, especially in the early days of Shorthorn development, a century or more ago, by the influence of the refined blood that was widely distributed through the country by the system of hiring out bulls for the season.

The ordinary farmer, looking purely to the commercial side of the question, has at least for a century maintained by selection the two qualities; viz., that of heavy milk-yielding and that of flesh-production at other periods than during the time of lactation, in the cows known by the name of non-pedigree Shorthorns. There is no doubt that the vast majority of these are as pure Shorthorn blood and probably as old as the registered breeds, but they have no paper pedigree and are only bought and sold as common cattle at prices which leave a prospect of a profit in the commercial market for the production of meat and milk.

The town dairies in the neighbourhoods of large centres of population in Northern England and Scotland are mainly supplied by such cows that have not reached their prime, viz., after their fourth or fifth calf, at prices ranging round £20 to £24. The yield in the best dairies averages $3^1/_4$ to $3^1/_2$ gallons per day during the 9 or 10 months period of lactation, at the end of which the cows, having been forced all the while by as much sloppy food as they can consume, are fat and ready to go to the butcher at a price which loses to the dairyman an average of £5 for each animal—a few years ago the loss averaged £8. The yield per stall not infrequently rises to over 1,200 gallons annually.

THE LINCOLN RED SHORTHORN.—The preface of the *Lincolnshire Red Shorthorn Association Herd Register* (1895) states that this breed "is distinguished by its length of frame, good constitution, great hardiness, capacity for milk, and great weight of carcase; 8 to 10 cwts. being usual weights for grass-fed three year old bullocks and up to 24 cwts. for stall-fed cattle."

It is descended from the large dingy breed of the Fens described by Professor Low, mated with improved Shorthorns. In the early days bulls were hired for the season, but females were also employed.

With a very excellent herd of cattle of medium size which "originally came from the neighbourhood of Darlington," Thomas Turnell is believed to have introduced the deep cherry red colour of hair for which the breed is now noted and which enhances its value for exportation, especially to Argentina where it is growing in favour with those who prefer dual-purpose cattle.

THE LONGHORN.-*Recent Revival of Popularity.*-In competition with the Shorthorn for public favour the Longhorn was seriously worsted; and, during the early part of the latter half of the 19th century, the breed was so reduced in numbers as to be threatened with extinction. This danger has passed away, as the herds belonging to the members of the Longhorn Cattle Society number 23, and there are over 500 registered Longhorn cattle in the country.

Improvement in the Breed.—The breed has meanwhile been developed and brought into line with modern requirements in the matter of an improved tendency to early maturity. The hardiness of constitution and power to live and thrive on coarse food have been retained, and this is a great advantage when returns from grazing and feeding cattle are low, and when it does not pay to supply the maximum of concentrated food to fattening animals. The quality of the flesh has been improved in colour, and it now ranks with the best of other breeds. Pure-bred Longhorns and their crosses with beef breeds have during recent years taken creditable positions in the leading fat-stock competitions in this country.

Milking qualities.—The latent milking powers are again developing, and good cows produce from 14 lb. up to 17 and 18 lb. of butter per week on ordinary pasture. The Longhorn-Jersey cross is a good milker.

THE HEREFORD.—*Wide Distribution of the Hereford Breed.*—Hereford cattle, (1) although only a local breed in England, have become almost cosmopolitan in their distribution as the most highly appreciated range breed in Australia and in both North and South America. They hold this proud position on account of the high quality of their marbled beef, the perfection of their feet and limbs, their activity, docility, and hardiness of constitution, together with their adaptability for crossing with other breeds. The larger build, and wonderful tendency to early maturity, of some Shorthorns under highly favourable food conditions may enable them to attain greater weights at two to three years old; but, on the open range as utility animals, Herefords have proved "more prolific and less prone to disease, while they mature earlier, travel better and consequently pay better than Shorthorns, for the reason the surroundings are better adapted to this particular breed."

Origin of the Breed.—The breed is believed to have descended by one side of its ancestry, like the Devon and Sussex breeds, from the old Red cow of Southern England, and, about a century and a quarter ago, it was generally whole-coloured "brown or reddish-brown with not a spot of white."

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(1) See *History of Hereford Cattle*, by Macdonald and Sinclair. London: Vinton and Co., Ltd., 1909.

The North Devon. — *General Appearance of the Breed.*—The North Devons, (1) the "Red Rubies" of the west, spring from a hilly region of limited area in the north of Devonshire. Like the Aberdeen-Angus in Scotland, they are almost perfect in symmetry, and produce beef of the finest quality. While nearly related to the Hereford they most strongly resemble the Sussex breed, and might even pass for a small variety of it, although the general colour is a brighter shade of dark cherry-red. The whole-red colour of the hair is frequently varied by distinct dappled markings; the skin is generally orange-yellow, but inside the ears orange-red.

Value of the Devon Breeds for Semi-tropical Climates.—As a ranching breed the Devon comes next to the range Hereford and the Shorthorn. It is smaller in size than either of those two breeds, and has been found specially suitable to the conditions prevailing in Uruguay and Brazil. In South Africa it is equally successful. Its introduction into Australia in the early days was checked on account of the excessive use of the stockman's long thonged whip. The temper of the breed would not submit to the cruelty perpetrated, and under its influence whole herds became wild and unmanageable. With modern humane methods of handling stock no such difficulty need now be feared, and the North Devon breed will find a place of importance which it can fill to best advantage in competition with other breeds in all the great cattle-rearing countries outside the tropics.

The colour of its skin and hair supplies a degree of natural protection against the sun, which makes the breed more suitable for semi-tropical countries than light coloured breeds.

Milking Qualities.— The original North Devons were a working and grazing breed, but many of the cows in the Somerset and Dorset dairies belong to the larger local types. Although the average cow is only a moderate milker, animals with excellent milking properties now and then appear to indicate that, if and when necessary, the material is there, from which to develop a dairy breed, or, more correctly, a good general purpose cow. The milch cows at present retain their flesh well and fatten into good beef after dropping their fourth or fifth calf.

The South Devon.—The South Devon differs so much from

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(1) See *History of the Devon Breed of Cattle*, by James Sinclair. London: Vinton & Co., Ltd., 1893.

the North Devon of all types, that it ranks as a distinct breed, although some of their ancestors were common to both. The South Devon is the largest general-purpose cow in England, if we except the Shorthorn or class it as an equal. It is coarser than the North Devon, less symmetrical and not so dark in colour.

Value both for Beef and Milk.—Within the last 30 years the South Devon has obtained a well deserved recognition as a general-purpose animal. The breed has spread to the surrounding counties, and there is a growing demand for animals for shipment to South Africa, South America, and the United States. Cows of 900 and 1,000 gallons yield of milk per annum exist in the best herds, and a Smithfield steer from Coombe near Kingsbridge, under two years old, scaled 1 190 lb., a daily increase of 1·78 lb.

The Sussex.—The Sussex breed reared on the heavy Wealden clays of the county from which it derives the name, although probably more directly related to the North Devon, resembles in size and quality the type of the South Devon. The Sussex is, however, purely a beef producer in high favour with local graziers, being second to none as regards early maturity and weight for age. The colour of hair is a much darker red than that of either the North or the South Devon and is at times almost black.

Value for Beef Production and Draught Purposes.—The Sussex, though superior to the North Devon in size and strength, lacks something of the neatness of the smaller animal, but the additional weight was in the favour of the bullocks as draught animals on the heavy clay soils of their native and adjoining counties. A famous ox from Burton Park, near Petworth, was recorded to be $16^1/_2$ hands high, girth behind the shoulders 10 ft,, and weight 287 st. 4 lb. It is claimed that "for beef production, draught purposes, hardiness, early maturity, beautifully fine-grained flesh, and ability to thrive on poor fare, few breeds can equal the Sussex."

As a beef producer the breed's record is good. At Smithfield Fat Stock Show in 1902, the first prize Sussex steer under two years gave the highest average daily gain of any animal in the Show, *i. e.*, 2 lb. 8·34 ozs., with 68·02 per cent. of carcass to live weight—a weight in excess of that of any other specimen of the same age present.

The West Highland.—*Origin.*—The West Highland or Kyloe, the native cattle of the Western Islands and Highlands of Scotland, is the shaggiest and hardiest of all British breeds, closely related to the gigantic white Caledonian bull which existed in its feral state in the primeval forests of the country. From among animals of many colours common to the breed swan-white sports with black points, similar to those of the wild park cattle, now and then appear to indicate their ancestral connections. One of the four remaining wild herds, that at Vaynol Park, Bangor, North Wales, but originally from Blair Atholl, Perthshire, was regenerated and saved from extinction by the introduction of pure-white West Highland blood.

Suitability for Severe Climates.—Its exceptional robustness of constitution and numerous good qualities will in time also find it a conspicuous place in our Colonies and in foreign countries such as the exposed South-Western parts of Argentina, when the relationship of the animal constitution to varying conditions of soil, climate and other natural surroundings are more fully investigated and better understood.

The Welsh Black Cattle.—Welsh Black Cattle are now the sole remaining breed of importance out of several that once existed in the Principality. They are natives of Carmarthen and all the western seaboard counties from Pembroke to Anglesea. Up till 1904, when Wales Herd Registers were united, there were supposed to be two breeds or types which differed in certain characteristics although mainly sprung from a common origin. The breed as a whole is noted for hardiness of constitution, aptitude for dairying purposes, and docility.

Black Welsh cattle have been much improved by selection within the last quarter of a century, and their constitutional vigour has not been weakened by in-and-in breeding. Their hardiness and other good qualities single them out as belonging to a type of general-purpose animal that would suit the pioneer settler in a new country; for the oxen have been for generations as noted in the yoke as the cow at the milk-pail and the " runt " as a producer of prime beef.

Gloucester Cattle.—The old Gloucester is a remnant of a superior milking breed which is supposed to have been an offshoot of the heavier and darker but similarly-marked Glamorgan cattle, that are now extinct, but were at one time numerous in the cheese-making districts of Gloucester and some of the adjacent counties, The milk, being rich in cream in small globules, was especially suited for cheese-making. The breed in a pure state has been preserved from extinction by the Dukes of Beaufort at Badminton, and some five or six other breeders own specimens of it more or less pure.

Red Polled Cattle.—*Milk Records.*—The Red Polled Society of Great Britain and Ireland was formed in 1888. Its regulations, formulated in 1899, recognise the dual-purpose qualities of the breed, and provide for the keeping of complete private milk-records of all the cows in a herd and for judging of both milking quality and general appearance. The breed is more noted for abnormally prolonged periods of lactation than for a very high average yield of milk and butter. The old herd of Mr. R. Harvey Mason, Necton Hall (43 cows, including 14 heifers), has yielded in one year an average of 203·12 pounds of butter fat—the best cow giving 4·41 per cent. of butter fat and yielding a total of 369·82 lb. The best heifer gave 10,396 lb. of milk containing 353·79 lb. of butter fat. After her third and last calf dropped in 1890 the cow Crocus during a period of nine years and four months yielded 50 427 lb. of milk, with 4·3 per cent. of butter fat during the last five years.

Lord Rothschild's herd of 37 cows gave in one year an average of 7 007 lb. of milk, and the best animal, Rosette, an average of 9 508 lb. per annum for 10 years.

Beef Production.—Steer put up to finish at about two years old, when they have stopped rapid growth, fatten quickly, and their carcasses command the highest prices in the London market.

The meritorious character of the breed, extending to the three qualities of colour of hair, milking, and flesh production, singles it out for the increasing favour of foreign and colonial buyers, when the steadily developing qualities are better known. The improvement in the quality in recent years has been remarkable, and Red Polls are steadily growing in popular favour.

The Aberdeen-Angus.—*Origin of the Breed.*—The Aberdeen-Angus breed, now widely distributed over Great Britain and Ireland, hails from the north-eastern counties of Aberdeen and Forfar, and parts of the adjoining counties. The existence of black cattle without horns was recorded in Aberdeen and Banff in 1523, and at the end of last century about half of the superior cattle of the rich-soiled district of Buchan were polled. That district, indeed, is accredited with the possession, from time immemorial, of a large and a small polled breed, both with superior milking qualities.

Milking Properties.—The milk is of superior quality, but the quantity is below the standard of a dairy breed, this matter having been neglected, as the calves were permitted to suck their dams.

Value for Beef Production.—The Aberdeen-Angus is in the front rank of beef-producing breeds in the United Kingdom. It occupies a position among Scotch cattle similar to that of the North Devon among English breeds, for refinement of style, perfection of the rounded type of symmetry, and the excellence of its marbled beef.

Success at Exhibitions.—During recent years no breed has been nearly so successful as the Aberdeen-Angus in open competition with all other breeds for the highest honours at the Smithfield, Edinburgh, and Birmingham Christmas Fat Stock Shows. In 1909 it capped its record by securing the Open Championship of the Show at each, as well as the Grand Championship and the Reserve Number for the best steer of any breed at the Annual International Fat Stock Exhibition at Chicago.

The Polled Cattle Society.—The Polled Herd Book first appeared in 1862, and the second volume in 1872. After the issue of the fourth volume the Galloway section was separated for independent publication. The Polled Cattle Society, established in 1879, has since then undertaken the registration of the breed. The English Aberdeen-Angus Cattle Association, formed in 1900, has for its main object the holding, at Birmingham, of an Annual Spring Show and Sale for bulls, and an Autumn Show and Sale for females, for the convenience of English breeders and buyers. It also gives breed prizes at the leading shows, and generally promotes the interests of the breed.

THE GALLOWAY.—*Origin of the Breed.*—The Galloway is one of the most ancient of the British breeds, hardy and slow in coming to maturity, but admirably suited to the cold and humid parts of the country to which it belongs, viz., the Stewartry of Kirckcudbright and Wigtownshire, a district in the south-west of Scotland which still bears the old name of Galloway,

At one time, before the development and extension of the Shorthorn and the Ayrshire, it was the prevalent breed reared in Southern Scotland west of the Tweed.

Value for Beef Production.—The breed belongs essentially to the class of beef-producers, and the beef is of the finest marbled quality. As the cows generally rear their own calves, few heavy milkers have been noticed, although the quality of the milk produced is excellent.

Suitability for Foreign Countries.—The establishment of a separate Galloway Herd Book in 1877 gave an impetus to improvement, and the breed has secured, in Canada and the Western States of North America, a reputation as range cattle which will doubtless spread to the colder regions of the Argentine Pampas and other countries when the qualities which enable them to resist exposure are more widely known.

The Jersey.—The Jersey breed is the more numerously represented of the two Channel Islands breeds both in this country and in America. The Island of Jersey itself, with its genial southern exposure, has a stock varying in number between 11 000 and 13 000. It is believed that both the Jersey and the Guernsey breeds, long mistakenly classified under the generic name of Alderney, are of French origin. The outstanding superiority of Jerseys as milking cattle dates back for nearly 200 years, and the introduction of foreign blood has been prohibited since 1763 by various "Acts of the States of Jersey," to maintain purity and give protection against disease. Tuberculosis is practically unknown among Island-bred cattle.

Demand for Jersey Cattle in the United States.—About 1853 a great demand for Jerseys sprang up in the United States, and, to retain good animals to breed from for a time, prizes gained by bulls were forfeited if the animals were not kept on the Island for a year. Another American boom in 1882 did much harm to the fountain-head of the breed, as too many meritorious cows were exported at prices ranging between £100 and £300 and some at £500 to £1 060. The highest priced bull was Wolseley, sold for £200. Denmark is now a good outlet for surplus cattle at commercial prices.

Jerseys bred out of the Island are generally more massive and not so deer-like, and when born in colder parts of the world they are able to withstand the less congenial climates better than native Jerseys.

The English Jersey Cattle Society.—The English Jersey Cattle Society (1878) issued the first Volume of its Herd Book in 1879. It instituted butter test classes at shows in 1886, an example which has been widely followed by other countries. At home the annual contests among all dairy breeds, as at Tring, where Lord Rothschild offers prizes, at the Royal Agricultural, Bath and West, Royal Counties, and British Dairy Farmers Shows, are valuable results of the movement.

The Guernsey.—The Guernsey, an offshoot of the Normandy breed, produces larger, stronger-boned, and more robust milch cows than the Jersey, and is capable of yielding beef of excellent quality but for its yellow colour. The Island of Guernsey has a colder and more exposed aspect than Jersey, and this has influenced the hardiness of its cattle. Like the sister island it has been jealous of the importation of live cattle from any other part, with the exception of Alderney, the cattle of which are a strain of the Guernsey, till recently smaller and darker in colour. By free use of bulls from Guernsey the types have become more alike. The cows are docile, but the bulls, like Jerseys, are irrepressible, treacherous and dangerous as they approach maturity, even to the attendants who feed them. They are so massive in the neck that they can only be securely tied by a chain round the horns and through the nose ring,

Butter Production.—Guernsey butter is much deeper in colour than Jersey butter. This has raised the breed in the estimation of dairy farmers in this country, who aim at including one or two Guernsey cows in their herds of Shorthorns or Ayrshires to impart a richer appearance to both milk and butter. An ordinary yield of butter from cows kept in a natural way, is 10 to 12 lb. a week.

Hardiness.—The hardiness and utility of the breed for practical purposes have been well demonstrated by a breeder as far north as Midlothian, who has kept for 19 years a herd, now numbering about 120, bred from the stock of Mr. P. D. Ozanne, Les Pelleys, Captel, Guernsey. After the first winter, the heifer calves run in the fields with merely an open shelter-shed to retire to at will until they come into profit at two years and three months old. The average annual yield of the herd is 700 to 750 gallons of milk, containing 8 ozs. of butter fat per gallon.

Herd Book.—There are between six and seven thousand cattle in the Island of Guernsey; about half are cows and heifers in milk and in calf, and over 1 200 are entered in the Herd Book of the Royal Guernsey Agricultural and Horticultural Society, in addition to those registered by the English Guernsey Cattle Society.

THE AYRSHIRE. (1)— *Origin of the Breed.*—The Ayrshire, the widely-reputed Scotch milch cow, sprang from the northern division of Ayrshire, a humid county on the south-west coast. The evolution of the modern improved breed began between 1750 and 1780.

Value for Milk Production.—The udders of Ayrshire cows that are found winning in the milking classes are practically perfect in form and unequalled in any other breed. The Ayrshire in Great

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(1) See *The Origin and Early History of the Ayrshire Breed of Cattle* by John Speir Newton. Kilmarnock, Standard Printing Works, 1909.

Britain shares with the Dexter and the Kerry in Ireland the credit of being able to yield a greater return of dairy produce on poor land and inferior food than any other breed in the United Kingdom. In many cheese-making dairies, where no attention has been paid to milk records and cows depend entirely on natural pasture during the grazing season, the annual yeld of milk does not exceed 480 to 500 gallons, but 600 and 700 gallons are now aimed at on natural food, and up to 1,000 gallons or more when rich concentrated food is given to increase the flow and extend the period of lactation.

Existence of the Breed in Australia.—The Ayrshire shared with the Shorthorn the distinction of being the foundation stock in the production of the common commercial purpose dairy cow of Australia, which now provides an indispensable supply of butter of the finest texture and quality to our home market. Pure-bred herds also exist in Australasia. In the southern section of the Island Continent the fashionable light-coloured varieties, with gay expanding horns, are in evidence; while in Queensland the earlier type of improved Ayrshire, dark in colour, with lower set and finer horns, is preferred.

THE KERRY AND THE DEXTER.—The Kerry, including its dwarfish offshoot, the Dexter, is the only remaining pure breed of cattle of ancient Irish origin, out of at least four distinct sorts which remained till no very distant date.

Value for Milk Production of the Kerry.—In general outline the Kerry has much in common with the Jersey and the Ayrshire, and conforms to the true milking type. It possesses a well-shaped and capacious udder and is a milk producer of no common order, apart from its capacity to live and do better than most breeds on indifferent natural food. In the records of the London Dairy Show it may be seen that one year eight Kerries averaged daily 36 lb. of milk yielding $3^1/_3$ per cent. of butter fat; another year, twelve gave $25^1/_2$ lb. of milk, with $4^1/_3$ per cent. of fat; and a third lot gave $33^1/_2$ lb. of milk and 3·69 of fat. The general average of milk throughout has been over 3 gallons daily, while in three different years the milk of 32 cows yielded $4^1/_4$ per cent. of fat. A Kerry cow in breeding form should not weigh more than 900 lb. and a bull 1,000 lb. live weight.

THE BRITISH-HOLSTEIN.—British-Holstein cattle are a remnant of the Dutch breed which is numerously represented in America under the name of Holstein Frisians. Before the prohibition of the importation of live cattle into Great Britain except for the purpose of immediate slaughter, milch cows were brought over from Holland in considerable numbers to share with the non-pedigree Shorthorns of the north of England the duty of stocking the town dairies for the supply of new milk to the public of our large cities. The modern animal is not so large as the original Dutch ancestors from the good land lying between and around Rotterdam and Amsterdam, but the true milking type is highly characteristic of the breed.

Value of the Breed.—Although the milking performances of the breed are so good in America that it has produced more than one world's milk record champion, the male calves when steered make good grazing cattle. In South Africa, where it holds a high reputation as a dual-purpose animal in competition with the Shorthorn, it is admitted to be a better forager. By crossing with any of our common breeds, useful milking or grazing beasts can be produced according to whether the selected breed be a milking or a beef-producing variety.

The establishment in 1909 of the British-Holstein Cattle Society will ensure the preservation of the remaining herds in this country and make for raising their standard of milk production.

The following is the list of Societies for the Breeding of Cattle in Great Britain, published by the Board of Agriculture and Fisheries, with indications on shows, prices, etc.

List of Breeding Societies of Cattle		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Aberdeen-Angus.	Aberdeen-Angus Cattle Society. Secretary: James R. Barclay, 9, Old Market Place, Banff, Scotland.	Annual Sales at Perth, Aberdeen, Inverness, Birmingham, Dublin. Shows:—Highland and Agricultural Society, Royal Northern Agricultural Society and Royal Agricultural Society.	At the Perth Sale in 1909, 254 bulls averaged £33 11*s.*, the highest price being £ 273. Females of all ages averaged £30, the highest price being £105.
	English Aberdeen-Angus Cattle Association. Hon. Secretary: Albert Pulling, Beddington, near Croydon, Surrey.	Annual Spring Show and Sale of the Association at Bingley Hall, Birmingham.	At the Birmingham Sale in 1909 the prices were as follows:—For bulls calved before 1st December, 1907, the average of 7 head was £28 19*s.* For bulls calved from 1st December, 1907, to 31st January, 1908, the average of 37 head was £23 6*s.* For 23 bulls calved on or after 1st February, 1908, the average price was £20 9*s.* The highest price at the Sale for a bull was £68 10*s.*
Ayrshire . . .	Ayrshire Cattle Herd Book Society. Secretary; John Howle, 58, Alloway Street, Ayr.	Sales at the principal towns in South-West Scotland, such as Glasgow, Greenock, Paisley, Lanark, Wishaw, Kilmarnock, Ayr, Dumfries, Castle Douglas, Stranraer. Shows:—Highland and Agricultural Society, Royal Agricultural Society, Ayr, Kilmarnock and Glasgow.	Ordinary cows at calving £12 to £18. Young pedigree cows at calving £30 to £50. Ordinary bulls £10 to £20. Young pedigree bulls from £20 to £30. Pedigree Ayrshire bulls and cows are only to be obtained by private treaty from breeders at their farms or at the principal shows.

List of Breeding Societies of Cattle		Principal Places of Sale and Average Prices of Animals of each Breed	
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Devon	Devon Cattle Breeders' Society. Secretary: John Risdon, Wiveliscombe, Somerset.	Taunton and Exeter	At the last sale 119 bulls averaged £26 17*s.* per head, while the highest price was 85 guineas.
Galloway . . .	Galloway Cattle Society. Secretary: Very Rev. J. Gillespie, LL. D., Mouswald Manse, Ruthwell, Dumfriesshire.	Sales at Carlisle and Castle Douglas. Shows, & c.:—Highland and Agricultural Society, Royal Agricultural Society, Dumfries, Castle Douglas, Newton Stewart, Carlisle.	From £18 18*s.* to £26 5*s.*
Guernsey . . .	Royal Guernsey and Agricultural Society. Secretary: H. Carré, States Arcade, Guernsey.	Few animals are sold at sales. .	At a recent public sale, cows averaged £30 each. Young bulls are now selling at about £2 per month of age. Several bulls have lately been sold for from £150 to £200.
English Guernsey	English Guernsey Cattle Society. Secretary: Robt. F. Ling, 12, Hanover Square, London, W.	Sales are held throughout the year, particulars of which can be obtained from the Secretary.	About £35.

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Hereford . . .	Hereford Herd Book Society. Secretary: W. G. C. Britten, 20, East Street, Hereford.	A show and sale of Bulls is held twice yearly by the Society in the Cattle Market, Hereford. Shows:—Royal Agricultural Society's Show and all the principal Live Stock Shows of England. Royal Dublin Society.	Bulls, from £21 to £105. At the last sale 189 bulls averaged £32 3*s*. per head. There are generally sales by auction in the autumn of each year in Herefordshire and the neighbouring counties. About 250 bulls, chiefly yearlings and 2 year old, are offered for sale at each of the Society's shows, and most are sold subject to the passing of the tuberculin test.
Highland . . .	Highland Cattle Society of Scotland. Secretary: Duncan Shaw, 15, High Street, Inverness.	Sales at Oban, Stirling, Perth, Inverness, Dingwall. There are various local shows in Inverness, Perth, and Argyle where Highland cattle are always exhibited.	Pedigree Bulls above 3 years £26; 2 year old Pedigree Bulls £28; Yearling Pedigree Bull £18; Pedigree Cows and Heifers £12. Non Pedigree Stock: Bulls £ 15 to £25; Cows and Heifers £9 to £15.
Jersey	Royal Jersey Agricultural and Horticultural Society. Secretary: J. A. Perrée, 8, Church Street, Jersey.	Show Ground, Jersey.	—

List of Breeding Societies of Cattle		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Jersey—*continued.*	English Jersey Cattle Society. Joint Secretaries: Messrs. T. W. Hammond & L. J. Craufurd, 19, Bloomsbury Square, London, W. C.	Shows:—Royal Agricultural Society, Bath and West Society, Royal Counties Society, Tunbridge Wells Society, Tring Agricultural Society, London Dairy Show, and the various County Shows. It is intended in the future to carry out public sales at various centres under the Society's auspices.	Sales are mostly carried out at the owner's estates and farms. Yearling bulls of quality readily make £21 and upwards, and cows and heifers in milk £21 to £26 5*s.* and upwards. The average price obtained at public auctions in 1909 for 627 head of pedigree cows, heifers and bulls was £16 12*s* 2*d.*
Kerry and Dexter	English Kerry and Dexter Cattle Society. Joint Secretaires: Messrs. Hammond & Crauford, 19, Bloomsbury Square, London, W. C.	Shows:—Royal Agricultural Society, Bath and West, Royal Counties, Royal Dublin, London Dairy Show.	Prices vary, but fair specimens may be obtained for from 15 guineas upwards.
Longhorn . . .	Longhorn Cattle Breeders' Association. Secretary: H. B. Parsons, Estate Office, Eastwell Park, Ashford, Kent.	Shows:—Royal Agricultural Society, Warwickshire Agricultural Society.	25 guineas to 45 guineas. At private sales prices for yearling young bulls reached 28 guineas and for heifers 35 guineas.

List of Breeding Societies of Cattle		Principal Places of Sale and Average Prices of Animals of each Breed			
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices		
Red Poll . .	Red Poll Cattle Society of Great Britain and Ireland. Secretary: Herbert P. Blofield, Morley Manor, Wymondham, Norfolk.	Spring and Autumn Sales at Ipswich. Shows: — Royal Agricultural Society, Essex Agricultural Society, Norfolk Agricultural Society, Suffolk Agricultural Society, London Dairy Show.	At the last Ipswich sale 98 cows and heifers averaged £23 11*s*. 7*d* per head, the highest price being £47 15*s*. 6*d*., and 34 bulls averaged £17 19*s*. 9*d*. per head, the highest price being £35 14*s*. At a recent sale held by one owner the prices of cows and heifers averaged £24 18*s*. 4*d*., and of bulls £36 18*s*., the maximum prices being £73 and £64 respectively.		
		Principal Collective Public Sales	Number of Animals offered	Number sold	Average Price
Shorthorn . . .	Shorthorn Society of Great Britain and Ireland. Secretary: E. J. Powell, 12, Hanover Square, London, W.	*February.*			£
		Royal Dublin Society's Show . .	110 Bulls	85	28
		Inverness Collective Sale . . .	139 »	102	22
		Perth » » . . .	141 Cows, 378 Bulls	365	39
		Aberdeen » » . . .	53 » 321 »	279	20
		Carlisle » » . . .	10 » 122 »	58	25

List of Breeding Societies of Cattle		Principal Places of Sale and Average Prices of Animals of each Breed			
Breed	Name of Society and Address of Secretary	Principal Collective Public Sales	Number of Animals offered	Number sold	Average Price
Shorthorn—*continued.*	Shorthorn Society of Great Britain and Ireland—*continued.*	*March.*			£
		Birmingham Show and Sale . .	296 Cows, 497 Bulls	501	45
		Darlington » » . .	47 » 109 »	122	30
		Penrith » » . .	10 » 88 »	74	30
		York Collective Sale.	147 Bulls	128	28
		Belfast Show and Sale	157 Cows, 303 Bulls	396	20
		Kingham (Oxfordshire) Collective Sale.	56 » 27 »	81	25
		April.			
		Royal Dublin Society's Show. .	46 Cows, 358 Bulls	189 Bulls	36
		May.			
		York Collective Sale.	125 Cows, 71 Bulls	190	22
		June.			
		Royal Agricultural Society. . .	70 Cows, 125 Bulls	111	75

List of Breeding Societies of Cattle		Principal Places of Sale and Average Prices of Animals of each Breed			
Breed	Name of Society and Address of Secretary	Principal Collective Public Sales	Number of Animals offered	Number sold	Average Price
Shorthorn—*continued.*	Shorthorn Society of Great Britain and Ireland—*continued.*	*September.*			£
		Birmingham Show and Sale . .	138 Cows, 142 Bulls	240	23
		Irish Shorthorn Breeders' Association Sale (Dublin).	50 » 11 »	54	18
		October.			
		Kingham (Oxfordshire) Collective Sale.	72 Cows, 38 Bulls	99	27
		Perth Collective Sale . . .	62 » 15 »	44	25
		Old Meldrum » » . . .	84 » 16 »	72	32
		Aberdeen » » . . .	149 » 43 »	121	40
		Inverness » » . . .	123 » 15 »	92	27
		York » » . . .	66 » 85 »	123	23
		Penrith » » . . .	68 » 44 »	91	22
		Darlington » » . . .	83 » 113 »	148	31
		[Many Public sales are also held by breeders on their Farms].			

List of Breeding Societies of Cattle		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Shorthorn—*continued.*	Dairy Shorthorn (Coates's Herd Book) Association. Secretary: F. N. Webb, Babraham, Cambridge.	Shows:—Royal Agricultural Society, Dairy Show, Royal Counties Society, Bath and West Society, and other agricultural shows.	Average prices at last sale, £60 to £63. Dairy Shorthorns are nearly always bought direct from breeders by private contract. Prices range from about £50 per head up to £500 for both males and females.
	Lincolnshire Red Shorthorn Association. Secretary: W. Frankish, St. Benedict's Square, Lincoln.	Shows:—Royal Agricultural Society Show, Lincolnshire and Peterborough Agricultural Shows, and London Dairy Show. Sales at Lincoln.	At a sale held at Lincoln in 1909, 236 bulls averaged £28 10*s.* 4*d.* per head. The highest individual price was 165 guineas.
South Devon.	South Devon Herd Book Society. Secretary: Alfred Michelmore, Gate Huse, Totnes, S. Devon.	Shows:—Royal Agricultural Society, Bath and West, Devon County, Royal Cornwall, Smithfield Club. Annual Sales of the Society at Totnes in April and October.	Price of bulls varied from 40 guineas to 70 guineas; heifers from 20 guineas to 30 guineas. At a private sale a fat steer, aged 1 year 11 months, live weight $17^3/_4$ cwt., was sold for £43 10*s.*

List of Breeding Societies of Cattle		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Sussex	Sussex Herd Book Society. Secretary: A. G. Holland, 12, Hanover Square, London, W.	Annual Spring and Autumn Sales of Pedigree Stock are held at Haywards Heath, and there are various private sales.	At the Spring Sale, 1909, 23 bulls averaged £26 7*s*. 9*d*. per head, the ages of the animals varying from 2 years 9 months to 6 months, At the Autumn Sale, 1909, 14 bulls averaged £19 6*s*. per head, the ages being from 1 year 9 months to 6 months; the average price for 3 cows was £33 19*s*. and for 4 heifers under 2 years, £18 7*s*. 1*d* At various private sales the average prices for cows varied from £18 to £32; for bulls from £19 to £53. Best individual prices: Bulls £141 15*s*; Cows £63.
Welsh Black .	Welsh Black Cattle Society. Secretaries: Messrs. J. Thomas & Son, 9, Victoria Place, Haverfordwest.	Royal Agricultural Society's Show, Welsh National Show and Sale at Aberystwyth, Whitland (S. Wales) Annual Show and Sale.	The average price of bulls at the last Welsh National Show and Sale was 23 guineas, and at the last Whitland Annual Show and Sale £16 10*s*.

THOS. MCROW. **Cattle at the Gloucester Show 1909.**— *The Journal of the R. Agric. Soc. of England,* Vol. 70, 1909, pp. 163-192.

In 1909 the seventieth "Royal" show was held at Gloucester.

Cattle.

This section comprised 114 classes in which 1146 animals were entered. This large number of exhibits has only once been exceeded, viz, at the Windsor show of 1889. There were no less than 423 Shorthorns among which a very strong class of Dairy Shorthorns, both for flesh and milk combined. The Herefords, Devons and South Devons were also very well represented. The Aberdeen Angus and the Galloway were not well represented as to numbers, but the quality was of high average.

The Ayrshire, Jersies, Kerry and Dexters contained animals of great merit.

Sheep.

The entries of sheep—833 in 108 classes—were the largest since the Windsor Show in 1889. The Shropshire were the most numerous with 115 entries, next came the Hampshire Downs with 90, Southdowns with 79 and the Kent or Romney Marsh, a breed which continues to make progress, also with 79, the Oxford Downs with 57.

Besides the above. Dorset Horns Ryelands, Kerry Hill, Lincolns, Leicesters, Border Leicesters, Wensleydales, Cotswolds, Devon Longwools, South Devons, Dartmoors, Exmoors, Cheviots, Lonks, Hardwicks, Welsh Mountain and Blackface Mountain were all represented by very fine animals, some of them of quite exceptional merit.

Pigs.

The number of classes, thirty-six, in this section was the same as in 1908, but the entries, 433 broke all records.

The Large Whites were exceptionally well represented by 84 entries. The Middle Whites were the best and most uniform of recent years. The Tamworths were very good and the Berkshires were the best seen for quite fifteen years. The Large Black were as a whole excellent, both as to merit and number. The Lincolnshire Curly-coated was also well represented.

The Shorthorn Society. — *The Farmer and Stockbreeder.* London, 27th June 1910.

At the annual meeting of the *Shorthorn Society* (which numbers 586 life members and 1103 ordinary members) a paper was read stating that the Reserve Fund amounted to £10 000 and that during the year 802 heads of cattle belonging to this breed had been exported for crossing and breeding purposes.

Of this number 609 were shipped for South America, 191 for South Africa, 40 for the United States, 25 for Canada, etc.

An appeal was made to all the members to promote the interests of the breed and to prevent animals that were not full blood Shorthorns being sold abroad under this famous name.

Birmingham Shorthorns Show and Sale. — *Mark Lane Express.* London, March 1910.

At the second spring show of Shorthorns held at Birmingham this year (1910) the highest prices ever known were obtained. A young bull was purchased by a South American for 700 guineas, and another, purchased by an English breeder reached the incredible price of 1000 guineas.

High Prices for Shorthorns at Perth. — *Mark Lane Express.* London, February, 1910.

474 head of cattle were offered at the show ot Shorthorns held at Perth. Prices ruled much higher this year than last: Whereas the highest price obtained last year was 80 guineas, this year 220 guineas were paid. The prices paid for breeding stock and calves were in proportion, that is to say they were three times what they were last year.

Channel Islands and Shorthorn breeds, crossing Jersey and Guernsey Cows. — *The Dairy.* Vol. XXII, n. 257, 128. London, May 15, 1910.

It is contemplated by careful grading and selection to secure a cross combining the heavy-milking qualities of the Shorthorn breed with the rich fat-contents of the milk of the Channel Islanders. As regards butter production it is shown that the Shorthorn yield of butter per 1000 lbs. live weight was 189 lbs. per annum, while that of the Jersey per 1000 lbs. live weight was 290 lbs.

From the mixing of the milks is obtained more butter yield than separately, and estimating the value of the butter at 1 s. 3 d. per lb., it is shown that the addition of one Jersey to every five Shorthorns causes the butter-making value of the mixed milk to be increased 18,11 per cent.

J. MACDONALD and J. SINCLAIR. **History of Hereford cattle.** — (London, 1909, rev, ed., pp. XVI+501, pls. 31). *E. S. R.*, May 1910.

A new edition of this well-known work, first published in 1886, revised and enlarged to include an account of the recent development of the breed.

J. WILSON. **The Evolution of a Breed of Cattle.** (Aberdeen-Angus Breed) — (*Mark Lane Express*, 102 (1909), no 4068, p. 293) *E. S. R.*, XXI, Dec. 1909.

This is an abstract of a paper read before the British Association at Winnipeg, 1900.

The Aberdeen-Angus Breed is used to illustrate the fact that nearly every breed of cattle is the result of crossing several breeds. The races which may be considered as factors in the origin of this breed are the Urus, the black Celtic brought to Britain before the Urus became extinct in the Bronze Age, the brown race of the Romans, and the hornless breed of the Norsemen. In the eighteenth century many large Dutch-flecked cattle were taken to the northeast of Scotland and crossed with the native stock, thereby increasing the size. When in the middle of the eighteenth century a demand for hornless cattle arose in England, the large horned cattle were crossed with the Norse hornless, finally resulting in the modern Aberdeen-Angus stock.

ERNEST MATHEWS, ex-Pres. of the English Jersey Cattle Society. **Jersey Cattle.** — *The Standard Cyclopedia of Modern Agriculture*, vol. VII, Gresham Publ., London, 1910, p. 189.

The cattle in the island of Jersey stand out from all other breeds of cattle in two particulars 1) that in purity of descent they are *facile princeps;* 2) that the milk yielded by the cows contains a larger percentage of fat than that from any other breed in Great Britain. It is obvious that this richness of milk is connected closely with the purity of the breed, which latter is accounted for mainly by the fact that from its insular position Jersey has been able to control the importation of animals from without, and so maintain that purity, which is so unquestionable that even now, after the lapse of forty-two years, no cows in the island are disqualified for entry in the herd book on the ground of being crossbred. Three other causes, however, contributed to make the Jersey cow what she is to-day: 1) Jealousy of the French, who in former days exported Brittany cows to England, where they were sold as coming from Jersey; 2) the Constitution of the island, which enabled the States to pass Acts of Parliament without consulting the English authorities; and 3) the careful attention given to the milking and butter-producing qualities of the cattle by the farmers and breeders on the island.

That Jersey cattle were until recently, and indeed still are, called Alderneys is explained by the fact that for a good many years the Channel Island steamers used to call at Alderney last on their voyages to England, from which they got to be known as the Alderney Packets, and as a natural consequence the cattle on board were called Alderneys.

