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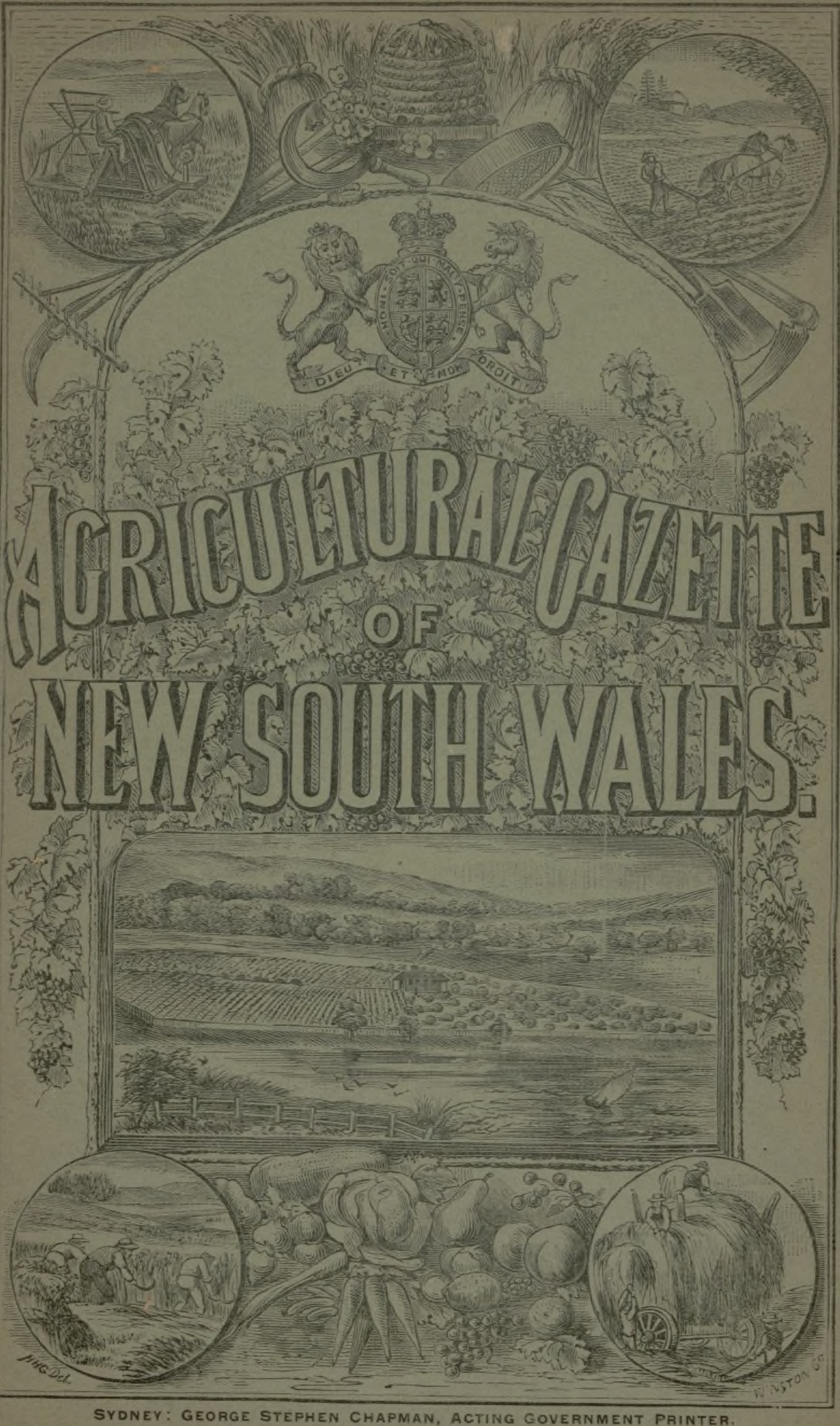
Agricultural Gazette of New South Wales.



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THE

AGRICULTURAL GAZETTE

OF

NEW SOUTH WALES,

ISSUED BY DIRECTION OF

THE HON. SYDNEY SMITH, M.P.,
SECRETARY FOR MINES AND AGRICULTURE.

H. C. L. ANDERSON, DIRECTOR.

VOL. II. PART 6.

JUNE, 1891.

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CONTENTS.

Progress of the Department.

Nearly sixteen months have passed since the Department of Agriculture was first created in the interest of the farmers and fruit-growers of New South Wales, and it is gratifying after such a brief space of time to look back to the amount of useful work achieved.

This progress is the more satisfactory when it is considered that it must of necessity be all uphill work with a new organisation, and that the setting of the departmental machinery into gear from the start is always attended with obstacles of the most varied sorts.

However, the kind recognition expressed from all parts of the country as to the useful character of the work already done is ample reward for the deep thinking, close study, and anxious expectations as to the character of the work performed by the newly-equipped department, and as to what kind of appreciation it would meet at the hands of the agricultural population of the country.

The attempts made to meet the long-felt want which led to the creation of the Department of Agriculture have been so far successful as to help in all possible ways in the object and purpose the Government had in view, and fulfil the realisation of their most sanguine hopes.