The Jersey is the best and most economical cow for butter production. The quality of her milk is the richest, about 18 to 19 lb. of milk only being required to make 1 lb. of butter, while for sustaining her flow of milk the Jersey cow has no equal. The average yields of butter which may be expected from Jersey cows in a year are given in "Jersey Cattle, their Feeding and Management" (Veritas & Co., London 1903), as follows: Cows under five years old, 260 lb.; cows five years and over, 320 lb. As milking cows, their yields average from 400 gal. as heifers to 900 gal. as cows, though of course there are herds where these figures are exceeded.

The average weight of the Jersey cow is about 850 lb. In England they are apt to grow coarser in bone and heavier than on the island of Jersey, which has been attributed to the fact that the island is on a granite formation. Being essentially dairy cattle they do not pretend to be of much use to the butcher—indeed a Jersey cow showing an aptitude to fatten would be discarded as a useless animal, the conformation of the dairy cow being opposed to the putting on of flesh.

The total number of cattle in Jersey may be put at a little over 11 000, of which 6000 are cows and heifers in milk. In England it is impossible to give the numbers accurately; but as there are over 500 members of the English Herd Book Society the number of pedigree Jerseys in England will not be far short of nine or ten thousand.

There are no special markets for Jersey cows in England, the trade being usually done through dealers in the island and in this country. Pedigree sales of Jerseys are held frequently in different parts of England, but usually these are confined to the particular breeder's herd. The export trade from Jersey is considerable: England takes about 1000 animals every year; Denmark has lately reached about 900; while the United States imports for 1907 reached 461. About 100 are sent annually to France.

ROBERT WALLACE. **British Breeds of Sheep.** [Board of Agriculture and Fisheries]. *British. Breeds of Live Stock.*—London, 1910, p. 1-137.

The following are some extracts from the important publication of the Board of Agriculture and Fisheries, in the part regarding Sheep.

British Sheep are classified as horned and hornless, black-faced and white-faced, mountain and lowland, long-wools and short-wools, long-tailed and short-tailed. There are no fat-tailed or tail-less sheep in this country. Two is the usual number of horns, but a remnant of the polycerate sheep, with four or more horns, exists in the Western Islands of Scotland and, as ornamental sheep, in a few enclosed parks. The sheep, like the goat, has two teats, and the usual number is one lamb at a birth, though two, three, and even five are not uncommon.

THE CHEVIOT.—The name is derived from the rounded green hills on the Scotch and English Borders which are the native home of the breed. Throughout Scotland, Cheviot ewes are kept on the lower green hills, while Blackface Highland ewes occupy the higher, black or heathery land. Many Cheviot ewes are sent, when about five years old, to lowland grazings in both England and Scotland, to breed lambs by Down and Long-wool rams, for the fat market or to fatten into tegs. Cheviot wether hoggets are in high favour with the butchers in spring, not only because of the excellence of the quality of the mutton and the great size of the gigot, but for the thickness of the neck which makes a carcass look well hanging in a butcher's shop.

THE SCOTCH BLACKFACE BREED.—The Scotch Highland Blackface is smaller and hardier than the Cheviot, and it thrives better on moory pasture and heathery land. Crosses by softer-constitutioned sheep brought from the lowlands speedily get wiped out by natural selection in stormy seasons. The allied varieties are (1) The Scotch Highland Blackface, (2) The Lonk, (3) The Rough Sheep, (4) The Dales (such as the Swaledale), (5) The Derbyshire Gritstone, (6) The Penistone, and (7) The Limestone breeds. The two last have undergone striking changes from the dark or mottled face and legs to white.

Value as a Meat Producer.—The mature mutton of three to five-year-old wethers, weighing 15 to 16 lb. per quarter, is of the finest quality, especially after hanging for a week or ten days. Although lambs direct from their mothers, weighing 25 to 30 lb. of dressed meat, are the tenderest and sweetest, the highest-priced mutton in the market is that produced by Blackface wether lambs weighing 36 lb., that have been fattened on good forage or aftermath after weaning. Mutton under 9 lb. per quarter is too small for the best customers.

The Blackface Sheep is wild and active, and, to thrive well on natural pasture, must travel a good deal; nevertheless, no breed is more suitable for house-feeding either in the case of ram lambs for breeding or of cast ewes being fed fat.

Character of the Wool.—The wool is wavy, loose and shaggy, nearly touching the ground; stronger and more hairlike and kempy than Cheviot wool. It is mostly used in carpet-making. The fleece averages $3^1/_2$ to $4^1/_2$ lb. for ewes, up to 5 lb. for the best mountain ewe flocks, and 7 lb. for wethers. Black or blue spots on the neck, tail, or other parts of the wool-producing part of the skin are objectionable.

An exceptionally strong-woolled variety of the breed has been developed during the last 35 years by Mr. Charles Howatson, of Glenbuck, and other breeders following his lines, sheep of this strain, receiving a liberal supply of food, produce immense fleeces. During recent years it has come to be widely believed that the long strong wool has been carried too far: especially when associated with the fashionable short-legged Showyard Sheep it is a serious disadvantage in snow and a danger to the first lambs of young ewes, as they may fail to find the mother's teats. The advocates of fine wool versus strong wool do not want a short dense coat like that of a Cheviot sheep, but a thick-set mellow wool, of good length and as uniform as possible all over the body. Sheep continue to yield heavy fleeces of this class of wool when they are aged.

THE DERBYSHIRE GRITSTONE BREED.—The Derbyshire Gritstone or Dale-o'-Goyt breed was promoted to a position of prominence in October, 1906, by the formation at Bakewell of the Derbyshire Gritstone Sheep Breeders Society. The name indicates the geological formation on which they have been bred pure for more than 100 years in the bleak hills and dales of the Peak of Derbyshire. The breed is dark or mottled on the face and legs. In size, general appearance, and hardiness it resembles the Herdwick more than any other breed, but, on the best authority, it is quite distinct—an assertion which is strongly supported by the absence of horns and the quality of wool, which is the shortest, closest, and finest of all mountain wools. The wool brings a high price, notwithstanding the occurrence of black patches, especially from about the belly, thighs and rump. The ewes are splendid mothers, and the lambs feed quickly into the finest mutton, not over-fat.

THE LIMESTONE BREED.—The Limestone breed has only attracted public attention in recent times, although on some farms it has been maintained for over 100 years. Its habitat embraces about eight parishes or townships on the dry limestones of the lower districts of Westmorland, only a few townships being in the higher parts of the county. To a limited extent it is found on the Pennine range in Derbyshire.

THE HERDWICK BREED.—The Herdwick breed, the most peculiar and the hardiest of all British Mountain sheep, is found in the Fell districts of North Lancashire, Cumberland and Westmorland.

Characteristics of the Breed—The first essential of a well-bred Herdwick is a good coat, and the next good bone. A few kemps in the wool when a sheep gets to six years old indicate true Herdwick character. The animal should walk freely and be square on his limbs in travelling to and from an observer, and have a good thick tail. The best sheep when turned up are grey below, and they are none the worse for being grey all over the body—showing a grey pelt after shearing. Strength is the predominating feature in the ram and quality in the ewe.

Ewes clip about 3 lb. of wool, hoggs and wethers 4 lb. or more, and rams 7 or 8 lb. Ewes do best when they lamb for the first time at three years old. Hoggs from some farms are wintered in the low country at a cost of 5*s.* to 5*s.* 6*d.* each, but on very high exposed places they are hardier and do better after, if wintered at home on hay. When wool became very low in price in 1901-02, the breed was threatened with extinction as the balance got on the wrong side of the animal accounts.

On Black Hall Farm, at the head of Duddon Valley in Cumberland, Herdwick ewes are from time to time found with 14 ribs on each side, or 14 on one and 13 on the other, in place of the normal number, 13 on each side.

THE WELSH MOUNTAIN SHEEP.—*Characteristics of the Breed.*—The distinguishing characteristics of the pure Welsh sheep are a yellow face and legs, a long, strong, and bushy tail, short, fine, thick white wool, in which kemp may appear in moderate amount. The finest parts of the fleece are made into Welsh shawls and woollen goods. The body is usually narrow, descending towards the shoulder. The rams have curved horns, while the ewes are generally hornless. The restless activity of the breed makes it difficult to restrain by fences. It can without difficulty jump a six-foot rough dry-stone wall.

The mutton in the Smithfield Market is of the finest quality, and is classed with Scotch Mountain mutton and that of the Southdown. The pure-bred Welsh carcass does not exceed 28 to 32 lb., but improved varieties run up to 36 and 40 lb., and on good pastures four-year-old wethers weigh up to 50 lb.

Mountain flocks graze on the hills from April to November, but come down to the lower land during the winter months for shelter and food. The ewes are cast at four years old and crossed, usually with a Shropshire ram, with the object of producing fat lambs for the May market.

The Welsh Mountain Sheep Breeders' Association and Flock Book Society was formed in 1905 and the first volume appeared in 1906.

THE KERRY HILL (WELSH) SHEEP.—The Kerry Hill (Welsh) breed is the best of a number of recently formed breeds of Welsh sheep. It derives its name from the Kerry Hills in Montgomeryshire, although flocks exist in Radnor, Hereford, Salop, Worcester, Denbigh, Brecon and Cheshire. The foundation stock of the Kerry Hill breed was described in the *Agricultural Survey of Wales* 100 years ago as the only sheep which produces perfect wool, that of every other Welsh breed being more or less mixed with kemp.

Characteristics of the Breed.—But for a thread ot kemp in the britch of the fleece Kerry wool would be equal to the finest Welsh wool. With Shropshire wool at $13^1/_2d.$ Kerry ranks at $12^1/_2d.$, Clun $11^1/_2d.$ and Radnor 11*d.* per lb.

The Radnor Sheep.—The Radnor breed had the very ancient Welsh Tan-face sheep as a foundation stock.

The Clun Forest Sheep.—The Clun Forest breed, although related to, differs from the Kerry and Radnor breeds. Its main centre is the Clun district of Shropshire. The original sheep was small and speckle-faced.

The Exmoor Horn or Porlock Sheep.—The Exmoor Horn or Porlock Sheep, one of the chief descendants of the old Forest breeds, has existed from time immemorial on the Exmoor and Brendon Hills in West Somerset and North Devon.

The Dartmoor Sheep.—The Dartmoor is the largest hill or moorland sheep in this country. It is a very old hornless breed, which was improved many years ago by a dash of Leicester blood. The size has increased, and the quality of flesh and wool has gone up in recent years by careful breeding and selection.

The English Leicester.—*History of the Leicester.*—The English Leicester was the first British breed improved by in-and-in-breeding and selection. Bakewell, at Dishley in Leicestershire, began the system about 1755, and the success of his efforts was secured by the simultaneous extension of the cultivation of the turnip as a field crop. A liberal supply of winter food was made available, and the old ungainly slow-maturity Leicester, which had been bred merely for size and a heavy fleece, was transformed into a compact symmetrical, moderate-sized animal, possessing great aptitude to fatten, and above all, a marvellous power of communicating its tendency to early maturity and its refining influence to breeds with which it was crossed. Bakewell aimed at producing a valuable carcass, and the fleece was a secondary consideration. Marvellous results were got by his methods and his matchless instinctive skill in mating his animals. He originated the practice of letting out rams for the season in place of selling them. This gave him a large number of sheep to select from in pairing different types. It took 20 years so to convince his neighbours of the soundness of his system that they were willing to pay a 10-guinea fee for the hire of some of his choicest rams. Four or five years later the fee rose to 100 guineas, and in 1786 he let two-thirds of the service of a ram for 200 guineas, and received in all 1,000 guineas for hires. So quickly did the merits of his sheep grow in public favour that "in 1789 he made 1,200 guineas by three rams, 2,000 guineas by seven others," and 3,000 guineas for the remainder. His highest rate was 800 guineas from two breeders for two-thirds of the season's services of his favourite, "Two-pounder."

The Dishley Society was formed in 1790 for the preservation of the purity of the Leicester, and, by means of rules of extraordinary stringency, an attempt was made to create a sort of monopoly in the interests of Bakewell and a few friends. The only unselfish condition of interest was that "no member shall give his rams at any season of the year any other food than green vegetables, hay and straw," a rule which ram-breeders would do well to follow now. Such fame did the Dishley Leicesters gain that "within little more than half a century they spread over every part of the United Kingdom," and by 1837 there were "few flocks of Longwool sheep in England, Scotland, or Ireland which were not in some degree descended from Bakewell's flock. No other sort of sheep possessed so great a propensity to fatten or become fit for the butcher at so early an age, but they could not travel far for their food, nor could they bear, so well as many others, occasional scantiness or deprivation of nourishment." This holds good to-day with improved breeds.

The pure-bred flocks are now mostly confined to East and North Yorkshire, Cheshire, Cumberland, Durham, and Leicestershire. In other parts the breed had to yield to the competition of other Longwools which had been improved by its influence, and to the Down breeds, especially the Shropshire.

The Border Leicester.—The Border Leicester was bred at first from the Dishley Leicester by crossing with the Cheviot, but it has long ranked as a pure breed, and one of the best and most popular of Leicester long-wools.

The Wensleydale Longwool Sheep.—The Wensleydale Longwool is a large, high-standing, long-sided, firm-fleshed Yorkshire-Leicester breed, with a characteristic deep blue colour in the skin of the face, legs, and ears, which sometimes extends over the whole body, though the shade is darker on the bare or hairy parts. The dark colour is favoured because of the extensive use of the rams in crossing with Scotch Blackface ewes, as they throw dark grey-faced lambs. The progeny are termed "crosses" in Scotland, where they are kept in large numbers, ewe and wether together, for hogging; and under the name of "Mashams," from the market where they are sold, many thousands of ewes are put in East Yorkshire and in Lincolnshire to early-maturity rams, and the wethers fattened during winter.

The name Wensleydale Longwool was assumed in 1876 to distinguish the breed in the showyard; and the two flock books, viz.: that of the Wensleydale Longwool Sheep Breeders' Association and that of the Pure Select Wensleydale Sheep Breeders' Association, were both established in 1890.

THE LINCOLN SHEEP.—The Lincoln Longwool is a white-faced breed with a woolly tuft on the forehead. It easily holds the first place in this country as a wool producer, and in size it is only rivalled by the Costwold, and, probably, the South Devon breeds.

Value for Crossing.—In spite of the quality of mutton being only second rate, the unequalled power of wool-production and large size of carcass have brought the breed into the highest repute in sheep-rearing countries abroad, where it has mated most successfully with Merino ewes to form a good general-purpose sheep for both wool and mutton. Over 20 years ago a breed of Lincoln-Merinos was formed in New Zealand, under the name of the Corridale breed, by mating superior specimens of the two breeds; and an intermediate type has been subsequently fixed by thorough elimination of undesirable forms.

Export of Lincoln Sheep from Great Britain.—The export record of the Lincoln breed reached high-water mark in 1906, when, for the year ending September 30th, certificates were issued by the Lincoln Longwool Sheep Breeders' Association for 3 674 rams, 1 614 ewes, 339 ram lambs, and 333 ewe lambs, total 5 960, an increase of 1 758 over the previous year's total. An important event in the history of Lincoln sheep was the sale of the entire flock (950 animals) of Messrs. R. and W. Wright, of Nocton Heath, Lincoln, to Señor Manuel Cobo, of Buenos Aires, for £30 000. The flock was founded in 1790, and was one of the most famous flocks in the country. The same purchaser secured the Royal Champion Shearling Lincoln Ram, Riby Derby Champion, for the record price of 1 450 guineas at Mr. Henry Dudding's Annual Sale. Other prices realised at that sale were an average of £151 1*s.* 9*d.* for 56 rams; £16 17*s.* 4*d.* for 23 ewes, or a total of £8 848 17*s.* 6*d.* for 79 sheep. The exports for 1908-9 were 1 184 rams, 239 ewes, 106 ram lambs, 43 ewe lambs, distributed as follows:— 669 to Buenos Aires, 11 to Holland, 12 to Australia, 7 to Germany, 55 to Canada, 12 to the United States, 28 to North America, 16 to Spain, 28 to Russia, 616 to South America, 2 to Uruguay, and 1 to France, or a total of 1 566, against 2 559 in the previous year.

It has been contended that the exportation of many of the best sheep must be injurious to the interests of the breed as a whole, but the influence appears to be all in the opposite direction. The high prices given by foreign buyers stimulate breeders at home to greater efforts. Moreover, the numbers exported are, after all, insignificant in consideration of the fact that Lincolnshire is, next to Northumberland, the county which contains the largest number (more than one million) of sheep in the United Kingdom.

THE KENT OR ROMNEY MARSH SHEEP.—*Characteristics of the Breed.*—The Kent or Romney Marsh sheep is unsurpassed for hardiness by any Lowland Longwool breed. It is a white-faced and white-legged breed, with an exceptionally close coat of good wool of a semi-lustre type. Owing to many sheep having lost the tuft of wool on the forehead, which was once a characteristic feature of the breed, a flock of ewes is wanting in uniformity of appearance. The backs of fat sheep are somewhat hard to the touch, and both the top of the shoulder and the backbone are liable to stand up too prominently, but the mutton is classified in the market next to Down mutton in quality, as it is not only finer in texture, but proportionately leaner than that of other longwools.

Distribution of the Breed.—Their hardy constitution and active disposition render them of special service in the North Island of New Zealand in hilly districts, where, for nearly a quarter of a century, the Romney Marsh sheep has been held in high estimation. It has increased in popularity abroad (especially in Argentina, Canada, and South Africa) since the foundation of the Kent or Romney Marsh Sheep Breeders' Association in 1895, and the *Flock Book*, the 15th volume of which was published in 1909, showed a membership of over 80 breeders. The breed is also successfully spreading at home to other counties than Kent, and to soils which differ from the rich alluvial plains of the Romney Marsh: successful registered flocks, for example, have been established in Herts and Rutlandshire.

Regulations for Entry in the Flock Book.—So stringent are the regulations for entry in the *Flock Book* laid down by bye-laws, that "no flock shall be eligible for acceptance for entry unless its owner is a member of the Association, and that all rams used therein during the three seasons preceding the application for registration, shall have been registered rams"; also, "that no ram or ewe, or ram lamb or ewe lamb, bred by a non-member shall be eligible for registration unless it be proved to the satisfaction of the council that its sire was a registered sheep and its dam by a registered sire."

THE DEVON LONGWOOL SHEEP.—The South Devon Longwool is a local Breed which was first brought into prominence in this country by the Bath and West of England Society offering special prizes for the breed at the Taunton Show in 1870. The establishment of a *Flock Book*, the first volume of which appeared in 1900, has brought it to the notice of foreign buyers.

THE SOUTH DEVON SHEEP.—The South Devon or South Dum is an ancient local breed of conspicuous merit, being the chief breed of Cornwall and largely in evidence in Mid-Devon. The publication of the first volume of the South Devon Flock Book Association, in 1904, saved the breed from local obscurity. The oldest foundation flocks date back considerably over a century, although many have been established within the last 25 years.

THE COTSWOLD SHEEP.—The Costwold breed is generally supposed to have derived its name from the Cotswold Hills in Gloucestershire, to which it belongs. It is not improbable, however, that the hills received their name from the "cotes" or shelters erected for the sheep on the "wold" or bleak open country. The antiquity of the breed is indicated by its hardiness and suitability to its rather trying surroundings, and to the fixity of its type, which has varied little for probably 100 years.

At one time there was a considerable export trade of Cotswold sheep to Germany, Russia, and the United States of America; but the tendency of the market fashions in mutton and wool have been against the increase in the numbers of the breed both at home and abroad, and its existence as a local breed now depends largely upon its superiority to other breeds in overcoming the adverse combination of circumstances due to the soil and climate of the district to which it belongs.

THE ROSCOMMON LONGWOOL SHEEP.—The Roscommon Longwood is the only remaining pure Irish breed, and is believed to be centuries old. It is a big upstanding sheep, taller than either the Cotswold or Lincoln,—a "hardy and active forager, which thrives well on bleak exposed uplands and on its native fertile plains, and is consequently a good tenant-farmers' sheep."

At the block test competition at the Dublin winter shows, the mutton has been proved to be "splendidly grained, evenly mixed with fat and lean, and of excellent quality."

THE DORSET HORN SHEEP.—The Dorset Horn is a pink-nosed, white-faced horned breed of exceptional merit and popularity. Apart from single flocks scattered widely over the country, "the chief home of the leading Horn flocks is now in the southern and western parts of the county, with Dorchester as the centre, and in the Isle of Wight, where very old established and extensive flocks are kept."

Wool.—The wool, classed as medium grade on the Continent, covers the crown and comes close up round the horns and ears and on to the jaws, as in the Merino, and forms a dense tuft on the forehead. The wool is closely set, dense and level on the surface. Shearing generally takes place in June, when both lambs and ewes are shorn. The lambs give from $2^1/_2$ to 3 lb. of wool, ewes 5 to 7 lb., and yearling rams 10 to 14 lb. The wool of the lamb is specially valued for its whiteness and other superior qualities. The Dorset Horn usually shares with the Ryeland breed the premier awards for fine short white wool at the Annual Show of the Royal Agricultural Society of England.

Early Maturity.—The special and peculiar feature of the breed is that the ewes come in season as early as April or May and can consequently breed "house lamb" for Christmas, weighing 10 to 12 lb. per quarter at 10 to 12 weeks old.

THE WESTERN SHEEP.—The Western Sheep is an improved and modernised remnant of the old slow-maturity, white-faced, long-tailed, horned Wiltshire breed, described by Low as the "largest of the fine-woolled sheep of England. Its fleece was not only light (about $2^1/_2$ lb.) but its belly was destitute of wool," a condition attributed to the warm, dry, chalky soil of the area.

THE RYELAND SHEEP.—The Ryeland breed is believed to be named from a poor sandy district in the southern part of Herefordshire, on which rye used to be grown.

THE SOUTHDOWN SHEEP.—The Southdown or Sussexdown is the breed which was employed to refine all the other Down breeds in the same way as the English Leicester was employed to improve the longwool breeds. The present refined and symmetrical animal has been developed by selection from the original stock, which was leggy and ill-proportioned. No outside blood was introduced, although Bakewell urged the use of the Leicester ram.

Wool.—The Southdown of to-day has a small neat head, woolled up to the ears and on the forehead—naked ears being most objectionable. Grey-brown is the uniform colour of the short hair on the face and legs, though it was once speckled. The fleece is short, close, thick and of fine quality, weighing 3 or 4 lb. per ewe and realizing the highest price per lb. of any native British breed. Any darkness or dullness of the wool when parted is an objection.

Mutton.—No breed surpasses the Southdown for rapidity of feeding and early maturity. Lambs dropped early in January are frequently sold fat in April at 45*s.* to 50*s.* each. The mutton is of excellent quality, but it can easily be fed too fat. Before early maturity became the rage, wethers rising two years old could be got to dress to 138 lb. per carcase or $34^1/_2$ lb. per quarter, and to yield 65.8 per cent. of their live weight.

THE SHROPSHIRE SHEEP.—*General Utility and Value for Crossing.*—The Shropshire is a medium-sized sheep, and on its merits the most cosmopolitan of all the Down breeds. It possesses at any age a thick uniform cover of flesh on the back and ribs when handled for the butcher. It is noted for its hardiness of constitution and tendency to early maturity; and its wonderful adaptability to many different soils and climates. It can be crossed with unique success with sheep of almost any pure breed, and with the common mongrels which constitute a large proportion of the sheep flocks of the world. It has a fairly heavy fleece of good bright wool; and a superior quality of mutton, indicated by darkness of the hair of the face and legs.

Over 2 000 registered Shropshires were exported in the great export year, 1906, and they went to the following countries:—Australia, New Zealand, Tasmania, Japan, Canada, United States of America, Argentine, Uruguay, Chili, Brazil, Jamaica, Demerara, Natal, South Africa, Algiers, Germany, France, Russia, Spain, Sweden, Denmark, and Finland.

THE DORSET DOWN SHEEP.—The Dorset Down, West Country, or Improved Hampshire Down breed was brought to public notice outside its home district in 1904 by the formation of a Dorset Down sheep society and the issue of Volume I of its *Flock Book.* This was about eighty years after the present type of the breed had been established.

THE HAMPSHIRE DOWN SHEEP.—*Origin of the Breed.*—The Hampshire Down sheep, according to the *Flock Book* (1890) of the Hampshire Down Sheep Breeders' Association, "undoubtedly dates its origin from the crossing of the old Wiltshire Horned sheep and the old Berkshire Knot with the Southdowns which were introduced into Wiltshire and Hampshire early in the 19th century." It was Humfrey, of Oak Ash and Chaddleworth, near Newbury, who, selecting his Southdown rams from the celebrated flock of Jonas Webb, took the lead in developing the modern Hampshire, the breed which now occupies large areas of Berks, Hants, and Wilts. "Many pure flocks also exist in Gloucestershire, Somerset, Surrey, Sussex, Kent, Herts, Cambridge, Essex, Norfolk, Bedford, and the Midlands generally. A strong point in the breed is that it is adapted for the high-lying and barren uplands of the chalk, where holdings are large, and flocks number from 1 000 upwards."

Value for Fattening.—The Hampshire is a larger, lower-set, more substantial, stronger-boned and coarser-looking sheep than the Shropshire, and when young it is not easily fed fat to the touch, although often forced to great weights by heavy feeding until the lambs begin to eat. Ewes on the better classes of farm are often allowed 1 lb. each per day of a mixture of equal parts of linseed cake and peas or cracked Egyptian beans until the lambs have learned how to eat, when it is gradually taken from the ewe and given to the lamb. A ram lamb weighing 19 lb. at birth in January may, with liberal feeding on green forage produced on the farm, weigh 150 lb. live weight on August 1st. Early lambs can be got, because the ewes' periods of œstrum begin earlier in the season than in the case of most other sheep, a signal advantage to the breed in competition with others at fat stock shows. Ewes are usually culled from the flock in early autumn, after the weaning of the third lamb, at the age of four and a-half years. A well-bred fattening lamb on good and liberal feeding will increase at the rate of $^3/_4$ lb. per day from birth and weigh 113 lb. at the end of May. Of this 68 lb., or 60 per cent., will be dressed carcase, weighing 17 lb. per quarter. The mutton is of good quality, not so fat as longwool mutton, and firmer to the touch.

The average weight of fleece is $4^1/_2$ to 5 lb. for ewes; the wool should be free from black patches and grow close up to and round the ears, dense and fine over the body, white when shed.

The Suffolk sheep.—The Suffolk breed was formed over 100 years ago by crossing ewes of the Blackface Norfolk Horned Mountain breed with Southdown rams. They were first known as Southdown Norfolks and as Blackfaces. In 1859, when classes were opened for them at the Suffolk Agricultural Association Shows, they were called Suffolks. The breed has made rapid strides since 1886, when it secured breed classes at the Royal Agricultural Society's Show and the Suffolk Sheep Society was established.

The Oxford Down sheep.—The Oxford Down breed was formed about 1830 by mating improved Hampshire ewes and a few Southdowns with Cotswold rams, the aim being "to secure the superior quality, and therefore a higher price per pound, of the mutton as compared with longwoolled sheep, and the superior weight of wool and of mutton as compared with short-woolled sheep."

The wool is longer and looser than that of any other Down breed, and ought to be classed as long-wool. The fleeces of ewes average 6 or 7 lb. each.

Oxford Down rams were first introduced into the Scotch Borders by the late Walter Elliott of Holly-bush, Galashiels, about 1867, and it is now found that they have no equal in producing crosses for hogging by Leicester-Cheviot ewes, and that they also cross well with Border Leicester ewes. The cross progeny of the Oxford ram is slower in reaching maturity than the progeny of the Border Leicester, but it can be fed to greater weights in spring, 65 to 68 lb. per carcase, without becoming too fat to be classed as finest quality. About a thousand Oxford Down rams are now sold annually in September under the auspices of the Border Union Society at Kelso.

The following list of Sheep-Breeding Societies, in Great Britain is published by the Board of Agriculture and Fisheries, together with indications on shows, prices, etc.

List of Breeding Societies of Sheep		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Blackface . . .	Blackface Sheep Breeders' Association. Secretary: R. Macmillan, Woodlea, Moniaive, Thornhill.	Sales at Lanark, Perth, Ayr, Stirling, Castle Douglas and Oban.	Average prices:—Shearling Rams, £5; Draft Ewes, 15s. to 20s.; Mid-ewe, Lambs, 10s. to 15s,; Top Wether Lambs, 9z. to 15s. At the Lanark Sale in 1909 a shearling ram of this breed was sold for £250, the record price for the breed.
Border Leicester	Society of Border Leicester Sheep Breeders. Secretary: Robert Wood, Admiral Street, Carnoustie, Forfarshire.	Ram Sales at Kelso, Perth, Edinburgh, Ayr and Loekerbie. Shows:—Highland and Agricultural Society, Royal Agricultural Society, Border Union, Northumberland, Angus, Ayr and Edimburgh Agricultural Societies.	The average prices ranged from £5 to £25 16s. at the Ram Sales held in September, 1909. Individual sheep sold at from £20 to £110.
Cheviot . . .	Cheviot Sheep Society. Secretary: John Robson, Newton, Bellingham, Northumberland.	Sales at Hawick, Rothbury, Bellingham and Lockerbie. Shows: —Royal Agricultural Society, Highland and Agricultural Society.	Rams, £5 to £100; average of 600 Rams, £7; Draft Ewes, £1 10s.; Ewe Lambs, 15s.; Wedder Lambs, 12s.; Top Ewe Lambs, £1 10s.

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Cotswold . . .	Cotswold Sheep Society. Secretary: James W. Tayler, Bourton-on-the-Water, Gloucestershire.	Gloucester Agricultural Show, Royal Agricultural Society's Show, and Cirencester Ram Fair.	Rams about £7 7*s*. Few are sold by public auction, many being purchased from breeders at home for exportation.
Derbyshire Gritstone.	Derbyshire Gritstone Sheep Breeders' Society. Secretary: William J. Clark, Alport, Bakewell, Derbyshire.	Royal Agricultural Society's Show, also at Bakewell and Buxton.	Average price at last sale for rams, 7 guineas.
Devon Longwool	Devon Longwooled Sheep Breeders' Society. Secretary: John Risdon, Wiveliscombe, Somerset.	Sales at Exeter. Taunton, Tiverton, Barnstaple.	Average price of 22 rams sold at last sale was £11, while the highest individual price was £31 10*s*.
Dorset Down. .	Dorset Down Sheep Breeders' Association. Secretary: E. B. Duke, 47, South Street, Dorchester.	Shows:—Bath and West, Dorchester and Blandford Agricultural Societies. Sales at Dorchester, Blandford and Sherborne.	Draft Ewes, £2 2*s*. to £2 14*s*.; Flock Ewes, £2 6*s*. to £4 4*s*.; Ewe Lambs, £1 8*s*. to £2 2*s*., Wether Lambs, £1 8*s*. to £2 6*s*.; Fat Lambs at 9 months of age, £2 4*s*. to £2 13*s*.

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Dorset Horn. .	Dorset Horn Sheep Breeders' Association. Secretary: Thomas H. Ensor, Cornhill, Dorchester.	Shows:—Royal Agricultural Society. Bath and West, Royal Counties, Somerset County, Royal Isle of Wight. Dorchester Sales and Shows.	Rams, 10 to 15 guineas; Ram Lambs, 4 to 12 guineas; Two-tooth Ewes, £2 12*s.* to £3 8*s.*; Four-tooth Ewes, £2 14*s.* to £3 10*s.*; Six-tooth Ewes, £2 8*s.* to £2 10*s.*; Ewe Lambs, £2 to £2 8*s.* These are average prices obtained at Fairs and Seles. Picked specimens would cost from 20 per cent. to 25 per cent. more.
Exmoor Horn .	Exmoor Horn Sheep Breeders' Society. Hon. Secretary: D. J. Tapp, Highercombe, Dulverton, Somerset.	Sales and Shows at Winsford, Dulverton, Bratton Fleming, and South Molton.	In 1909, 50 rams averaged £5 per head. The highest individual price was £20 for a shearling ram. In 1908 the average price of ewes was £1 15*s.* In 1909 over 2,000 ewes were sold at an average price of £1 8*s.* 3*d.* per head.
Hampshire Down	Hampshire Down Sheep Breeders' Association. Secretary: J. E. Rawlence, 49, Canal, Salisbury.	Shows:—Royal Agricultural Society, Bath and West, Royal Counties, and Wilts County. The following Fairs, amongst others:—Salisbury, Wilton, Britford, Weyhill, Oxford, Marlborough, Arlesford, Overton.	The average price obtained for Ram Lambs at various sales varied from £6 6*s.* to £18 6*s.* At one sale Flock Ewes averaged £2 17*s.*, and at another £4 4*s.* One entire flock of Ewes and Ewe Lambs averaged £2 5*s.* per head.

List of Breeding Societies of Sheep		Principal Places of Sale and Average Prices of Animals of each Breed	
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Kent or Romney Marsh.	Kent or Romney Marsh Sheep-Breeders' Association. Secretary: W. W. Chapman, Room 4, Mowbray House, Norfolk Street, Strand, London, W. C.	Annual Sale of the Association and Sales at Ashford, Romney, Ham Street, Maidstone, Strood, Rye and Sittingbourne. Shows: — Royal Agricultural Society, Royal Counties, Tunbridge Wells, East Kent and Mid Kent Agricultural Societies.	The average price for 412 rams sold at the Annual Show and Sale of the Association held in 1908 was £11 14*s*. 5*d*. The average price for 365 Yearling Rams at other Sales was nearly £6 14*s*. The highest individual price for a ram was £136 10*s*.
Kerry Hill . .	Kerry Hill (Wales) Sheep Breeders' Association, and Flock Book Society. Joint Secretaries: Messrs. Morris, Marshall & Poole, Chirbury, Shropshire.	Shows:—Royal Agricultural Society, Welsh National, Shropshire and West Midland. Annual Sales at Kerry (Mont.) and Craven Arms (Salop).	Average price for Ewes at last Sale, £1 15*s*. to £2; highest price £2 11*s*. Rams averaged 8 to 10 guineas; highest price 49 guineas. Ram Lambs averaged 5 guineas; highest price 15 guineas.
Leicester . . .	Leicester Sheep Breeders' Association. Secretary: W. A. Brown, Elms Villa, Driffield, Yorkshire.	Sales at Driffield, Malton Fair, Hull Cattle Market (Fair Days), and Stokesley Agricultural Society's Show.	Average price at last sale, £8 15*s*. A good specimen of a male sheep (lamb or yearling), £8. Four Prize rams averaged £31 5*s*. per head.

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Lincoln Longwool	Lincoln Longwool Sheep Breeders' Association. Secretary: W. Frankish, St. Benedict's Square, Lincoln.	Shows:—Royal Agricultural Society, Lilcolnshire, Nottinghamshire, Yorkshire. Sales at Lincoln.	At the July, 1909, sale at Lincoln 81 rams averaged £23 1*s.* per head. At the September, 1909, sale 293 rams averaged £12 19*s.* per head. The highest individual prices were: in July, 200 guineas; in September, 85 guineas.
Lonk	Lonk Sheep Breeders' Association and Flock Book Society. Secretary: J. C. Ashworth, Overtown, Cliviger, near Burnley.	Shows:—Royal Agricultural Society, Royal Lancashire, Whalley. Crawshawbooth, Colne, Cliviger, Padiham, Worsthorne and Newchurch. Fairs:—Near Todmorden, Moses Hall, Marsden, Meltham, Holme in Cliviger, and Haslingden, and Annual Fair at Holme each September.	Prices at last sale £2 to £3; for rams, £5. These are average prices and would not purchase the best sheep.
Oxford Down. .	Oxford Down Sheep Breeders' Association. Secretary: Howard Sammons, 68, St. Giles, Oxford.	Oxford Ram Fair Cirencester, Kelso Fair.	Rams, 10 guineas; Ram Lambs, 7 guineas. Good first-class rams can be bought from leading breeders at about 15 guineas each, and rams for show purposes up to 100 guineas each. Picked yearling ewes can be obtained from the best breeders at about 5 guineas each.

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Ryeland . . .	Ryeland Flock Book Society. Secretary: J. T. Pinches, Stoneleigh, Ryelands, Hereford.	Shows: — Royal Agricultural Society, Herefordshire and Worcestershire. Sales:—Brecon, Talgarth, Hereford.	Draft Ewes, £1 15*s.* to £2 10 *s.* per head; Rams £5 5*s.* to £10 10*s.* each. Moderate specimens may occasionally be bought for £4.
Shropshire . .	Shropshire Sheep Breeders' Association. Secretaries: Messrs. Alfred Mansell & Co., College Hill, Shrewsbury.	Royal Agricultural Society's Show and other important live stock shows.	At the last show of the Royal Agricultural Society the average price of Two-shear Rams was £35 14*s.* of Shearling Rams £39 13*s.* The highest prices were £175 and £150. At various private sales the price of Rams averaged about £11 and of Ewes about £3, the highest prices being 65 and 5 guineas respectively.
South Devon . .	South Devon Flock Book Association. Secretary: W. W. Chapman, Room 4, Mowbray House, Norfolk Street, Strand, London, W. C.	Shows:—Royal Agricultural Society, Bath and West, Royal Cornwall, Devon County, and Smithfield. Sales:—Totnes, Liskeard, Truro and South Brent.	At Totnes, 1908, average price of 174 rams sold was £10 4*s.* 11*d.*, the highest price being £47 5*s.* At the Liskeard and Truro sales the average price was £8 16*s.* 9*d.* and £7 11*s.* 10*d.* per head respectively.

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Southdown . .	Southdown Sheep Society. Secretary: W. J. Wickison, 12, Hanover Square, London, W.	Sales are held annually at Chichester, Lewes, Findon, etc.	The prices at the Chichester Sale, 1909 for rams were from £3 3*s*. to £46 5*s*.; for Ram Lambs from £2 2*s*. to £26 5*s*. 1,443 head of Shearling Ewes averaged £2 17*s*. At the dispersal of registered flocks in 1909, ewes sold up to £5 10*s*. each.
Suffolk	Suffolk Sheep Society. Secretary: E. M. Prentice, 25, Marlborough Road, Ipswich.	Ipswich, Newmarket, Great Bentley, Sutton (Woodbridge), Kesgrave (Ipswich).	In 1909 Yearling Rams averaged £7 19*s*. 7*d*; highest price £16 16*s*. Ram Lambs averaged about £10; highest price £60 18*s*. Yearling ewes averaged £3 11*s*.; highest price £9. Ewe Lambs averaged £2 2*s*.; highest price £3 18*s*. Ram Lambs are largely used for breeding purposes and have realised £152 5*s*. Yearling Rams are chiefly sold privately and have realised as much as £94 10*s*. The cost of Ram Lambs for pure breeding is about £10 10*s*. and upwards; for crossing purposes the price is from £5 5*s*. to £10 10*s*.

List of Breeding Societies of Sheep		Principal Places of Sale and Average Prices of Animals of each Breed	
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Wensleydale . .	The Incorporated Wensleydale Blue-faced Sheep Breeders' Association. Hon. Secretary: John A. Willis, Manor House, Carperby, Yorkshire.	Sale held annually at Hellifield in October. Shows:—Royal Agricultural Society, Yorkshire, Royal Lancashire.	Average prices:—Yearling Rams, £7 to £10; Ram Lambs £5 to £7. Shearling Rams of special merit fetch from £12 to £35, and Ram Lambs from £10 to £30.
	Wensleydale Longwool Sheep Breeders' Society. Secretary: R. B. Hodgson, Hallwith, Spennithorne, Leyburn, Yorkshire.	At the following towns in Yorkshire:—Northallerton, York, Hellifield, Leiburn, Kettlewell, and Middleham Moor; and Kirkby Stephen in Westmorland.	Average prices:—Shearling Rams £6; Ram Lambs, £5; Shearling Ewes. £3; Ewe Lambs £2 5*s*. Highest individual prices:—Shearling Rams, £20; Ram Lambs, £25 10*s*.; Shearling Ewes, £5 10*s*.; Ewe Lambs, £3.
Welsh Mountain.	Welsh Mountain Sheep Breeders' Association and Flock Book Society. Secretaries: Messrs. T. & W. Leathes, Agricultural Hall, Ruthin.	Shows:—Royal Agricultural Society, Welsh National, Shropshire and West Midland, Oswestry, Llanfyllin, Llangollen, Denbighshire, East Glamorgan, Derynock, Vale of Clwyd, and Bedwelty Agricultural Societies.	Ram Lambs, £5 5*s*.; Shearling Rams, £3 10*s*. The prices given are the highest realised at an auction sale at the last show of the Welsh National Agricultural Society's Show, at which however, the number of entries was small.

Increase in Sheep Exports, in 1909. — *The Farmer and Stockbreeder.* London, January 1910.

The exports of English sheep for crossing and acclimatisation exceed those for 1908. 7118 heads were sold for a sum of 86 190 pounds sterling. The bulk of the exports go to New Zealand, Argentina, Australia, Uruguay, Canada, the United States and Germany.

Caution to Flockowners in regard to the Dipping of Sheep. — *The Journal of the Board of Agriculture.* June 1910, vol. XVII, N.° 3, p. 239.

"The dipping of sheep is the only practicable and certain remedy for Sheep-scab, and two dippings within twenty-one days are necessary for a complete cure, since the unhatched acari of sheep-scab are not always killed by the dip. The second dipping should take place betwen the tenth and twenty-first day. During the interval any eggs not destroyed by the first dipping will most probably have hatched out, but the laying of eggs by the new generation of acari will not have commenced so that when the second dipping takes place there will be only living acari to destroy. Dipping must be efficiently and effectually carried out as regards each sheep.

Sheep-scab may exist unrecognised in a flock for from two to three months or even longer, and usually manifests itself in early winter. If, as a matter of precaution, all sheep in a district are twice dipped at the above intervals the disease should be effectually eradicated in a year or two provided that all persons concerned co-operate in making the dipping thorough and complete, and that any outbreaks of sheep-scab that occur in the interval are energetically dealt with under the Sheep-scab Order of 1905.

Dipping to be effective against Sheep-scab must be carried out with an efficient dip, and a dip bath of sufficient volume must be made up strictly in accordance with the directions issued by the makers of the dip. Each sheep must be completely immersed for the period required by the directions, and the dip bath must be at all times kept up to the required strength, and be kept clear of dirt.

To comply with the Board's Orders requiring dipping of sheep the dip must be one approved by the Board, under the Sheep-scab Order of 1905. Approved dips have to contain sufficient of one constituent to make the dip effective for the cure of Sheep-scab at the strength approved. It is therefore inadvisable to make up the dip bath by mixing two or more dips containing different ingredients, even in cases where each dip has been approved for use by itself. For exemple, to mix carbolic and arsenic dips may result in destroying the efficacy of both ingredients, and even the mixing of dips containing the same ingredients may result in the bath being below standard. In some cases, also, the use of mixed dips may injure the sheep."

Prescriptions for Sheep-Dips. — *The Journal of the Board of Agriculture.* June 1910, vol. XVII, n. 3, p. 238.

"The following prescriptions for Sheep-Dips have been approved by the Board of Agriculture and Fisheries for Sheep Scab, and can be used by sheep owners who prefer to make up their own dips.

1) *Lime and Sulphur.* — Mix 25 lb of flowers of sulphur with 12 $^1/_2$ lb of good quicklime. Pound or rub the mixture with water until a smooth cream without lumps is obtained. Transfer this to a boiler capable of boiling 20 gallons; add to the mixture sufficient water to make up 20 gallons; boil and stir for half an hour. The liquid should then be of a dark red colour; if yellowish, continue the boiling until the dark red colour is obtained, keeping the amount of liquid up to 20 gallons by adding water if necessary.

Half the above quantities may be used to make 10 gallons, if more convenient.

After the liquid has cooled, pour it off from any small quantity of insoluble sediment.

To 20 gallons of the mixture add 80 gallons of water to make a bath.

The mixture will keep good for twenty-four hours if kept in a covered vessel, and for a month or even more if kept in jars or drums securely corked.

Period of immersion for sheep in this dip, not less than half a minute.

2) *Carbolic acid and soft soap.* — Dissolve 5 lb of good soft soap, with gentle warming, in 3 quarts of liquid carbolic acid (containing not less than 97 per cent of real tar acid). Mix the liquid with enough water to make 100 gallons for the bath.

This mixture after being prepared will keep good for three months if kept in securely stoppered jars or drums in a cool place.

Period of immersion for sheep in this dip, not less than half a minute.

3) *Tobacco and sulphur.* — Steep 35 lb of finely ground tobacco (known as offal tobacco) in 21 gallons of water for four days. Strain off the liquid and remove the last portions of the extract by pressing the remaining tobacco. Mix the whole extract and add to it 10 lb of flowers of sulphur. Stir the mixture well, to secure its being evenly mixed, and add sufficient water to make up 100 gallons for the bath.

The mixture will not keep.

Period of immersion for sheep in this dip, not less than half a minute.

In every case the dip-bath should be of sufficient volume to allow of each sheep being completely immersed in the bath.

Where a number of sheep are to be dipped, the bath must be cleaned out from time to time, otherwise the efficacy of the dipping may be impaired.

The dip-bath should not be made up by mixing together different kinds of dip."

Goats: Breeding Society, Shows and Prices. [Board of Agriculture and Fisheries]. — *British Breeds of Live Stock*, pp. 136-137. London, 1910.

There is only one goat breeding society in England: The British Goat Society. Hon. Secretary H. S. Holmes Pegler, Coombe Bury House, Kingston Hill, Surrey. Goats are exhibited at the Dairy show at Agricultural Hall, London, and at Tunbridge Wells.

The average prices for stud goats are from £8 to £10; she-goats in milk from £3 to £15. Long-haired Irish Breed from £1 to £2.

The chief breeds for milk in England are the Anglo-Nubian and the Toggenburg. The latter are comparatively scarce in England, and the prices for milk-goats of this breed vary between £5 and £20.

BELLINGHAM. **Disastrous year for Sheep Farmers in Northumberland. Rise in the prices of Cheviot wool.** — *Mark Lane Express*, London, January, 1910.

The sheep of Northumberland have suffered terribly from the spring storms followed by a cold summer. Such heavy mortality amongst lambs had not been known for 50 years. This has led to an enormous rise in the price of Cheviot lamb's wool.

How Wool is prepared for Market in Great Britain. — *Monthly Consular and Trade Reports*, No. 346, p. 115. Washington, July 1909.

Consul Frederick I. Bright, of Huddersfield, furnishes the following from the Yorkshire Post, prepared by a well-known wool expert, as illustrating the pains taken by British producers to meet the demands of their foreign customers and showing American sheep farmers how the English prepare their wool for market:

It is a well-known fact that the Americans are by far the best customers to the English and Irish farmers when their wool is bred and got up in a suitable style. It should be tub-washed with 2 pounds common soda to 1 pound soft soap, renewed each 20 sheep. As much as possible of the liquor should be kept from beginning to end, as the grease from the sheep improves the wash. In case of a large quantity of sheep two tubs should be used, lading off the liquor when the sediment is settled.

After leaving the tub the sheep should be put through a stream of clear water while wet or rinsed well with hose or watering can and run on grass as much as possible for 6 to 8 days. In housing the sheep for the night bed with green rye, nettles or bean straw. When clipped, care should be taken in winding, by placing the best wool outside — that is, the breast and shoulders. Wind the fleeces 24 to 28 inches long, neatly and securely tieing in the center with twisted wool. Pack in a chamber clear of corn and chaff. Sheet well down.

The following breeds are the best for the American markets: Lincolns crossed by Wensleydales for bright wools. The same ewes crossed by Oxfords, Hampshire, or Shropshire Downs are the best class of halfbreds.

The farmer, by paying attention to the above conditions, will find he will be rewarded by making at least a profit of 100 per cent on his small extra outlay.

A. M. Wright. **Absorption of atmospheric moisture by wools.** — (*Journ. Soc. Chem. Ind.*, 28, 1909, N. 19, pp. 1020-1022); *E. S. R.* Washington, March 1910.

The purpose of this investigation was to determine under what conditions wool absorbs moisture from the atmosphere, and what constituents cause it to absorb relatively large amounts.

The results are summarized as follows: " The relative humidity of the atmosphere influences the absorption of moisture, more moisture being absorbed during a period of high relative humidity than when the humidity is low. Pure wool fiber, of which greasy wool contains from 50 to 70 per cent and slipe wool about 75 per cent, can absorb from 18 to 20 per cent of its weight of moisture from the atmosphere, but this amount is not sufficient to account for all the moisture absorbed by the dry normal wool fiber. Natural wool fat, present in greasy wool to the extent of nearly 17 per cent and in slipe wool to 6 $^1/_2$ per cent, is capable of absorbing about 17 per cent of its weight of atmospheric moisture. Suint, or wool perspiration present in greasy wools to the extent of nearly 13 per cent, and in slipe wools to about 2 per cent, is very hygroscopic, and can absorb from 60 to 67 per cent of its weight of moisture when exposed to the atmosphere. Fatty matter other than natural wool fat, present in slipe wools to an amount of from 2 to 6 times that found in greasy wools, and picked up by the wool from the greasy underside of the skins during the washing process, has a retarding effect on the amount of moisture absorbed."

R. H. Rew. **Importation of Wool in Great Britain, in 1909.** — *Board of Agriculture and Fisheries. Agricultural Statistics 1909*, Vol. XLIV, Part III, p. 198. London, 1910, Cd. 5268.

The total quantity of sheep, lamb, and alpaca wool imported in 1909 amounted to 809 000 000 lbs., exceeding the total of the previous year by 85 000 000 lbs. The importation in 1909 is the highest ever recorded, the previous highest being that of 1895, when 775 000 000 lbs. were received. The total quantity re-exported in 1909 was 391 000 000 lbs., so that the supply retained for home consumption amounted to 418 000 000 lbs., a quantity which was exceeded as recently as 1907, when the net imports amounted to 451 000 000 lbs. Except for 1907, the net imports were the largest on record.

Of the gross imports of 1909, about 666 000 000 lbs. (82 per cent) came from the British Empire, an increase of 67 000 000 lbs. on the previous year. The countries of South America sent about the same quantity as in 1908, but Russia, Belgium, France, and Turkey increased their consignments. Of the British Dominions, Australia sent 313 000 000 lbs., or 8 000 000 lbs. less than in 1908. The receipts from each of South Africa, India, and New Zealand were the largest yet recorded.

A. E. Ingram. **Trouble caused by Vegetable Fibres in Wool.** — *Monthly Consular & Trade Reports*, 1910, n. 353. Washington Gvt Print. Office, p. 257.

Referring to his previous report on the accidental presence of vegetale fibers in wool, U. S. Consul Augustus E. Ingram writes from Bradford:

The source of considerable trouble to British manufacturers and merchants of woollen and worsted goods is due to the fact that as the vegetable fibers will not take the dye their presence is not detected until the wool has been dyed. The following extracts from a recent discussion of this subject by the Yorkshire section of the Association of Managers of Textile Works may be of interest:

The vegetable fibers causing the trouble are the loose fibers of jute from the bagging or string, and the tax on the industry involved by burling, to remove these fibers, has increased enormously during the last 15 or 20 years, owing to the great deterioration of the packs. The better class packs made in Dundee, which were formerly used, have been superseded by a cheap, loosely woven article made by native labor in India.

The ideal remedy would be to pack wool in wool. At any rate a material valued at anything from £12 (303 frs.) to L. 18 (454 frs. 50 c.) should be worth packing in something better than a cheap ravelling cover costing 36 to 49 cents (1 frs. 80 c. to 2 frs. 45 c.). If the quality of the pack were raised to, say, 3s. 9d. (4 frs. 70 c.), a cover could be obtained so closely woven as to mitigate the evil.

The practicability of paper-lined packs was discussed, as their use seemed to have promise of good results.

Regent. **The World's Wool Clip.** — *Textile World Record*, Volume XXXIX, No. 2, 3-313-316. June 1910.

Sheep statistics are, and perhaps always will be, eyed with some suspicion. They are taken loosely in most countries, are the result of guesses in others and have to be collated from widely different sources at varying periods of time. There is no real check on them and sets of figures purporting to tell how many sheep there are in the world must be accepted with the reserve that is due to their mixed and obscure origin. It will illustrate the difference of opinions on the subject to point out that one of the publications of the year makes the total 544 382 049. Another gives 482 884 528 as the grand total. Flaws are evident in the compilation of both sets and although implicit reliance need not be put in either, note may be taken of the lower estimate of the two. Dalgety e & Co., Ltd., the largest handlers of Australian wool, compare the figures at latest date with those of 1895. Their summary follows:

Sheep

	Latest date	1895
Europe and Russia, in Asia (chiefly 1904-907) . . .	177 330 608	198 194 214
Australasia (1908)	109 345 967	110 516 331
South America (chiefly 1908)	91 187 013	102 847 134
North America (chiefly 1907)	59 252 721	57 158 652
Africa (chiefly 1904) . . .	27 764 492	31 890 052
Asia (chiefly 1904). . . .	18 003 727	21 957 752
Total . . .	482 884 528	522 564 135

Loss of Sheep, 39 679 609; approx. 7 1/2 per cent.

In comment on these figures it can be said that the total cannot possibly be right, altough the comparison may indicate the general trend of things more or less faithfully. Holland (with over 600 000 sheep), Turkey, Persia, Afghanistan, Tibet, and China are all missing from the account and except by guesswork their flocks cannot be estimated. The table shows a decline in Europe of 21 million head inside a period of about 13 years. Sheep culture in the old or industrial countries palpably is declining; Germany, which had 25 million sheep in 1870, had 8 million in 1904. So far as concerns number of head, expansion in the new countries does not counterbalance contraction in the old.

Number of sheep is not everything in considering the supply of wool. The general influence of improved breeding methods is to increase the yield per animal. Thus in Australasia a century ago the clip was about 3 pounds per sheep; last season's average was 6 pounds 14 ounces. Last season 1000 fleeces made 20,92 bales and in 1896-97 only 16,75 bales.

On many stations the average fleece weighed ten pounds and in Australia, Argentina and even South Africa they are now breeding from merino sires that give 20 pounds of wool in shearing and from Lincolns which give 30 pounds. The very break-up of large estates in Australia, although it may do detriment to the get-up of wools, contributes to increase the weight per animal. The smaller grower, with one eye on the fat lamb market and the other on his rough grazing, decides on cross-breds, which have larger frames and return more and coarser wool than blood stock. Cross-breds form 90 per cent of the 22 million sheep in New Zealand, and South American wool once preponderantly merino is now preponderantly of mixed growth. With some figures to show the rise of sheep growing in Australasia and the appalling checks administered by the great droughts one may pass from sheep to wool production.

Sheep in Australasia (millions and decimals):

1860 . . .	20,30	1895 . . .	120,77
1870 . . .	49,68	1900 . . .	90,47
1875 . . .	61,89	1901 . . .	90,82
1880 . . .	65,49	1902 . . .	92,55
1881 . . .	75,16	1903 . . .	72,95
1884 . . .	84,04	1904 . . .	74,88
1885 . . .	76,12	1905 . . .	84,96
1886 . . .	82,72	1906 . . .	94,51
1890 . . .	101,93	1907 . . .	104,67
1891 . . .	114,68	1908 . . .	110,20
1892 . . .	124,98		

The National Association of Wool Manufacturers made for 1903 an estimate of the world's clip of wool, which can be thus summarized:

Europe	lbs.	938 000 000
North America	»	304 500 000
South America	»	510 000 000
Central America and W. I. .	»	5 000 000
Asia	»	274 000 000
Australasia	»	500 000 000
Africa	»	134 450 000
Oceanica	»	50 000
Grand total	lbs.	2 666 000 000

Except in an indefinite way this calculation cannot be regarded as a very valuable statistical exercise. At all events as regards Asia there must remain a doubt of the complete authenticity of the figures and for practical purposes a calculation of the wool that is shorn is a good deal less valuable than one giving the quantities that find their way to civilization and the centers of manufacture. The wool that tribesmen of the primitive races grow, industrially speaking, does not matter. It matters a good deal to know with reasonable certainty how much wool passes the ports and here we can get satisfactory assurances from the Customs.

The following shows the increase now in progress in shipments of wool from Australia and New Zealand, the principal source of import supplies.

Shipments from Australia and New Zealand in bales:

1902-03 . . .	1 440 722	1906-07 . . .	2 090 188
1903-04 . . .	1 366 912	1907-08 . . .	2 057 831
1904-05 . . .	1 595 734	1908-09 . . .	2 288 104
1905-06 . . .	1 869 455		

Net pounds, 710 168 448 — 686 818 010 and 756 590 163.

Increase in seven years, 847 382 bales (279 636 000 pounds).

The River Plate, the second great source of foreign wool, has no such increase in progress. Its wool exports are growing but the general character of the supply is stationary or worse. The exports are quoted from Wenz & Co's tables:

Shipments from River Plate in tons (2000 pounds):

1897-898 . . .	273 350	1903-04 . . .	236 610
1898-899 . . .	269 720	1904-05 . . .	231 110
1899-900 . . .	263 340	1905-06 . . .	226 270
1900-901 . . .	243 980	1906-07 . . .	227 590
1901-902 . . .	261 800	1907-08 . . .	251 460
1902-903 . . .	272 140	1908-09 . . .	256 300

Increase in three years, 30 030 tons (60 060 000 pounds).

Reports show an improvement in River Plate shipments in the last wool year. Up to September 16 1909, a fortnight before the close of the season, 554 276 bales had been shipped as against 472 631 in the same part of the season previous. For the season 1908-09 shipments of Plate wool are hence over 513 000 000 pounds and this with the Australian supply gives approximately 1 270 000 000 pounds; half, or nearly half, of what is generally supposed to be the world's clip. No distinction is here drawn between clean wool and greasy, so that a liberal allowance for guesswork must be made in arriving at the yield after washing.

For estimates of the amount of clean wool that is available for the uses of manufacturers in North America and Europe the wool world is much indebted to Helmuth Schwarze & Co., wool brokers, London. Mr. Sauerbeck of that firm is a practical economist of the first order, whose statistical labors are universally esteemed. He deals in the statistics which follow with the amount of wool produced in North America and Europe (excluding the Balcan Peninsula) and with the wool imported into the same two continents, the United Kingdom included. Out of consideration of space the table relating to grease wool is omitted. Let it suffice to say that in estimating yields, shrinkages have been allowed for approximately as follows:

British wools	25 %
Continental	33 »
North American	66 »
Plate and Australian.	50 »
Other wools, mohair, etc.	35 »

During 1909 imports into the two continents will of course show a large increase but as the table stands, Europe and America had in the one set of six years an average of 1 220 000 000 pounds of clean wool at their service and in the next six an annual average of 1 258 000 000 pounds. How does this work out per head of population in the countries of the two continents concerned? Helmuth Schwarze & Co. present these figures.

Clean wool at disposal, per capita:

1861-870.	lbs.	2,26		
1871-880.	»	2,43	increase	7 1/2 %
1881-890.	»	2,57	»	6 »
1891-900.	»	2,76	»	7 1/2 »
1901-908.	»	2,62	decrease	5 »

The same authorities give estimates year by year of the proportion of merino to crossbred in the Colonial and River Plate clips. These estimates may help to explain why with a rising population the quantity of wool per head of people is as well maintained. The calculation is that in 1895 the proportion of scoured crossbred wool was 31.7 per cent, it was 50.7 by 1900, 48.1 in 1902 and 51.8 in 1904. The proportion fell until 1907 when 45 per cent was indicated; it rose to 46.7 per cent in 1908. It is the conviction of those men who know the colonial markets best that crossbred will increase relatively to merino. It cannot be said that the prices obtainable for mutton for twelve or eighteen months past have done much to stimulate the breeding of mutton sheep, but the American tariff — putting as it does a premium on light-condition wool — continues unmistakably to encourage pastoralists to aim at the production of a fine crossbred quality of fleece.

ROBERT WALLACE. **British Breeds of Pigs.** (Board of Agriculture and Fisheries). *British Breeds. of Live Stock.* — London, 1910, p. 1-137.

The following are some extracts from the important official publication of the Board of Agriculture and Fisheries in the part regarding Pigs.

Our domestic pigs are believed to be descended from the wild hog, *Sus scrofa*, crossed with refined white Chinese pigs of a different species, *Sus indicus*, and also with an earlier black offshoot of that species brought from Italy, under the name of the Neapolitan.

Consanguineous breeding is not successful in pigs, as it induces sterility or deformity, and begins to show immediately, in the deficiency of hair on the body, and in the loss of the tail, which drops off at an early stage in the animal's development.

Pigs are divided, irrespective of breed, into two classes—the Bacon Hog and the Fat or Lard Hog. The latter has reached its greatest development in America, the greatest pig-rearing country in the world, through the preponderance of maize in the food, and pigs of this class become loaded with fat until they weigh enormously and bulge out of shape both before and behind.

THE WHITE YORKSHIRE BREEDS.—There are three varieties of White Yorkshire, viz., the Large, the Small, and the Middle breeds—the last evolved from mating the Large and the Small together. The Small breed had a preponderating proportion of Chinese blood, and was almost perfection in symmetry, but carried too much fat, and was too small and not prolific enough for a commercial pig. As a natural result it has ceased to be a rent-paying animal, and is now represented by a very limited number of survivors, which are kept as a matter of historical interest rather than of utility.

THE LARGE WHITE.—The Large White Yorkshire vies with the curly-coated Lincoln for the position of being the largest British white breed. It has a long and abundant coat of fine white hair on a white skin, which may now and then show a few blue spots.

A full-grown boar in show condition may weigh up to about

10 cwt., while pigs at a year old weigh up to $5^1/_2$ cwt. The Irish Department of Agriculture has pronounced the Large White to be admirably suited to the requirements of Irish farmers, for, among other reasons, its "neat head, light neck and shoulders, good girth, and plenty of depth through the heart, well-sprung ribs, with moderate depth of side, great length of body on short legs, thick loins and stout thighs." A strong constitution, immense size, quickness of growth, and lean flesh are its characteristic qualities.

THE LINCOLNSHIRE CURLY-COATED PIG.—The Lincolnshire Curly-coated breed is one of the oldest in the country, and with little doubt one of the ancestors of the famous Chester White breed of America, but till within the last few years its merits were known only in its own locality in the east of Lincolnshire. The skin, with the exception of blue spots, and the long abundant curly hair, are white. The face is short, and the ears fall right over it; the snout is a good length and quite straight.

Early Maturity and Rapid Growth.—The breed is strong-boned, robust in constitution and prolific, and it is claimed to be, as tested by Smithfield show records, unequalled in early maturity and development. It was admitted for the first time to compete in 1908, and secured the premier position for class average daily gain, and in the single pig class under twelve months.

The Secretary of the Lincoln Curly-coated Pig Breeders' Association states that ten pigs at an average age of 161 days have given an average weight of 170 lb., or a daily gain of 1 lb. 1.68 ozs. It is equally good as a "sucker" and a bacon pig, producing the right kind of animal for the pork-butcher, at 8 stones (of 14 lb. dressed pork), 12 stones, 18 stones, or any weight up to 40 stones. A sow easily reaches 30 to 35 stones at a year old; 40 stones at 20 months after rearing a litter of pigs, and 60 stones at three years old. Crossing with other British breeds has proved successful, especially with Berkshire, Large White and Large Black.

THE LARGE BLACK PIG —The Large Black is one of the oldest breeds, but has only recently emerged from local obscurity. There are two original habitats, viz., Suffolk and Essex, and Devon and Cornwall; but since 1900, when the breed was admitted to competition at the shows of the Royal Agricultural Society, the Bath and West, and the Smithfield Club, the patrons of the breed have increased at an unprecedented rate and herds of registered animals have been established in many parts of England, and one in Scotland.

The Two Types of Large Black Pigs.—The West Country pig from Devon and Cornwall is the larger and more refined type, while it is claimed for the East Country sort from Suffolk and Essex that they are more numerous. They are probably also more hardy and prolific, but a few years will blend the good qualities of both.

Weight.—While market fashion now demands a young carcase weighing 160 to 190 lb, a quarter of a century ago the practice was to feed to maturity and attain the enormous weights of 40 score (of 20 lb.) and upwards.

THE BERKSHIRE PIG.—The Berkshire is perhaps the most widely known and widely distributed of British pigs. It was one of the first to be improved, and, being suitable to American conditions, it has become one of the most successful breeds in that country. It is black with a pinkish skin, with distinguishing breed markings in a little white on the nose, forehead, ankles, and tip of the tail.

THE TAMWORTH PIG.—The Tamworth or Staffordshire breed is most numerously represented around Birmingham. It is an ideal bacon hog, exceedingly light in the offal, with a long trim body very smoothly covered with firm flesh, indicating a desirable mixture of fat and lean.

Value for Crossing.—The Tamworth crosses admirably with all other British breeds, and produces a hardy commercial class of pigs that are better able to withstand cold than pigs of some of the more refined and delicate breeds, like the Berkshire. The chestnut colour, although better than white, is not so well able to resist sun-scald as black.

THE LARGE WHITE ULSTER PIG.—This breed has been known in the North of Ireland in very much its present form for over fifty years, although its origin is unknown and it was not a registered breed till about 1906. When the Royal Ulster Agricultural Society, after consultation with the Irish Department of Agriculture, decided to establish a *Herd Book*, a scale of points was drawn up, and arrangements made to determine by inspection the eligibility of boars and sows for registration. This inspection is made by competent judges at various centres throughout Ulster at a stated period each year. Before the end of 1909 there were 160 boars and 332 sows entered in the Herd Book.

The Board of Agriculture and Fisheries publishes the following list of the Pig-breeding Societies in Great Britain, busides indications on Shows, prices etc.:

. List of Breeding Societies of Pigs		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Berkshire . . .	British Berkshire Pig Society. Secretary: Edgar Humfrey, Shippon, Abingdon.	Shows;—Royal Agricultural Society, Royal Counties, Bath and West, Oxfordshire, Suffolk, Notts, Wilts, Tring, Royal Lancashire, and Peterborough.	Crdinary prices for good Berkshires from a private herd about 10 months old; Boars and Sows 5 to 10 guineas each. For superior show animals and winners of prizes from 20 to 50 guineas each. Sales are principally conducted on the farms. At a private sale in 1909, 83 head averaged £7 3*s.* while at a private sale in 1908, the average was £10 11*s.*
Large Black . .	Large Black Pig Society. Secretary: W. J. Wickison, 12 Hanover Square, London, W.	Royal Agricultural Society's Show and Sale.	First-class pedigree Boars from £15 to £20; Sows from £10 to £12. For young animals the price is approximately £1 per month of age, a six months' pig costing about £6. The only special sale for Large Blacks is that held in connection with the Annual Show of the Royal Agricultural Society. At this show in 1909, 19 boars averaged £6 18*s.* per head, and 17 sows £6 1*s.* per head. At a private sale in 1909, 52 head averaged £8.

List of Breeding Societies of Pigs		Principal Places of Sale and Average Prices of Animals of each Breed	
Breed	Name of Society and Address of Secretary	Principal Places of Public Sale, Exhibitions and Shows	Average Prices
Lincolnshire Curly Coated.	Lincolnshire Curly Coated Pig Breeders' Association. Hon. Secretary: Charles Edward Williams, Thornhayes, Sleaford, Lincolnshire.	Shows: — Royal Agricultural Society, Lincolnshire Agricultural Society, Peterborough Agricultural Society.	At a recent sale 11 boars averaged £14 5s. per head, and 25 gilts £7 11s. per head.
Tamworth . .	British Tamworth Pig Breeders' Association. Secretary: J. G. Kerr, Estate Office, Cholderton, Salisbury.	—	—

R. H. Rew. **Number of Breeding Sows in Great Britain, 1900 to 1909.** — *Report to the Secretary of the Board of Agriculture and Fisheries.* Board of Agriculture and Fisheries. *Agricultural Statistics*, 1909, Vol. XLIV, Part. I; *Acreage and Live Stock returns of Great Britain.* London, 1910, Cd. 5064, p. 18.

" The following table of the number of breeding sows returned in each of the past ten years in each part of Great Britain shows the rapid changes, both in the way of reduction and recovery, which occur in even the most stable class of the pig population.

Year	England	Wales	Scotland	Great Britain
1900	279 782	36 130	16 609	332 521
1901	268 909	35 446	15 369	319 724
1902	295 237	36 826	16 937	349 000
1903	332 735	39 404	17 761	389 900
1904	327 904	36 621	17 531	382 056
1905	285 372	33 439	16 197	335 008
1906	284 950	34 480	16 892	336 322
1907	321 740	39 718	18 809	380 267
1908	315 524	37 510	16 442	369 476
1909	268 401	32 857	15 294	316 552

Suggestions for Pig-Feeders. — *The Journ. of the Board of Agric.*, December 1909, Vol. XVI, N. 9.

" Pig-breeding in Great Britain is an industry of great importance, but it is one which has shown little tendency to develop. The number of pigs kept fluctuates from year to year, but, without actually decreasing, it has shown no permanent signs of growth during the past thirty years. There would seem, however, to be no reason why a considerable increase should not take place. The breeding and feeding of pigs offers a fair profit in most years, and the fact that this country pays huge sums annually for imported pig-meats suggests that a proportion of the demand might, with advantage, be supplied by the home producer. Tha fall in the pig population of Great Britain during the past year or two, combined with the high prices which have lately prevailed, should certainly prove a stimulus to the pig-keeper to secure some of this trade and afterwards retain it in his own hands.

It will be seen from the table which follows that the pig population in 1909 was lower than either in 1907 or 1908.

	1907	1908	1909
England	2 257 136	2 439 087	2 046 284
Wales	232 996	240 611	204 784
Scotland	146 634	143 784	129 819
Great Britain . . .	2 636 766	2 823 482	2 380 887

The number of pigs in 1908 was 200 000 greater than in 1907 but also 440 000 (over 18 per cent.) greater than in 1909. It seems probable that breeding sows have been extensively marketed, for the number is lower this year than at any time since 1893, when it was 308 722, compared with 316 552 in 1909 and 369 476 in 1908."

W. J. Colebatch. **Lincolnshire Curly-Coated or Boston Pigs.** — *Jour. of the Dept. of Agric. of S. Australia*, Vol. XIII, n. 7, Febr. 1910. Adelaide, pp. 582-089, illustrated.

For generations past there has existed in the county of Lincoln, chiefly on the eastern side, a top-eared breed of large white, curly-haired pigs known locally as the "bacon pigs of Lincolnshire."

In their own immediate locality they have been appreciated and most carefully bred for a very long period, but it is only during the last 4 years that they have spread and taken their place among the Berks, Yorkshire and other great breeds.

In March 1907 the Lincolnshire Curly-coated Pig-Breeders Association was incorporated. Its objects are the following:

1) The encouragement of the breed at home and abroad, and the maintenance of its purity.

2) The publication of a herdbook, with pedigrees, etc.

3) The holding of shows and sales.

4) The promotion of the interests of the breed at all shows throughout the country.

5) The publication of transactions relating to shows, sales, etc.

6) The securing for the breeders of a fair share of the demand existing for stud stock of high quality.

The society has hitherto registered 179 herds and has shown itself active in promoting the interests of the breed They have drawn up a table of the points of the breed for the guidance of breeders and purchasers.

This breed was first exhibited at Smithfield in 1908, but classes and prizes have now been arranged for it at the principal shows. At Buenos Ayres in 1909 it was allotted first classes.

From a table given by the author it appears that this breed has made the highest daily gain (average and individual) of any pig weighed at the Smithfield Show, London 1908.

This pigs are unequalled in their aptitude to fatten and to mature early, and they are both pork producing and bacon producing. Whilst their shrinkage on slaughter is below the average. They are besides hardy, vigorous, sound and prolific.

At the first annual sale held at Louth, young boars were selling at from 15 to 30 guineas, and at Mr. Freir's sale, 50 guineas were paid for one sow.

The government of S. Australia has requested Professor Perkins to select some animals of this breed as the nucleus of a herd for the Government Experimental Farm at Kybybolite.

Pig feeding experiments in Scotland, Swine Husbandry in the United Kingdom and Denmark. — Report of the Canadian Commission, 1909, 17-18. Ottawa, Jan, 1st., 1910.

The West of Scotland Agricultural College at Kilmarnock has for a number of years been experimenting with different kinds and mixtures of foods in pig feeding. When the Commission visited the College in July four lots of pigs were being fed. Each lot comprised 8 pigs each being given a different mixture.

The following Tables show the results of the use of different foods and mixtures in experiments conducted in 1906, 1907 and 1908.

EXPERIMENTS OF 1906.

Lot	No. of pigs	Food	Total live weight at beginning of experiment	Period of experiment	Total gain in live weight	Meals consumed	Milk whey consumed
			lbs.	Days	lbs.	lbs.	galls.
1	4	Separated milk and barley meal.	342	42	217	434	504
2	4	Whey and barley meal . .	450	42	217	434	672
3	4	Whey and corn meal. . .	453	42	239	448	672
4	4	Whey and Paisley meal . .	460	42	283	448	672
5	4	Whey alone	499	42	174	. .	882

EXPERIMENTS OF 1907.

Lot	No. of pigs	Food	Total live weight at beginning of experiment	Period of experiment	Total gain in live weight	Meals consumed	Milk whey consumed
1	5	Whey and barley meal throughout	508	98	651	1 447	2 000
2	5	Whey and barley meal for first period; barley and corn meals; corn meal to finish .	478	98	704	1 491	2 000
3	5	Whey and corn meal throughout	479	98	714	1 479	2 000
4	5	Whey with corn meal first period; barley and corn meals; barley meal to finish.	452	98	658	1 471	2 000
5	5	Whey and Paisley meal throughout	467	98	599	1 344	2 000
6	4	Whey alone	472	98	599	. .	3 400

EXPERIMENTS OF 1908.

Lot	No. of pigs	Food	Total live weight at beginning of experiment	Period of experiment	Total gain in live weight	Meals consumed	Milk whey consumed
1	4	Whey and barley meal throughout	462	77	518	848	1 100
2	4	Whey with barley meal first period; barley and corn meals; corn meal to finish.	545	77	543	1 078	1 100
3	4	Whey and corn meal throughout	555	77	555	1 079	1 100
4	4	Whey and corn meal first period; barley and corn meals; barley meal to finish.	481	77	436	892	1 100
5	4	Whey and Paisley throughout.	468	77	432	892	1 100
6	4	Whey alone	484	77	364	. .	1 850

W. A. HENRY. **Feeding Pigs before and immediately after Weaning.** — (*Feeds and Feeding*, 1906, p. 541). *The Journ. of the Board of Agric.*, December 1909, Vol. XVI, N. 9.

" Experiments conducted with several litters of pigs showed that the sow and pigs together before weaning, and the pigs alone after weaning, required almost identical quantities of milk and meal for the production of 100 lb. net gain. The foodstuffs used were maize meal, middlings, oats, barley, and skim milk, weaning taking place when the young pigs were ten weeks old, and feeding being continued for a further seven weeks. The average of twelve litters showed that for 100 lb. gain the sow and pigs before weaning required 231 lb. of meal and 534 lb. of skim milk, while after weaning the young pigs (eight litters) needed 230 lb. of meal and 539 lb. of skim milk.

Henry showed at the Wisconsin Experiment Station that the weight at birth of a large number of young pigs averaged 2.5 lb., the heaviest pig weighing 3.6 lb. and the lightest 1.6 lb. By weighing the young pigs regularly for seventeen weeks it was found that they gained in weight on the average 1.9 lb. in the first week, 3.1 lb. in the fifth week, 4 lb. in the seventh, 5.4 lb. in the tenth, 5.9 lb. in the fourteenth, and 7.6 in the seventeenth week. The average gain for the last seven weeks amounted to 6 lb. per week per pig, and at the end of the seventeenth week the pigs were gaining over 1 lb. each per day. This will be clear from the following table:"

WEIGHT AT BIRTH AND AVERAGE WEEKLY GAINS OF YOUNG PIGS.

Before weaning (10 weeks) Twelve litters (86 pigs)			After weaning (7 weeks) Eight litters (62 pigs)		
Week	Average weight	Gain	Week	Average weight	Gain
	lb.	lb.		lb.	lb.
At Birth.	2,5	—	10	41,5	—
1	4,4	1,9	11	46,7	5,2
2	7,0	2.6	12	52,0	5,3
3	9,8	2,8	13	58,3	6,3
4	12,5	2,7	14	64,2	5,9
5	15,6	3,1	15	69,8	5,6
6	18,6	3,0	16	76,5	6,7
7	22,6	4,0	17	84,1	7,6
8	27,8	5.2			
9	33,1	5,3			
10	38,5	5,4			

Pig feeding experiments in Wiltshire. Swine Husbandry in the United Kingdom and Denmark. — Report of Canadian Commission 1909, 12-13. Ottawa, Jan. 1st., 1910.

" To encourage production in quantity and quality of pigs the Wilts County Council was induced to take up a series of pig feeding experiments and demonstrations in cheap production. A Committee of ten members consisting chiefly of farmers was formed. Contributions to carry on the work were made by Lord Lansdowne whose estate joins Calne, the Harris Company and the County Council. A thoroughly capable and painstaking secretary was appointed to keep records, while a son of one of the leading farmers was entrusted with the actual feeding. The tests and demonstrations were carried on for five years after which time the Secretary and scientific adviser gave courses of lectures throughout the country and distributed reports.

During the five years 720 pigs were fed from store to finished condition. No special care was taken to select stores, which were of no special breed, and were bought in the manner customary among the great majority of the farmers in the district. For the feeding tests comfortable and sanitary pens were erected each to accomodate ten pigs. The foods used were those commonly employed in that part of England and consisted of the following: corn, barley, oats, peas, and bean chop, bran, separated milk, potatoes and mangels as also a number of proprietary foods. The dry food was soaked in water in the proportion of one peck of the former to 5 gallons of the latter, except when separated milk was used it replaced its own volume of water in the mixture. The potatoes were boiled and the mangels sliced. The pigs were fed three times a day as much each time as they could clean up.

The weights of pigs at the commencement of fatteuing ranged from about 90 to 140 lbs. The live weights when finished ranged from 133 to 236 lbs. The feeding periods ranged from 7 to 14 weeks. An examination of the exhaustive report of the tests shows the following conclusions: The diets which gave the highest weekly increase in live weight were:

1) Barley, separated milk and potatoes . . . . . . 15,8 lbs.
2) Corn, separated milk and potatoes . . . . . . 15,1 »
3) Barley and separated milk . . . . 13,3 »
4) Corn and separated milk. . . . . 13 »
5) Barley and potatoes . . . . 12,8 »

A larger proportion of best pigs for bacon was obtained with barley than with corn feeding.

The addition of either milk or bran, but especially the latter, to barley or corn raised the proportion of best pigs.

The addition of potatoes to barley increased the proportion of best pigs, whilst a similar addition to corn, decreased it.

The addition of beans and oats to corn increased the proportion of best pigs.

To produce 100 lbs. increase in live weight about 5 per cent. more corn than barley was required.

When fed with barley 63,4 gallons of separated milk replaced 127 lbs. of barley, or one gallon of separated milk equals 2 lbs. of barley.

When fed with corn 59,6 gallons of separated milk replaced 186,7 lbs. of corn, or 1 gallon of separated milk equals 3 lbs of corn.

Fresh separated milk gave a better result than stale separated milk.