A brief enumeration on the other hand of what the Department of Agriculture has tried to do since the date of its formation for the farming community and the agriculture of the country will best convey to the mind the nature, scope, and degree of usefulness of the work (practical, technical, and scientific), done through the agency of the different branches composing the Department.

One of the chief objects of the Department is to act towards the agriculturists of this country as a board of advice, always at their disposal, which they can readily and confidently consult on all matters appertaining to the welfare and management of their land, their crops, their trees, and their stock.

This privilege has been freely and to a great extent made use of by settlers from all parts of the country, and advice of the most varied nature solicited as to the planting of the most suitable varieties of crops and fruits—considering the requirements of each district, and the purpose in view; as to pruning vines and fruit-trees; training and generally cultivating them; as to the eradication and destruction of pests of all kinds—weeds, fungi, and insects; also as to preparing produce for the market, so as to insure their best keeping capabilities, and show to best advantage their respective and distinctve merits, besides information as to the probable demand for particular products, or the best way of treatment of the raw material obtained from the land, into manufactured and marketable produce.

Specimens of the most varied nature have been daily received for identification from all quarters, and on every conceivable agricultural matter. Thus have distinctive varieties of cereals, grapes, and fruits of all sorts been correctly named, and their value or want of quality pointed out; shrubs, grasses, and plants generally, identified; insects named and information given as to their friendly or destructive habits of life, and microscopic diseases diagnosed, and remedies offered for keeping them in check.

Investigations of a varied, interesting, and important nature have been conducted through the agency of the officers having charge of the different branches under the Department.

Thus, exhaustive researches have been directed to elucidate the question of Australian rusts in wheat and in other cereals; also the peach rust, and the presence of similar fungi on other plants either cultivated or growing in the wild state. Nor has the problem of tracing the nature and the cause of different rusts, and finding remedies that would minimise the damages caused each season to our crops, solely engrossed the attentions of the Pathologist; other researches as well have been conducted relating to parasitic diseases, such as those that affect root crops and are indicated by root-galls or knots caused by a minute little worm or nematode, probably identical with one known to devastate large tracts of beet-growing land in Germany and potato land in America.

Blights of various sorts have received attention, or are under observation, such as the bitter-rot of the apple, the apple scab, the black spot and anthracnose in grapes, and other diseases which in unfavourable seasons do considerable damage to fruits and crops generally.

Plagues of different nature have received the attention of the Entomologist, and the habits and life-history of insects, either noxious or friendly, have been brought to the notice of farmers and orchardists; various means have been suggested for checking the ravages done by them and preventing their increase.

Several natural enemies of our most destructive insects have been discovered, depicted, and described, and are themselves under close observation with a view of devising means to foster their rapid propagation. Thus have ichneumon flies and beetles of the lady-bird genus, described as being in proportion to their size, as sanguinary and ferocious as the most savage beasts of prey, been identified and made known; also small lizards and insectivorous birds, and quite recently a most interesting hemipterous fly which penetrates the body of grasshoppers, and has been proved to destroy them by millions, not to speak of the minute orange-coloured larvæ of the Hessian fly family that have been proved to unmistakably feed on the spores found on rusted plants.

To illustrate the value of such investigations, I may state—what is now a matter of history—that the orange orchards of California were being devastated by a bug called the "cottony cushion scale." (*Icerya Purchasi*). The American Government entomologist determined that it was advisable to search for an enemy for this scale. This was found in a lady-bird in New Zealand and New South Wales (*Vedalia cardinalis*), and the result has been that the pest has been exterminated from California, and the gain is estimated at no less than £1,000,000. Now I have seen young children and older persons taking particular pains to kill off all insects visible, friends as well as foes; hence may be seen the great need of discrimination in such matters.

To the Botanist has been entrusted the care of classifying a herbarium of the native grasses and fodder plants, that abound in all parts of the country, and are particularly adapted for the wants and exigencies of our climate. Weeds, also, have received attention, as well as poisonous plants, which, owing to their acrid or stupefying properties, are the cause of great loss of stock every year.

Thus it is seen that the Department does not rest content with benefiting the farming and fruit-growing element of our agricultural community, but has also at heart all questions related to the prospect of pastoralists. If all the money that has been sent out of the Colony to import exotic grass seeds, which often prove a failure in this land of drought and flood, had been expended on the cultivation, or even systematic conservation of our native grasses and other herbage, in all probability we should not periodically hear of thousands of cattle and sheep dying of starvation during every recurring drought.

An illustrated monograph is now being published in the *Agricultural Gazette* of the grasses of New South Wales, also of weeds and supposed poisonous plants either introduced or indigenous in the country.

The care of calling the attention of the farming community to the profitable growing of commercial and economic plants new to the country has also been entrusted to the Botanist, who, in a series of articles compiled with that object, and published in the official organ of the Department, has pointed out what mines of wealth and resources of the most varied nature our soil and climate can offer to the industrious agriculturist. There is also in the press, and will shortly be issued, a complete account, fully illustrated, of all the native fodder plants of New South Wales, giving full details as to the comparative value of each as a food for sheep and cattle.