When bran was fed with barley, 143,9 lbs. of bran replaced 179,7 lbs. of barley, or 1 lb. of bran equals 1 $^1/_4$ lbs. of barley.

When bran was fed with corn 155,8 lbs. of bran replaced 181,3 lbs. of corn, or 5 lbs. of bran equals 6 lbs. of corn.

When pea meal was fed with corn 103 lbs. of the former replaced 183,5 lbs. of the latter, or 1 lb. of peas equals rather more than 1 $^3/_4$ lbs. of corn.

When bean meal was fed with corn 101 lbs. of the former replaced 189 lbs. of the latter, or 1 lb. of beans equals 2 lbs. of corn nearly.

To produce 100 lbs. dressed weight, the quantity of barley alone used was very slightly in excess of the corn meal alone.

81,6 gallons of separated milk fed with barley, effected a saving of 141,4 lbs. of the latter, or 1 gallon of separated milk equals 1 $^3/_4$ lbs. of barley meal.

72 gallons of separated milk fed with corn meal replaced 205,2 lbs. of the latter, or one gallon of separated milk equals rather more than 2 $^3/_4$ lbs. of corn.

Where bran was fed with barley, 202,5 lbs. of bran replaced 172 lbs. of barley. In this case therefore the value of the bran in increasing dressed weight was very considerably less than that of the barley.

Where bran was fed with corn, 186 lbs. of the latter were replaced by 191 lbs. of the former, i. e., the two food stuffs were of nearly equal value in the production of dressed weight.

Where pea meal was fed with corn, 131,5 lbs. of the former replaced 173,5 lbs. of the latter, or 1 lb. of peas equals 1 $^1/_3$ lbs. of corn.

The five diets which gave the best quality meat, arranged in order, are as follows:

1) Barley and bran	990	points.
2) Barley and potatoes	989	»
3) Barley and milk	988	»
4) Barley and corn germs	983	»
5) Barley alone.	974	»

The practical nature of the lessons learned from these tests are indicated in the above deductions. The series of lectures held, in which the whole work was made plain, established an exceedingly rational system of pig feeding throughout the district."

LOUDON M. DOUGLAS. **Bacon-curing in Scotland.** — *Trans. Highl. and Agric. Soc. of Scotland,* V series, vol. XXI. Edinburgh, 1909, illustrated, pp. 58, 74.

In England and Ireland bacon-curing has become an extensive industry; it has progressed but slowly in Scotland.

Since 1876, there are fairly accurate returns of pigs, and these show considerable fluctuations.

In 1876 the numbers in Scotland were estimated at 154 000:

in 1886	133 890
» 1896	144 615
» 1906	130 199
» 1908	143 784

The decline in 1906 was due principally to the presence of disease.

In comparing the figures for Scotland with England and Wales it is noticeable that Scotland is far behind the others.

Number of pigs in Great Britain in 1908:

England	2 439 087
Wales	240 611
Scotland	143 784

The distribution of pigs in Scotland is somewhat unequal, the counties with the largest numbers being Aberdeen, Ayrshire, and Wigtown.

In earlier days the breeds of pigs in Scotland were much neglected and this contributed, no doubt, to the absence of development in the manufacture of pig products. In recent years the Highland breed has been entirely eliminated from the country and their place has been taken by the recognised modern breeds.

In so far as bacon-curing is concerned the class of pig that is wanted is one which weighs about 16 stone live weight.

The "dead weight" will be about 168 lb., and for the generality of purposes this is the most profitable kind of pig to produce. Other styles of pig are, however, in demand for special trades. The ham trade, for example, requires a small pig which will weigh about 112 lb. dead weight. A 12 stone pig should be produced in about seven months with steady careful feeding, provided that there is a plentiful supply of separated milk and that the pigs are comfortably housed.

The author treats next of the Relationship of Creameries and Pig-Breeding, of the Present Centres of Bacon-Curing, and of the Old Process of Curing and thus comes to the:

Present-day Process. — The Dumfriesshire and Ayrshire cured bacon is made now by what is known as the "wet-cure" process.

That is, the bacon is immersed in pickle instead of being cured in the dry state, as is the case with Wiltshire bacon. The only advantage of the wet process lies in its being adaptable more easily where there is no machinery, and where the cooling is derived from a naturally cool cellar, or from a cellar cooled with ice.

The process of handling the pigs for curing may he divided as follows:

Slaughtering.
Cooling in the open air.
Skinning and cutting up.
Chilling and trimming.
Curing.

The author describes each of these operations and states that it is essential for bacon-curing purposes that the whole of the blood should be let out, and in doing this, care should be taken that the knife does not enter either of the shoulders, as otherwise the fore end of the side so touched will most likely be destroyed.

The curing of the whole sides with the backbone and the blade-bone taken out is the Wiltshire method. This is now being practised in many parts of Scotland and it is likely to extend very much in the future.

Wiltshire bacon is always produced by, first of all, pumping the whole sides with pickle and then dry-salting them on the bacon bed. They are usually stacked in tiers in ten sides,—one on the top of the other—and in this way are cured in about 14 days.

The Danish bacon, which comes to the United Kingdom in large quantities is generally cured in the Wiltshire manner.

The modern bacon factory is not complete without having a sausage department and one for lard. The first utilises the trimmings of the carcases, and in some factories it is customary to slaughter a number of hogs for the use of the small goods department.

On the whole, the outlook of the bacon business in the United Kingdom in satisfactory and there are not wanting signs of a general revival in connection with the industry.

This revival has begun in Ireland, it has spread to England, and has also come to Scotland.

K. J. J. Mackenzie (University Lecturer in Agriculture, Cambridge). **Baby Beef.** — *The Journal of the Board of Agriculture*. London, June 1910, vol. XVII, n. 3, p. 177.

" The term " baby beef " is used to indicate as tersely as possible the faculty of early maturity in cattle which are wanted for beef production. For the last hundred and fifty years our breeders of horned stock have constantly endeavoured to hasten the early development of their animals, and the object of this paper is to put before the reader the question of the advisability of taking full advantage of the extraordinary power which is possessed in this respect by well-bred cattle of the British " beef breeds. "

A large bullock put up to fatten will want about 100 lb. of food a day for sustenance and increase, and of this about 75 lb. will be used for sustenance and 25 lb. for increase. If it is fed upon 8 lb. of linseed cake, 10 lb. of hay, and 82 lb. of roots, we find, using the figures given in Warington's " Chemistry of the Farm," that the food has been employed somewhat as follows: For increase: 2 lb. cake, 5 lb. hay, 20 lb. roots. For sustenance: 6 lb. cake, 5 lb. hay, 62 lb. roots.

In order, therefore, to obtain the greatest possible profit from animals wanted for beef, it is necessary to "keep them moving." If for any length of time they stop growing heavier, no return is then being given for the money spent on their sustenance. In other words, a beast that is wintered in a strawyard on an allowance of food which merely keeps it alive is doing nothing to help pay for all the money and trouble that is being expended upon it.

Yield of Meat in Animals of Different Ages. — In the case of beef-making, young animals give, considering the food they consume, a greater proportionate increase than do older ones; or, in other words, the greater the age of the animal, the greater is the proportion of the food required for sustenance, and the smaller the increase obtained. This is shown by the following figures, which are taken from the published accounts of the Smithfield Carcass Competition, and represent results obtained from five breeds, namely, Shorthorns, Herefords, Aberdeen Angus, Sussex, and Devons. The weighings were obtained in eight years from:

77 yearlings	slaughtered	at about	22	months old
89 two-year olds	»	»	33	»
54 three-year olds	»	»	44	»

As regards yearly increase, we find the yearlings (live-weight 1344 lb.) gave an average of 63 stones (of 14 lb.) and 5 lb. of beef each, or at the rate of 34 $^1/_2$ stones per 12 months of life. The two-year-olds (live-weight 1750 lb.) yielded 84 stones 7 lb. of beef, which gives a rate of 30 $^3/_4$ stones per 12 months, while the three-year-olds (live-weight 2112 lb.) gave 96 stones, or at the rate of only 26 $^1/_5$ stones per 12 months.

The financial advantage of selling early may be seen from the following table, in which the prices realised per month of life for the youngest and oldest animals sold at Mr. R. Bond's Auction Sales at the Ipswich Fat Cattle Shows are given for three years and four years respectively:

Year	Age	Live weight	Weight of dressed Carcass	Percentage of Carcass to Live weight	Price realised at Sale	Price realised per month of life
	Yrs. m. d.	Cwt. qr. lb.	Cwt. qr. lb.		£ s. d.	£ s. d.
1904.	1 0 0	9 0 2	5 1 6	58.8	21 0 0	1 15 0
1905.	1 0 14	9 0 6	4 3 0	52.5	18 0 0	1 8 10
1907.	1 1 20	11 2 12	7 0 4	60.6	22 10 0	1 12 11
Average of youngest .	1 1 20	9 2 25	5 2 16	59.0	20 17 0	1 10 7
1904.	1 8 13	11 1 16	7 1 2	64.6	26 0 0	1 5 5
1905.	1 5 0	10 3 16	6 3 8	62.6	24 10 0	1 8 10
1907.	1 9 4	9 2 13	5 1 26	57.0	21 0 0	0 19 11
1908.	1 9 14	11 3 18	7 0 6	59.2	28 10 0	1 6 7
Average of oldest . .	1 8 0	10 3 23	6 2 17	60.7	25 0 0	1 5 0

It will be noticed that in the case of animals whose average age is just over 13 months, the return per month is 5 s. 7 d. more than in the case of beasts just 20 months old.

In the case of the yearlings, i. e., beasts slaughtered at about 22 months old, for twelve months' keep we get 34 $^1/_2$ stones' worth at 8 s. = £13 6 s. The two-year-olds, i. e., animals that lived 11 months longer, gave an increase of 21 stone, so that for about another year's feeding we should receive £9 3 s. Going a step further, we find that the three-year-old for a further 11 months' feeding gives an increase of 12 stone. This is at the rate of under £5 5 s. for the last 12 months' feeding.

The following table sets out the facts more clearly:

Age of Beasts	Percentage of Dead to Live weight	Carcass weight	Value of meat	Increase of value for last twelve month (calculated)
Months.		Stone	£ s. d.	£ s. d.
22	66.0	63	25 4 0	13 15 0
33	67.5	84	33 12 0	9 3 0
44	69.2	96	38 8 0	5 5 0

Unfortunately the Smithfield Show does not include beeflings or calves ready at about 12 months old, and it is to them more especially that the author refers when speaking of baby beef and he gives some particulars of five such animals—only one being a show beast—and these animals averaged 8 cwt. live weight at just under 12 months old. Assuming that they would only average 57 per cent. of carcass weight to live weight, they would give a return of 36 stone for each beast. This would give £14 8 s. for the first 12 months of life.

Baby Beef-making on the Pail. — In the *Journal of the Royal Agricultural Society* previously mentioned, Mr. H. Evershed gives an account of a system, to which the author refers in some detail.

The farm consists of about 300 acres, of which only 15 vere in grass. A few large deep milking cows were kept, and every year from 100 to 150 young bullocks went out at from 12 to 18 months old. In one year 170 bullocks went out at an average of 15 months (they ranged from 14 to 18 months, but wery few were more than 15 months old). The average carcass weight of these 170 bullocks was 37 stones (of 14 lb.) which at 8 s. a stone gives a value of £14 16 s. each.

The calves were bought in, except the few from the above-mentioned cows, and the homebred ones were found to do the best of all. For the first four weeks of their lives the calves had, on an average, 1 $^1/_2$ gallons a day of whole milk, which makes a total of 42 gallons each. On this system calves must have some whole milk given them. For the next eight weeks 1 $^1/_2$ gallons of liquid was given, made up of half new milk and half water of skim milk, and boiled linseed and oatmeal as a cream equivalent. From the twelfth till about the sixteenth week pail-feeding went on even if skim milk were not available, for nourishing and palatable fluid was believed to be of great importance. At about 14 weeks old the calves would be getting 1 $^1/_2$ gallons of skim milk plus 1 lb. of boiled linseed and oatmeal gruel, or 1 $^1/_2$ gallons of water plus 2 lb. of gruel. This was gradually discontinued till at 4 months old the calves were on dry food, the best of hay having been supplied from the fifth week.

All through their first summer—that is to say, from the age of 4 to 7 months or so the calves were in boxes made in old barns, very little litter being used, the feeding being all the greenfodder crops they could consume without scouring, all the hay they would eat, and from 3 to 4 lb. a day of best linseed and bean meal, half and half per diem.

Six to nine months' autumn and winter feeding followed, when they received per diem $^3/_4$ to 1 bushel of cut roots, 4 to 6 lb. of cake and meal, and all the good hay they could eat. They were usually sold at about 13 months old, but if the market was against them they were fed on, receiving a little more cake and corn, though never more than 8 lb. a dav, till prices improved. February was found to be the best month for the sale of this small beef, though June and July were also very favourable.

Mr. Evershed states that the success of the system depends largely upon the men being made to take an interest in the animals, and that the beasts should be fed regularly and never over-fed at any one time. While calves are being pail-fed their food must be kept scrupulously clean, and their stalls must also be kept clean and sweet, otherwise scour will spread, and then, he says, "good-bye to one's profit."

Refrigeration in the Meat Industry. — (*Ice and Cold Storage*, 12-1909, No. 137, pp. 173-179, figs. 11; 138, pp. 199-206, figs. 11; 139, pp. 225-232, figs. 14, London); *Exp. Stat. Rec.*, Febr. 1910. Washington.

An illustrated discussion and summary of data regarding various questions concerned with the cold storage of meat, including the effects of freezing upon meat fibers, the transportation of frozen and chilled meat, and the transport of such meat on board ship.

G. S. Buchanan and S. B. Schryver. **The application of Formaldehyde to Meat.** — (*Local Gt. Board* (*Great Britain*) *Food Reports*, 1909, N. 9, pp. 12; *E. S. R.*, Washington, Febr. 1910).

This report contains an account of the circumstances of the investigation by G. S. Buchanan, and data on the presence and detection of formaldehyde in meat by S. B. Schryver, from which the following conclusions were drawn:

"The results indicate that, in the case under consideration, formaldehyde was not readily removed from meat even when the latter had been kept for prolonged periods after formalization; that where muscular surface was exposed to the vapor, the contamination was relatively large (1 in 3 500); and that a common depth of penetration into muscular tissue was 20 mm. under a thin superficial layer of connective tissue."

R. H. Rew. **Prices and Supplies of Live Stock and Meat.** — *Board of Agriculture and Fisheries. Agr. Statistics 1909*, Volume XLIV, Part III. London, 1910 (Cd. 5268), p. 189.

"Statistics of supply: the following table summarises the receipts from oversea, during each of the past five years, of beef, mutton, and pig-meat respectively. In the case of beef the imports of live cattle (excluding those from the Channel Islands), with their estimated carcase weight, are separately shown:

Year	Beef	Live Cattle		Total Beef Imports Live & Dead	Total Mutton Imports Live & Dead	Total Pig-Meat
		Number	Equivalent Weight			
	Cwts		Cwts	Cwts	Cwts	Cwts
1905 . . .	5 778 357	563 624	3 669 680	9 448 037	3 940 940	7 529 010
1906 . . .	5 981 473	559 576	3 636 800	9 618 273	4 187 519	7 543 551
1907 . . .	6 033 736	470 214	3 060 660	9 094 396	4 675 183	7 320 223
1908 . . .	5 997 964	381 786	2 475 612	8 473 576	4 493 886	7 753 799
1909 . . .	6 583 559	319 032	2 060 784	8 644 343	4 891 306	6 441 475

"The total imports of beef in the two latter years of the period were considerably smaller than in the three years 1905-07, and the deficiency, assuming home supplies to be stationary, would suffice to account for the rise in prices. It may be noted that whereas in 1908 the number of live cattle fell off without any compensating increase in the imports of beef; in 1909, on the other hand, the decline in live imports was more than counter-balanced by the increase in beef, which reached the highest total on record. The total imports of mutton were also larger in 1909 than in any previous year, notwithstanding the practical disappearance of the trade in live sheep. Imports of pig-meat, on the other hand, showed a remarkable decline and, indeed, fell to a smaller total than in any year since 1895.

"For home supplies of meat there are at present no official data, although in their absence use has frequently been made of the estimates which I laid before the Royal Statistical Society in 1903. I hope before long that the information now being collected and tabulated by the Board will afford a still more satisfactory basis for such calculations in the future. But in any case, as all estimates of this nature must necessarily be founded on the returns of stock collected in June each year, it will be very difficult to measure the quantity of home-produced meat coming into consumption in a calendar year. It is, however, possible to obtain an index of the plentifulness or scarcity of home supplies from year to year from the returns of the number of stock exposed for sale at the 30 markets throughout Great Britain, for which the entries have been reported weekly during the past five years in the Board's Return of Market Prices. The numbers of fat stock entering these markets have been as follows:

Year	Cattle	Sheep	Pigs
1905	888 023	3 537 692	532 544
1906	884 531	3 403 630	481 492
1907	916 448	3 483 424	552 820
1908	887 255	3 338 005	600 901
1909	914 953	3 844 983	541 578

A. D. Hall. **The Meat Trade in England.** — Agriculture and the Development Grant. — *The English Review.* April 1910, London, p. 135.

"Year by year our farmers are losing the meat trade, simply because the great firms importing foreign meat from America, the Argentine, Australia, and New Zealand, have covered the country with a standard article on which it can rely. The retail tradesman need no longer back his judgment in buying live stock, he is freed from all anxieties about killing and storage, for which his facilities are often poor, he can order his stuff by telephone from the daily price list and then concentrate his energies on the one problem of selling. This organisation will beat the British farmer out of the market except for the very choicest produce; it has already rendered the ordinary fat-stock business a very uncertain source of profit. We must set up rival organisations, by establishing in each district a slaughtering and cold-storage depot at some convenient railway centre, and by organising the local farmers and butchers, the one to furnish fat stock and the other to buy dead meat from the depot according to grade. This may seem an impossible undertaking, but one example successfully started would soon take effect all over the country, because the purchaser prefers British meat even at a higher price provided that he can get it properly hung".

The Rise in Prices of Butcher's Meat in England. — *Sole.* Milano, 26th June 1910.

The decrease in the quantity of cattle supplied by the United States and Canada to the English market has caused a great increase in the price of butcher's meat in England.

Both in Canada and in the United States, less cattle is now raised than was the case formerly, whilst at the same time the numbers of meat consumers in those countries have increased.

Besides the above causes, no importation of live stock from the Argentine is now allowed for reasons of hygiene.

Between 1907 and 1909 the importation of cattle from the United States has diminished by nearly one half, and the quality has become poorer.

The free admittance of Argentine live stock is asked for.

Frank W. Mahin (U. S. Consul. Nottingham). **Controversy between Butchers and Farmers regarding Warranty of Meat against Tuberculosis.** — *Monthly Consular and Trade Reports.* Washington, January 1909, N. 340, p. 73.

A controversy between butchers and farmers in the Midlands and other parts of England as to who shall bear the loss caused by tuberculosis in cattle threatens serious complications touching prices and supplies of beef. The loss has always been borne by the butchers, but several months ago the British Federation of Meat Traders' Associations decided that the loss should be shifted to the cattle grower, and that their members should buy only of farmers who would give a warranty against tuberculosis. Accordingly, the Nottingham butchers, numbering 300, issued notice to the local farmers that on and after November 2, 1908 no cattle would be bought from them without such warranty. It seems that the loss to the Nottingham butchers on meat condemned by inspectors has been from $1000 (5180 frs.) to $2000 (10 360 frs.) a year. It is understood that butchers generally throughout the country will take similar action on November 2.

This locality is particularly interested on account of the large cattle market in Nottingham. Most of the beeves are bought by butchers, and a boycott by them would destroy the market excepting for cattle wanted for milk or breeding purposes. More important to the public, however, would be the resultant scarcity and high price of beef, at least temporarily.

On the other hand, the farmers have organized to resist the butchers' demands. They claim that a warranty would be unfair to them, because tuberculosis is rarely discovered till after the animal is slaughtered, and that a warranty is impracticable, because the animal usually passes through several hands before reaching the butcher, and a warranty could not follow it through, as identification would be impossible. A suggestion that the farmer could protect his risk in giving a warranty by insurance on his cattle is also considered impracticable on the ground of difficulty of identification. In a West of England district, however, a qualified form of insurance has existed for many years. For each beef sold at auction the auctioneer is paid sixpence (10 frs. 63 c.) or a shilling (1 fr. 26 c), for which he guarantees the animal to the first purchaser, but no farther.

Some farmers intimate that if the butchers persist in their demand they will slaughter their own cattle and go into the meat trade themselves, while expressions made at recent meetings indicate that many farmers will quit raising beef cattle rather than give the warranty.

The butchers of this locality have been encouraged to stand firm by information that in a section of the north of England farmers now warrant their cattle, paying a small sum on each head sold, into a common fund from which compensation is made to the purchasers in case tuberculosis is discovered."

R. H. Rew. **Dead Meat Trade.**—*Standard Cyclopedia of Modern Agriculture*, ed. by R. P. Wright, vol. IV, p. 119. London 1909.

The total quantity of dead meat annually imported into the United Kingdom nearly approaches a million tons. Excluding rabbits, poultry, and game, there is now consumed about 48 lb. per head of meat killed in other countries. Forty years ago the quantity was only about 4 lb. per head. The total quantities of beef, mutton, and pigmeat imported have increased from a yearly average of 77,000 tons in 1861-5 to 870,000 tons in 1901-5. In the absence of equally precise figures for home production the exact proportion which this bears to the total consumption is a matter of estimate, but according to the best calculations available, it may be reckoned to represent not less than two-fifths of the national butcher's bill. The imports of live animals, which do not furnish more than 5 or 6 per cent of the total supply, may almost be regarded as unimportant in comparison.

The sources from whence dead meat is sent to the United Kingdom are world-wide. Beef comes mainly from the United States, Argentina (which together send about nine-tenths of the whole), New Zealand, Australia, Uruguay, and Canada, with small contributions from Holland, Germany, and Denmark. Nearly half the mutton comes from New Zealand, and the remainder from Argentina, Australia, Holland, Uruguay, Chile, the United States, Denmark, France, and Belgium. Nearly half the bacon and two-thirds of the hams come from the United States, Denmark sending one-third of the bacon, and Canada more than one-fourth of the hams. Adding all three kinds of dead meat together, the following statement gives the quantities in tons imported in 1907 from each country sending more than 1000 tons:

	Tons
Argentina	215 422
Belgium	2 442
Chile	1 375
Denmark	101 778
France	1 112
Holland	44 469
Russia	2 557
United States	305 415
Uruguay	6 768
Australia	51 795
Canada	80 965
New Zealand	121 920

Altogether were received 682 873 tons from foreign countries, and 254 705 tons from the Colonies in 1907, the quantity from the United

States being below the average, and that from Canada and New Zealand being above it.

To these vast contributions to the carnivorous demands of the British people must be added about 35 000 tons of rabbits, and an amount of poultry and game of which the total quantity is unknown, but the value of which exceeded a million sterling."

XXXVII.

Dairy farming and dairying. Breeding and improvement of dairy cattle. Feeding experiments. Physiology of milk-production. Chemistry of milk. — Storing, preservation against noxious germs. — Butter-making. Cheese-making. Other industries connected with milk. Bacteriology of milk and milk products. — Legislation regarding the sale of milk and of dairy products. Trade of dairy products.

JOHN PRINCE SHELDON. **Dairy Produce in the United Kingdom.** —*Standard Cyclopedia of Modern Agriculture.*—Edited by R. Patrick Wright. Vol. 4, p. 109, London 1909.

"The numbers of 'cows and heifers in calf' vary annually in the United Kingdom, an average being about 4 100 000. Mr. R. H. Rew, of the Board of Agriculture, estimates that each of these animals yields on an average about 420 gal. of milk per year, available for domestic use, which is calculated into an aggregate yield of 1 723 000 000 gal. The utilization of this prodigious quantity—which, does not include what is used in rearing calves—is summarized as follows giving the equivalent quantities in gallons and in hectolitres.

	Gallons	Hectolitres
Consumed as milk	620 000 000	28 148 000
» cheese	153 000 000	6 946 200
» butter	944 000 000	42 857 600
» condensed milk, &c.	6 000 000	272 400
	1 723 000 000	78 224 200

Assuming, in the United Kingdom, that the foregoing estimates are approximately near the mark, the consumption of milk—as milk, and for purposes of cookery—amounts to about 15 gal. per inhabitant, but this proportion would require to be differentiated as between different classes of society. The quantity of cheese consumed amounts to about $3^2/_3$ lb., and of butter to $22^1/_2$ lb. The item of cheese seems small, but it is to be borne in mind that cheese is largely imported from abroad..

British Dairy Farmers' Association. — (*British Year-Book of Agriculture and Agricultural Who's Who 1909-10*). — London, 1909, p. 89.

Founded 1875. 1006 members. Subscription, £1, but Dairy Instructors and Tenant Farmers, 10*s.* 6*d.* The objects of the Association generally are the improvement of dairy stock and dairy produce by encouraging the breeding and rearing of stock for the special purpose of the dairy; a larger and more general production of butter, cheese, and eggs; erection and invention of improved buildings, appliances, etc. Recent annual receipts (excluding Show receipts) over £1100, including £725 subscriptions; and the payments (excluding Show) £1500, including £309 salaries and £178 invested. The receipts from the Dairy Show exceed £7780, including £4474 entry fees, and £1785 Gate. The payments for the Show exceed £7420, including £2756 prizes. The surplus of the Society's assets (1909) amounts to £3580, principally in Consols and Railway Stock.

In addition to holding the annual Dairy Show each October at the Agricultural Hall, Islington, London, which is the great feature of the Association, an annual Conference is held for the discussion of matters of importance. The Conference for 1908 was held in Derbyshire and Staffordshire in June, and excursions were made to places of interest.

The British Dairy Institute, Reading, is conducted by the Association and University College, Reading, and Diplomas, etc., are awarded. Members of the Association have the privilege of veterinary services, botanical and bacteriological examinations, chemical analyses, etc., at stated fees.

An annual Journal is issued free to members. The Association takes a watchful interest in Corporation and other Bills in Parliament containing clauses relating to tuberculosis, etc. The Show for 1908 was held on October 6-9, the entries being 8362, as compared with 8175 in the previous year. The following were the details: Cattle, 247; milking and butter tests, 224; goats, 72; poultry, 3280; pigeons, 2564; British cheese, 357; bacon and hams, 76; butter, 668; cream, 47; skim milk bread, etc., 135; honey, etc., 85; poultry and pigeon appliances, 50; new and improved inventions, 37; roots, 184; butter-making contests, 207; milkers' contests, 132. The prizes were over £2500, including over £500 for cattle."

Dairy Students' Union Yearbook for 1909. — (Notice in *Nature*, Vol. 83, April 21, 1910).

The Dairy Students' Union was founded four years ago to assist its members with advice and to create and stimulate interest in scientific research and new inventions in the dairy world.

The book contains several short articles by Messrs Blackshaw, D. A. Gilchrist, T. R. Robinson, C. W. Walker-Tisdale and other dairy writers.

Dairy Farming on Mixed Land.—(*Live Stock Jour.* (London), 70, (1909). n. 1859. pp. 554, 555). — *E. S. R.* March, 1910, Washington.

This contains data on the number of acres required to keep a cow in a good dairy district of Cheshre, England. On three typical farms the amount of land required varied from 2 to over 4 acres per cow.

W. J. Fraser and R. E. Brand. **Dairy Suggestion from European Conditions as seen in the British Isles, Holland and Denmark.** — (*Illinois Sta. Bull.*, 140, 461-321, figs. 92); *E. S. R.*, XXII, May 1910.

This bulletin reports a study during an entire summer of the methods employed in the production of milk on the farms of the intensive dairy countries of Great Britain, Holland, and Denmark.

In the opinion of the authors the chief particulars in which the European dairymen excel are uniformly good cows, economical feeding, painstaking care of the stock, and sanitary methods of handling milk, cream, butter, and cheese. Among other items noted from which American dairymen might profit, the following may be mentioned: Successful dairying in the County of Ayrshire, Scotland, is due to the milk-producing capacity of the cattle and the excellence of the Scotch cheese, the high quality of which lies not so much in the skill of the cheese-maker as in the care of the cows, stable, cheese room, and utensils, thus keeping the milk clean so that it is delivered to the cheese vat in almost perfect condition. British agricultural stock and dairy shows differ from American shows because they are conducted for the sole purpose of stimulating interest in agriculture.

F. P. Walker. **Experiments on the Feeding of Dairy Cows.** —(*Durham County Council, Ed. Com., Offerton Bul. 3, pp. 5-20;* abs. *Dairy,* 21 (1909), No. 248, p. 217). *E. S. R.*, XXI, Dec. 1909).

This is a report of an experiment to discover the effect of feeding brewers' grains upon the quantity and quality of milk and is a continuation of earlier work (*E. S. R.*, p. 870).

Two lots of 5 cows each were used in this experiment, which lasted 10 weeks. The daily ration of lot 1 consisted of 4 lbs. of maize meal, 2 lbs. of Bombay cotton cake, 3 lbs. of chopped straw, 12 libs. of hay, 20 lbs. of brewers' grains, and 20 lbs. of swedes per 1 000 lbs. live weight. The average daily yield per head for this lot was 11.435 qts. of milk, containing 3.34 per cent milk fat and 13.48 per cent total solids, Lot 2, which received a similar ration except that the brewers' grains were replaced by 40 lbs. of swedes, gave an average daily yield per head of 11.505 qts. of milk, containing 3.37 per cent fat and 13.44 per cent total solids. Lot 1 lost on an average 2.5 lbs. per head in body weight, whereas lot 2 made an average gain in body weight of 5.6 lbs. per head.

At the end of the above experiment the rations of the 2 lots were reversed, with the following results: The average daily yield of lot 1 for 10 weeks was 10.595 qts. milk, containing 3.49 per cent fat and 9.21 per cent solids not-fat. Lot 2 gave an average daily yield per head of 10.86 qts. milk, containing 3.45 per cent fat and 9.09 per cent solids not-fat. Both lots lost in body weight, the first lot losing 14 lbs. and the second lot 19.6 lbs. per head.

J. Speir. **Influence of Temperature on Milk Yield. Experiments in the Production of Milk in Winter under Free "versus" Restricted ventilation.** — *Trans. Highl. and Agr. Soc. Scotl.*, XXI, 255-306. Edinburgh, 1909.

Within the last few years it has been doubted in Scotland whether the benefit to be obtained from keeping farm animals in the comparatively high temperature aimed at in past years is really as great as is generally believed. The prevalence of tuberculosis among farm stock in most countries, and the success of the open air treatment in arresting this disease among human beings, have probably had something to do with the consideration which this subject has received during recent years.

But in most of the experiments carried out it has been generally omitted to take into consideration the fact that where the heat was derived from the bodies of the animals the air was much polluted, and that the experiments, instead of being confined to one essential—viz., the degrees of temperature—were in reality influenced by two—viz., heat and fresh air.

Most of the experimenters have, however, come to the conclusion that animals did not derive so much benefit from being kept what was called warm as was generally supposed, neither did they seem to suffer so much as usually expected when kept cool or cold.

Trials in America. In the winters of 1902-03 and 1903-04 the Pennsylvania State College divided, each winter, 24 bullocks in two lots, one of which was fed in a byre under a barn, and the other in an open shed. The experiment in the latter year began on 10th Dec., and was continued till 4th April. During that period the lot in the byre gained 230 lb. on an average, while those in the shed gained 227 lb. For the first two months the average temperature of the byre was 38.6 degrees F., while that of the shed was 14.5 degr. F. The animals in the byre consumed rather less food than those in the open, the value of the extra-food used being equal to $^1/_2$ d. per lb. of live weight increase. In this experiment, although carried on for two winters, the number of animals employed was too limited to provide conclusive results and the winter was too far advanced before the experiment began.

Trials in England. In the autumns of 1901, 1902, 1903 and 1904 an interesting experiment having an important bearing on this question was carried out at the Harper Adams Agricultural

College, Newport. In Shropshire the regular practice is to leave all cows in the field at night till the end of October, after which they are kept in the house at night and put out during the day. In each year two lots of 5 cows each were selected for experiment, the cows corresponding as nearly as possible as to date of calving, length of time in milk and weight of animal. Both lots went in the same pasture during the day, but at night one lot was kept in the house, while the other was put out into the field. In each year the climatic conditions varied considerably during the progress of experiment, and there were nights when the thermometer fell below the freezing point. The lot of cows outside, however, yielded more milk with increased per cent of fat, as well as increasing in live-weight.

Experiment in Scotland. On the suggestion of the author it was arranged that five stocks would be placed at the disposal of the Science Committee of the Highland and Agricultural Society in the autumn of 1908, and that arrangements would be made for erecting a suitable division across the byres, and for providing persons and apparatus suitable for experiment.

A set of instructions for persons carrying out the experiment are reported, as well as the preliminary trials. Details are given of the accomodation, ventilation, etc., provided at each centre; of the food used, and of the age and date of calving of the cows.

It was found that the cows in the freely ventilated byres gave on average a trifle more milk during the cold period than they did during the warm period, when the temperature of the air of the byres was on the average 12.5° F. higher. The same applies to those which had been restricted in ventilation and been kept warm, only in their case the increase during the cold period is a trifle more.

While the uniformity in the yield of milk indicated good milking all over, there were a number of cows the milk of which varied in fat much more than the others. From a close study of the individual cows and milkers employed in this experiment, the author comes to the conclusion that much of this irregularity is the result of careless or indifferent milking; and he believes that with efficient and reliable milkers, there should at least be no difficulty in getting uniform percentages of fat from weekly composite samples of milk.

The following table is reported, giving the total milk produced at each farm by the cows in the restricted ventilated byres for an average of the last two weeks of February and the last two of March, compared with the first two weeks of March when the weather was bitterly cold.

Byres With Restricted Ventilation.

FARM	Mild Weather 14th to 27th February 14th to 27th March			Cold Weather 28th February to 13th March		
	Total milk in lb.	Avg. milk daily	Avg. p. % of fat	Total milk in lb.	Avg. milk daily	Avg. p. % of fat
Newton	6 171.0	24.5	3.71	6 137.5	24.3	3.74
Woodilee	3 091.3	22.1	3.26	3 217.5	22.9	3.17
Crichton	2 576.5	23.0	3.41	2 532.5	22.6	3.37
Hartwood	3 627.0	32.3	3.47	3 633.0	32.3	3.61
Rosslynlee	2 316.5	27.5	3.28	2 296.5	27.3	3.39
Total for 50 cows for 14 days.	17 782.3	—	—	17 817.0	—	—
Average	—	25.40	3.48	—	25.45	3.51
Average excluding Woodilee.	14 691.0	26.2	—	14 599.0	26 07	—

The following table gives the total milk produced at each farm by the cows in the freely ventilated byres for an average of the last two weeks of February and the last two of March, compared with the first two weeks of March when the weather was bitterly cold.

BYRES FREELY VENTILATED.

FARM	Mild Weather 14th to 27th February 14th to 27th March			Cold Weather 28th February to 13th March		
	Total milk in lb.	Avg. milk daily	Avg. p. °/₀ of fat	Total milk in lb.	Avy. milk daily	Avg. p. °/₀ of fat
Newton	6 438.7	25.5	3.80	6 406.0	25.4	3.85
Woodilee	3 073.4	21.6	3.43	3 185.2	22.7	3.45
Crichton	2 529.0	22.6	3.63	2 504.5	22.3	3.57
Hartwood	3 255.0	29.0	3.43	3 292.0	29.4	3.61
Rosslynlee	2 409.0	28.7	3.73	2 416.0	28.7	3.85
Total for 50 cows for 14 days.	17 705.1	—	—	17 803.7	—	—
Average	—	25.3	3.63	—	25.4	3.69
Average excluding Woodilee.	14 631.7	26 1	—	14 618.5	26.1	—

Then tables follow giving the average monthly temperature of the air of each byre, and the average humidity; as well as reports upon the conditions of the health of the animals.

The following are the conclusions which it would seem reasonable to draw from the experiments made:

1. That fresh air is a much more important factor in the production of milk in mid-winter than it is generally considered to be by milk-producers in this country. While most people agree upon the need of fresh air in regard to the health of the animals, it seems almost as desirable in mid-winter if a full supply of good wholesome milk is to be produced.

2. In order that the greatest advantage may be derived from the fresh air, the animals should at no time have the ventilation restricted in autumn, but should be kept as cool as possible, so that they may not only retain all their hair, but if necessary increase it.

3. There is no difficulty, much less impossibility, in producing milk in freely ventilated byres in the coldest weather likely to be met with in Great Britain, if the cows are freely ventilated and kept sufficiently cool in early autumn.

4. While the reported experiment shows that rather more milk had been produced under conditions of free ventilation than where ventilation was restricted, it would be injudicious, till these results have been corroborated by other trials, to consider that this will invariably happen. It is unquestionable that the general health of the cows would be better under free than under restricted ventilation.

5. Milk produced in a building kept at a high temperature, or during a warm period, does not seem to be any richer in fat than that produced at a low temperature or during cold weather.

6. It seems hopeless to expect to be able to keep the air of any byre, no matter how the byre may be constructed, at from 60° F. to 63° F. during the ordinary weather of an average winter without excessive pollution of the air.

7. While the effect of a high or low temperature is probably felt by animals almost instantaneously, and very likely produce its results at once, we have little information indicating how long a cow may breathe a vitiated atmosphere before that effect shows itself on the animals or their production of milk. At Newton the influence seemed to show itself between the fourth and fifth week after the experiment began.

8. The great causes of variation in the fat in milk are: 1) Irregularity in the hours of milking; 2) The individuality of the cow; 3) Want of perfection in milking.

9. Any saving in food which is effected by keeping the animals at a higher temperature is equalled, if not exceeded, by improved digestion when they have plenty of fresh air but a lower temperature.

10. There is reason for believing that those great scourges of the dairyman, mammitis or weeds and tuberculosis, may be reduced to a minimum if cows are kept in freely ventilated byres in winter.

Finally tables are appended giving the detailed yields.

E. Porter. **The Construction of Cowsheds.** — *The Dairy*, Vol. XXII, No. 255, 67. London. March 15, 1910.

To produce milk of the best quality and condition it is necessary that the cowhouses should be constructed on the best possible lines.

Consequently the principles for cowshed constructing would be the following ones:

1. As regards the site, this should be chosen, where ever possible, so that drainage and surface water should flow away from the building and not into it.

2. The interior of the building should have a good, even surface, so as to avoids cracks and crevices wherein disease germs and others matters might lodge.

It is preferable to have the roof open at the ridge.

However opinions differ as to the best floor, one of cement concrete, if carefully laid, is one of the best floors; it should not be too low in comparison with the outside surface, and there should be no covered drains if they could be avoided.

3. Several methods have been adopted for the arrangement of the cattle, but the best is to have them in one line along the building, wiih a feeding passage in front and a milking passage behind.

4. An important matter is the size and arrangement of the stalls, with from 40 to 50 square feet of floor space per animal; as to air space 600 to 800 cubic feet are allowed, and with regard to the admission of fresh air about 40 square inches per cow is retained a good allowance.

JOHN SPEIR. **Milk Records.** — *Trans. of the Highl. and Agricultural Society of Scotland*, Vol. XXI, 5th series, 1909, pp. 175-196.

This work which had been carried on by the Society from 1903 to 1907 was at the end of 1907 transferred to the Ayrshire Cattle Milk Records Committee, which has supplied the materials for this report.

There has been an enormous increase in the number of cows tested during the past season. The number of Milk-record Societies increased from 7 (in 1907) to 13 (in 1908) and the number of cows tested from 3931 to 8132.

New societies as a rule begin too late and often lose a part of the value of the first year's work. The tendency is now to begin earlier, so as to obtain as many full lactations as possible.

Inferior and medium milking cows give a full lactation in a limited period of testing, while the best cows require a much longer period, and even in a cheese-making district these cannot be fully tested in much under 11 months.

The author reports upon the work done by these societies, among which the following are here noticed:

Fenwick Milk Record Society.—This Society tested 44 cows on 15 farms which yielded between 1000 and 1100 gallons (4543 to 4997 litres) of milk.

22	cows on	9	farms,	between	1100	and	1200	gals.
23	»	11	»	»	1200	»	1300	»
10	»	4	»	»	1300	»	1400	»
7	»	4	»	»	1400	«	1500	»

1 which gave over 1500 gallons of an equivalent of 3 per cent of fat.

Most of these cows had calves within the year or were due to calve in a little over the year.

Nithsdale Milk Record Society.—Work began on 23rd March and continued till 23rd November, a period of 35 weeks. A record was made of each herd every 21 days. 562 cows were tested for the members. In the comparatively short period over which the testing extended:

1 cow yielded over 1100 gals. of milk of an equivalent of 3 per cent of fat.

6	on	4	farms	with over	1000	gals.
22	»	9	»	» »	900	»

of the same quality of milk.

Two of the herds contain almost the half of these superior cows.

Rowallan Milk Record Society.—One cow yielded 1300 gals. of 3,5 per cent fat in 47 1/2 weeks. In another herd there were 4 cows, of which:

one	gave	1253 1/2	gals. of	3,3	per cent fat	in	44	weeks
one	»	1178 1/2	»	3,4	»	»	46 1/2	»
one	»	1089 1/2	»	3,7	»	»	57	»
one	»	1139	»	3,7	»	»	58 1/2	»

These are exceptional yields and reflect great credit upon the owners and the district.

Stewartry Dairy Association.—In one other herd there were 3 cows, each of which had over 1100 galls. of milk of an equivalent of 3 per cent of fat; and out of 11 cows which yielded over 1000 gals. of a similar quality, 9 were in one herd. Other 2 herds had one cow each which yielded this quantity. Among 11 herds constituting the section, 6 of them contained one or more cows which yielded 900 gals. or over of milk of an equivalent of 3 per cent of fat. There were altogether 21 cows which yielded over 900 gals.

Stewartry Dairy Association, Dalbeattie Milk Record Station. — A general improvement is very noticeable over all the herds belonging to members of this section compared with the previous year. Thus there are only two herds which have not had one or more cows which have given 900 gals. of milk of an equiv. of 3 per cent of fat. In 1907 there was only one section for the Castle-Douglas and Dalbeattie district, while in 1908 there were two. In 1907 there were 23 cows out of a total of 969 which gave an equivalent of 1000 gals. of milk of 3 per cent of fat, which is equal to 2,37 per cent of those tested.

In 1908 there were 27 cows out of 576 which gave that quantity of milk, which is equal to 4,7 per cent of the total number, so that the good cows may be said to have been doubled.

Lower District of Wigtownshire Milk Record Society.—During the season 881 cows were tested for the 15 members.

30 cows yielded between 900 and 1000 gals. of milk of an equivalent of 3 per cent.

7	between	1000	and	1100	gals.
1	»	1100	»	1200	»

1 gave 1265 gals. of 3 per cent.

In districts such as the south of Scotland, where a large proportion of the cows are let on what is known as the "bowing" system, the introduction of milk records is likely to exercise a most important influence on the sum paid per cow. They afford besides both owner and dairyman valuable information regarding the cows which should or should not be discarded.

Yield of Milk and Percentage of Fat by Cows of different ages. — Up to the present no reliable information exists regarding the quantity of milk yielded by cows of different ages, or the average of fat in their milk.

Since the last report, the author has calculated, for all the milk record societies up to the end of 1907, the yield and fat per cent of all normal cows which have completed their lactations and produced a calf within the ordinary time in the succeeding year. Producers of milk differ greatly regarding the milk yielded by cows at different ages, and more particularly as to its per cent of fat.

The number of cows on which the averages in the following table are based is, for many of the ages, too limited to be looked on as final, but between the ages of three and ten years the figures are almost certain to be fairly reliable.

Average yield of milk and per cent of Fat of all Cows, according to Age, which have completed their Lactations, in the Ayrshire Cattle milk Record Societies up to the end of 1907.

Age of the cow	Number on which the average in based	Average milk in gallons	Average per cent of fat	Milk of 3 % of fat in gallons
2.	22	450,6	3,88	582,8
2 ½	38	495,5	3,89	642,5
3.	320	565,8	3,87	730 —
4.	189	656,4	3,74	818,3
5.	152	721,3	3,65	877,6
6.	159	738,7	3,67	903,7
7.	127	750,5	3,63	908,1
8.	87	774,5	3,64	939,7
9.	58	771,1	3,69	948,8
10.	46	804,8	3,56	955 —
11.	26	819,6	3,62	989 —
12.	23	740 —	3,67	905,3
13.	9	869,1	3,46	1002,3
15.	5	784,4	3,69	964,8
16.	3	616,6	3,53	725,5
20.	1	878 —	3,70	1073 —
Total . . .	1,265	—	—	—

A cow yielding 600 gals. at a lactation is said to leave 100 gals. available as profit after paying for food and all expenses; a cow giving 700 gals. could be kept on almost the same food and would give twice as much profit. If this is so—and there is every reason to believe that it is—with cows which yield 600 to 700 gals. it is not difficult to realise what profits might be reached if cows could be bred to yield 800, 1000 or 1200 gals.

A "Milk Contest" in Oxfordshire.— *The Journal of the Board of Agriculture.* July 1909, vol. XVI, n. 4, pag. 303.

With a view to encourage dairying under the best conditions, the Oxfordshire Agricultural Society recently awarded three prizes to be competed for by tenant farmers residing within a radius of twelve miles of Oxford. In allotting the prizes, not only the quality of the milk, but also the condition of the cows and cowsheds, cleanliness of milking, etc. were taken into consideration, marks being given according to the following scale:

Full Marks	Points
4	Condition of cow.
4	Cleanliness of cows.
4	Cleanliness of cowsheds.
5	Careful removal of manure.
3	Equipment of dairy, provision of hot water, pails, strainers, etc.
5	Care and cleanliness of utensils.
2	Health, etc. of attendants.
5	Cleanliness of milking.
3	Prompt and efficient cooling where required.
20	Average quantity of milk per cow from a commercial point of view, allowance being made for period of lactation.
10	Flavour of milk.
20	Composition of milk.
20	Keeping quality of milk.

Ernest Mathews. **Milk and Butter Tests at the Gloucester Show 1909.** — *Journal of the R. Agric. Soc. of England,* Volume 70, 1909, pp. 221-238.

The Society offered prizes for milk-yield tests, butter tests and experiments in the dairy, which comprised the sampling of milk, the colouring of milk and butter and the making of Wensleydale cheese.

The experiments, on the whole, confirm the opinions expressed in last year's report to which the following additions may be made:

That milks rich in fat make better cheeses than the poorer quality milks and produce a heavier weight of cheese, but against this it must be noted that there is always more risk in using rich milk, that greater care is required in the making, as well as more salt.

That the use of the acidimeter is to be recommended.

J. A. Mandel. **Analysis of the Cleavage products of the Nucleoprotein of the Mammary glands.** — (*Proc. Soc. Expt. Biol. and Med.*, 7, 1909, No 2, pp. 24-26); *E. S. R.*, Abstr. N. 5.

The author finds a close correspondence between casein and the nucleoprotein of the cells in the mammary gland, which he thinks is strong proof that the casein of the milk is formed by a breaking down of the nucleoprotein of the protoplasm, with a setting free of the carbohydrates and the purin and pyrimidin bases.

R. T. Hewlett, S. Villar, C. Revis. **On the Nature of the Cellular Elements present in Milk.** — (*Jour. Hyg.* (Cambridge) 9 (1909), no. 3, pp. 271-278). — *E. S. R.* March, 1910. — Washington.

A review of investigations and theories on the cellular structure of the udder, the formation of milk in the udder, and the nature of the cellular elements found in milk.

The authors agree with Winkler, and Michaelis that the cells found in normal milk are not leucocytes but young epithelial cells and cells of the germinal layer which have been thrust into the lumen of the alveolus. They are not amœboid, do not ingest bacteria, and do not stain like leucocytes. The majority of the multinucleated cells are different from the polymorphonuclear leucocytes. Leucocytes and lymphocytes do appear in the milk, however, in the advanced stages of mastitis.

R. Hewlett Tanner and Sidney Villar. **The Cellular Elements of Milk.** — *The Dairy*, Vol. XXII, No. 259, p. 183. London, July 15th, 1910.

A joint preliminary report of an "Investigation into the Cellular Elements present in Milk" has been issued by the authors at the instance of the British Dairy Farmer's Association, that resuming others. The authors' observations conclude:

1. The vast majority of the cells present in milk (the so-called leucocytes) when critically examined distinctly differ from leucocytes.

2. However fresh the milk may be, the vast majority of the cells in it never stain like active leucocytes with ordinary blood stains.

3. While many multi-nucleated cells are present, these are distinctly different from polymorpho-nuclear leucocytes.

4. The cells present in milk, however fresh, are scarcely ever amoeboid.

5. Ingestion of bacteria by the cells present (phagocytosis) is practically absent.

6. In milk obtained from perfectly healthy cows these cells may occur in vast numbers, and since the mammary gland in structure resembles other glands, it is against analogy that vast numbers of leucocytes should occur in its secretion.

7. The cause of the presence of a considerable number of cellular elements at times when there is no obvious reason, such as in quarters of the udder which have a previous history of mastitis, etc., is easily explained if these cells are tissue cells and not leucocytes.

W. G. Savage. **The Significance of Leucocytes in Milk.** — (*Jour. of Roy. Inst. Publ. Health*, 18, 1910, No. 2, pp. 65-71). *Exp. Stat. Rec.*, Vol. XXII, June 1910, No. 7. Washington.

In the opinion of the author a differential enumeration of leucocytes is of great value. Rigid standards as to the number of leucocytes to allow in milk can not be set up, but the count indicates the need for local investigation. With extended experience it may do much more than this. The enumeration can be rapidly performed. It gives definite information which inspection frequently can not furnish, and the procedure reaches its highest utility when combined with a bacteriological examination of the milk.

A bibliography of the literature is appended.

Effect of Brewers' grains on Milk. — (*Durham C. C. Education Com. Offerton Bull.*, No. 3) *The Journal Board of Agriculture*, December 1909, No. 9, p. 753.

" Experiments to test the effect of brewers' grains on the quantity and quality of milk were carried out on behalf on the Durham C. C. at Offerton Hall in 1905-06. (*Journal of the Board of Agric.*, May 1907, p. 87). The experiments were continued in 1907-8, ten cows being selected and divided into two lots of five each. They were fed on a ration of 4 lb. maize meal, 2 lb. Bombay cotton-cake, 3 lb. chopped straw, and 12 lb. hay; Lot. I, received in addition 20 lb. of brewers' grain and 20 lb, swedes, while Lot II received 60 lb. swedes. Feeding in this way was continued for ten weeks, when the rations were reversed — that is, Lot I received the increased quantity of swedes and Lot II the brewers' grains. The variations in the results were not great, but the two series of experiments are considered to point to the following conclusion:

"1) A moderate allowance of 20 lb. of brewers' grains per day has the effect of increasing at all events for a certain period, the daily yield of milk. The period over which such increase is maintained has its limit, and the practice of changing the diet is a good one.

"2) The effect of brewers' grains on the yield is not confined to the earlier period of lactation, and it is probable that by a judicious use of brewers' grains the lactation period might be considerably extended.

"3) The evidence of the experiments with regard to the percentage of fat in the milk seems conclusive that, so far as the daily average of fat is concerned, brewers'grains in moderate quantities produce in the long run no appreciable diminution of fat, although the percentage of butter fat in the morning's milk seems to be lowered more frequently. Having regard to this fact and the 3 per cent standard, brewers' grains are not to be recommended where the mixed milk of a herd of cows is habitually low in the morning. It must also be borne in mind that the above conclusions are based on results obtained by feeding brewers' grains in moderate quantities only and with a good complement of artificial foodstuffs.

"In these experiments no effect was produced by the brewers' grains on the non-fatty solids, nor was the effect on the live-weight of the cattle very marked."

Composition of Milk. — [Journ. Bath and West and Southern Counties Soc.]. Vol. III., 1908-909. — *Journal Board of Agric.*, Dec. 1909. — London, p. 756.

"The object of these investigations, which were carried out by the Somerset C. C., was to discover the composition of the milk of a herd of ordinary cows kept under the ordinary conditions prevailing in the dairying districts of Somerset. Daily tests were made for various periods four times in the year, and weekly tests were made almost throughout the year. The milk was also weighed daily. The conclusions arrived at are almost identical with those obtained in similar enquiries at Leeds, Newcastle, and Edinburgh. the central fact brought into prominence being that the quality of the milk yielded by a cow depends more upon the individuality of the cow than upon any other factor.

While individual cows vary considerably in the frequency with which they give milk low in composition, the milk of cows giving a large quantity is more likely to be deficient in fat than that of cows giving smaller quantities. Certain cows, however, may give a very small quantity of milk of very low quality.

In very hot weather, when the intervals between the milkings are fairly equal, cows may give richer milk in the morning than in the evening ".

COLLINS. **Slide rule for Calculating the Total Solids in Milk Analysis**. (Proceedings of the University of Durham Philosophical Society). — Notice in *Nature*, vol. 83, April 21, 1910, p. 229.

The direct determination of the total solids in milk presents certain practical difficulties. It is found however that a simple formula expresses with sufficient accuracy the relation between the total solids, the fat [as determined by Gerber's or similar methods], and the specific gravity determined by the lactometer. Mr. Collins gives an account of a slide rule be has invented, which is now on the market, by which the necessary calculations, including the temperature correction, may be made at one sitting.

Such a rule will be of great benefit to the busy milk analyst, who has hitherto had to work out the calculation in the ordinary way.

JOHN PERCIVAL. **The Enzymes of Milk.** — *Agricultural Bacteriology*, pp. 242-244. London, 1910.

In 1897 Babcock and Russell discovered that the proteins of milk underwent proteolytic disintegration even in the presence of ether, chloroform and other compounds which inhibit the growth of bacteria. Milk which contained on an average 20 per cent of its proteins in a soluble form after being kept for three or four weeks in vessels to which antiseptics had been added to prevent bacterial action, was found to contain 38 per cent of its proteins as albumoses and peptones. Milk which has been heated to a temperature sufficient to destroy enzymes does not undergo such changes. Subsequent investigation showed that the proteolytic decomposition of milk obtained and kept under aseptic conditions was due to the presence in it of a trypsin-like enzyme, to which the name of galactase has been given.

The amount in milk is very small, and although at first it was thought that it played a major part in the ripening processes of cheese, its influence in this direction is now known to be comparatively slight.

Traces of lipase, diastase, and other enzymes are said to occur in milk, but the evidence for the statement is not very convincing.

Positive results are readily obtained with tests for peroxidases but whether they are caused by galactase only or by other types of enzymes is not known with certainty.

Since the enzymes in milk are destroyed when the latter is heated for a short time to 80° C. the presence or absence of reaction with tincture of guaiacum or paraphenylendiamine and hydrogen peroxide affords a ready means of distinguishing boiled from fresh milk.

In some countries where regulations are enforced with a view of checking tuberculosis among farm stock the separated milk from public creameries must be pasteurized at a temperature not less than 80° C. before being returned to the farms for the feeding of calves and pigs; these tests assist in determining if the regulation has been carried out.

J. PERCIVAL. **Action of Heat on Milk.** — (*Agricultural Bacteriology.* London, 1910, pp. 245-247).

" When milk is boiled even for a few minutes it acquires a characteristic taste which is disliked, especially by children accustomed to the fresh liquid.

Its properties are considerably changed owing to alterations in the physical and chemical nature of several of its costituents.

The cooked flavour is acquired if a temperature of 80° C. is maintained for more than about ten minutes, and in much shorter time as the boiling point is approached. The objectionable taste, however, is removed to a large extent both from the cream and the separated milk if the heated milk is passed through the separator.

Little change, if any, occurs in the chemical constitution of the fats, and cream can be heated to a higher temperature than milk before the cooked flavour is produced. The small groups or clusters of fat globules which are found in fresh milk are largely disintegrated into separate globules by heating, and the cream, which rises slowly, is thin.

The milk sugar is slightly oxidized, and acids are split off from it, the alkaline phosphates of the serum assisting the change; the milk becomes distinctly acid if it is boiled for three or four hours, and yellowish or brownish in colour, the altered tint, however, being more likely due to alteration in the proteins than in the sugar.

Very striking changes are made in the proteins of the milk by heating. The soluble albumin becomes coagulated and probably decomposed to some extent with the evolution of a small quantity of sulphuretted hydrogen at temperatures from 70° C. to 100° C. The pellicle or skin which forms when milk is heated in an open vessel consists of coagulated albumin and dried caseinogen, with fat and other constituents also.

The power of curdling by rennet and acids is very much reduced, a point of great importance to the cheese-maker. For the coagulation of the caseinogen more rennet is required and the curd is too crumbly and soft for the manufacture of hard pressed cheeses. The altered character of the caseinogen appears to be chiefly connected with the precipitation of insoluble calcium phosphate, and although some improvement in the curdling property can be made by the addition of dissolving agents such as carbon dioxide, hydrochloric and other acids, or by the addition of soluble calcium salts, no really characteristic Cheddar, Cheshire, or other hard cheese has yet been made from strongly heated milk.

As stated previously heating destroys the normal enzymes of milk. There is little doubt that the coagulation of the albumen, the changes in the solubility of the casein and calcium salts, and the destruction of the enzymes render the milk less digestible and reduce its nutritive qualities."

A Prize for Experimental Work on Milk. — *The Farmer and Stockbreeder.* London, 18 July 1910.

The International Dairy Federation bave established a prize for the best work on a subject to be selected. The subject for the first competition is: The determination, by means of new experiments made at any rate partly on man, of the comparative nutritive value of raw and cooked milk (pasteurised, sterilised and dried). In the event of an advantage being shown in favour of raw milk, to determine the part played by the enzymes of milk in nutrition.

S. H. Collins. **The Transfer of Boric Acid from Cattle Food to Oow's Milk.** — (*Durham County Council*, Ed. Com., *Offerton Bul.*, 3, 21-4; abs. *Dairy*, 21, 1909, N°. 248, 217). *E. S. R.*, XXI, Dec. 1909.

This experiment was undertaken because boric acid is often used to prevent Indian cotton-seed cake from becoming moldy. Boric acid appeared in the milk as soon as cows were fed daily $^1/_4$ lb. of a meal which contained 5 per cent of boric acid. About one-fiftieth of the boric acid appeared in the milk. When the meal contained 1 per cent of boric acid about one-seventieth appeared in the milk.

" As milk needs $^1/_4$ per cent boric acid to produce any useful preservative influence, there seems no difficulty in distinguishing between milk preserved with boric acid and milk contaminated by the use of foods containing boric acid. If milk be found to contain more than 0,1 per cent boric acid the milk has probably been deliberately preserved with some boric preservative, but if less than 0,01 pes cent boric acid be found in the milk, the source of that small amount of boric acid is to be looked for in the food of the cow. "

The Handling of Milk in the Tropics. — *The Tropical Life*, Vol. VI, p. 98. London, May 1910.

The most recent, and probably the most valuable method of preserving milk is that known as Buddeization, an account of which appeared in the *Lancet* of December 14 1907. Put very briefly, the process consists in cooling (which however, must not be carried to far, because, in excess, it destroys the natural antibacterial qualities of the milk), heating to 50° C., centrifugating, again heating in a vat, and adding peroxide of hydrogen. This acts, both in virtue of its own strong germicidal power, and still more owing to the fact that the milk catalase (an enzyme of the living cell) is able to decompose the hydrogen peroxide, setting free nascent oxygen, which has a still greater bactericidal action. 50° C. is found to be the best temperature for this action. There is a stirrer in the vat, and when the sterilisation is complete, the milk is either cooled first and then bottled or run into sterile bottles and then cooled. As the presence of the catalase is not absolutely uniform, it is best to add so much peroxide of hydrogen that there is certain to be a trace left at the end of the process. Then immediately before bottling, a few drops of catalase solution are added.

C. K. MILLARD. **Dried milk as a food for infants.** — (*Brit. Med. Journ.*, 1910, No 2561, pp. 253-254). *E. S. R.* Abstr N., June, 1910.

On the basis of extensive tests of dried milk at Leicester Corporation Infants' Milk Depot, conclusions favorable to the use of this material as infant food were reached. According to the author, the advantages attending its use are ease of digestion, bacterial purity including freedom from tubercle bacilli and contamination by flies, the fact that it may be kept in hot weather without souring, its cheapness as no waste is involved, and its convenience, and palatability.

" Its disadvantages are of a theoretical nature, and consist in the presumed destruction of the antiscorbutic properties of fresh milk. This, however, can be compensated, if thought necessary, by administration of fruit juice. For domestic purposes apart from infant feeding, dried milk has distinct limitations as a substitute for fresh milk, as, owing to its taste, it is not so suitable for adding to tea or coffee. "

RALPH VINCENT. **Pure and Healthy Milk versus Boiled Milk.** (The Ethics of Food). — *Science Progress in the Twentieth Century. A Quarterly Journal of Scientific Work and Thought.* N°. 16. April 1910. London, p. 541.

" In November 1903, Dr. George Newmann, then Medical Officer of Health for Finsbury, published an elaborate report on the conditions of the milk-supply in that borough and the facts there collected may be regarded as fairly typical of the conditions generally prevailing.

He found that 90 per cent, of the milk was obtained from country farms and that 95 per cent. of these were situated at a greater distance than 100 miles from London. As a rule, the evidence showed that the cow-sheds from which the milk was derived were ill-lit, overcrowded, badly ventilated and badly drained. Of the milk-shops, 52 per cent. were found to have one or more sanitary defects and 73 per cent. of the vendors failed to keep the milk covered or protected from dust. The average number of bacteria in unpreserved milk was found to be 2,370,000 per cubic centimetre. Pus and dirt were present in numerous cases. In consequence of the contaminated condition of the milk as commonly supplied, various processes of heating milk have ben introduced in order to destroy the numerous microorganisms and thus protect infants and others from the effects of contamination. These methods have been enthusiastically advocated by many writers, so that the boiling or sterilisation of milk has almost come to be regarded as a desirable practice, typical of sanitary advance and medical progress.

Whatever may be the excuse of expediency, the whole argument is unsound and inconsistent with the principles of scientific procedure. To supply an infant with contaminated milk is certainly far from advisable but milk that has been contaminated remains contaminated whether boiled or unboiled.

Moreover, boiling of the milk does not protect the infant. It irretrievably injures the food of the infant, definitely destroying elements essential to nutrition; whilst the interference with the natural processes of digestion is so great that the infant fed for any considerable period on boiled milk suffers severely from malnutrition directly arising from atrophy of the digestive glands.

Among the poorer classes the boiling of milk plays an important part in relation to the production of the most fatal disease of infancy—zymotic enteritis. This disease is chiefly caused by the putrefactive decomposition of cooked milk. The changes that occur can only be produced when the milk is cooked or its natural characteristics are interfered with, raw milk being protected from these poisonous changes by the action of the lactic organisms. These organisms acting in raw milk, produce lactic acid and the acidity thus engendered protects the milk from putrefactive changes which can only occur in milk that is neutral or alkaline. For a fuller discussion of the effects of the boiling of milk, vide the writer's "Nutrition of the Infant", 3rd Ed. 1910.

Recent developments in the milk trade have been distinctly retrogressive. In the summer months it is becoming a common practice for some of the milk companies to pasteurise the milk prior to delivery. This is a matter of serious moment. Milk is a natural article and the business of the milk-vendor is to supply it in its pure and natural condition.

The most pernicious of all practices in connection with milk is the use of " preservatives ". The action of these substances on the infant is of the most serious character. At the very beginning of gastric digestion processes essential to the health of the infant are directly interfered with. In consequene af this perversion the chemical changes attending digestion in the intestine are interfered with and atrophic enteritis develops. In the case of an infant suffering from the effects of preservatives in the milk it had consumed, the full extent of the injuries can scarecely be appreciated until the cause has been removed. It is not till then that the harm done is fully realised, the digestion being so injured that the most delicate adjustments of the diet are required, and it is frequently several months before the infant fully recovers.

In the worst cases, when the infant has received considerable amounts of preservatives, such as boric acid, over a considerable period, the atrophy of the digestive glands may be quite incurable and death ensues after lingering illness characterised by much pain and suffering ".

" Great harm has been done by the persistent advocacy of " boiled " milk. The boiling of milk is quite ineffectual as a means of protection. The advocacy of the practice has done more than anything else to mislead the public and to encourage all sorts of wild expedients which leave the essential problems untouched. There is only one way in which clean milk can be obtained, namely be ensuring cleanliness and sanitation from its production to its delivery and giving special attention to the peculiar hygienic precautions indicated by the peculiar qualities and properties of milk ".

J. Percival, **Milk and Tuberculosis.** — *Agricultural Bacteriology.* London, 1910, p. 321.

" One of the great scourges of the human race is tuberculosis. The number of deaths per annum in the British Islands due to various forms of the disease is over 60 000 and probably more than ten times this number suffer from it.

The disease is also found extensively distributed among domestic animals, being specially prevalent in cattle and pigs; less of the trouble is met with in horses, sheep, and goats. Cats and dogs are subjet to it, and a form of the disease is common among poultry.

There are from 2 $^{1}/_{2}$ to 3 millions of cows and heifers in Great Britain; about 25 to 30 per cent (600 000 to 800 000) are tuberculous; according to M'Fadyean about 2 per cent of them, representing a total of over 50 000 cows, have the disease in the udder and yield milk containing the virulent germs of the disease.

In Islington (London) Dr. Harris found, in 1899, over 14 per cent of the samples of milk examined contained the tubercle bacillus; from 23 to 38 per cent of the milk examined in Berlin in 1897 by two different observers was found to be infected, and in Paris 33 per cent, of the samples gave similar results. The undoubted presence of these bacilli in the milk supplied to the public makes the question of the transmissibility of the disease to mankind through the consumption of this article of diet a matter of first-rate importance."

A. Halstead. **Pure Milk for Cities.** — (*Daily Cons. and Trade Rpts.* (U. S.), 1909, No. 3626, 7). *E. S. R.*, Vol. XXII, January 1910.

This is a report on recent efforts which have been made by the health department of the city of Birmingham, England, to combat the spread of tuberculosis by supplying dairy farms within 10 miles of the city with free tuberculin and veterinary assistance for testing their cows.

A Voluntary System of Control in Milk Production. — *The Journal of the Board of Agriculture.* June 1910, vol. XVII, n. 3, p. 225.

" A system of voluntary control of milk is in operation at Plymouth. If a farmer supplying milk to Plymouth undertakes to comply with certain conditions calculated to obviate risk of infection and to ensure a supply of clean milk, the fact is advertised once a year by the Local Authority by means of press notices and placards, and he is allowed to exhibit in the shops where his milk is sold a certificate, signed by the Medical Officer of Health, to the effect that the premises on which the milk is produced are sanitary, and that the conditions imposed by the Corporation are complied with.

The system was introduced in 1898, and the number of farms under control has recently increased. About one-fifth of the milk supply of Plymouth is produced under the 'control.'

Milk from the 'control' farms does not command a higher price than other milk, but large firms, hospitals, and clubs invariably deal with dairymen under the 'control,' and doctors recommend their patients to deal with them. Visitors coming to the town often inquire from the Medical Officer of Health where they can obtain pure milk, and though he cannot recommend an individual, he can send them a list of the 'control' dairies.

The farms are inspected at least twice a year. It is found that in practice the dairy farmers under the 'control' observe the conditions. There is at present no veterinary inspection of the cattle or bacteriological examination of the milk, but such inspection and examination have been suggested, and there is no doubt that the adoption of these additional precautions would increase the value of the 'control,' both to the producers of milk and to the public.'

Milk Control. — Harrogate Milk Dealers and Cowkeepers. — *The Dairy*, Vol. XXI, No. 225, 74. London, March 15th, 1910.

In support of the Tuberculosis Committee, the Harrogate Milk Dealers' and Cowkeepers' Association has taken the following resolution: That any legislation dealing with the milk supply should be general in character and uniform in its application throughout the country, and pending such general legislation being passed, no further powers should be given to any local authority by private legislation.

C. E. North. **Disinfection of a large Dairy Premises and many Employees after Scarlet Fever.**—(*Engin. News*, 62 [1909] no. 4 pag. 106); *E. S. R.*, Febr. 1910.—Washington.

Details are given of the method of disinfecting the employees and premises of a large dairy after 2 cases of scarlet fever had been discovered among the employees.

The milk was pasteurized each day in order to give consumers absolute safety from infection without interrupting the operation of the plant. The dairy house, dairy utensils, and dormitories for the employees were disinfected, and the dormitory disinfection was tested by control cultures of bacteria. The employees were disinfected, provided with sterilized clothing, and their throats and noses examined daily by the visiting physician. At the end of 15 days, no other cases having been discovered, the pasteurization of the milk was discontinued.

Tuberculosis (Animals) Committee. — *Mark Lane Express*, London, February, 1910.

The Committee for protection against Tuberculosis of animals has passed a resolution calling for legislative measures for preventing and fighting the disease, in view of the importance of a healthy milk supply.

Dairies (Scotland) Bill. Proceedings at Board meetings of the Highland Society. — *Trans. Highl. and Agric. Soc. of Scotland*, Vol. XXI, 1909, p. 440.

At the meeting of the Directors of the Highland and Agricultural Society of Scotland, on 6th May 1908, an exhaustive report on the Dairies (Scotland) Bill was submitted by the special committee on the subject.

Dr. Gillespie moved that the Board welcome and support reasonable regulations for securing the purity and quality of the home dairy produce offered for sale, but resolved that earnest representations be made to the government to have satisfactory measures taken to make sure that no dairy produce will be admitted from any country in which the regulations for the sanitary control of the same are not at least equal to those in Scotland.

The motion was unanimously adopted.

Milk and Dairies Bill. Memorandum. — *Journal of the British Dairy Farmers' Association*, Vol. XXIV, London, 1910, p.42.

The main objects of this Bill are to provide for:

1) The more effective registration of dairies and dairymen;

2) The inspection of dairies and the examination of cows therein;

3) The prohibition of the supply of milk from a dairy where

such a supply has caused or would be likely to cause infectious diseases including tuberculosis;

4) The prevention of the sale of tuberculous milk;

5) The regulation of the importation of milk so as to prevent danger to public health arising therefrom;

6) The issue of regulations for securing the supply of pure and wholesome milk;

7) The establishment by local authorities in populous places of milk depots for the sale of milk specially prepared for infants.

The provisions as to registration supersede the provisions as to the registration of dairies contained in the Contagious Diseases (Animals) Acts and the Orders made thereunder.

The provisions as to the inspection of dairies and the prohibition of the supply of milk reproduce with amendment section 4 of the Infectious Diseases Prevention Act 1890, section 71 of the Public Health (London) Act, 1891, and the model milk clauses incorporated in many local Acts.

The clauses as to the prevention of the sale of tuberculous milk is also taken from the model milk clauses, but the scope of the enactment is somewhat extended.

The Board of Agriculture and Fisheries will in connection with this Bill issue an Order under the Diseases of Animals, Act, 1894, dealing with the notification of tuberculosis in cattle, and the inspection, examination, detention, isolation, and slaughter of tuberculous cattle, and the giving of compensation in appropriate cases.

Arrangement of Clauses.

Clause:

1) Registration of dairies and dairymen;
2) Inspection of dairies and prohibition of supply of milk;
3) Prohibition of sale of tuberculous milk;
4) Power to take samples of milk;
5) Appointment of veterinary inspectors;
6) Power of Local Government Board to make Orders;
7) Amendment of Sale of Food and Drugs Acts as to warranties in the case of milk;
8) Regulations as to imported milk;
9) Establishement of milk depots;
10) Enforcement of duties of local authorities;
11) Service of notices;
12) Expenses of local authorities;

13) Provisions as to offences;
14) Interpretation;
15) Application to London;
16) Application to Ireland;
17) Short title, commencement, extent, and repeal.

Some of the more interesting Sections of the Bill are the following:

2. — (1) If the milk from any dairy is being sold or used for human consumption within the district of any sanitary authority, the medical officer of health for that district shall, whether the dairy is situate within or without the district, have power at all reasonable hours to enter and inspect the dairy, and if accompanied by a veterinary inspector or some other properly qualified veterinary surgeon, to inspect the animals therein;

Provided that if the dairy is not situate within the district of the sanitary authority the medical officer of health, shall not be empowered so to enter and inspect the dairy unless he has evidence that infectious disease is caused, or is likely to be caused, by consumption of the milk supplied from the dairy, and shall, before inspecting the dairy, give notice of the intention to do so to the clerk and medical officer of health of the district in which the dairy is situate.

2) If on any such inspection the medical officer of health or the veterinary inspector or surgeon has reason to suspect that any cow in the dairy is suffering from tuberculosis with emaciation or from tuberculosis of the udder, or is giving tuberculous milk, he may require the cow to be milked in his presence and may take samples of the milk, and the milk from any particular teat shall, if he so requires, be kept separate, and separate samples thereof furnished.

3) Every dairyman and the persons in his employment shall render such reasonable assistance to the medical officer of health or a veterinary inspector or veterinary surgeon as he may require for all or any of the purposes of this section, and any person refusing such assistance or obstructing such medical officer of health or veterinary inspector or veterinary surgeon in carrying out the provisions of this section shall on summary conviction be liable to a fine not exceeding *five pounds*.

4) If on any such inspection the medical officer of health is of opinion that infectious disease is caused, or is likely to be caused by consumption of the milk supplied from the dairy, or of the milk

of any particular cow kept therein, he shall report thereon to the sanitary authority, and to the local Government Board, and his report shall be accompanied by any report furnished to him by the veterinary inspector or veterinary surgeon, and the medical officer of health, if he considers the case to be one of urgency on account of the spread or suspected spread of infectious disease, may, pending the decision of the sanitary authority;

a) agree on behalf of the sanitary authority with the dairyman that the dairyman shall, on such terms and to such extent and subject to such conditions as may be agreed, stop the supply and use of milk from his dairy or from any particular cow kept therein; or

b) make an interim order prohibiting the supply for human consumption or the use, or supply, for use, in the manufacture of products for human consumption, of milk from the dairy or from any particular cow kept therein, until the expiration of such time, not exceeding ten days, as may be specified in the order, either absolutely or unless such conditions as may be prescribed in the order are complied with.

11) If any order is made under this section either by the medical officer of health or by the sanitary authority without due cause, or if the sanitary authority or medical officer of health unreasonably refuse to withdraw any such order, the dairyman shall, if not himself in default, be entitled to recover from the sanitary authority full compensation for any damage which he has sustained by reason of the making of the order, or of the refusal to withdraw the order, and in the case of an appeal the Board to whom the appeal is made may determine and state whether an order the subject of appeal has been made without due cause, and whether the withdrawal of the order has been unreasonably refused, and whether the dairyman has been in default.

9. — (1) The sanitary authority of any district (other than a rural district) with a population of fifty thousand or upwards may, subject to regulations under this section, establish and thereafter maintain depots for the sale of milk specially prepared for consumption by infants under two years of age, and purchase and prepare milk and provide such laboratories, plant, and other things, and exercise and perform such other powers and duties, as may be necessary for the purposes of this section.

This provision shall extend to any district (other than a rural district) with a population of less than fifty thousand, but not less than ten thousand, if the sanitary authority of the district make an application for the purpose to the Local Government Board and the Board consent.

J. Nugent Harris. **The Organisation of the Milk Supply.** — *The Journal of the Board of Agriculture*, Vol. XVI, No. 10. London, 1910, p. 811.

"The Wensleydale pure milk Society may be chosen as the first example of organisation of milk supply because it combines the producer, the distributor, and the consumer in its operations. The formation of the Society came about in the following way: Mr. Philipp Burt of York, and Dr. Moore Ede of Newcastle, were members of a party who visited Denmark in 1904."

They were impressed by the Copenhagen Pure Milk Company, and as a result, undertook the establishment of the Wensleydale Society, etc.

The Organisation of the Milk Supply. — *Board of Agriculture and Fisheries*, Leaflet No. 235, p. 8. London, June 1910.

The chief feature of the organisation of the milk supply is the establishing, preferably at or near a railway station, of milk *collecting depôts*, equipped with a refrigerating plant and cold store, as well as with the necessary plant and utensils for the manufacture of cheese, butter and other forms of milk products.

As an indication of the lines on which these depôts are supplied in Scotland, it may be useful to give an extract of the rules for members of dairy societies who (affiliated to the Scottish Agricultural Organisation Society) are suppliers of milk to the depôts.

To ensure that the milk sent to the depôt or creamery shall always be clean and pure, and in the best possible condition, the following simple rules should be rigidly observed by suppliers:

1) The byres in which the cows are housed should be limewashed twice a year, kept scrupulously clean, and thoroughly well lighted and ventilated.

2) The cows should be kept clean, and prior to milking the udders should be brushed or wiped with a damp cloth.

3) Clean overalls should be provided for the milkers to put on during milking. Care should be taken to see that the milkers' hands are perfectly clean before beginning to milk, and provision

should be made in the byre for milkers cleaning and drying the hands after milking each cow.

4) The filthy practice of dipping the fingers in the milk during milking should not be allowed.

5) When necessary, the hair about the udders and tail of the cows should be clipped, in order that they may be more easily kept clean.

6) The milking pails and milk cans should be scrupulously cleansed and thoroughly scalded every time they are in use, and, where possible, exposed to the air and sun when not in use.

7) The process of milking should be carried out in the cleanest manner possible and at regular intervals. The milk is more uniform in quality when the milking periods are equally divided.

8) It is good practice to reject the first two or three strains from each teat. The first milk is poor in quality and of little value, and often contains objectionable bacteria which are harmful to the milk and its manufactured products.

9) Milk which may, from various causes, be stringy or tinged with blood must be rejected.

10) All milk should be carefully strained, immediately on being milked, through a fine strainer covered with muslin or other modern appliance.

11) Where milk has to be conveyed for several miles before reaching the Depôt, it should be cooled by being passed over a refrigerator immediately on being milked. In the case of farms situated in near proximity to the Depôt, and when during the winter months the milk is only sent once daily to the Depôt, it should, preferably be promptly cooled by being passed over a refrigerator, but where that is not possible it should be placed in shallow pans and kept in a cool dry milkhouse overnight, or, if placed in cans, these should be set in cold water.

12) No preservative of any kind should ever added to the milk. Cleanliness and prompt cooling are all that is needed to ensure its keeping sweet and in good condition.

13) Foods, such as turnips, which are calculated to impart an objectionable flavour to milk, should always be fed *immediately after milking*, never before. Turnip leaves should never be given to cows when in milk. When cows are being fed on cabbages, all decayed leaves should be kept out.

14) An adequate supply of pure water is vitally essential to the welfare of the cows, and they should never be allowed to drink impure or stagnant water.

15) No milk from newly calved cows should be sent to the Depôt for the space of four clear days from the date of calving, and no milk from any cow that is not in good health, or that is under physic, should at any time be sent.

16) When the milk is being delivered once a day only, the morning's and evening's milk must be sent in separate dishes. On no account must warm milk be mixed with cold.

17) In the event of any outbreak of contagious or infectious disease in the household of a supplier, or of any person employed by the supplier in attending the cows, notice must be at once sent to the Secretary or Manager of the Depôt or Creamery, and the supply of milk discontinued until all danger of spreading disease through the milk is certified by the Medical Officer of Health for the district to have passed.