With a view of bringing the Department into closer touch with the farmers, and obtaining on agricultural matters generally more precise and definite information, the Inspector has already visited several centres of agricultural activity, and reported on matters of interest, collected valuable notes respecting the precise nature of the soil formation, variety and respective range of each particular climate met with in this country, for the purpose of offering to farmers sound and reliable advice as to the most remunerative utilisation of their land for growing special produce.

Such information will also be found of value in the planning of comprehensive agricultural maps for the Colony.

These maps, it is expected, will be found of great assistance to those who wish to break new ground, and will serve, besides, as an accurate guide in directing inquiries as to the crops and industries suitable for each district in the Colony.

Although the Inspector has been more generally engaged in inspecting the vine-growing districts, and acting generally as expert in viticulture, investigations have been conducted and reports submitted by him on various topics connected with the agriculture of this country, and more especially on the industry of the sugar-cane in the fertile coastal district through which flow our northern rivers.

The suitableness of extensive ranges of country, more especially on the table-land of the New England District, has also been specially ascertained for growing sugar-beets, and steps have forthwith been taken by the Department in obtaining sufficient quantity of seeds of several of the leading varieties of beet roots, with a view of testing their respective merits and their value as sugar producers in this country. Applications for these seeds are now invited from farmers in suitable districts for experimental purposes, and the results of experiments will be carefully collated, and chemical analysis of samples conducted by the chemist of the Department.

Other inspecting officers as well have visited various centres of the Colony in order to confer with the farmers, deliver lectures on matters of agricultural interest, and give advice as to diseases, manures, weeds, insect pests, methods of cultivation, also treatment of crops, management of orchards and vineyards, proper conducting of fermentations. The heartiness with which these officers have everywhere been welcomed points to the need of having a few competent men scattered about the country to bring the Department into touch with the farmers, advise where possible, and generally look after the agricultural interests of their respective districts.

The increasing and enormous demand for dairy produce in the United Kingdom and other extensive markets shows what a grand opening there is for our dairy produce, provided always that it is of high quality. In order to meet a demand and impart instructions to the settlers in the subjects relating to this branch of the farming industry, a travelling dairy has been established, to proceed from district to district throughout the Colony, and numerous applications have already been received from different agricultural centres for practical demonstration in dairy matters.

The farmers have been invited since the formation of this Department to submit samples of soil, manures, fodders, ashes of plants, and other agricultural produce for chemical analysis free of cost, and the privilege has been largely made use of and highly appreciated. Thus, a clear knowledge of a comprehensive nature will be arrived at as regards the relative quantities of plant food in store in any particular soil, by means of which in course of time a fairly general knowledge will be gained of extensive stretches of soils of different formations in various parts of the country.

Thus, also, the farmer is made acquainted with any weak point in his soil, and special fertilisers to make up that deficiency are duly prescribed. The relative value of his crops are determined, either as cattle food or for industrial purposes of the most varied kind. He knows also exactly of what amount of fertilising matter his field has been robbed by the removal of the crops, and what proportion of any given manure will be required to counterbalance the loss entailed on the ground, and make it good for the following crop.

It must be borne in mind that to use manure when not needed is waste, and in the same way to use a manure that contains too much of one substance but too little of another is equally waste. Hence every commercial fertiliser for sale in New South Wales is being analysed, and the relative value of each indicated for the benefit of those interested, thus protecting the farmers from imposition, and aiding the manufacturers of genuine manures.

Numbers of small farmers and fruit-growers, whose soil is naturally poor or exhausted by long cropping, have received advice as to manures, which they have gratefully acknowledged.

Samples of water, too, have been analysed, in order to determine their value or otherwise for irrigation purposes; and in cases where trees and plants watered from a swamp, a well, or a spring, are dying without any apparent cause, an analysis of the water supply may very likely assist in deciding the question.

The mass of painstaking and valuable information thus collected, expressed, and offered would, however, be of little avail if some means did not exist for giving to them adequate publicity; and the energy of an efficient and gradually increasing clerical staff, even if taxed to the utmost degree, would fail in the attempt at conveying at the proper time and to the proper persons satisfactory answers to inquiries made or the results of investigations and experiments pursued by the Department.

The purport and object, therefore, of the *Agricultural Gazette*, which is the official organ of the Department, is to convey such information as promptly as possible, to give seasonable notes on matters of scientific, practical, and industrial interest, and to serve as a record always available for reference.

The *Gazette* is conducted by the Director, who sees that it is published regularly every month, collates, registers, and chronicles matters of interest published in colonial as well as foreign agricultural papers, and supervises its due transmission to a considerable number of *bona fide* settlers and agriculturists, to all educational institutions, agricultural societies, and other bodies that can utilise its contents.

Most complimentary notices of the value of this publication have been received from the leading agricultural authorities of America and England, and from eminent scientific men in Europe; and the best index of its value that I can give is the large number of applications, accompanied with subscriptions, received from all parts of Australia, America, and England. The monthly issue is now 4,200 copies.