One vitally essential factor in ensuring success is the provision by the members of an adequate supply of good well handled milk all the year round, in such proportions as the demands of the business necessitate. In order to keep up the proportionate supply required, members should arrange to have cows calving at different periods throughout the year.

Provision should be made by suppliers, as far as may be possible for a continuous supply of those field crops, suitable for milk production, to augment the daily ration when pastures fail in autumn, and for winter keep. Great loss is incurred if the milk supply is allowed to go down in consequence of failing pastures.

It is in the interest of, and should be the duty of, milk suppliers to a Co-operative Creamery not only to send in their own milk in the best possible condition, but also to see that their fellow members do likewise.

Railway Companies and the Milk Traffic. — *Mark Lane Express*, London, March, 1910.

A conference promoted by the Chamber of Agriculture was held under the auspices of the Board of Agriculture for regulating the carriage of milk by rail to the towns, so that it may exercise its beneficent effect on the market without injury to the farmers.

WILLIAM SMITH. **The Making and Marketing of Butter.** *Transactions of the Highl. and Agric. Soc. of Scotland,* 5th. Series, Vol. XXI. Edinburgh 1909, pp. 42-51.

The annual value of the milk produced in the United Kingdom is over 50 million pounds sterling (1262 millions of francs), and one third of the whole is used in butter making.

This industry is one in which scientific knowledge is of paramount importance. The difference in price between the choicest and inferior brands is sometimes as much as 50 per $^{0}/_{0}$ and unfortunately in this country a large proportion of the butter made is still of an inferior quality. Our dairy schools and itinerant classes are beginning to cause our butter makers to produce a better article but this tuition has no command over the breed of the cow nor over the production of the milk and it is here that the science of the choicest butter-making begins.

The belief that the richness of the milk can be regulated almost at will by feeding has been contradicted by careful experiments which prove that it depends most on the breed of the cow and that it can only be slightly altered by the feeding. On the other hand it must not be supposed that poor feeding will pay. A well nourished body is essential to the prolonged production as well as to the richness of the milk.

It is certain that a great deal of the inferior butter produced is due to the want of knowledge as to how the cream ought to be prepared for churning. The majority of dairy men have heard of the "starter" and know that this is advocated for the production of the finest and best keeping butters. But many seem to have vague ideas as to what it is, and how it is to be obtained and applied·

The "starter" is a culture of bacteria capable of ripening cream to the best advantage. That cream or milk must by ripened for the best results is a point beyond debate and the process is considered complete when 0.75 per cent of acid has been produced.

Once it was difficult to obtain a good "starter." Cultures of bacteria were, and are still, sold in a preserved dry or liquid medium. The novice may experience much difficulty in preparing from the culture a "starter" ready for adding to his cream, as these cultures may have to be propagated before use and so the leading firms have placed on the market a "starter" prepared in milk and ready for use.

For creamery use as many as 100 gallons (450 litres) of " starter " may be required daily. The best method is to sterilise sufficient skim-milk and inoculate this with the prepared culture. This has to be done daily, the milk inoculated one day being coagulated thc next. By sterilising the skim-milk the work of the desired bacteria is not impeded. If the culture is simply added to the unpasteurised skim-milk, other germs may be present and impair the action of the culture and the butter-maker may have trouble.

To the crops grown, the dairy farmer has now to add the lactic acid bacterium and here also many weeds may be met with, if he is negligent, if he pays little heed to the scalding of utensils and ripens the cream in any corner. On the other hand by a little care and much cleanliness the bacterium may be considered as a most faithful servant.

The packing of butter for the fresh butter trade is best done by wrapping each brick or print in pure parchment paper, and packing them in boxes made the exact sixe of a certain number of packages.

As for the marketing an entire change has come over the system during the last fifty years. Formerly every town had its own weekly butter-market, where the farmers' wives and daughters brought their butter and sold it directly to the consumers. About 1860 Holland and Denmark began selling their butter to wholesale houses who in turn offered it through travellers to retail grocers. On the other hand the habits of the housewives and consumers were changing. And thus one of the most pernicious systems has been introduced, that of the grocer's carts who go round buying butter, paying the same low prices both for the good and the bad.

The only remedy to this state of things is cooperation. Collect the raw material, milk or fresh cream at common centres, handle it according to scientific methods by means of a competent staff, produce butter in bulk and buyers will never be wanting.

The prices, according to the experience of the past and to present prospects would not be less than a shilling per lb. (2 frs 75 per kg.) yearly average, or 30 % more than the actual price in many counties in Scotland.

Ireland is working out its agricultural salvation on these lines. There is no glut in the market although Ireland is sending to the English market hundreds of tons more of butter a year than it did 10 years ago. The consumption of butter increases more rapidly than the population, and there is plenty of room for a great increase in the production of choice home made butter provided it be put on the market rationally as is done with other wares in the provision trade.

Potting Butter. — *The Dairy*, vol. XXII, n. 259, 190. London, July 15, 1910.

It is often better policy to resort to potting butter than to part with it when the market rates are too low to make it profitable. Careless methods are always a failure, but when it is properly done butter will keep its best qualities for several months. Success is certain, if the following instructions are carefully observed: 1) Properly ripened cream; just of the right acidity, i. e., containing 5 or 6 per cent, lactic acid—if too sweet or too sour the chances are not so good for securing sound-keeping butter. 2) Liberal washing of the bntter while in the granular state, in order to free it from casein, is essential. 3) Incorporation of a sufficient quantity of salt to make it keep; the quantity employed is usually 1 oz. of salt per pound of butter, and a thorough working is needed in conjunction to get rid of as much water as possible. 4) The butter must be properly consolidated in the vessels in which it is packed, and kept out of contact with the air. Add salt at the rate of 1 oz. to the pound and partially work the butter; then set it aside for the salt to dissolve, and afterwards re-work until it is well dried.

Glazed crocks, thorougly scalded and cooled, are the best receptacles in which to store the butter. Use a butter packer and consolidate well, covering the butter on the top with a layer of salt about two inches in thickness, and over the crock stretch parchment or bladder. Sometimes strong brine is poured on the top and renewed every now and again, but dry salt is better. Always store away in a dry room.

When required for use cut the butter up in pieces and place in a churn of water at a temperature of 60 to 65 degs. F., and leave for twenty minutes; then work and make it up. This rids the butter of a lot of the salt, and it should be none the worse for its long storage. Saltpetre and sugar, also preservatives, are often added, as well as salt.

L. A. ROGERS. **Cold storage of Butter.** — *The Dairy*, Vol. XXII, No. 254, 39. March 15th, 1910.

The causes of changes in butter being: the action of bacteria and other micro-organisms, spontaneous chemical changes which may take place without the action of vital force, extraneous flavours which may be absorbed from the atmosphere, wood, or other surroundings; storage becomes a question of protecting butter from absorption of foreign flavours, and holding it at temperatures sufficiently low to check spontaneous chemical changes and deteriorations due to previous bacterial growth.

Results from experimental butter held at—10, 0, and 32 F. (—23.3,—17.7, 0, C.), have consistently shown that the condition in which butter is found after remaining for a while in storage is much more dependent on methods of manufacture than on the storage temperature.

The difference in the condition of butter coming from storage at high and at low temperatures is much greater with butter made from poor cream than with butter made from good cream.

However, the flavour of butter may be damaged by absorbing odours from the surroundings: ammonia, paraffined wood, fruit and others, dependent upon storage conditions and cares used.

Coulommier, Pont l'Evêque and Camembert. Soft Cheese-Making. — (*Journ. of the Bath and West and Southern Counties Soc.*, Fifth Series, vol. III, 1908-9). *Journal Board of Agric.*, 1909, London, p. 789.

" Experiments were undertaken at the Dorchester Show for the purpose of ascertaining the value of different qualities of milk for making the varieties of soft cheese known as Coulommier, Pont l'Evêque and Camembert.

The experiments showed: (1) that the profit on making these cheeses is considerably more than on selling the whole milk; (2) that while the milks richer in fat make the better quality cheese, the higher price paid for such milk does not show such a corresponding advantage in the price paid for the cheese as to warrant the use of richer milk than that usually yielded; and (3) that Shorthorn milk is more suitable for soft cheese-making than milk from Kerry cows. "

T. A. Coward. **Studies connected with the Manufacture of early season Cheeses.** — (*Univ. Leeds and Yorkshire Council Agr. Ed.* [Pamphlet], 77, 1910 pp. 15). *E. S. R.* Abstr.

The characteristics of early and late cheeses were studied with a view to overcoming the defects which commonly occur in cheeses made early in the season. Chemical analyses were made and compared with the results obtained by other investigators.

In a study of the bacterial flora of internal rust and off-flavor cheese, 3 chromogenic species of bacteria were isolated; *Bacillus prodigiosus* var. (?), *Bacterium acidi propionici* var. (?), and *Bacillus mahogani.* Suggestions are offered for preventing the growth of these organisms in order to obtain a more uniform product throughout the season.

New Method of Marketing Cheese. *The Farmer and Stockbreeder.* London, June 1910.

One of the choicest varieties of English cheeses is the Wensleydale. Last year there appeared on the market a small cheese in outward appearance closely resembling the Wensleydale.

It weighed only a pound and a quarter and its colour was greenish. This cheese met immediately with much favour, not so much for its intrinsic qualities which are the same as those of the Wensleydale as for its reduced size which is more suitable to the consumers.

P. G. Craigie. **Statistic of Cheese in the United Kingdon.**— *Standard Cyclopedia of Modern Agriculture*, edited by Professor R. P. Wright. Vol. 3, p. 182. London.

" No official estimate exists as to the quantity of cheese annually manufactured in the United Kingdom, although the subject has been occasionally dealt with by individual enquirers into questions of agricultural economics. Reviewing these various conclusions, but basing their own estimates largely on the relative consumption of cheese by various classes of the community, a recent Committee of the Royal Statistical Society, in reports explained to that body by Mr. R. H. Rew, suggest 10 $^1/_2$ lb. per annum as the probable ration of cheese consumed by each unit of the population in this country at the present time. Two-thirds of this, it is clear from

British import records, which form the sole reliable factor in the calculation, come from abroad, whence for some time there has been received a yearly quota of just 6.8 lb. of cheese per person. Not very much more than half as much, or 3.7 lb. per head apparently, therefore, represents the present domestic manufacture of this commodity. It would take less than 9 per cent of the milk furnished annually by the cows of the United Kingdom to supply this quantity. Practically 153,000,000 gal. of milk out of 1,723,000,000 gal. available for all purposes may thus be taken as supplying 1,366,000 cwt. of all forms of British cheese. The imports for the same group of years gave us nearly twice as large a figure, or a net total of 2,520,000 cwt. For the year 1907 this importation was indeed somewhat reduced, but taking a longer survey it may be said that over the whole period from the end of 1895 up to 1907 the receipts of cheese from abroad have kept very closely to an average of 2,500,000 cwt., a calculated ration of nearly 6.8 lb. per head having been thus maintained without much variation for a dozen years. The cheese imports of the United Kingdom have not increased with the same rapidity that has distinguished those of butter, but if the comparison be made with the period before 1870, when the total was below a million cwt., or with the five years 1871-5, when it averaged only 1,350,000 cwt., the addition is nevertheless considerable, the sea-borne supply being nearly doubled.

Unlike some other forms of imported food, the cheese which arrives in Great Britain is, as to tree-fourths of its bulk, the produce of a single British colony Canada, whence in the last five years it has been accustomed to draw annually quantities varying from 1,700,000 to 1,900,000 cwt., — larger totals than the entire British production of cheese supplies. This source of imports has grown, while the quota furnished by the United States has of late steadily declined, reaching only 5 per cent of the total receipts in 1907. Holland with 242,000 cwt., of cheese, and New Zealand with 192,000 cwt., are the only other important contributors to British wants — the French and Belgian exports of cheese to this country collectively do not reach 120,000 cwt. in recent years.

The available statistics of the prices of cheese are not very satisfactory, but the published average of the Board of Agriculture '*Market Prices*' for 1906 gave a mean of 73 s. per cwt., for British Cheddar, and 71 s. for Cheshire of first quality, while the average for Canadian Cheddar, which formed the bulk of the imports, was from 61 s. in the lower to 63 s. in the higher grade. For the whole year 1907 the Board of Agriculture figures quote British Cheddar as reaching a price of 76 s. per cwt., but Canadian cheese prices remain as before, although for these the trade circulars of one of the firms engaged in the import trade, the figures for the year ended 30th June, 1907, run higher than this, or an average of 64 s. 1 d. for Canadian Cheddar compared with only 54 s. per cwt., in the similarly collected prices for the whole ten years 1898-1907. The more general average values to be obtained from the Customs records of all grades of imported cheese over the two years 1906-7 stand at 58 s. per cwt., while a price of less than 50 s. per cwt. was ruling in the first five years of the century, and 45 s. 8 d. only in 1896-1900. To find an average of imported cheese values above 60 s. a cwt. it would be needful to go back to 1866-70."

WILLIAM E. BEAR. **Imports of Butter into Great Britain.** — *Jour. of the R. Agr. Soc. of England*, Vol. 70, p. 168. London, 1909.

"Our imports of butter, which nearly doubled between 1894 and 1906, when they reached the maximum, have declined slightly, chiefly on account of decreases in shipments from Canada, Australia and the United States. From the country last named they were never very large, and now they have fallen to an insignificant quantity. Denmark is much the most extensive contributor, followed by Russia, France, Sweden, Australia and New Zealand. Russia (Finland) has made the greatest headway in recent years, while Denmark, with some fluctuations, has greatly increased her consignments in a series of years, those of 1908 representing the maximum.

Margarine which competes with our butter, comes chiefly from the Netherlands.

The quantity under its proper name has decreased greatly since 1892; but whether the quantity of adulterated butter, which should be styled margarine, has fallen off or not it is impossible to say.

Unfortunately, our latest Act relating to the sale of butter allows adulterated stuff to be sold under other names than that of margarine."

William E. Bear. **Importation of Cheese into Great Britain.** — *Agricultnral Competitions. Cheese.* — *Jour. of the R. Agr. Soc. of England*, Vol. 70, p. 158. London, 1909.

" For a great number of years the bulk of our imported cheese came from the United States.

In 1878, for example, nearly three-fourths of the total were derived from that source, and as recently as 1885, or possibly a little later, that country was still the greatest contributor. Canada, however, had then been steadily gaining ground on the strength of superior quality of her cheese and its freedom from the adulteration with extraneous fat which impaired the prestige of her rival producer.

By 1901 Canada was sending us nearly three times as much cheese as we received from the United States, and 1908 she sent us about fifteen times as much.

Both the Netherlands and New Zealand now supply us with more than twice as much cheese as the United States send.

Indeed, if the figures for the eleven months of 1909 ended with November be taken into account, New Zealand's contribution is six times that of the United States, whence the supply has become quite unimportant.

New Zealand has made the greatest advance in the exportation of cheese in recent years, though Canada still sends considerably more than half the total.

Australia at one time seemed likely to be a considerable competitor, but has supplied us with only small quantities of cheese occasionally in recent years.

Our total imports of cheese have fallen off since 1900."

R. H. Rew. **Prices of Butter and Cheese on British Markets.** — *Board of Agriculture and Fisheries. Agr. Statistics 1909*, Vol. XLIV, Part III. London, 1910, Cd. 5268, p. 192.

Expressing the value per dozen lbs. in the equivalent per cwt. it is of interest to note how the price of British butter of first and second quality compares with the price of its nearest rivals, viz. Irish creamery and Danish butters.

The following is the comparison for five years:

Year	British				Irish Creamery				Danish			
	1st		2nd		1st		2nd		1st		2nd	
	s	d	s	d	s	d	s	d	s	d	s	d
1905	126	0	112	0	109	0	106	0	115	0	112	6
1906	133	0	121	4	111	6	108	6	118	6	116	0
1907	128	4	116	8	108	6	106	0	114	6	112	0
1908	132	4	121	4	116	0	113	6	121	6	119	0
1909	130	8	119	0	111	6	108	0	118	6	116	6

British butter sold in the country markets at per dozen lbs. clearly makes more money than its rivals. The much wider difference in value between first and second quality in the case of British butter than in Irish or Danish butter indicates, perhaps, that comparative lack of uniformity which is commonly alleged as a fault of the home product.

The prices of home-produced cheese improved slightly in 1909. At the Chester, Nantwich, and Whitchurch cheese fairs Cheshire cheese recovered the fall of 3 s. per cwt. which occurred in 1908. Best Cheddar cheese also slightly improved in price, but Canadian cheese declined 1 s. per cwt in the year.

R. H. Rew. **Dairy Produce imported in Great Britain, in 1909.** — *Board of Agriculture and Fisheries,* Agr. Statistics 1909, Volume XLIV, Part. III. London, 1910 (Cd. 5268) p. 196.

" The total quantity of butter imported in 1909 was 4 063 000 cwts., being a decrease of about 150 000 cwts. as compared with 1908. The deficiency was mainly due to reduced receipts from Denmark, the Netherlands, and Russia, which were only partially made up by increased imports from Sweden, France, and New Zealand.

Imports of margarine were larger by 55 000 cwts than in 1908, and reached 868 000 cwts., of which 819 000 cwts. came from the Netherlands.

The importation of cheese amounted to 2 390 000 cwts., a quantity larger than that received in 1908 or 1907, but lower than the average of the past decade. A further increase in consignments from the Netherlands and New Zealand occurred. Supplies from Canada showed some recovery, but those from the United States continued to diminish, falling from 138 000 cwts, to 55 000 cwts. The importation of fresh whole milk practically ceased in 1909, only 21 cwts., being received as against 953 cwts. in 1908. The total quantity of cream imported (6,837 cwts.) was almost the same as in 1908, receipts from France increasing to 5 876 cwts., but those from Norway and the Netherlands falling off. The imports of separated milk (2 921 cwts.) practically the whole of which was from France, arrived chiefly in February, March, November, and December, and were 800 cwts., less than in 1908, but 200 cwts. more than in 1907. About three-quarters of the separated milk was described as machine-skimmed.

XXXVIII.

Aviculture. Poultry. Pigeons, etc. The feeding and fattening of poultry. Production, preservation and trade of eggs. — Trade in feathers and bird-skins. — Bird-life in connection with agriculture. Protection of bird-life from wanton destruction. Wild birds.

EDWARD BROWN. **British Breeds of Poultry.** [Board of Agriculture and Fisheries, *British*]. *Breeds of Live Stock.* — London, 1910, p. 1-137.

The following are some extracts from the important official publication of the Board of Agriculture and Fisheries, in the part regarding Poultry.

Great Britain has long been recognised as a country where poultry of all kinds, equally with other classes of live stock, are bred to their greatest perfection, both as to their external characteristics and their economic qualities. In past centuries the Game Fowl, bred for fighting, the Dorking, the White English or Aylesbury Duck, the two great types of Geese, and the Turkey, were evolved by careful selection, while in more recent times the number of races has been largely increased, either by the development of new breeds, or by the selection and improvement of breeds imported from other countries. Essentially practical, British breeders have generally kept the laying or table qualities of the breeds in view, and those which have attained the greatest measure of popularity are profitable either as egg or flesh producers.

The reasons why Britain has excelled in its races of poultry are many. One is the remarkable variation in the nature of its soil and local conditions. Few countries of the same area present such variation as Great Britain, and for the attainment of success it has been necessary to find birds that were suited to those conditions. Another reason is that the limited area of land available has compelled a reduction in the number of poultry kept and the rigid selection of breeding stock in accordance with the object in view. A further influence is that for a long period there have been people of all classes with sufficient means, opportunity and leisure, to enable them to breed poultry, formerly for sport as cock-fighters, and latterly either for the market, or for purposes of exhibition as examples of systematic breeding. It is of interest to note that the greatest and most successful breeders of pure-bred poultry have been men engaged in industrial pursuits. The miners and mill workers of the North of England, the men engaged in the iron and spinning trades of the Midlands, and the tin miners of Cornwall have for generations been famous in this respect.

The number of poultry breeders in the country has been greatly increased during the last 60 years as a result of the establishment of Poultry Exhibitions. Small local competitions had been held in the valleys of Yorkshire and Lancashire for many years prior to that time, but exerted small influence outside the immediate district. With the advent of poultry shows, an impetus was given to poultry breeding which has never been lost. Existing races of poultry were classified. Standards were adopted, so that breeders had ideals toward which they could direct their efforts. New varieties, both native and foreign, were introduced. Old breeds were revived, and as a result other countries began to look to Britain for stock to enable them to develop poultry breeding on advanced lines. Within recent years the number of breeds has grown very considerably. The science of breeding has received a great amount of attention. Not only has attention been paid to improvement of the external characteristics, but much has also been done to advance productiveness both in respect to eggs and meat. The older type of British poultry was, however, always remarkable for the quantity and quality of its flesh.

The breeds may be classified according to their principal characteristics as follows:—

FOWLS.

Table Breeds. (*Suitable for fattening.*)

Dorking.
Sussex.
Game Fowl.
Indian or Cornish Game.

Laying Breeds. (*Most suitable for egg production.*)

Minorca.
Andalusian.
Hamburgh.
Redcap.
Scotch Grey.
English Leghorn (or Italian).

General Purpose Breeds.

(*Suitable both for the table and for egg production.*)

Orpington.
Plymouth Rock.
Wyandotte.
Langsham.
Brahma.

Fancy Breeds. (*For exhibition.*)

Game Bantams.
Bantams.
Cochin.

DUCKS.

Table Breeds. (*Suitable for fattening.*)

Aylesbury.
Rouen.

Laying Breeds. (*Suitable for egg production.*)

Indian Runner.
Pekin.

GEESE.

Embden.
Toulouse.

TURKEYS.

Mammoth Bronze.
Black.
Cambridge Bronze.

TURKEYS.—Britain has for a long period been famous for the quality of its Turkeys, which in flesh qualities are among the finest in the world. At one time the Black Norfolk was largely kept, but it has almost disappeared and its place is occupied by the Mammoth Bronze and the Cambridge Bronze varieties. There was also formerly a Grey Turkey of good quality, but that is now merged in the Cambridge Bronze.

MAMMOTH BRONZE TURKEY.—This is the largest of the Turkey family, descended from the wild species found in North America. It has a very long body, deep through from back to keel, both of which are broad and massive. The long neck and tail add considerably to the length, and the wings are very large. The head appears small in relation to the size of body, partly due to absence of comb, the place of which is taken by full caruncles in the male, bright red in colour. In that sex the rich wide-spreading tail adds greatly to the massiveness. The body plumage is bright bronze: with a narrow band of black at the extremity of each feather, and the head and neck feathers are brilliant bronze. English Mammoth Bronze are specially characterised by richness of plumage. Weights, 14 to 34 lb.

The hens are good layers and excellent sitters and mothers. They are hardy, grow quickly, and carry a large amount of flesh, which is of good quality.

CAMBRIDGE BRONZE TURKEY.—This race is not quite so long as the Mammoth, but is very deep in body and massive, and is comparatively light in bone. The plumage is of a dull bronze and each feather is marked with grey where black would be found in the former breed. The result is that it lacks brilliance of appearance, and, as a consequence, is very seldom seen at exhibitions. Weights: 12 to 24 lb.

In respect to flesh qualities the Cambridge is the finest race of turkey known, especially as it increases greatly in weight when fatted, and the light frame indicates greater amount of flesh in relation to the total bulk. The breast meat is full and compact, very thick, and excellent in colour. It is soft and very fine in flavour. The very best turkeys which are placed on the English markets at Christmas are of this breed.

BREED SOCIETIES.

The following is a list of the Societies formed in the interests of the breeds named above:

Breed.	Secretary's Name and Address.
Brahma Fowl	A. E. Ward, Great Wafford, Mobberley, Cheshire.
Cochin Fowl.	S. J. Ballard, The Pagnells, Park Avenue, Chelmsford.
Dorking Fowl	C. E. Richardson, Kirklevington Hall, Yarm, R.S.O., Yorks.
Game Fowl (Old English)	J. H. Hartley, Station Hill, Wigton, Cumberland.
Game Fowl, Modern . .	A. H. Edwardson, 6, Hamilton Square, Birkenhead.
Hamburgh Fowl. . . .	Rev. J. N. Williams, The Vicarage, Chapel-le-Dale, Kirkby Lonsdale, Westmorland.
Indian Game Fowl. . .	Dr. Jn. H. Goodal, Brinnington, Chester field.
Langsham Fowl, Croad .	Herbert P. Mullens, Oaken, Wolverhampton.
Langsham Fowl, Modern	Harry Wallis, Northend, Warley, Brentwood.
Leghorn Fowl	W. Clarke, 25, Broadhinton Road, Clapham, London, S.W.
Minorca Fowl	Curtis Wilmot, 297, Main Street, Bulwell, Notts.
Orpington Fowl, Black .	W. M. Bell, St. Leonards, Ringwood, Hants.
Orpington Fowl, Buff. .	W. J. Golding, Westwood Farm, Weald, Kent.
Orpington Fowl, Spangled	Ernest Wilkins, Cold Norton Farm, Kidmore End, Reading.

Breed.	Secretary's Name and Address.
Orpington Fowl, White .	Frank Bloomer, Foxcote, Stourbridge.
Plymouth Rock Fowl . .	A. A. Fleming, White House, Pulloxhill, Ampthill, Beds.
Redcap Fowl	Joshua Heathcote, Villa House, Elton, Matlock.
Scotch Grey Fowl . . .	John Carswell, 148, Graham Road, Falkirk, Scotland.
Sussex Fowl	S. C. Sharpe, Grantham Villa, Lewes, Sussex.
Wyandotte Fowl . . .	O. F. Bates, Harlow Court, Harrogate, Yorks.

BANTAMS.

Modern Game	A. H. Edwardson, 6, Hamilton Square, Birkenhead.
Old English Game. . .	J. H. Hartley, Station Hill, Wigton, Cumberland.
Variety	E. J. W. Buckpitt, The Cedars, Bridport, Dorset.

DUCKS.

Indian Runner	J. W. Walton, 22, High Street, Tow Law, Durham.
Waterfowl (Ducks and Geese).	W. B. Bygott, Ryehill, Wingoakam, Rutland.

Poultry and Game imported in Great Britain, 1909. — *Journal Board of Agric.*, London, Jan., 1910, p. 841.

" Poultry is chiefly received from Russia, United States, France, and Austria, and the figures of value exhibit no great change as compared with the previous two years. Russia's share in the trade amounted to £353 000, that of the United States to £150 000, and that of France and Austria to £156 100 and £108 800 respectively, out of a total for this item of £971 000 ". This total is equivalent to 23 255 250 francs.

MURRAY et AL. **Departmental Committee on Poultry-breeding in Scotland.** — (*Government Publ.*, pp. IV+18. Edinburgh, 1909). *E. S. R.* Washington, May 1910.

This report is the result of an inquiry upon the methods commonly followed in the Highlands and islands of Scotland in the breeding and keeping of poultry and the sale of poultry and eggs, and especially into the results of the efforts of the Congested Districts Board to promote this industry and to suggest how it may be developed and improved.

Production of Poultry in England. — (*Journal of the National Poultry Organis. Soc.*, April 1910) *Nature*, Vol. 83, p. 532. June 30th 1910.

The keeping of poultry continues to attract always more attention in England. The national Poultry Organisation Society avails itself of these favourable conditions in its endeavours to introduce cooperative methods in the production of eggs.

E. BROWN and C. A. FLATT. **Feeding Poultry with Earth Salts.** [Notes on experiments with poultry]. — *The Journal of the Board of Agriculture*, Vol. XII, n. 8, 635-639. London, November 1909.

In preventing that mortality among young stock. which is the chief trouble of the chicken breeder wherever artificial methods are adopted, it has been suggested the feeding with salts prepared as follows:

	Parts
Common salt	30
Phosphate of soda	9
Calcium fluoride	1
Ferrous sulphate,	1
Bone ash	30
Chalk	14
Epsom salts	10
Charcoal	2
Flowers of Sulphur	3
	100

Two lots of 16 and 18 chickens, White Wyandottes and Buff Orpingtons mixed, were placed in the same class of brooder, and kept on ground devoid of natural food, they were fed in exactly the same manner, except that lot I had the mineral salts added to the food, at seven weeks $^1/_4$ o3, and eleven weeks $^3/_4$ oz per diem for the entire lot, whilst lot II, had none. The following table gives the comparative weights obtained in the experiments done:

At	Average weights Lot I with salts oz.	Lot II without salts oz.	Gain of salt-fed oz.
4 weeks	6.69	5.83	0.86
7 »	11.73	10.00	1.73
11 »	26.88	20.3	6.58

Dividing them according to breed, the results were as follows:

At	Average weights White Wyandottes with salt	without salt	Buff Orpingtons with salt	without salt
4 weeks	6.4	5.9	7.0	5.6
7 »	11.0	11.0	12.8	0.6
11 »	28.8	20.0	25.3	21.0

Use of charcoal in fattening Ducks and Geese. — *The Journal of the Board of Agric.*, March, 1910. London, vol. XVI, n. 12. p. 1026.

"The Board of Agriculture and Fisheries, London have been furnished by Mr. H. de Courcy with an account of some experiments carried out by him for the purpose of deciding the exact value of charcoal as a means of keeping birds that are closely confined during fattening in good health.

"Eighteen large healthy Aylesbury ducklings were selected from a large flock and divided into three pens each pen containing six ducklings of as uniform weight as possible. Each batch of six ducklings weighed fifteen pounds, or an average of two-and-a-half pounds per head.

"Throughout the experiments the ducklings were fed upon foods which previous experiments had shown to be profitable and economical, namely, boiled potatoes, barley meal, ground oats, skim milk, and tallow greaves. The method of preparing the food was to boil, strain, and pound up the potatoes, which before boiling would constitute about one-third by weight of the mash. Barley meal and ground oats were then mixed in equal parts and mixed with the potatoes. Skim milk was added to form a rather wet mash. This was fed to the ducklings from the end of the fifth to the beginning of the ninth week. During the last two weeks of fattening animal food in the form of rough fat or tallow greaves was added to the mash, the allowance being about two ounces per day to each duck. Grit and water for drinking were liberally supplied. Apart from the charcoal the food received by all the ducklings was the same.

"Pen No. 1 was allowed no charcoal, Pen No. 2 was given an unlimited amount of rough charcoal, while in the case of Pen No. 3 powdered charcoal was mixed with the mash at the rate of one-fifth charcoal to four-fifths of other ingredients, the charcoal being thoroughly incorporated with the meals before they were moistened."

The resulted are shown in the following table:

TABLE N. 1 — DUCKS.

Pen	Number of Ducks in pen	Weight at 6 weeks old		Weight at 8 weeks old		Weight at 10 weeks old		Increase in 4 weeks		Increase per head in 4 weeks	
		lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
N. 1 (no charcoal) .	6	15	2	21	6	23	0	7	14	1	5
N. 2 (rough charcoal)	6	15	0	24	8	27	2	12	2	2	0
N. 3 (Charcoal mixed with the food)	6	15	0	25	8	27	14	12	14	2	2

"The trials show that charcoal in one form or another is essential in the profitable fattening of ducks. It appeared to keep the ducklings healthy, and enabled fattening to be continued with profit for a much longer period than wheu charcoal was not allowed.

"The experiments with geese were conducted on similar lines and gave almost identical results, as shown in the following table. The breed was the Embden-Toulouse. The foods fed to the geese were the same as those fed to the ducks, except that they got steeped oats instead of mash for the evening meal, mash being fed in the morning.

Pen No 1 received no charcoal. Pen No 2 had charcoal in a trough, and Pen No 3 one-fifth charcoal in the mash."

TABLE N. 2 — GEESE.

Pen	Number of Geese in pen	Weight at 14 weeks old		Weight at 16 weeks old		Weight at 18 weeks old		Increase in 4 weeks		Increase per head in 4 weeks	
		lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
N. 1 (no charcoal) .	6	50	0	56	8	59	2	9	2	1	8
N. 2 (rough charcoal)	6	49	10	60	4	65	8	15	14	2	10
N. 3 (charcoal mixed with the food)	6	50	2	62	0	66	12	16	10	2	12

The charcoal fed to both ducks and geese was burnt wood, broken fine.

The Demonstration Egg Train. — *The Gardeners' Chronicle*, n. 3617, p. 265. London, April, 23, 1910.

The first demonstration egg train run in England left Paddington station for S. Wales on April 15. The adoption of the well-known, excellent American method for the dissemination of knowledge on agricultural methods is due to the joint action of the National Poultry Organisation Society, the Agricultural Organisation Society and the Great Western Railway.

The train will stop at all the important stations in South Wales, lectures will be given by travelling experts, and those interested in the industry will have opportunities of seeing demonstration on the best methods of packing and marketing eggs and poultry.

One great advantage of this system is that the very best information is rendered available to people living in isolated districts.

Grouse Disease. — *Nature*, vol. 83, n. 2124, London, July 14, 1910, p. 48.

The *Journal of Hygiene* for April (vol. X, N° 1) contains a report on an investigation of *grouse disease* by Drs. Cobbet and Graham-Smith. It was found that the diseased birds generally harbour large numbers of iutestinal worms, in particular a *strongylus* (*Trichostrongylus pergracilis*), which may occur in hundreds or even thousands. The conclusion is that the disease does not appear to be a specific bacterial infection, but that those birds which are more or less severely affected by strongyli suffer injury partly by interference with nutrition, partly by the absorpion of irritating or poisonous substances which weaken them, and in bad weather may prevent them from gaining a living, and also renders them susceptible to various bacterial infections.

National Poultry Experiment Station. — *The Dairy*, vol. XXII, N. 256, 110, April 15, 1910.

A preliminary committee has been formed to take steps to secure the formation of a National Poultry Experiment Station. A meeting has been held of delegates from the Board of Agriculture and Fisheries, the Agricultural Organisation Society, the British Dairy Farmers' Association, the Central Chamber of Agriculture. the Royal Agricultural Society of England, the National Poultry Organisation Society and other public bodies. A statement was submitted that, since the College Poultry Farm, Theale, was closed in September last, there has been no central educational poultry farm and experiment station in Great Britain. After discussion, it was resolved: That, in view of the growing importance of the poultry industry in Great Britain and the need for advanced instruction and experimental work, the meeting deems it advisable that a National Poultry Institute and Experiment Station should be founded.

A draft scheme has been provisionally approved by the Board of Agriculture and Fisheries, who, should donations and annual subscriptions be forthcoming on a sufficient scale, are prepared to support the proposed Institute.

Feeding-habits of Rooks. — *Nature*, Vol. 83, April 28, 1910, p. 263.

The Land Agent's Society some time ago commissioned Mr. Walter E. Collinge to institute an inquiry into the feeding-habits of rooks.

Observations were made on more than 800 specimens from various parts of England.

Percentage of the food of Rooks:

Grain, 67.5 %, this by the inclusion of roots and fruits, is raised to	71
Animal food	29

The rook is not a particularly beneficial bird to the agriculturist, although its utility might be increased if the numbers were diminished.

S. W. BIRCHLEY. **British birds for Cages, Aviaries and Exhibition.** — (London, 1909. Vol. I, pp. XIV + 302, pls. 45; vol. II, pp. VIII + 234, pl. 52). *E. S. R.*, March 1910.

Under the 72 species taken up descriptions are given of the parent birds, attractive qualities, habitation. catching, steadying and meting off, hand rearing, exhibition, food, nest and eggs, and countryside notes. Accounts are also given of the common ailments, their causes and cure, the moult, and the bird-room, and of the cages, avaries, and bird-room requisites.

Ventilation of Poultry Houses. — (*Jour. of South-Eastern Agric. Coll.*, No. 17, 1908); *The Journ. of the Board of Agric.*, March. 1910. London, Vol. XVI, No. 12, p. 1029.

" The ventilation of poultry houses is a matter of vital importance to poultry keepers, since overcrowding is known to impair the vitality of the birds, to render them susceptible to numerous diseases, including tuberculosis, diphtheritic roup, etc., and to diminish the number of eggs produced in winter ".

" An investigation into these points was carried out by Dr. Russell, and measurements were made of the amount of air required by poultry and the amount of impurity produced in poultry houses. Preliminary inquiry showed that 40 cubic feet of air per hour might be regarded as suitable air allowance for poultry, but this must be supplied at a suitable rate to prevent draughts ".

" Two houses were put up so arranged that each bird was getting about 40 cubic feet per hour, but in one the air was changed five times and in the other nine times per hour. The number of eggs laid was taken as an index of the well-being of the birds, which had been very carefully selected to secure equality, and the result showed that in 15 weeks the hens in House No. 1, laid an average of 38.8 each, while those in No. 2 laid only 28.5 each. The birds therefore did better when the air was changed only five times per hour, and the difference is attributed to the smaller loss of heat by the birds, which shows itself in production."

"It is concluded, therefore, that it is desirable that each bird should be allowed 40 cubic feet of air per hour and that this 40 feet should be supplied at a reasonably slow rate. Under conditions known by experience to be favourable to the birds, the air changes in a large house four times, and in a small house five times, per hour, which appears to be a very suitable rate".

"Dr. Russell observes that it is clearly impossible for the practical man to test the air in his poultry houses and ascertain the amount of carbonic acid present, nor is there any necessity to do this, because, under similar circumstances, the amount does not show a very great variation. The above conditions are all fulfilled in houses of a more or less cubical shape and also in the low types of house, when (*a*) there is a floor allowing a certain amount of air to enter from below, e, g, bricks about a quarter-of-an-inch apart covered with peat moss, or spaced boards if the floor is of wood; (*b*) there is top ventilation, two inches being open under the eaves of a high house, or a few large holes bored in the sides if a low house; and (*c*) each bird is allowed ten cubic feet of space".

A. Balfour. **Further observations on fowl spirochetosis.** — (*Jour. Trop. Med. and Hyg.*, 12, No. 19, pp. 285-289. London, 1909). *E. S. R.*, Vol. XXII, No. 4. Washington, March 1910.

This is a record of new development of which some of the more important observations are tabulated and illustrative cases described.

"It has been found that lice (*Menopon* sp.?) can, in all probability trasmit the disease from the sick to the healthy chick... In chicks relapses are common... The results of inoculations in the case of chicks have differed from those obtained in fowls... Ticks (*Argas persicus*), either as larvæ, nymphs, or adults, fed on chicks with acute spirochetosis exhibit the peculiar chromatin granules first described by Leishman in the case of *Ornithodoros moubata* fed on blood containing *Spirochæta duttoni*... Chicks, inoculated with an emulsion of crushed larvæ, showing these granules, but no spirochetes, develop acute spirochetosis... Pigeons are apparently not inoculable with this form of spirochetosis."

M. F. Guyer. **Atavism in guinea-chicken hybrids.** — (*Jour. Expt. Zool.* 7, 1909, No, 4, pp. 723-745, pls. 4). *E. S. R.*, March 1910, Washington.

The author describes hybrids obtained by crossing a Black Langshan cock with guinea hens. They possess a curious color pattern, not present in either parent, which consists of white, U-shaped vermiculations on a dark background. This, the author thinks, is a return to a generalized type of color more or less present in pheasants, peacocks, and other species of the same family.

F. V. Theobald. **Poultry Fleas and the Red Hen Mite.**—(*Illus. Poultry Rec.*, 2, 1909, No. 2, pp. 92-94, figs. 2). *E. S. R.*, March 1910. Washington.

The common fowl flea (*Ceratophyllus gallinæ*), which has been recorded from many other birds besides the domesticated fowl, the head flea (*Sarcopsylla gallinacea*), and the red hen mite (*Dermanyssus avium*), are briefly discussed. Altough ticks are not very common on poultry in England, *Dermacentor reticulatus* has been found on turkeys and *Argas reflexus* on poultry, including pigeons.

W. C. Finch. **Note on partial Leucosis in a Hen.**—(*Biometrika*, 7 (1909), no. 1-2, pp. 234, 236, figs. 5). — *E. S. R.* Febr. 1910 — Washington.

An account of birds which were obtained by a cross between an Indian game and a true Houdan. One hen turned from black to spotted in her first year, the spots since that time having diminished annually. Another hen has been once black, once white, then once spotted, and again white.

M. E. Pennington. **A Chemical and Bacteriological Study of Fresh Eggs.** — (*Journ. Biol. Chem.*, 7, No. 2, pp. 109-132). *E. S. R.* abs., No. 7. June 1910.

In this paper, which was presented at the Congress of Applied Chemistry, held in London in June, 1909, the author reports the results of studies of the proximate composition of Plymouth Rock and Leghorn eggs as well as the nitrogen partition in the white and the character of the fat in the yolk.

On an average the white of Plymouth Rock eggs contained 1.54 per cent of total nitrogen, 0.171 per cent of nitrogen non-coagulable by heat, 0.075 per cent of albumose nitrogen, and 0.005 per cent of amino nitrogen. The yolk of the Plymouth Rock eggs showed on an average an iodin value of 62.8, saponification number of 179.9, acid value of 5.8, ester value of 171.2, Hehner number of 76.1, calculated oleic acid 2.92 per cent, and an index of refraction of 1.4626. The values as reported for the Leghorn eggs are very similar.

A study of the bacterial content of eggs was reported, the number found and listed being 36 varieties per 100 eggs.

"In the 57 experiments, 18 had a decidedly greater number of bacteria in the yolk; 11 had the majority in the white and 21 had an almost even distribution; 7 were sterile."

Both Plymouth Rock and Leghorn eggs were used and spring and autumn and fertilized and unfertilized eggs were compared. According to the author, it may be that the differences in bacterial content which were observed depend upon breed and the conditions under which the eggs were laid as well as the season. In general, the autumn eggs contained a greater number of bacteria than the early spring eggs.

"That perfectly fresh eggs from healthy hens may contain bacteria is a generally recognized fact. That they are sometimes sterile is also admitted. Whether the organisms enter the egg during its passage down the oviduct or whether they penetrate the shell either at the time of laying or afterward are questions on which opinions are contrary. The fact that certain pathogenic organisms characteristic of fowls, as vibrios of chicken cholera, have been found in the eggs argues for infection in the oviduct, as do the presence of foreign bodies, such as small insects; while the trade experience indicates that organisms can enter through the shell".

Y. R. G. SINCLAIR. **Egg Farming an Important Industry in Scotland.** — *The Dairy*, Vol. XXII, n. 254, 38. — London, February 15, 1910.

The import of eggs into Great Britain is about 2 000 000 000 a year, valued at £7 000 000. The egg industry in Scotland is more important than the rearing of poultry for fattening purposes, because the climate is not quite suitable for producing the very best table birds. It is reported that Orkney during recent years exported eggs to the value of £60 000, which was more than the rental of the whole of the islands.

Simple Scotch Method for Preserving Eggs. — *Monthly Consular Reports.* Washington, March 1909, No. 342, p. 111.

The following information is given by U. S. Consul Maxwell Blake, of Dunfermline.

The great fluctuation in the price of fresh eggs in Great Britain, ranging from 15 cents per dozen in summer to 60 to 75 cents per dozen in winter — and procured with difficulty even then — gives popularity to the economical practice of artificially preserving them during the cheap season; the most successful method employed by the householder being as follows:

Mix together in an earthenware jar 9 parts of boiled water, which has been thoroughly cooled, and 1 part of glass-water (sodium silicate). Glass water is obtained by fusing 2 parts of quartz sand with 1 of sodium carbonate, adding one-tenth part of small coal. Place the cool cleaned eggs into a jar and cover well with the liquid, continually adding sufficient liquid to keep the eggs entirely covered as others are added. Water-glass can be purchased in Great Britain of chemists, and generally bears on the labels the exact proportion to be used, varying from 3 to 10 per cent. Eggs preserved in this way are less brittle in the shell than those preserved in lime water, and will sometimes boil without cracking if a small pin-point aperture is made in them.

The proportions used for the lime preservative in Scotland are 20 gallons of water, 4 of lime, and 1 of salt. Allow to stand for a few hours, then pour it over the eggs in the same way as the water glass. A little lime should be added from time to time, during the period of preservation; otherwise, the solution will lose its strength. The eggs preserved in this way become rough and brittle and must be handled carefully when taken out for use.

The popular method of preserving eggs by cold storage in the United States is not at all general in Great Britain, and it is rather surprising that more has not been done along these lines.

When eggs are only required to be preserved for two or three months they keep very well packed in dry salt or bran. The meat of the egg may shrink and rattle within the shell when shaken, but its edibility is not impaired. Coating the egg with vaseline or butter will also keep it for a short time, or any application which effectively seals the pores of the shell and excludes air will prolong the freshness of eggs. If it is even momentarily submerged in boiling water, the albumen thereby becomes sufficiently coagulated to prevent the entrance of air. In some of the rural parts of this country eggs for home consumption are smutted over with a mixture of sulphur and lampblack, a cheap and effective preservative ".

Bear, W. E. **Importation of Eggs in England.**—*The Journal of the Roy. Agricultural Soc. of England*, vol. LXX, 157, London, 1909.

Russia is reported as supplying England with nearly twice as many eggs as any other country. Denmark stands next, followed by Germany, Belgium, and France. These five countries make up between two-thirds and three-fourths of the immense total of over eighteen million great hundreds (of 120) that England imports in a year. The total had long been increasing almost every year up to 1904, since which date there has been a reduction. The prices paid for imported eggs would not be remunerative to home producers, and it seems impossible that their production in such countries as France and Germany, where corn is dearer than in England, can leave any profit upon their sale. The average imported price in 1904 was 1*s*. for over eighteen eggs, and all the expenses of collection and transport, as well as the foreign dealer's profit, have to be deducted. The price has risen since the year named, but no higher than 1*s*. for fifteen and sixteen and probably less than 1*s*. for twenty is paid to the producers. It may be supposed that they feed their hens chiefly upon tail corn and house scraps, and that they have no idea of the cost of production. Eggs are among the few farm products that have risen rather than fallen in price in England since the time of agricultural prosperity.

Imports of Eggs into Great Britain 1909.—*Journal Board of Agric.*, London, Jan., 1910, p. 842.

An interesting feature in the egg trade is that the imports have now been for five years below the figures reached in 1903 and 1904, and this may possibly indicate that with the extension of poultry-keeping in this country a greater portion of the supply is being provided from our home resources.

The decrease in the supply during the past year was due to diminished receipts from Denmark, Germany, Italy, and Austria, while the receipts from Russia and France increased.

E. Brown. **Declining Import of Eggs in Great Britain.** — Report on the Poultry Industry of 1909. *Nature*, Vol. 83, p. 167, April 7, 1910.

The decline in the import of foreign eggs, which has been going on since 1903, still continues, not so much as a result of increased home production as of increased requirements by Germany, now the largest importer of poultry produce in the world.

It is urged that farmers and small holders have now an opportunity in connection with poultry raising such as they never had before.

A. R. Galloway. **Canary breeding.** [A partial analyses of records from 1891 to 1909]. — (*Biometrika*, 7, 1909, No. 1-2, p. 1-42, pls. 5, figs. 4). — *E. S. R.*, Febr. 1910. — Washington.

This paper contains the results of 17 year's breeding with many types of canaries. The author considers that diversity of type has arisen from crosses between cinnamon sports and the wild green bird. This theory is advanced from (1) a study of wild sports in nature and in confinement, (2) cinnamon and cinnamon bred hybrids which frequently show characteristics of canary varieties arising *de novo*, (3) collateral evidence of a similar nature in poultry and pigeons, and from (4) a study of the earliest canary literature.

Mendelian inheritance in canaries is discussed at length. Dark-eye and pink-eye are found to behave generally in Mendelian fashion, for it is evident that there is a homozygous type of dark-eye canary and also a heterozygous or impure form occurring in the male as well as the female. There is some evidence that the female of the homozygous type of dark-eye canary is homozygous as well as the male. Other characters which are seen to behave as recessives are buffness and crest-bred plain-headedness; their corresponding qualities (yellowness and crestedness) exhibit more or less imperfect dominance. The majority of crests appear to be heterozygous with respect to crest.

Some of the results obtained by Davenport are stated to be different from those of the author, because of the breeding stock used by Davenport and his interpretation of fancy points. The need for a more strict definition of characters and their nomenclature is indicated. Colored plates and engravings are used to assist in improving the terminology of canary fanciers.

Protection of the Lapwing or Plover in Great Britain. — *The Journ. of the Board of Agriculture*, Vol. XVI, No. 9. December 1909.

"Representations were recently made to the Board of Agriculture and Fisheries to the effect that a considerable diminution was taking place in the number of lapwings in Great Britain, and in view of the utility of this bird to agriculture, the Board have caused an inquiry to be made into the subject through their honorary correspondents.

The Lapwing, Green Plover, or Peewit is a familiar bird in most parts of Great Britain. It breeds in marshes, moors, and meadows, and is seen in large flocks in the autumn and winter. It is one of the most useful of British birds, as it devours snails, wireworms, beetles, and the larvae of various insects that infest crops, but, unlike most other wild birds, its increase is much restricted by the demand for its eggs, which fetch a good price at certain times of the year.

The evidence which the Board were able to obtain shows, however, that the Lapwing is still common in most parts of Great Britain, but 75 out of 177 observers, or 42,3 per cent., observed a decrease. Out of 177 replies from practically all counties, 129 declared the bird to be common, while thirty-four considered it uncommon, or not very plentiful in their districts.

The question whether there had been an increase or a decrease in their numbers naturally admitted of considerable difference of opinion, but there was evidence that the numbers were decreasing in many districts. The replies may be classified as follows:

	England	Wales	Scotland
Increase observed. . . .	12	1	5
Decrease observed . . .	47	4	24
No decrease observed . .	43	4	26
Indefinite.	7	—	1

As regards the evidence of an increase, the changes in this direction appear to be strictly local. In a number of cases a decrease was reported from districts not very far removed from those in which an increase was stated to have occurred, so that although increases have no doubt occurred here and there, there is nothing to suggest any general extension in the number of lapwings.

Practically only one cause for its decrease is given, and that is the practice of egg-collecting. This is referred to more or less emphatically as an evil by a number of correspondents, many of whom say that egg-collecting is on the increase, and urge that the eggs should be protected under the Wild Birds Protection Act.

The trapping of these birds by bird-catchers seems to be quite unknown, and the interference with the natural increase in this country, apart from casual shooting, appears to be confined to the destruction of their eggs ".

Bill for the Protection of Rare Birds. — *Nature*, Vol. 84, p. 81. London, July 21, 1910.

In the House of Commons a bill " to prohibit the sale or exchange of the plumage and skins of certain wild birds " was brought in and read for the first time. This bill aims at preventing the absolute extinction of a few rare birds. The bill that passed the House of Lords in 1905 prohibited the importation of the plumage of almost all birds. Mr. Alden includes in the present bill only a few birds that are on the point of extinction.

A. E. Shypley. **The Parasites of Grouse.** — (Cambridge, 1908, p. 12). *E S. R.*, XXI, Aug., 1909.

Among the ectoparasites of the grouse here recorded are 2 species of bird lice (*Goniodes tetraonis* and *Nirmus cameratus*), the louse fly (*Ornithomyia lagopodis*), 2 species of flea (*Ceratophyllus gallinulæ* and *C. garei*), the European castor-bean tick (*Ixodes ricinus*), and the mite (*Aleurobius farinæ*). It is stated that *I. ricinus* has only been found on grouse in the nymphal and larval stages.

The endoparasites reported include 3 specie of cestodes (*Davainea urogalli*, *D. cesticillus*, and *Hymenolepis microps*), 5 species of nematodes, and 2 species of protozoa. *D. urogalli* is the commonest and by far the largest tapeworm found by the author in grouse. *Trichostrongylus pergracilis*, the species of roundworm most commonly met with in grouse, lives in the paired ceca, and is the cause of serious lesions. The fly *Scatophaga stercoraria*, while not a parasite of the grouse, lays its eggs in grouse droppings and its maggots live on and in these dejecta.

The Introduction of the American Robin into England. — *Nature.*, 81, 2078. Aug. 26. 1909, 264. London.

An attempt is being made near Guildford, Surrey, to acclimatize the American robin (*Merula migratoria*). Seventeen birds (nine cocks and eight hens) were imported last spring, and after being kept for a short time in a large open-air aviary, all, with the exception of two or three pairs, were liberated about the middle of June. They mated immediately, and began nest-building almost at once. The nests—coarse bulky constructions — were placed in trees, with little attempt to concealment, and clutches of from four to five blue eggs, about the size of those of the thrush, were laid. Old and young, the birds now number between forty and fifty. Fears are entertained that at the approach of winter these robins, impelled by their strong migratory instinct, will leave England and become dispersed; but those who know the nature of birds are confident that by feeding them abundantly as cold weather draws on they can be induced to remain as permanent residents.

George Malcom & Aymer Maxwell. **Grouse and Grouse Moors.** *Illustrated by Charles Whymper.* Pp. VIII 286 London; A. & C. Black, 1910.

Protected Area for Birds in Sussex. Abs. *Nature* N° 2134. September 21, 1910, p. 371.

In the September number of the Selborne Magazine Mr. E. G. Woodd states that an additional protected area for birds has reeently been established by the County Council in east Sussex. The area extends from Eastbourne to Hastings and inland so far as Lewes, and within these limits such birds and their eggs as specially need protection have been scheduled.

XXXIX.

Useful insects and their products. Beekeeping.—Silk-production. Honey. Wax. Silk. Trade in these products. Other useful insect products.

THOS. MC ROW, **Beekeeping at the Gloucester Show, 1909.**— *Jour. of the R. Agr. Soc. of England.* London, 1909, p. 191.

At the Gloucester Show 1909, in the department: Hives, honey, etc., a splendid show of appliances was made, and bee-keepers desiring to be up to date had the opportunity of seeing the best that most of the leading manufacturers could stage.

Only a very few new-season novelties were shown.

The first prize went to a very promising invention, capable perhaps of improvements in some details, while the « Simplex » honey-jar was well worth trial.

In the Extractor Class the « Cowan » and « Rapid » again deservedly came out first.

H. GEARY. **Bees for Profit and Pleasure.** — Edited by T. W. Sanders, F. L. S. London, W. H. & L. Collingridge. *The Gardeners' Chronicle*, N. 3619, p. 292. London, May 7, 1910.

A valuable handbook on bee-keeping, giving useful hints on such subjects as choice of locality, manipulation of bees and the general management of the apiary.

JAS. HENRY. **Beekeeping in Scotland and Honey Importations.** — *Trans. of the Higl. and Agric. Soc. of Scotland*, vol. XXI. Edinburgh, 1909, pp. 101-106.

Although beekeeping has not hitherto been carried on to a great extent in Scotland it has been pursued by a number of enthusiasts in certain districts, whose efforts have proved that, if undertaken intelligently, beekeeping is at once fascinating and profitable, and deserving of every encouragement that can be given to it.

The climate of Scotland is on the whole favourable to the production of excellent honey.

The author in support of his opinion mentions among others the following beekeepers:

Mr. D. M. Macdonald who for years made no profit, but as his knowledge of bees increased, his management of them improved to such an extent that now his profits range from £10 to £20 yearly, according to the season.

Another Banffshire bee-keeper increases his income annually by £10 or £50 according to the season, with a general average for more than 20 years of over £25 per annum.

One who started quite recently increased his hives from four to eight, and moreover secured a surplus of 430 lb. of honey, which he sold at such a price that he made £12 to the good.

In many parts of Scotland it is almost a proverb that several stocks of bees are more profitable than a cow and her followers.

The following figures give the imports of honey from 1901 to 1907.

1901	£ 42 837
1902	„ 27 126
1903	„ 30 349
1904	„ 29 127
1905	„ 34 763
1906	„ 33 897
1907	„ 31 929

F. W. L. Sladen. — **Queen-Rearing in England,** published at the office of the *British Bee Journal*, 23 Bedford St. Strand, London, W. C.

Reviewed in *Nature*, vol. 83, p. 496-7, London, June 23, 1910.

Contains a study of a membrane of the working honey-bee, situated between the 5th and 6th dorsal segment of the insect. This membrane secretes a substance giving a strong pungent odor which attracts other bees.

W. Herrod. **Bees and the Fertilisation of Flowers.** — Lecture at the Farmers' Club, London, Feb. 28, 1910. *Nature*, vol. 83, April 14, 1910, p. 199.

Most plants depend on insects for fertilisation, although in some it is done by the wind. Amongst insects, the whole family of bees are of the greatest use; next come butterflies and moths, while flies even do their share of the work, but it is more especially the hive-bee that is the blossoms' partner by carrying the pollen from one flower to another.

That bees are useful to the farmer even with ordinary farm crops, and that some farmers realise this, is proved by the fact that hives of bees are carried into bean fields just after horse-hoeing, when the plants are about to bloom, that the bees may be close to the crop to carry out the work of fertilisation.

XL.

Fresh-water Fsih-Culture in its Relations to Agriculture.

P. D. Malloch, **Life-history and Habits of the Salmon, Sea-trout, Trout, and other Fresh-water Fish.** — London, Adam and Charles Black, 1910. Reviewed in *Nature*, August 11, 1910, vol. 84.

This book is almost entirely devoted to the salmon of the Tay, sea-trout, and brown trout.

« The other fresh-water fish » are but slighly dealt with and the chapters allocated to them call for no particular notice.

XLI.

Industries connected with agriculture. Fermentation industries. Technical mycology and bacteriology connected with these industries. — Wine and wine products. Wine diseases. — Beerwort and Beer. Cider and other fruit-wines. — Spirit industry and special alcoholic beverages. — Frauds in the sale of wine and other alcoholic beverages.—Legislation to prevent fraud in name and in substance.

British drink-bill.—*A large Decline in Expenditure. Monthly Consular and Trade Reports.* June, 1909, Washington.

" The *London Times* has just published Dr. Dawson Burn's annual statement of the British nation's drink bill, which U. S. Consul Church Howe of Manchester, states shows an actual decrease last year of nearly $29 000 000 (150 220 000 frs.) or allowing for increase of population, a decrease in expenditure equal to $36 644 321, (189 817 582 frs.). The following are the items:

	1908	Decrease from 1907
	$	$
Spirits	245 890 521	12 273 381
Beer	480 899 821	12 365 806
Wine	49 710 743	4 344 315
Other liquors	7 299 750	—
Total	783 800 835	28 983 502

The totals are equivalent to 4060 millions of francs in 1908, with a decrease of 150 millions of francs from 1907.

The sums spent per head of population in the three divisions of the United Kingdom were:

	England	Scotland	Ireland
	$	$	$
Spirits	4.90	9.63	5.99
Beer	12.08	3.59	8.33
Wine	1.18	1.03	0.57
Other liquors	0.18	0.04	0.06
Total	18.34	14.29	14.95

In francs the sums spent per head of population are the following:

	England	Scotland	Ireland
	francs	francs	francs
Spirits	25.38	49.88	31.03
Beer	62.57	18.60	43.15
Wine	6.11	5.34	2.95
Other liquors	0.93	0.21	0.31
Total	95.00	74.03	77.44

The alcohol consumed per head, is as follows for the three parts of the United Kingdom:

	Gallons	Litres
England	1.9	8.62
Scotland	1.3	5.90
Ireland	1.5	6.81

A. R. Ling, **Malting Barleys of 1909.** (J. Inst. Brewing, 1910, 16, 16-21). Abs. *Journal of the Society of Chemical Industry.* Vol. XXIX, 643-44, Lond, May, 31, 1910.

On the whole, the quality of the 1909 barleys must be regarded as unsatisfactory though the author considers that with rational malting, it should be possible to produce good brewing material from the majority of the barleys. From his experience of the 1909 barleys, he considers that their main characteristics may be summed up as follows; Maturation, indifferent: colour, bad; odour, bad; moisture, high; nitrogen normal or low; mellowness, satisfactory; size of corns uneven; diastatic activity, high. The author recommends sweating the barley; omission of this has been found to lead to uneven germination and under-modification of the malt. Aëration of the steep should be especially useful this season; if this is not practicable, the grain should be left exposed to the air between each change of water. Whenever possible, the temperature of the steep-water should be raised to 55° F. With regard to the use of lime-water in the steep, the first change of water should be so prepared that it contains about 19 grains of calcium hydroxide per gallon; the remaining change should be plain water. Different waters require different amounts of lime-water to bring them up to the strength above mentioned, but even the most highly calcareous waters, which precipitate the lime as carbonate, would not probably need more than an equal volume of lime-water. It is undesirable to add lime itself to the cistern. It has been suggested in Germany that preliminary steeping in warm water is advantageous; in the author's opinion this departure requires thorough investigation before it can be recommended. The 1909 barleys appear to work very freely on the floors, and the author considers that in practice, the malts will turn out much better than might be anticipated from the appearance of the barleys. In the discussion on the paper, it was remarked that the 1909 barleys appeared to require a longer storage after sweating than usual; it was also suggested that with this year's barleys (1909), especial care should be taken to get a good strong rootlet, or that what rootlet did grow was not allowed to get "wind withered".

HORACE T. BROWN. **Nitrogen in the Brewery.** — *Monit. Scient.* Paris, Janvier 1910, No. 817, pp. 5-12; Fevrier 1910, pp. 88-103; Avril 1910, pp. 217-234 à suivre.

This work, published by the Author in the *Journal of the Institute of Brewing*, Vol. XIII, p. 394, contains the following: general considerations, a study on the nitrogenous constituents of malt which are constantly soluble in cold water and on the assimilation of the nitrogenous constituents of the extracts of malt and of worts, by yeasts.

The Author contributes original observations on the "assimilable nitrogen" of worts and of beers, and on the conditions which regulate the quantities of this nitrogen in such liquids. This second part of Mr. Brown's work which begins in the April number will continue. The Author investigates the relation between the initial amount of nitrogen existing in the barley and the quantity of assimilable nitrogen found in the wort; the variations caused by the different treatment of the grain during the process of malting; the production of soluble nitrogen in English malts compared with that of foreign malts; the effects of temperature, of the duration of the process of brewing and of watering.

THOS MC ROW. **Cider and Perry at the Gloucester Show 1909.** — *Journal of the R. Agric. Soc. of England,* Vol. 70, 1909, pp. 163-192.

The judges in presenting their report, state that the exhibits as a whole showed a vast improvement in quality and get-up, and that there was a general advancement as regards purity. There were, however, still too many exceptions. Saccharine had been used to sweeten some exhibits and in others analysis showed the presence of preservatives. Some were either too sweet or too acid and a few not sufficiently fermented. A great number of the exhibits were very fine and some decidedly superb.

The following are the results of the chemical analyses of the samples gaining first prizes:

	Specific gravity	Alcohol	Total solids	Acidity
		per cent	per cent	per cent
Cask of dry Cider, made in 1908.	1,0181	4,70	6,07	0,495
Cask of sweet Cider » »	1,0327	3,50	9,28	0,284
Cask of Cider, made previous to 1908	1,0117	7,05	5,36	0,489
Bottled dry Cider, made in 1908.	1,0234	4 —	7,46	0,318
» sweet Cider » »	1,0336	2,96	9,59	0,395
Bottled Cider made previous to 1908	1,0364	2,90	10,34	0,380
Bottled dry Perry	1,0234	4,20	7,60	0,529
» sweet Perry	1,0396	2,30	10,77	0,639

Researches on the Storage of Apples and on Cider. Report on the National Fruit and Cider Institute, Long Ashton, Near Bristol. — Acting in connection with the counties of: Devon, Gloucester, Hereford, Monmouth, Somerset and Worcester, and the Bath and West and Southern Counties Society. Annual Report on the Distribution of Grants for Agricultural Education and Research in the year 1907-1908. London, 1909, (Cd. 4802) p. 67.

Experiment on the storage of fruit has engaged attention during the past two seasons. It has been a subject which has been much neglected in the past. Those who sell fruit to cider-makers frequently send it in a bruised and bad or rotten condition, and no care in the after management of the juice can remedy the initial defects caused by a practice such as this. On the other hand, cider-makers who grow their own fruit generally allow it to fall from the trees as it ripens, and then gather it into heaps on the grass of the orchard until it is convenient to press it. Others store the fruit under cover, and others again store it in the open on hurdles which may or may not be covered to keep off the wet. Continental authorities appear to favour the storage of fruit under cover. At the Institute the plan adopted was to divide a quantity of fruit into five lots of half a ton each.

Amongst many other most interesting experiments may be mentioned one having as its object the improvement of low class ciders of which, from various reasons, there must always be some in a season.

After the pomace from freshly milled fruit had been twice pressed, and would then, in the ordinary course of events, have been discarded, it was broken up and inferior cider poured over it. It was allowed to stand and soak for about 18 hours, and was then again placed under the press, when the resulting juice was found to be profoundly modified in flavour and character and was eventually made into quite passable cider. Moreover, it was found that the amount of cider thus obtained was invariably greater than that which had been added to the pomace, There was thus a gain in quantity as well as quality, which more than paid for the extra trouble and expense involved in the operation.

A department of economic biology has now been established at University College, Bristol, and will be of material assistance to the Institute. Courses are being arranged to last throughout the year, and will be held partly at the College, in botany, bacteriology, chemistry, entomology, etc., and partly at the Institute in cider-making and fruit-growing.

Research is also being conducted at the College in conjunction with the Institute. This should prove of very great value, as under present conditions at the Institute it is impossible alone there to cope with more than a portion of that which urgently demands attention.

The investigations at present being jointly undertaken deal with organisms in cider, and fungoid diseases of fruit trees, and also, partly from the geological, physical and chemical, and partly from the practical cider-making point of view, with the soils of certain typical orchards in that part of the country.

Finances of the National Fruit and Cider Institute. — The expenditure during the year amounted to £1 058. Grants from the contribuing counties amounted to £550, and from the Bath and West Society to £100, while £76 was received in fees from members and from affiliated societies; sales amounted to £169 and miscellaneous receipts to £44. The Board made a grant of £300.

B. T. P. BARKER (National Fruit and Cider Istitute). **The Rate of Fermentation of Ciders and Perries.** *The Journal of Agricultural Science,* Vol. III, Part. I. December 1908.

Variations in the rate of fermentation of ciders and perries led to investigations of the various factors acting in this process

Chemical composition of the juice with special regard to "sours" "sweets" and "bittersweets" juices and the quantity of malic acid and tannin present in relation with the state of ripeness of the fruit at the time of making were studied; also the organisms taking part in fermentation, the temperature at which the fermentation was conducted, and the aeration of the cider.

The addition of assimilable nitrogen causes an increase in the rate of fermentation and the effect is so pronounced that the factor of the quantity of such substances naturally present in the juice is quite sufficient in itself to account fully for the differences in the rate of fermentation of any ciders made and fermented under similar conditions. The addition of ammonium tartrate to juices from ripe fruit causes a decided increase in the rate of fermentation, thus showing that the comparatively slow rate is due very considerably at least to a deficiency of assimilable nitrogenous material. Mucilaginous substances frequently lead to the separation in insoluble form of various pectinous compounds. The variety of yeast used, plays at the most but a secondary part in determining the rate of fermentation and from the results obtained in experiments made with yeasts of limited fermentative power, it seems probable that normally the rate is not far short of the maximum, which the composition of the juice as regards assimilable nitrogenous matter allows.

The more rapid fermentation of the "keeved" juice is due to the greater exposure to air, the aeration of the juice having a marked effect upon the rate of fermentation. The temperature at which the fermentations are conducted affects the rate in the customary manner.

E. B. Pearce and B. T. P. Barker. **The Yeast Flora of Bottled Ciders.** — *Journ. of Agricultural Science*, Vol. III, Part I. December 1908.

The work described in this paper deals exclusively with the yeast flora of certain hottled ciders. It was undertaken as a section of an extensive scheme of investigation of the organisms which are concerned in the fermentation of English-made ciders. Apart from the more purely biological side of the question the main objects of the whole scheme are to determine how far the customary method of conducting the fermentation of cider in this country is satisfactory, and whether it could be improved from a practical point of view, by certain modifications or by the substitution of other processes, such, for example, as the use of selected yeasts. Fermentation with pure cultures of special yeasts has been adopted with great success in the brewing industry; it has also been applied with some success to the preparation of wines, while its use in connexion with cider has not been so exhaustively tested. The method used to isolate in the pure state the different varieties of yeasts present in the ciders under investigation was that of fractional plate cultures on 10 % beer-wort gelatine. The results obtained in the culture of the yeasts upon different media were used both from the point of view of ascertaining the specific characters of each form, and also of distinguishing the varieties from one another.

Detailed description is given of the species isolated. The five samples examined had a flora so diverse, that it is clear that the fermentation of cider in the ordinary manner is most uncertain in character. Uniformity in the character of the products cannot be looked for under the old system, and at times the quality is certain to fall short of that which might have been obtained if a selected yeast had been used to dominate the fermentation.

Cider-making Experiments. — (*The Journal of the Board of Agriculture*). London, February 1910, vol. XVI, n. 11, p. 938). *National Fruit and Cider Institute, Report, 1908*,

In the cider-making season of 1907-908 the experimental work in the cider-house consisted mainly in the examination of a number of varieties of apples from the vintage point of view, single-variety ciders being made from each kind as in previous years. Details of the characters and qualities of the individual ciders are given in the report. Probably the most noteworthy result which this work on single-variety ciders has established is that the quality of cider depends primarily upon the kind of apples from which it is made, and that other factors, such as the ferments present, the methods of manufacture, and general management, although important and capable of exercising an appreciable influence upon the nature of the product, nevertheless take a secondary place, and cannot be compared with the fruit factor in their power of determining the quality of the beverage. Unfortunately for the cider-maker, many of the varieties most desirable from a vintage point of view, make comparatively poor trees and yield badly in most situations, while on the other hand some quickgrowing, vigorous, and heavily cropping trees, yield fruit of inferior vintage quality.

Y. Hereford. **Final Report of the Royal Commission on Whisky and other Potable Spirits.** Pp. III + 147. London, 1909.

In this report the Commission give the conclusions which were reached regarding whisky and other potable spirits and the evidence upon which the report was based.

The main conclusion is that 'whisky' is a spirit obtained by distillation from a mash of cereal grains saccharified by the diastase of malt; that 'Scotch whisky' is whisky, as above defined, distilled in Scotland; and that 'Irish whisky' is whisky, as above defined, distilled in Ireland.

With reference to brandy, the conclusions of the Commission are that the term 'brandy' is applicable to a potable spirit manufactured from fermented grape juice and from no other materials, but that the compounded spirit long recognized by the name of British brandy is entitled still to be so named and sold as 'British brandy,' and that the determination, however, of the application of the term 'brandy' in Great Britain can not be controlled by the nature of the apparatus or process used in the distillation of the sptrit.

The definition of rum as a spirit distilled direct from sugar cane products in sugar cane growing countries, is considered fairly representing the nature of the spirit which a purchaser would expect to obtain when he asks for 'rum.' The Customs already recognize the distinction between 'rum,' 'rum from Jamaica,' and 'imitation rum,' which should be continued.

Geneva, gin, liqueurs, and other spirits were also taken into account by the Commission. In the absence of information as to the nature of the materials employed, it expressed no opinion on the wholesomeness or otherwise of particular compounds; stating, however, that no evidence was received about any spirits of this nature (with the exception of absinthe) having a specially toxic action.

Bonding, labelling in bond, and questions concerned with trade in potable spirits under the British Food and Drugs Acts are also considered.

XLII.

Cane sugar and Beet sugar industries. — Other sugar industries. — Industries of starch and glucose.

British School of Sugar Refinery. — *La Sucrerie indigène et coloniale.* No. 23, June 7th, 1910. p. 541).

A circular issued by the West Indian Commission announces the foundation of a Sugar Refinery School in Glasgow, as an annex to the Technical College, for the training of chemists and engineers for cane sugar refineries.

G. Martineau. **A Beet Sugar Industry in England.** *The International Sugar Journal*, Vol. 12, No. 137, 218-221. Altrincham. Manchester, July 1910. Home Grown Sugar. *Idem*, 222-225.

From the numerous letters sent to the press of late it may be gleaned that the great mass of opinion has been strongly in favour of starting a beet sugar industry in England. The opinion is quoted of a prominent East Prussian agriculturist, who stated that the soil of England is for the most part more fertile than that of Germany; on similar land the German farmer grows sugar beet with success, and pays double the rent the English farmer pays; there seems to be no reason why cultivation of sugar beet, which is possible in Germany, should not successfully be carried out in England.

Mr. A. Balfour does not doubt the value of this form of industry to English rural population, as it gives employment at the very time of the year when work is least in demand for other operations connected with agriculture.

Mr. Martineau sums up the position stating, that if it turns out— as it possibly may—that in England they can get a better weight of roots off the best English soils than the average weight for the whole of Germany—11 568 kg.—nearly 12 tons per acre; and if they can also get—as seems certain—an average yield of sugar of 14 per cent, then the English beet grower can beat the foreigner, and with an unlimited market at his doors.

Thorne and Jeffens, **The Details of a modified Method for the Hydrochloric acid Extraction Process in the Polarimetric Determination of Starch. —** (Abs. in *Chem. Ztg.*, 33 (1909), No. 69, p. 624) *E. S. R.* XXI, Dec. 1909.

A modification of the Effront-Ost-Lintner method is suggested. In this method 5 gm. of the material, ground as fine as possible, are rubbed up in a mortar with water until the mass ceases to cling to the side of the vessel, 20 cc. of water being generally required. About 40 cc. of hydrochloric acid of specific gravity 1.15 is added, amid constant stirring, until the mass swells and forms a viscous fluid. The mixture is allowed to stand for 10 minutes and then transferred to a 200 cc. flask, containing 10 cc. of a 4 per cent phosphotungstic acid and 20 cc. of hydrochloric acid. The mortar is washed out with dilute hydrochloric acid and the flask filled therewith to the 200 cc. mark. The flask is then shaken, the contents transferred to a wide-mouthed bottle, and the whole well shaken until a definite flocculent precipitate is obtained and the supernatant fluid is practically clear. The solution after filtration is ready for polarization. If the 200 mm. tube of the Schmidt-Haensch scale is employed with white light the percentage of starch is calculated by the formula $P = \frac{RX\,40}{11.6}$, The concentration of starch in this method never runs over specific gravity 1.1.

XLIII.

Milling industry. Flour. Bread. Bye-products. — Other industries for the preparation of grain-foods. Preservation of grain-foods. Seed and olive oils and other vegetable oils. — Legislation regarding fraud in the oil-trade. — Secondary products of the oil-industry.

A. E. HUMPHRIES. **Quality in wheaten flour.**—(*Miller's Gaz.*, 33, 1909, n. 29, pp. 352-354). *E. S. R.*, Febr. 1910, Washington.

In this summary of a paper presented at the meeting of the British Association at Winnipeg, 1909, the author considers flavor, color, strength, size and shape of loaf, stability of doughs, and yield of bread per sack of flour.

W. D. HALLIBURTON. **The bleaching of flour.**—(*J. Hyg.* Cambridge, 9, 1909, No. 2, pp. 170-180). *E. S. R.*, XXII, Jan. 1910.

Investigations are reported in connection with a general discussion of flour bleaching.

According to the author's results with samples of starch and protein (fibrin) to which small quantities of sodium nitrite were added, the nitrite hindered and lessened the action of amylolytic and proteolytic enzymes, the retarding action being very great in the presence of quite minute amounts of nitrites.

" Seeing that nitrous acid and its salts produce no known chemical action on starch, their inhibiting action on its digestion by amylolytic enzymes can only at present be explained by their action on the enzyme.

" But in the case of protein there are two possibilities, action on the enzyme and action on the substrate (protein)."

From further studies of this question the author concludes that " the presence of nitrous acid (even in the comparatively innocuous form of a salt) hinders enzyme action.

" Previous treatment with nitrous acid alters a protein in such a way as to render it less readily susceptible to the solvent action of digestive juices."

Similar results to those with starch were obtained in salivary digestion of samples of bleached flour.

In studies with separated gluten the comparative indigestibility of that from bleached specimens of flour was marked. The decrease in digestibility was not proportional to the amount of nitrite-reacting material present in the flour. " From this one would judge that the main deleterious action is exerted by the nitrous fumes while in contact with the flour, and the diminution of digestibility does not depend on the more or less accidental quantity left behind...

" The results obtained by those who have had the opportunity of examining the breads show that the lessening of digestibility of the bread is less marked than it is in the flour. This appears to be partly due to the reduction of the amount of nitrite-reacting material which occurs during baking, and in reference to the protein (gluten) one can only suggest that the process of baking increases the difficulty of digestion of that substance even in unbleached specimens, so that any difference in digestibility between a loaf made from it and one made from bleached flour would not be so noticeable. It can hardly be doubted that this, which after all is the most important question from the standpoint of the consumer, has had considerable influence with judges in deciding as they have that the objection to artificial bleaching is more or less theoretical. But knowing as we do the possible practical dangers which might ensue were millers allowed a free hand in the use of the very strong reagent they employ, it is necessary that a strict watch should be exercised to keep its use within the limits of safety."

F. I. Bright. **New English Method of Bread Making.**—*Daily Cons. and Trade Rpts.* (*U. S.*), 1909, No. 363, p. 11. — *E. S. R.*, Vol XXII, No. 4, March 1910. Washington.

A brief note on a method of making bread which it is said includes pepsin in small quantities. It is claimed that this makes the loaf more digestible and does away with all risk of the bread becoming sour.

The Nutritive Value of Black Bread.—*Nature*, Vol. 83. May 5, 1910, pp. 282-283.

So called Black Bread is made from rye, and has the property of keeping moist for a longer time than wheaten bread.

From the various analyses which have been published, the amount of nitrogenous material contained in the different cereals does not differ greatly nor constantly; but wheat has its nitrogenous matter in the form of gluten, and there is no reason to suppose that this body is more nutritious than the other nitrogenous bodies.

It is not generally known that the comparatively dark colour of whole-meal bread is not due to the particles of bran which it contains, but to the fermentative changes having gone further. This is due to the husk containing another nitrogenous body which also acts as an active ferment. In fact in white bread a large proportion of the starch remains unchanged instead of breaking up into dextrin and glucose.

Whole-meal bread is well known to have a higher nutritive value than white bread, probably partly on account of this conversion of the starch; and it is richer in inorganic salts by the retention of the husk.

Rye bread is not of necessity black, as a light coloured bread can be made from rye flour, the depth of colour depending upon the treatment.

There is no reason to suppose that black bread is inferior as a nutritive food to white bread, but rather the contrary. Rye contains as much starch and fatty matter as wheat.

It contains more lime, about the same amount of magnesia, a good deal more silica and slightly less phosphoric acid.

As for phosphates of lime and magnesia, whole-meal wheaten bread and rye bread are about the same, and both are superior to white bread.

In conclusion, the chemistry of the different breads gives no support to the idea that black bread is an inferior article of diet.

M. Young. **Dirty Bread.** — (*Ann. Rpt. Med. Off. Health Marylebone*, 1908, rev. in *Pub. Health*, 23, No. 2, p. 60, London, 1909); *E. S. R.*, March 1910. Washington.

Attention is called to the probable contamination of bread when it is carried through the streets for delivery without special protection, and some information is given regarding the cost of wrapping bread so as to insure protection. In the experience of a London baker the cost of paper and string for this purpose was about 8 cts. (0 fr. 40 c.) per 100 2 lb. loaves.

Alfred Smetham. **Soya Beans or China Oil Beans.: Soya oil and Soya-bean cakes.** — Some New Feeding Stuffs and their Relative Value as Cattle Foods. Liverpool, 1909, p. 4.