The valuable and instructive illustrations of insects, fungi, grasses and weeds, economic plants and farm crops, fruits, models of agricultural machinery, specimens of stock, &c., are due to the facile and precise pencil and pen-and-ink drawings of the artist to the Department; and, as a glance at the collection of issues of the *Agricultural Gazette* will show, these drawings are reproduced by the best methods available, and add considerable clearness in making more expressive and explanatory the subjects described by the Department's specialists in exhaustive and technical articles on questions which, being familiar to few of the readers for whom they are intended, are for that very fact sometimes difficult to grasp at first sight. This publication is issued free to all *bonâ fide* settlers on the soil who make application to the Director of Agriculture.

An agricultural museum has been formed, and is already supplied with a complete collection of the grasses, salt-bushes, and other fodder plants of the Colony, together with a typical collection of many hundreds of the different species of grain and seed grown in New South Wales.

A large number of insects, friendly and injurious, have been collected, also specimens of vegetation affected with different fungi.

A collection of full-grown leaves and well-summered wood of the choicest grapes grown in the Colony is being made, for assisting in the identification of specimens submitted for that purpose.

Also, an artist has been engaged to make correct models of all the fruits of the Colony. The assistance of the fruit-growers having been invited, a constant supply of material has been kindly sent in from all parts of the country, so that there is already a fair typical collection of all varieties of fruit to the number of about 450.

In order to compare the Australian types with the original ones from England, a collection of models of the 600 best varieties grown both in the Old World and here has been ordered through the Royal Horticultural Society of England. These will be exhibited from time to time in the principal fruit-growing centres of the Colony.

Steps have also been taken to obtain specimens of the spraying pumps most in favour in European vineyards and orchards, and their methods of working and practical value will be demonstrated to those interested.

Diagrams and photographs and models of agricultural machines and implements best adapted for our requirements will be obtained. For example, the Strawsonizer, a machine by which, it is asserted, an acre can be effectively sprayed with a gallon of liquid and manures can be most evenly distributed, will arrive in a few days, and be publicly tested for the benefit of those interested.

The appointment of a thoroughly competent Pomologist, or fruit expert, has been decided on to help in advancing the best interests of fruit-growers, give advice as to the best marketable sorts to grow, methods of packing best suited for each variety of fruit, pruning of fruit trees, relative value of each individual variety for different characters of soil and well-defined climates, and generally conduct such experiments in fruit culture as will make his advice valued by all fruit-growers.

Each officer of the scientific staff of the Department has been supplied with a scientific library, containing the most reliable standard books referring to his special branch, and materials are being gradually collected and classified as will lead to the issuing under the authority of the Department of text books, pamphlets, and monographs written with special reference to the peculiarities and special requirements of the country.

Pathological and entomological laboratories have also been established, where work of interest and minute investigations are being conducted.

The Department also gives advice as to the handiest and most reliable instruments required in the pursuits of the industries of wine-making, dairying, &c. Saccharometers are tested and compared with standard instruments, and consultations given on diseased wines, and the best remedies to apply or the best way to deal with them.

An open trial of sprinklers and spraying machines and pumps was held at Parramatta, in order to call the attention of fruit-growers and vine-growers to these machines of various designs, constructed for distributing liquids or insect powders in the very finest form.

Valuable addition has been made to the reports and pamphlets issued through the Department, under the form of bulletins bearing on special subjects, by the publication of a system of judging stock by points, according to their relative value.

It is hoped that the publication of this bulletin, due to the Chief Inspector of Stock of New South Wales, will assist in helping the judges at Agricultural Shows in the determination of the value of stock.

Another bulletin has been issued giving the collated experience of the sixty fruit-growers who met me in conference last year. This publication is most valuable to intending fruit-growers, as giving the results of experiments made by the earlier growers during the past thirty years, and thus showing beginners what to avoid, and what to imitate, indicating also well-approved remedies for the chief diseases and insect pests that affect fruit trees and vines.

The time has arrived when farmers can no longer sit quietly down amongst the least instructed of the producing classes, leaving it to chance and the chapter of accidents whether they make money by their business or not, for the successful management of land now takes rank with the most arduous of the liberal professions, and if not deeply versed in them all, the farmer at all events should be acquainted with the principles of botany and the growth of plants; with chemistry, that he may be able to cater for the special wants of his growing crops and cultivated land; with entomology, that he may be acquainted with the causes which give birth to insect life, and the conditions under which they will live or die, and that he may be able to distinguish between his friend or foes; with geology, because a slight acquaintance with its outlines will indicate the comparative value of the resulting soil, and may sometimes enable him to drain land at a trifling outlay, and save the expenditure of large sums of money, through being familiar with the character and history of the formation in his farms; with mechanics, so as to arrange the proper distribution of force in traction and a hundred different forms in which power is directed, from the first simple form of the lever, and upwards; with meteorology, that he may take advantage of recognised signs of the weather and its probable influences in bringing about certain results and contingencies, against which he may often be able to provide; and with natural history, so that he may be familiar with the peculiar habits of his various animals and the creatures by which he is surrounded on every side.

A knowledge of the veterinary practice is frequently of great value to a farmer, more especially in isolated districts, where it would take too long to go to ask help of a neighbour more experienced than himself.

The Hawkesbury Agricultural College, at Richmond, will prove a most valuable institution to educate our boys in all these subjects, as well as giving a *thorough practical* knowledge of the best methods of farming, with a view to commercial success. The Colony is very fortunate in securing the services of Mr. J. L. Thompson, a gentleman of such wide-spread experience, as Principal. Some of Mr. Thompson's late pupils at Dookie, Victoria, are now occupying good positions as managers of large farms, or are farming good holdings of their own. The fee for this college education, including cost of living, is only £25 per annum, and for promising students whose circumstances preclude the payment of this fee, free education will be provided by means of bursaries.

The establishment of the Experimental Farms and Agricultural Schools connected with them will be a great boon to the entire Colony; boys will be taken as pupils when they are fit to leave primary schools, and will be taught to farm profitably as well as scientifically, and will, if they please, be enabled to finish their education at the Hawkesbury College, where diplomas will be awarded to deserving scholars. Already four sites have been chosen for Experimental Farms and Agricultural Schools: at the Richmond River, a district with sub-tropical climate; Wagga, with its dry climate, and specially suitable conditions for vine-growing and wine-making; Uralla, with its English climate and peculiar suitability for root crops and cereals; and Goulburn, a centre that offers peculiar facilities for fruit-growing and dairying.

These sites are all naturally adapted for illustrating the value of economical irrigation, which, when thoroughly understood and established in this Colony, will make the tilling of the soil independent of droughts, and enable the farmers and fruit-growers to reckon on their crops giving an adequate return for the labour expended on them. It is hoped that farmers and others will here see such object lessons on irrigation as to stimulate them to experiment and enter upon similar enterprise for themselves. Inquiries are also being made with a view of selecting suitable sites for experimental farms in the western and coastal districts.

The valuable prizes offered by the Department to farmers holding various sized areas of land will, it is hoped, create a healthy spirit of rivalry among our agriculturalists, and induce them to pay increased attention to their breeds of live stock, state as to cleanliness of their land, and general neatness and suitability of their house and farm buildings,—all these items being among the chief qualifications for becoming the winner of a national prize.

The prizes are distributed among five districts—these I and II, North and South Coasts—in which two prizes (1st, £50, and 2nd, £25) are offered for farms up to 100 acres, and the same amounts for farms over 100 acres, also same amounts for dairy farms under similar conditions, thus giving the farmer of slender means an opportunity of showing what can be done by the skilful management of a small area of land.

On the north and south tablelands two prizes in each division are (1st, £50 2nd, £25) offered for mixed farms of 200 acres, and similar sums for farms over 200 acres. There is, in addition, in these districts two prizes for dairies with regard to buildings, methods, and appliances, 1st prize being £15, and 2nd £10.

On the western plains two prizes are (1st, £50, and 2nd, £25) for farms up to 640 acres, and similar prizes for farms over 640 acres.

Orchardists, too, have great encouragement offered to them in the shape of six first prizes of £50 each, and six second prizes of £25 each. These are distributed among three classes, as follows:—Citrus orchards, English fruit orchards, and mixed fruit orchards. These are divided into (I) those of any size up to 10 acres, and (II) those of 10 and over, thus again providing for men operating in a small area as well as for those with larger space for the exercise of their energy.

Viticulturists have also been carefully considered, and two classes—one for wine grapes, the other for table grapes—are provided. Each of these classes is subdivided into (I) vineyards up to 10 acres each, and (II) those over 10 acres, each section being provided with a 1st prize of £50, and a 2nd prize of £25.

There are special prizes open to the whole Colony for irrigation—1st prize, £50, and 2nd prize, £25; for apiculture, two classes each, with prizes of 1st, £15, and 2nd, £10; poultry farms, 1st, £15; 2nd, £10.; conserving fruits and vegetables on a commercial basis—1st prize, £10; 2nd, £5.

There are two champion prizes of £50 each, one for the best mixed farm under 200 acres in the Colony, the other for the best mixed farm over 200 acres which will be required to be thoroughly mixed farms in every sense of the word.

The pathological and entomological prizes of £25 each are offered with a view of encouraging good collections of the insect pests and fungi injurious to animal and vegetable life, and thus enabling, if possible, methods to be devised for their destruction. A prize of £25 is also offered for the best collection of Australian grasses and fodder plants.

The whole of these awards will be made by the gentlemen selected strictly on the judging-by-point system, by which means the unsuccessful competitors will know in what respects they are deficient.

Rust in wheat has received earnest and unremitting attention at the hands of the Department; as yet no definite conclusion has been arrived at. Questions were sent out to a large number of farmers throughout the Colony with a view of getting the opinions of some of the most practical men on this important subject; from the collected reports of the answers to these questions, of which ninety-seven were received, it appears to be generally conceded by those most qualified to give an opinion that the way to combat with the rust pest is to plant the best obtainable rust-resistant wheat, to plant early, and to keep the ground clean and free from weeds, in order to minimise the numbers of hosts on which the rust spores may rest.