" Most notable, perhaps, of the new foods is the Soya Bean, which has come meteor-like into England in large quantities during the last year or so."

Mr. Smetham proceeds with the following remarks:

" What circumstances or combination of events have made it possible at this particular period for merchants to ship the vast quantitaties of the Beans which have recently reached England I have not been able to discover, but it seems to me that the chief factor is to be found in the development of Manchuria by the Japanese as the result of the Russo-Japanese war. It is said that during the campaign Soya Beans entered largely into the dietary of the Japanese army, and, doubtless, during the progress of the war the Japanese became familiarised with the Bean-producing districts, and the exportation of the surplus supplies is the result. Be that as it may, the fact remains that up to the end of next August, so I am informed on very good authority, the estimated sales in the United Kingdom of the Soya Oil Beans may be roughly estimated at 250 000 tons. What the future is likely to be is uncertain, but from conversations I have had with those who have studied the subject, the general impression seems to be that they " have come to stay ", and that in the near future at all events the Beans, either whole or crushed into cake, will have to be reckoned with as a serious competitor of the better known and more generally used feeding stuffs."

. . . .

"Having regard to the relatively high price of Soya Bean Oil (£21 15s. to £22 Naked London) compared with the Soya Oil Beans (£5 18s. 9d. to £6 1s. 3d.), it seems probable in the light of our present knowledge of the use of an excessive quantity of oil in a ration, that a large proportion of the imported beans will find its way into the hands of Cattle Food Manufacturers, who, either by hydraulic pressure or by solvents, will extract a portion of the oil and sell the residue in the form of Cake or Meal, in which condition it is better suited to general feeding purposes. In general, it may be said that the resultant Cake or Meal will have a feeding value about equal to good Decorticated Cotton Seed Cake or Meal, and I anticipate that when used in place of the latter and in similar proportions the Soya Cake or Meal will prove as effective as the Cotton Cake or Meal. As I write, Soya Cake is quoted in London at £6, 5s. to over £7., as compared with Decorticated Cotton Cake in the same market at £7, 5s. to £7, 7s. 6d. per ton. Those farmers who have the courage of their convictions, and who experiment with Soya Bean Cake immediately will, I believe, be amply recompensed."

. . . .

"The following analyses may be taken as fairly representative of the Soya Bean Cake recently put upon the market:

Composition of Soya Bean Cake and Meal.

	Water	Oil	Albuminoids.	Carbohydrates	Woody Fibre	Ash.	Sand.	"Food Units"
China Bean Cake (Imported) . .	17.50	9.00	40.50	23.78	4.47	5.25	.40	147
do. do. do.	17.75	5.00	47.50	18.46	5.49	5.80	.35	150
Soya Bean Meal	3 85	11.33	43.25	30.77	5.45	5.35	.25	167
Soya Bean Cake	12.70	11.07	38.82	26.51	5.85	5.05	.35	151
Chinese Bean Cake (Rolled). . .	8.65	17.60	39.00	25.48	4.42	4.85	.15	167
Chinese Bean Cake (Crushed) . .	9.10	10.23	42.75	17.82	4.90	5.20	.20	160
China Bean Cake (from Southern Ports)	11.65	5.60	46.12	25.46	4.47	6.70	1.20	155
Manchurian Bean Cake	15.60	8.60	41.37	24.81	4.37	5.25	.20	150

J. H. Holland. **The Soy Bean and the Extraction of Soy-oil.** — *The Gardeners' Chronicle*, n. 3615, p. 238. London, April 9, 1910.

Speaking before the Linnean Society, Mr. J. H. Holland stated that the seeds of the Soy Bean may be black, brown, green or greenish yellow, yellow, or mottled. The plant is variously known as the Soy, Soja, Soya, White Gram, American Coffee-berry, and China bean. In China and Japan, where the plant has been cultivated for many years, the beans are an important food, and they are also said to be used as a substitute for coffee. Bean cake, and the sauce commercially known as Soy is also made from them. Their cultivation has been extended to India, Africa and other warm countries, and in America the plant has been grown for a number of years as a forage crop, and has special value as green manure.

The principal use of the Beans in England is for the extraction of the oil of which they contain about 18 °/₀, which is used as a substitute for cotton-seed oil. The residue after the extraction of the oil is suitable for feeding cattle, and is likely to compete seriously with sunflower-seed and cotton-seed cakes. The Beans can be bought in London at about £5 to 6 per ton; the oil realizes from £21 to 22 per ton, and the cake about £6 to 7 per ton.

Beans and bean cake exported from China have gone chiefly to Japan and Asia, but since 1908 an important trade has grown up in the beans between Manchuria and Europe. The cause of this is the increase in the cultivation which took place at the time of the Russo-Japanese war to meet demands for food for the Russian army. When the army was withdrawn, the production being found profitable and the home demand reduced, other markets were sought, and from Japan the trade extended to Europe. 180 000 tons of the 1908 crop were exported to Europe, the greater part destined for the English market. It is estimated that at present prices Europe may eventually take at leat 1 000 000 tons annually.

The Consumption of Olive-Oil in England.—*Il Sole*, Milan, Italy, July 15, 1910.

England imports 5000 tons of olive-oil per annum, of which 2000 come from France, 1500 from Italy, 1000 from Turkey, and the remainder from Spain and other countries. Italian oils command the highest prices, being paid 1325 francs per ton. The favourite qualities are those of Lucca and Provence. The demand amongst

English people is trifling, and the oil is chiefly consumed by foreigners residing in Great Britain. The regulations against adulteration are very strict. The trade is entirely in the hands of a few firms.

XLIV.

Foods. Dietaries of rural population. Legislation regarding the purity of food.

W. G. Savage. **Administrative measures for the protection of the food supply.** *(Jour. Roy. Inst. Pub. Health,* 17, (1909), no. 11, pp. 677, 683). — *E. S. R.* March, 1910, Washington.

A summary of data and discussion of conditions in Great Britain.

Alexander and Meredith Wynter Blyth. **Foods: Their Composition and Analysis, with an introductory Essay on the History of Adulteration.** London, Ch. Griffin & Co. Ltd. 1909. Pp. xxv + 619 with fgs. 80.

In this sixth edition, thoroughly revised, enlarged and re-written, of Messrs. Wynter Blyth's standard work, much new matter has either been added to or substituted for the older text.

The newer types of instruments for spectroscopy, the identification of alcohols, the detection of cocoanut oil in butter, and the bacteriological and chemical examination of water, have in particular received special attention. For those interested in pure food work may be pointed out the App. II, with "The Sale of Food and Drugs Act, 1875" the "Margarine Act, 1887" the "Sale of Food and Drugs Act, 1899" the "Butter and Margarine Act, 1907" which are connected to the important introductory essay on the history of adulteration.

XLV.

Tannin industry. Hides. Leather. Trade in these products. Other animal industries.

GORDON PARKER. **The principles of tanning.**—*Journal of the Society of Chemical Industry*, No. 15, August 15, 1910, p. 912-916. London.

Innumerable new methods have been proposed and patents have been taken out during the last century for the acceleration and improvement in tanning leather, mostly by those but remotely connected with the trade. In spite of this the general outline in process of tanning sole leather is much the same today as carried out a thousand years ago. In short, the changes which have taken place between the tanning sole leather even 1000 years ago and to-day consist not so much in principle as in a more intelligent method of carrying out the process.

The raw material for the British tanner is the hide of oxen and cows, and is drawn from practically all parts of the globe. From the Argentine, Uruguay, China, and Africa, come hides which have been dried in the sun; from America, from all parts of Europe and the Colonies, come hides in what is known as the salted condition: the hides are piled, a sprinkling of salt between each, and gradually the salt draws out the water, becomes dissolved, and diffuses in to the interior. After lying in pile for some time, the excess water is thrown off, and the hides are resalted; in this condition they frequently contain as much aa 30 per cent. of salt ou the original weight of the hide. From the home market the hides are usually obtained "green" or "fresh." The first process, therefore, is the soaking and cleansing to soften the fibres, remove extraneous matters, salt, blood, dirt, etc., and to bring the hide back to its natural state. In bygone days this was done by suspending the hides in a running stream by the tanyard, but now the common custom is to soak the hides in pits containing water. The hides are usually given a change of one or two waters; salted hides receive a longer treatment and several changes of water until moderately free from salt; dried hides are, after a preliminary soaking, sometimes "stocked" or "milled," in a large machine which pummels the hide and gradually breaks up the fibres, after which the hides are returned to the water. Revolving drums and other similar appliances are also used. The softening of flint dried hides is by no means an easy operation and considerable care must be exercised in bringing the hide back to its natural conditions without loss of pelt substance through putrefaction, the germs of which are present in the hide. With some hides it is difficult to soften in less than 6 to 8 days, and to aid the softening process sulphide of sodium, or caustic soda is often added to the soak water. These materials have a swelling effect wich accelerates the penetration of water, and the subsequent softening of the fibres, but at the same time they slightly increase the solubility of the hide. It has been shewn that the higher the temperature at which hides are dried for preservation in foreign countries, the more difficult becomes the subsequent absorption of water, and consequent softening in the tan yard. It is very essential that hides should not only be thoroughly softened but they should be in a clean state before passing to the next process. The English tanner has a great fear of losing pelt substance by using too much water at this stage; but it is undoubtedly wrong to leave hides in a foul dirty water, and the more clean water they have the less is the loss of pelt substance. The Author was very much struck some three years ago when visiting the large tanneries in the United States, to note the efficient way in which their process of soaking was carried out, no hides being allowed to pass on to the next process without at least three changes of water, to which sometimes a half hour's running in a revolving drum was added. The pelt looked much healthier, there was no loss of pelt substance, and the hide gave a better leather, owing to the fibres being more open, and better prepared for the subsequent process.

The hides are placed in a saturated solution of lime containing lime in excess for the purpose of loosening the hair and swelling the hide. The scientific control of the liming process deserves far more attention than it has hitherto obtained, for in this process, to use an old tanner's expression "the leather is made or marred."

After the hides have been properly limed the hair is removed; either by hand or by machines. The most satisfactory machines consist of a revolving spiral roller which travels over the hides as they rest upon a rubber bed, which yields to the pressure as it is increased and thus avoids damages. The reserve side of the hide is then freed from the superflous flesh, consisting of a thin network of coarse fibres heavily loaded with fat. This is removed on a similar shaped beam, the knife in this case being kept sharp. This by-product together with the hide trimmings, including the nose, ears, shanks, tail. etc., form the raw material for the manufacture of glue and gelatine.

Formerly the hides for sole leather were tanned whole without rounding, and, after colouring from six to twelve weeks in weak sour liquors made from oak bark and water, were frequently handled and moved forward from time to time into liquors of gradually increasing strength. With the introduction of new materials and the gradual substitution of machinery for hand labour, the old process has been gradually altered.

Among the newer materials which have come into use during the past century, valonea, the acorn cup of the Turkish oak, must be the first mentioned. Although introduced into England at an earlier period, it is only in the early forties that it began to be used in other than experimental lots to blend with oak bark; its more extended use was chiefly due to the enterprise of some West of England tanners, who having allowed a shipper to store a large quantity of this material in their bark barns until it could be sold, had permission to use what they required in their process. Using a little at a time in more or less homeopathic doses they found that not only did its use do no harm to their leather, but it actually improved it and made it firmer and more solid. With further experience came more confidence so that a larger proportion of this material was blended with the oak bark, and still the leather appeared to improve, until the whole of the shipment of over 200 tons was used and they became regular buyers. Other tanners in the district followed suit, until in the seventies, Bristol or West of England leather, chiefly tanned with valonea, had achieved a reputation for solid hard wear, especially suitable for heavy walking boots and for repairs. It was not long before tanners all over England commenced to blend with this material.

Myrobalans (often miscalled myrabolams), the fruit of the *Terminalia Chebula* one of the Indian forest trees, which had been used by the native tanners of India for many years, soon found favour when introduced because of its power of rapid penetration, the light colour which it imparted to the leather, and its somewhat rapid souring properties.

"Terra Japonica" or gambier, was early used for the purpose of modifying the sharpness or astrigency of valonea, and in West of England tannage played an important role in the early tanning stages; its special characteristic was its swelling powers, thus keeping the texture of the hides open and nullifying the contracting action of the stronger tans.

Acacia bark (*Mimosa*) from Australia and South Africa, dividivi from India, algorabilla from South America, all of them containing over three times as much tannin as does oak bark, had a considerable influence upon the changes that have taken place.

Reference has been made above to the heavy layer of bark between each hide; this was afterwards burnt or thrown away half spent; but with stronger and better tanning materials in use, it became general to put this dusting material into large pits, called leaches, lecks and spenders, in which the tannin of the bark was extracted by means of water. These leaching pits were arranged in series and the liquor pumped from one pit to the other, until by passing through successive pits of partly spent material it gained sufficient strength for use in saturating the bark between the hides, producing liquors of much greater tanning strength.

The introduction of Tanning Extract in the early seventies, however, had more effect on the method of tanning than anything else. It was first introduced from France made from chestnut wood and later from Hungary, produced from oak wood. In the manufacture of this material, the wood is reduced to fine shreds by powerful machinery and the rasped wood is afterwards extracted in large wooden vats by the aid of hot water. The resulting liquor is decolorised by means of blood which is added to the cooled liquor; the temperature is then raised and the coagulated albumen separating out carries with it the darker colouring matter of the bark together with some of the tan. The clarified liquor is then concentrated in large copper vacuum pans at a comparatively low temperature, and shipped to England in concentrated form in casks; the Extract contains upwards of 30 per cent. of soluble tannin ready for immediate use, for blending in with the tanner's leach liquors.

The effect of these stronger liquors was that of hide which had hitherto been tanned in one piece the thin part became too much tanned before the thinck part had had sufficient tan, with the result that "rounding" became more general. This brought about a great change; and square pits sunk in the ground became general.

Among the points that especially require attention and chemical control is the ratio of tan to non-tans in the early liquors, i. e., the ratio in which the tannic acid exists in proportion to the natural acids formed partly by hydrolysis of tannins and partly by fermentation of the glucoses ever present in all tanning materials.

The chemistry of the hide is not fully understood and the exact composition of many of the tannins is not yet established. Finally the newer science of colloidal chemistry urgently demands consideration and application.

XLVI.

Land Sanitation. Repression of Malaria. Inquiries on some diseases connected with agriculture. Measures for promoting the health and physical welfare of the rural population and favouring country-life.

Malaria Investigations.—(Report of the Advisory Committee for the Tropical Diseases Research Fund for 1909. Printed by H. M. Stationery Office, 1910. Cd. 4999. Pr. *2s.* 8*d.*). Reviewed in *Nature*, Vol. 83, April 21st, 1910, p. 226.

In it are to be found reports from all parts of the world in which results of scientific investigations are communicated by those engaged in studies bearing directly or indirectly upon tropical diseases of all kinds.

The first appendix contains reports on the measures taken for the prevention of malarial fever. A Circular letter is given in the appendix, despatched by the Colonial Secretary to the Colonial Governors.

Replies are printed from Ceylon, Mauritius, East Africa, Nyasaland, Somaliland, Uganda, Gambia, Gold Coast, Sierra Leone, Northern and Southern Nigeria, South Africa, Bahamas, British Guiana, British Honduras, Jamaica, Leeward Islands, Trinidad, Windward Islands, Australia and Cyprus.

In general the defence of dwellings and individuals against mosquitoes, the destruction, so far as possible, of the breeding-grounds of the mosquitoes, and the free distribution of quinine, are the measures most commonly adopted.

The Acting Governor of the Leeward Islands reports favourably on the efficacy of the small fish known as "millions" (*Girardinus poeciloides*) in keeping down mosquitoes.

Sir Rubert W. Boyce. **Mosquito or Man? The Conquest of the Tropical World.** — Sec. Ed. London, Murray, 1910. Pp. xvi + 267, with 50 illustrations.

The first edition of this book was published in October 1909, the second in February 1910.

The subtitle of this work, "The Conquest of the Tropical World," is amply justified by the paramount importance of logical discoveries and problems here dealt with. The volume furnishes a survey of the wonderful work done since the discovery of the association between the mosquito and the propagation of malaria, yellow fever, and sleeping sickness, and provides a guide to the salutary measures which have been and may be adopted in various localities. It is hardly necessary to add that the book carries the highest authority, as coming from the Dean of the Liverpool School of Tropical Medecine.

The author has endeavoured in this volume to epitomise the tropical medical movement, which, initiated in Great Britain by the sympathetic encouragement of the then Secretary of State for the Colonies, Mr. Joseph Chamberlain—and energetically supported by the liberality of the late Sir Alfred Jones, and subsidised by merchants interested in the health-progress of tropical countries, has now spread all over the civilised world. From whatever standpoint the movement is regarded, the reader cannot fail to be impressed with the immense success which has been obtained.

"The tropical world", are the concluding words of the author's preface, "is unfolding once again to the pioneers of commerce, who now do not dread the unseen hand of death as did of old the Spanish Conquistadores of Columbus and Cortes. The British public has and must always have a paramount interest in this practical conquest, which is destined to add a vast slice of the globe, of undreamt-of productiveness, to their dominions and activities, and as a contribution to the history of the conquest this small volume is launched by one who has been privileged to take a humble part in the movement and in not a few of its successful compaigns."

From Chapt. VIII, a summary of the antimarial compaigns, the following general statements may be quoted:

"In his 'Researches on Malaria' Ross very truly remarks that malarial fever is important not only because of the misery which it inflicts upon mankind, but because of the serious opposition which it has always given to the march of civilisation in the tropics.

Unlike many diseases, it is essentially endemic, a local malady, and one which unfortunately haunts more especially the fertile, well-watered, and luxuriant tracts—precisely those which are of the greatest value to man. There it strikes down not only the indigenous barbaric population, but, with still greater certainty, the pioneers of civilisation—the planter, the trader, the missionary, and the soldier. It is therefore the *principal and gigantic ally of Barbarism.* No wild deserts, no savage races, no geographical difficulties have proved so inimical to civilisation as this disease. We may also say that it has withheld an entire continent from humanity—the immense and fertile tracts of Africa. What we call the Dark Continent should be called the Malarious Continent; and for centuries the successive waves of civilisation which have flooded and fertilised Europe and America have broken themselves in vain upon its deadly shores,"

"We cannot obtain accurate figures to give us some indication of the mortality and sickness-rate amongst the populations of Africa. We can, however, agree with Ross that Africa is to-day what it is, as compared to Europe, because of its malaria-bearing mosquito. But we can well imagine that such figures would be gigantic if for a moment we consider what malaria does in India. Here we have available data, and they show that there were 4 919 591 deaths recorded under the word Fever in 1900, the vast bulk of which was no doubt of malarial origin. Taking next the military population, out of a total force of 305 927 in 1900, there were 102 640 cases admitted into hospital, suffering from malaria (1).

Figures like these give the world some idea of the magnitude and importance of antimalarial mosquito warfare; they are figures only exceeded by the mortality which was common in the fifties in the West Indies from yellow fever, when the mortality sometimes reached 69 per cent amongst the soldiers! No wonder, then, that antimosquito work is attracting increased attention all over the world. The method of attack is simple and the victory to be gained is overwhelming, as the narrative of the campaigns against malaria abundantly proves.

"Historically, the first antimalarial work was undertaken by Ross when in India, and subsequently in Sierra Leone. He organised mosquito brigades to do away with the breeding places of the anophelines, to drain the land, or oil the pools,—not every patch of water, however."

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(1) Ross, "Researches on Malaria," 1905.

XLVII.

Farm-Buildings. Roads. Waterways. Transports.

No abstract given under this heading.

XLVIII.

Agricultural implements and machinery. Legislation regarding agricultural machinery.

WILLIAM E. BEAR. **Exportation of Implements and Machines into Great Britain.** — *Journal of the R. Agric. Soc. of England*, Vol. 70, 1909, pp. 151-163.

The classification of the imports of implements, tools and machines into Great Britain is not so definite as could be desired. Under "implements and tools" there is no distinction between those of the agricultural and other classes; but it may be assumed that the implements are nearly all agricultural, and as to tools, machine tools are excluded. More than three fourths, judging from the values, which alone are given, are received from the United States, but there has been a great decrease—about 62 per cent.— in imports from that source since 1904, probably because British manufacturers have recently made implements similar in type to those which come from the United States. It seems strange that the Netherlands should stand second in this connection, and probably this is in relation to tools not nearly all agricultural.

France, Germany and Canada follow in the order given, not one of them however exceeding the value of £20 000 (505 000 frcs) in a year. The total weight of agricultural steam engines in 1908 was only 36 tons. Other agricultural machines come chiefly from the United States, Canada being the only other important contributor. The total value in 1908 was under £726 000 (equal to 18 331 500 frcs).

David Bruce. **Chaff-Cutting Machines Act.** — *Standard Cyclopedia of Modern Agriculture*, edited R. P. Wright, vol. III. — London, 1909, p. 166.

By the Chaff-cutting Machines (Accidents) Act, 1897, it is provided that every Chaff-cutting Machine worked by motive power, other than manual labour, shall so far as reasonably practicable be fitted with a contrivance to prevent the hand or arm of the person feeding the machine from being drawn between the rollers to the knives. The flywheel and knives must be kept sufficiently fenced during the working. Anyone contravening the provisions of the Act is liable to a penalty not exceeding £5, and in the prosecution of the owner of the machine, or the person for whose benefit it is used, if it is shown that the machine did not comply with the requirements of the Act, such person shall be deemed to have permitted the same, unless he satisfy the Court he took all reasonable precaution to comply with the requirements of the Act. Any constable acting on the instruction of an inspector may enter premises to inspect a machine.

XLIX.

Preparation of products for the market. Marketing. Storage and Refrigeration of agricultural products.

W. Y. Sulis (U. S. Vice-Consul in Liverpool). **Consumption of Cold-storage Provisions in the United Kingdom.** — *Monthly Consular and Trade Reports*, April 1909, n. 343, p. 126.

U. S. Vice-Consul W. J. Sulis, of Liverpool, sends a report on the development of refrigeration in the transportation of foodstuffs, and the increased imports of such articles into the United Kingdom, of which the following is a résumé:

The transportation and preservation of perishable produce has become one of the most serious problems which can engage the attention of engineers and others interested in the efficacious and rapid dispatch of foodstuffs from one part of the world to the other. Statistics and statements from high authorities go to show that the transport and preservation of perishable produce is an enormous and growing business, and likely in the future to be one of the most important in the world. In the Annual Report of the British Board of Agriculture the following reference to the dead meat imports into the United Kingdom is made:

To the development of this trade the resources of science and the ingenuity of inventors have greatly contributed, and the capital employed in it is now very great. It appears highly probable that the dead-meat trade will continue in the future to increase year by year with the ever-growing requirements of our population, while the oversea transit of live animals may be expected to diminish and eventually to disappear as a relic of an age of imperfect economic development.

Sources of food supply. Refrigerator ships. — In spite of the careful fostering of home industries intended to provide the food supply of the United Kingdom, the imports of provisions are regularly increasing. Instead of drawing on near-by countries, the English people are looking more and more to their colonies in distant parts of the world for these supplies. This is made possible by the present methods of refrigeration.

There are 358 ships engaged in the trade of the United Kingdom that are fitted in part or throughout with a total refrigerating capacity of 36 266 000 cubic feet (m. c. 1 015 450). Of this number, 71 ships, with a capacity of 3 341 000 cubic feet (m. c. 93 550) for perishable produce, bring supplies from the United States; from Australia and New Zealand, 92 ships, with 15 514 000 cubic feet (m. c. 434 390) cold-storage capacity, bring chiefly beef, mutton, and butter. From Canada come 47 ships, with 1 829 000 cubic feet (m. c. 51 212) capacity, chiefly with meats and dairy products. The number of ships coming from South America carrying refrigerated cargo is not given, but their capacity for this class of goods is placed at 7 611 000 cubic feet (m. c. 213 110).

The port of London is at the head of the list in the number of vessels and their carrying capacity, and takes most of the Australian and New Zealand cargoes, while Liverpool is second and takes most of the North and South American cargoes. However, the shorter trips of the Liverpool steamers bring the yearly sailings and capacity as high or higher than those of London.

Cold-storage Warehouses. — Increased Imports of Foodstuffs. — As the large quantities of foodstuffs arriving in England cannot be distributed direct to consumers, cold-storage warehouses have increased at the various seaports, in large centers of population, and at the principal distributing markets. The following table shows the approximate refrigerating capacity of these warehouses in the principal towns:

Towns	Capacity Cubic feet
London	9 000 000
Liverpool	4 000 000
Southampton	2 000 000
Glasgow	1 500 000
Manchester	1 000 000
Bristol	500 000
Newcastle	500 000
Cardiff	500 000
Leith	250 000
Hull	3 500 000
Other towns	250 000
Total	23 000 000

The value of butter imports into the United Kingdom increased from $ 38 920 417 (201 607 760 frs.) in 1887, to $ 108 951 120 in 1907 (564 366 800 frs.), the largest increase coming from Australia. In meat imports the value increased from $188 160 046 (1 004 669 070 frs.) in 1903 to $ 202 651 818 (1 049 736 407 frs.) in 1907. The average annual value of imported fruits, apples, apricots, peaches, oranges, pears, plums, lemons, and bananas for five years, from 1900 to 1904, was $ 38 086 016 (197 285 562 frs.) while for the imports of 1907 the value was $ 45 257 228 (234 432 441 frs.).

In the following table is given the average yearly import per head of population in the United Kingdom of the principal food products, taken in five-year periods from 1861 to 1905.

Imports of Food-stuffs per head of population.

Period	Population	Meal and flour		Meat		Margarine		Cheese		Lard		Eggs
		Pounds	Kg.	Pounds	Kg.	Pounds	Kg.	Pounds	Kg.	Pounds	Kg.	Number
1861-1865 .	29 459 465	224	101.47	5.9	2.67	3.9	1.76	2.9	1.41	1.3	1.3	9
1866-1870 .	30 696 335	255	102.92	4.2	1.90	4.3	1.94	3.4	1.54	0.9	0.9	14
1871-1875 .	32 189 540	335	151.15	10.6	4.93	4.8	2.17	4.7	2.12	1.8	1.8	19
1876-1880 .	33 929 039	425	192.54	19.2	8.69	6.2	2.80	5.7	2.58	2.5	2.5	22
1881-1885 .	35 466 129	423	192.19	18.9	8.56	7.2	3.26	5.7	2.58	2.5	2.5	26
1886-1890 .	36 891 538	436	197.50	23.3	10.55	8.7	3.94	5.8	2.62	3 1	3.1	31
1891-1895 .	38 529 228	488	175.76	30.4	13.77	10.4	4.71	6.3	2.85	3.8	3.8	36
1896-1900 .	40 410 538	525	237.82	43.7	19.89	11.6	5.25	6.8	3.08	5.4	5.4	44
1901-1905 .	42 375 114	527	238.73	45.9	25.79	13.2	5.97	6.8	3.08	4.9	4 9	53
Per cent increase .	—	230	230	780	780	340	340	230	3.08	380	380	600

"There is great activity displayed by the British colonies to encourage the export of dairy products. In Canada, factories are encouraged and assisted to install small refrigerating plants, so that the manufacture of the article may be carried out under the best conditions, and such produce can be delivered to the railways in a cool and firm condition. The railroad companies are paid a small subsidy under an agreement to provide an adequate number of properly iced cars, and to run these on scheduled time.

" Steam-ship companies are encouraged to provide cold-storage and air-cooled space, and inspectors are employed to see that the produce is properly attended to, and that the transit arrangements receive the necessary attention. It is contended that by virtue of this complete cold-storage chain and the elimination of all factors likely to injure the quality of the marketed article that the Canadians have secured a large portion of the dairy-produce trade. The New Zealand Government, too, has taken charge of the dairy-produce exports and is insisting on everything from the cattle to the ship being in proper order. While the Australian States are not so far advanced, they are moving on the same lines.

"In the same manner Canada, Australia, and New Zealand are dealing with fruit exports with a view to securing uniformity of grading, general excellence in their exports, and the provision of proper transport and handling facilities by the railroad and harbor authorities. Apples, oranges, and bananas are the principal fruits imported, but the more delicate varieties are also received in Great Britain in large quantities. Much of this imported fruit comes in refrigerator ships, and it is the most delicate class of cargo to be dealt with."

L.

Weights and Measures. Miscellaneous.

Weights, Measures and Coinage of the United Kingdom.

MEASURES OF LENGTH:

12 Inches (in) = 1 Foot (ft); 3 Feet = 1 Yard; 6 Feet = 1 Fathom; 1760 yards = 1 Statute Mile.

1 Inch = 0.0254 metres
1 Foot = 0.3048 metres
1 Yard = 0.9143 metres
1 Fathom = 1.8287 metres
1 Statute Mile = 1609.3 metres
1 Geographical Mile, Admiralty knot or Nautical Mile = 1851.8 metres
1 League = 3 Miles.

SQUARE, SURFACE, OR LAND MEASURE:

144 square Inches = 1 square Foot; 9 square Feet = 1 square yard; 30.25 sq. yards = 1 Rod, Pole or Perch; 40 Rods = 1 Rood; 4 Roods = 1 Acre = 4840 sq. yards; 640 Acres = 1 square Mile.

1 Square Mile	= 2.5898	Square	kilometres
1 Acre	= 4046	Square	metres
1 Rood	= 1011.67	»	»
1 Rod or Perch	= 25.29	»	»
1 Square yard	= 0.8361	»	»

CUBIC OR SOLID MEASURE:

1 Cubic Inch = 0.0000163 Cubic Metre
1 Cubic Foot = 1728 Cubic Inches
1 Cubic Foot = 0.0283115 Cubic Metres
1 Cubic Yard = 27 Cubic Feet = 0.764505 cub. Metres.

LIQUID MEASURES:

1 Gill = 8.665 Cubic Inches
1 Pints = 4 Gills
1 Quart = 2 Pints
1 Gallon = 8 Pints.

1 Gallon = the volume of 10 lb. of distilled water (temperature 62° F.; pressure 30 Inches).

1 Gallon = the volume of 4.5359 kgs. (temp. 16°.6 C.; pressure 759 millimetres),

1 Gill = 0.14197 Litres
1 Pint = 0.5679 »
1 Quart = 1.1358 »
1 Gallon = 4.5434 »

DRY OR CORN MEASURE:

2 Gallons = 1 Peck; 8 Gallons = 1 Bushel; 8 Bushels = 1 Quarter.

1 Gallon = 4.5434 Litres
1 Peck = 9.0869 »
1 Bushel = 36.3476 »
1 Quarter = 290.7808 »

1 Load (imperial) = 5 quarters = 1453.904 Litres
1 » (market) = 5 bushels = 181.738 Litres
1 » (Manchester) = 4.8472 quarters = 1409.4727 Litres.
NB. — The United States Bushel is 35.2 Litres.

AVOIRDUPOIS WEIGHT:

7000 Grains = 1 Pound avoirdupois (lb). 27.34375 Grains = 1 Drachm (dr).

16 Drachms = 1 Ounce (Oz).
16 Ounces = 1 Pound (lb).
14 Pounds = 1 Legal Stone (st).
28 Pounds = 1 Quarter (qr).

112 Pounds = 1 Hundredweight (cwt).
20 Hundredweight = 1 Ton (T).

1 Pound = 0.453 Kilogrammes
1 Hundredweight = 50.8 Kgs.
1 Ton = 1016 Kgs.

COINAGE:

1 Pound sterling (£, Lst) = 20 shillings (s)
1 Shilling (s) = 12 Pence (d)
1 Pound st (£) = 25.25 Francs
1 Shilling (s) = 1.25 Francs
1 Penny (d) = 0.1051 Francs.

THERMOMETER:

0° Fahrenheit	=	$-17^\circ.77$ Centigrade
32° »	=	0° »
59° »	=	15° »
100° »	=	$37^\circ.77$ »
212° »	=	100° »

$$\text{N.}^\circ \text{ Fahrenheit} = \frac{5\,(N - 32)}{9} \text{ Centigrade.}$$

CONVERSION OF SOME ENGLISH AGRICULTURAL WEIGHTS AND MEASURES PER ACRE INTO METRICAL WEIGHTS AND MEASURES PER HECTARE.

1 Bushel per acre = about 0.9 hectolitres per hectare
1 Pound » = » 1.12 kilogr. » »
1 Stone » = » 15.7 » » »
1 Hundredweight per acre = about 125.6 kgs per hectare
1 Ton » = » 2510 » » »

ENGLISH EQUIVALENTS OF METRIC WEIGHTS AND MEASURES:

1 Metre = 39.37 Inches = 3.28 Feet.
1 Kilometre = 0.6214 Mile.
1 Are = 1076.4 Square Feet.
1 Are = 0.0247 Acre.
1 Hectare = 2.47 Acres.
1 Sq. kilometre = 0.386 sq. Miles.
1 Stere or cubic metre = 35.31 cubic Feet.
1 Gramme = 0.035 ounce.
1 Gramme = 0.0022 lb.
1 Kilogram = 2.205 lbs.

1 Quintal métrique = 220.5 lbs.
1 Ton = 1000 kgs = 2205 lbs.
1 Litre = 1.76 pints.
1 Hectolitre = 22 gallons, liquid.
1 » = 2.75 bushels, dry.
1 Hectolitre per hectare = 1.1121 bushels per acre.
1 Kilogramme » = 0.8928 lbs per acre.
1 Quintal metr. (100 kgs) per hectare = 89.28 lbs per acre.

Weights per Bushel of wheat and other cereals as usually reckoned.

One Bushel	English weight per bushel	Metrical weight per bushel coefft. 0.453	Approximate weight per hectolitre coefft. 1.233
	lbs.	Kgs.	Kgs.
Wheat, English	63	28.5	77.7
» Foreign	62	28	76.5
Maize	60	27	74
Barley, English	52 - 56	23.5 - 25.3	64.1 - 69
» French	52 1/2	23.7	64.7
» Mediterranean	50	22.6	61.6
Oats, English	40 - 42	18 - 19	49.3
» Foreign	38 - 40	17 - 18	49 - 52
Rye	60	27	74

Hay and straw.

Truss of straw = 36 Pounds = 16.308 kgs
Truss Old Hay = 56 » = 25.168 »
Truss of New Hay (to Septemb. 1st) = 60 Pounds = 27.18 kgs

Load = 36 Trusses {
Straw = 11 cwt 2 qrs 8 lbs = 587.7 »
Old Hay = 18 cwt = 914.4 »
New Hay = 19 cwt 1 qr 4 lbs = 965.2 »

SPECIAL WEIGHTS AND MEASURES.

Cotton Wool:

U. S. A. Bale average	477	lbs	=	216	kilogs
Egyptian	719	»	=	325	»
East Indian	396	»	=	179	»
Brazilian	220	»	=	99	»

Cotton Yarn:

Thread	=	1 1/2 yards	=	1.21	metres
Lea, or Skein	=	120 »	=	109.72	»
Hank	=	7 Leas	=	768.01	»

Timber and wood:

Cubic foot . . . . . = 0.028315 cubic metres

Stack of wood	= 108 cub. ft	= 3.058	»	»	
Cord of wood	= 125 »	= 3.539	»	»	
1 Load	= 40 cubic feet	rough	=	1.1326	c. m
	= 50 » »	squared	=	1.4157	»
	= 50 » »	planks	=	1.4157	»

Oil:

Tun = 252 gallons = 1144.08 Litres.

Wine:

Pipe of Portwine	=	115 gallons	=	522.10	Litres
» » Sherry	=	108 »	=	490.32	»
» » Marsala	=	93 »	=	422.22	»
Hogshead of Madeira	=	46 »	=	208.84	»

Raisins:

Barrel = 112 lbs = 50.73 kilogs.

Potatoes:

1 Sack = 3 Bushels = 1.09 hectolitre.

Fruit:

The Covent Garden Bushel-basket is 17 1/2 inches (0.437 metres) in diameter at top; 10 inches (0.25 metres) at the bottom and 10 inches (0.25 metres) deep.

The Half Bushel called *Half Sieve*, or commonly *Sieve*, is a basket containing 21 lbs (9.526 kgs) of apples or pears, or 24 lbs (10.886 kgs) of other fruit.

The empty *Sieve* weighs 3 to 4 lbs (1.500 to 1.700 kgs)
Diameter at top 14 inches (36 centim.)
Depth $7\,^{8}/_{4}$ inches (20 centim.).
The oval *Flein* weighs empty about 1 lb. (500 grams)
Diameter at top 13 inches $\times\ 7\,^{1}/_{2}$ (0.34 $\times$ 0.19 met.)
Diameter at bottom $7\,^{3}/_{4}$ inches $\times\ 5\,^{1}/_{2}$ (0.20 $\times$ 0.14 met.)
Depth $5\,^{1}/_{2}$ inches (0.14 met.).

BRICKS:

1 Load = 500.

COALS (Scotch):

1 Load = 1 Ton = 1016 kgs.

GRAVEL or earth:

1 Load = 1 cub. yard = 0.764505 cub. met.

LIME:

1 Load = 32 bushels = 1.163 cub. metre.

BUTTER:

Firkin	=	56 lbs	=	25.36 kilogs
Barrel	=	4 Firkins	=	101.44 »

EGGS:

1 Great Hundred = 120 eggs.

WOOL:

Clove (cl)	=	7 lbs	=	3.171	kgs
Stone (st)	=	14 »	=	6.34	»
Score (score)	=	20 »	=	9.06	»
Tod (td)	=	28 »	=	12.68	»
Pack (Pk)	=	240 »	=	108.7	»

BUTCHER'S MEAT:

Customary stone (st) = 8 lbs = 3.624 kgs.

FLOUR:

Peck of Flour = 2 Gals = 14 lbs = 6.342 kgs
Sack or Load of Flour = 2 Bolls = 280 lbs = 126 kgs.

BREAD:

Quartern Loaf = 4 lbs = 1.812 kgs.

English and other Yearbooks, Journals and Reviews consulted in preparing the present Volume, with Key to Abbreviated Titles.

Agricultural Economist and Horticultural Review. London . . .	Agr. Econ. & Hort. Rv., Lond.
Agricultural Gazette. London . .	Agr. Gaz., Lond.
Agricultural Record. London . .	Agr. Rec., Lond.
Agricultural Students' Gazette. Cirencester	Agr. Stu. Gaz., Cirencester.
Analyst, The. London	Analyst, Lond.
Annals of Botany. London . . .	An. Bot., Lond.
Biedermann's Zentralblatt für Agrikulturchemie. Leipzig	Bied. Zblt. f. Agrikulturchemie.
Board of Trade Journal, The. London	Bd. Trade J., Lond.
British Yearbook of Agriculture and Agricultural Who's Who. London.	Agric. Who's Who., Lond.
Bulletin of the Imperial Institute of the United Kingdom, Colonies and India. London	Bull. Imp. Inst., Lond.
Chemical News, The. London . .	Chem. News, Lond.
Chemist and Druggist, The. London.	Chem. & Drug., Lond.
Cold Storage and Ice-Trade Review. London	Cold Stor. Rv., Lond.
Country Home, The. London . .	Country Home, Lond.
Contemporary Review, The. London	Contemp. Rv., Lond.
Dairy, The. London.	Dairy, Lond.
Dairy World and the British Dairy Farmer, The. London	Dairy Wld. & Br. D. Farmer, Lond.
Edinburgh Review, The. London .	Edinburgh Rv.
Engineer, The. London	Engin., Lond.
English Review, The. London . .	Engl. Rev., Lond.
Experiment Station Record, U. S. Dpt. of Agriculture. Washington .	E. S. R.
Farmer and Stock Breeder and Chamber of Agriculture. London	Farm. & Stock Breeder, Lond.
Fruit, Flower and Vegetable Trade's Journal. London	Fr., Fl. & Veg. Tr. J., Lond.

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