These is no doubt that the rust spore is universally present, and only requires certain climatic influences, such as heavy showers of rain, followed by hot sun, to enable its pestiferous ravages to spread over the plant it attacks.

Among the most rust-resistant wheats, Ward's Prolific, White Tuscan, Rattling Jack, and Steinwedel, have shown the best results in this Colony, and in the order mentioned.

The conference of delegates from the four colonies, equally composed of practical farmers and scientific investigators, have fully considered the evidence available, and have been able to register a distinct advance in the knowledge of the subject. They have submitted a series of resolutions advising the farmers as to preventive measures, which will be found very valuable by those interested. It may fairly be hoped that a common plan of operation throughout Australia, as dictated by mutual counsels of this sort, will yet greatly diminish the ravages of this fungus.

The travelling dairy will be of inestimable value to the farming community in showing the best and cleanest methods of cheese and butter making; and judging from the number of applications received by the Department for the dairy to visit various districts, there is no doubt but that it is already appreciated. The exportation of butter cannot but engage the attention of all thoughtful farmers, and instruction in a good system of dairying is a want that has been felt. In this we should open up a great industry, for England is now dependent to a very large extent on a supply of butter from Normandy, Denmark, and other parts of the Continent, and there is no reason why New South Wales should not compete favourably in this respect, for we can produce and export good grass-fed butter just at the time when the article is so dear and poor in quality in England, for the cows there are principally stall-fed from October to May, which cannot but be an expensive process; and, as is well known, grass-fed butter is infinitely superior to that produced by cows existing under the comparatively unnatural condition of artificial feeding.

The dairies where really first-rate cheese is produced in the Colony can be numbered on the fingers. The establishment of a travelling dairy should remedy this. Good cheese is a most important and valuable article of food, and too much attention cannot be given to its manufacture, for if the curd is not at a proper temperature for the operation of the curd-breaker a bad cheese must be the result. There are, however, other important details which will be explained by the person having charge of the travelling dairy, whose lecture and instruction are open for the benefit of all interested in the subject. The apparatus consists of the Laval and Danish separators, with atmospheric churns, which are worked by a 2-horse power engine. The curd-breaker is of a most modern pattern, and does its work thoroughly, and all the other parts are as modern and complete as could be got.

With a view to the improvement of breeds of horses, cattle, sheep, and pigs, the Department has devoted a considerable sum to offering, through District Agricultural Shows, valuable money prizes—called National Prizes—for best animals in their various classes. Good prizes are also offered for wines, for farm products, implements, collection of grasses, exhibits of poultry, ensilage, hay, vegetables, butter, cheese, and several other items, full particulars of which have been sent to the various Agricultural Societies through the Colony. Communication has been opened up with the proper authorities in France, Italy, Britain, and America, with the object of introducing new machines, new seeds, new varieties of fruit-trees, such as mulberries and olives, now little cultivated for their commercial products.

All this, in my opinion, cannot but tend to the advancement of the Colony, for agriculture has always been the mainstay of nations, and will always continue to be so, and a sufficient competency can always be got out of the land by industry and steady perseverance, combined with an intelligent system of cultivation.

I have, at different times, invited delegates from the different fruit-growing districts, the chief wine-making centres and the Agricultural Societies to meet me in conference, in order that I might ascertain for myself the actual condition of the several agricultural industries, and the pressing wants and wishes of the different sections of the agricultural community.

The result has been the initiation of many of the agencies I have now sketched out.

I wish it to be distinctly understood that I am always open to confer with bodies or individuals who wish to consult with me or give me their ideas on any pertinent subject.

I have thus fully sketched out what my Department has done during the past fifteen months, in order to convince the agriculturalists that I have not been idle in attending to the needs of those now on the soil and the education of those who are to succeed them.

During the first three months of the Department's existence, March to May, 1890, 1,200 letters were received from farmers and others on matters of agricultural interest; during the same months of this year 2,300 were received and fully answered. I hope the number will go on increasing year by year at the same rate. During the first five months of the current year over 1,000 letters were written by the Department giving specific advice on manures, analysis of soils, insect pests, and parasitic diseases, and have been gratefully acknowledged; 18,000 Gazettes and Bulletins have been distributed, and 7,000 ciculars sent out. This indicates a lot of work, and, as I trust, useful and reproductive work.

The sole aim of my labours has been to benefit the farmers of this Colony in every way possible, and in this I have been ably and heartily supported by the whole scientific and official staff of the Department. We feel amply rewarded by the many kind and sympathetic letters we get from farmers of all grades throughout the Colony, and, so long as we have their approbation on our exertions, shall be stimulated to further exertions in our endeavours to raise agriculture in New South Wales to the proud eminence as an honorable calling and an exact science which it has long enjoyed in the most highly civilized countries of the Old World.

Sporobolus indicus. R. Br.
(Parramatta or Tussock Grass.)

The Grasses of New South Wales.

(*Continued from Vol. II, page* 238.)

By F. TURNER, F.R.H.S.,
Botanist to the Department of Agriculture, New South Wales.

SPOROBOLUS INDICUS, *R. Br.* "Parramatta or Tussock Grass." *Flora Austr., vol. VII, p.* 622.

An erect tufted grass of 1 foot to 2 feet, glabrous except a few cilia at the base of the leaves. Leaves chiefly at the base of the stem, narrow, ending in fine points, the upper ones few with long sheaths. Spike-like panicle very narrow, 3 to 8 inches, or even longer, continuous throughout, or when long often much interrupted. Spikelets very numerous, crowded along the very short, erect, almost imbricate or distant branches. Outer glumes almost hyaline, obtuse, one-nerved, the lowest about ½ a line, the second ¾ line long, flowering glume about 1 line, of a firmer consistence, broad, but almost tapering to a point, one-nerved (the whole spikelet rather smaller in some specimens). Palea nearly as long, faintly two-nerved. Grain broadly obovoid, the very thin pericarp sometimes appearing loose, though often evanescent or undistinguishable in the dried state.

An erect growing tussocky grass, sometimes attaining a height of 2½ feet, and found generally all over the coastal districts, and in some situations very plentifully. In fact, in some places, where land has been broken up and sown down with exotic grasses, this species is now master of the situation, much to the disgust of dairy farmers. Whilst in a young state it affords capital feed, but when old is very tough and wiry, so much so that it will loosen the teeth of horses and cows when kept too long on pastures where this grass predominates. Owing to the tough nature of this grass, I have often recommended it for paper making. If it did prove valuable for this purpose there is plenty of material in the Colony to fall back upon. The Sporobolus is a prolific seed bearer, and the seeds are eaten by many small birds. They ripen at various times of the year, but principally in the summer and autumn months. There is a variety (*var elongatus*) of this grass with narrower leaves, and a longer and looser panicle. With these exceptions, however, its qualities are much the same.

A few weeks ago Messrs. Anderson & Co., seedsmen, Pitt-street, Sydney, received a letter from a firm of seedsmen in New Zealand, offering to supply seed of a grass that was largely grown there under the name of *Alopecurus Agrostis*, commonly called "Cat's tail," and praised up its qualities. Messrs. Anderson sent to ask if I knew a grass by such a name, I told them there was no such species, as it was a fictitious name, and simply two generic ones of distinct grasses. I advised that specimens of this wonderful grass should be procured before an order was given for any seed; my suggestion was acted on, and a specimen obtained, and I identified it as *Sporobolus indicus, R. Br.* The New Zealand firm informed Messrs. Anderson & Co., "that they had received some good orders from Sydney for the grass." If such is the case it is sincerely to be hoped that the seed will not be distributed to our farmers or pastoralists. If this is done, however, it will be quite in keeping with what has been the practice for many years past—the importation of of useless grasses to the country. Thousands of pounds have been sent out of the Colony to import exotic grasses, which have turned out failures in this land of drought and flood. As I have pointed out time after time, we have far superior grasses to any that have been introduced. This I have proved by actual experiment. If only a part of the money that has been sent out of the Colony to import exotic grass seeds, had been devoted to the cultivation, or even systematic conservation of the best of our native ones, we should not hear periodically of cattle and sheep dying in thousands during every recurring drought. It is satisfactory to know, however, that much more interest is now being taken in our indigenous forage plants and grasses than formerly, and many inquiries are now made of the Department respecting them.

Reference to plate.—A, a portion of the panicle showing the arrangement of the spikelets on the rhachis; B, spikelet—the caryopsis ejecting its seed; C, showing the relative size of the outer glume to the flowering one; D, two different views of the grain. All variously magnified.

Deyeuxia Billardieri. Kunth.
(Bent Grass.)

DEYEUXIA BILLARDIERI, *Kunth.*, "Bent Grass."

Flora Austr., Vol. VII, p. 580.

Stems sometimes very short and tufted, usually about 1 foot high or more; leafy to the inflorescence, which is usually enclosed at the base in the broad sheath of the upper leaf. Panicle, when fully out, often nearly 1 foot long, though sometimes much smaller, with long capillary-divided branches in regular whorls; outer glumes very narrow and pointed, about 3 lines long; flowering glume not half so long, quite glabrous, with two narrow pointed teeth; the dorsal awn attached much below the middle, and rather longer than the outer glumes; palea short and narrow; rhachis produced into a hairy bristle.

This species and *Deyeuxia forsteri* (Kunth.), having many intermediate forms, are often closely connected, but in the typical species the plants are so structurally different as to be easily distinguished. The details of the inflorescence of this species are much larger than those of *D. forsteri.* When growing together even the most superficial observer can distinguish between the two; *D. billardieri* has wide leaves, and a slightly reddish inflorescence, while *D. forsteri* has narrow leaves, and a light-coloured inflorescence. The species under notice has an extensive range of growth in the coastal districts, being found from Illawarra to the Tweed. It usually grows from 6 to 18 inches high, according to the soil or situation it is found in. On rich moist pasture land it will grow throughout a greater part of the year, but on high dry land it will die about the beginning of December It is a capital winter and early spring grass, and on good soils it yields a fair. quantity of rich succulent herbage, of which sheep are very fond. It produces a quantity of seed, which ripens in October and November.

Reference to plate.—A, spikelet; B, floret; C, grain, back and front views. All variously magnified.

PASPALUM DISTICHUM, *Linn.* "Water Couch."

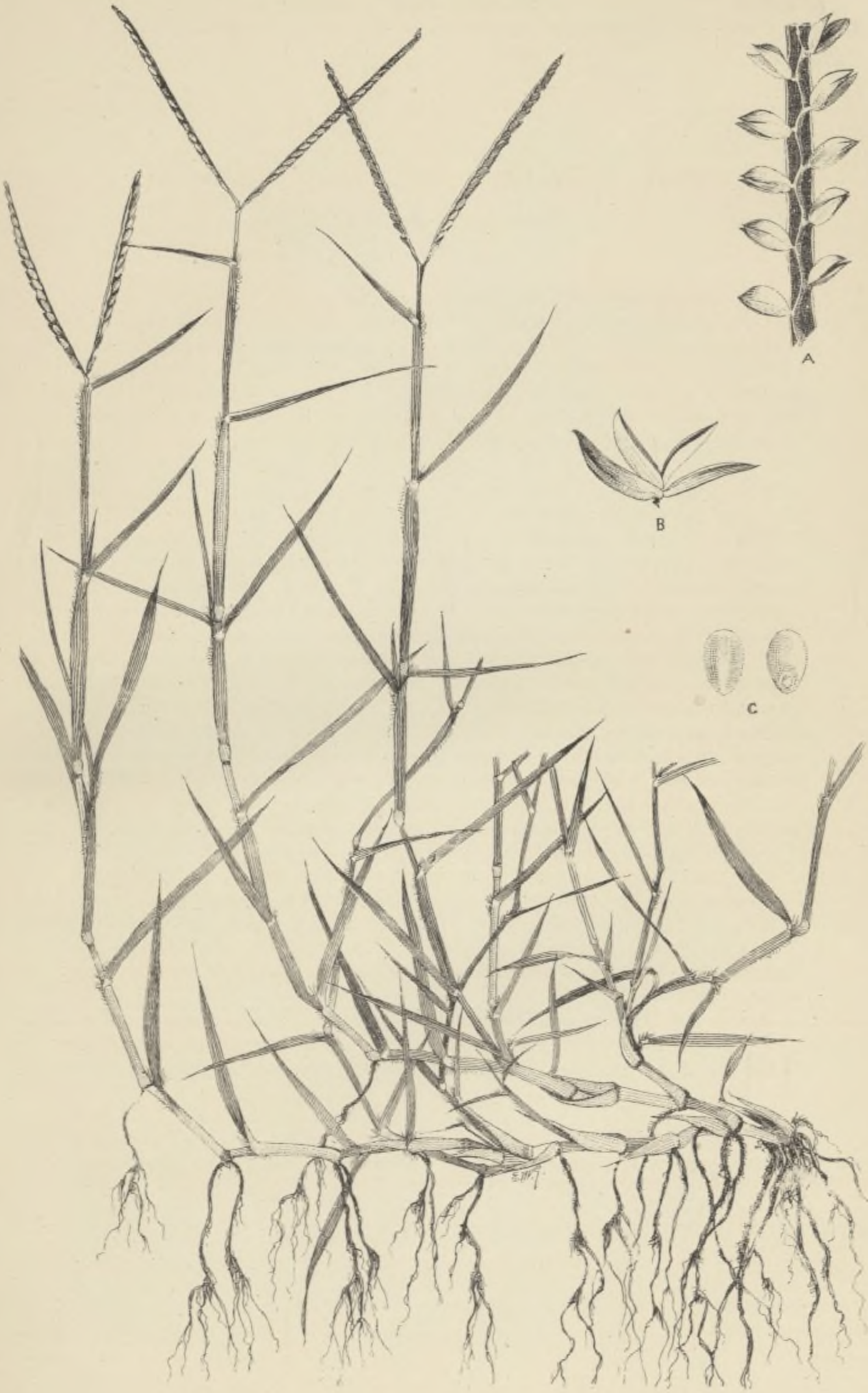
Flora Austr., Vol. VII, p. 460.

STEMS often creeping and rooting in the sands to a great extent, the ascending extremities, varying from short, and entirely covered with the leaf-sheaths, to slender 1 foot long or more, with the leaves distant; leaves, either linear-lanceolate and flat, or involute and almost subulate, glabrous, or with a few long hairs at the orifice of the sheath and base of the lamina; spikes, two, close together, or the lowest at a distance of 1 to 2 lines, quite glabrous, the rhachis not above ½ line broad; spikelets, sessile, in two rows, oval, oblong, acute, or acuminate, flat, 1½ to nearly 2 lines long; outer empty glumes equal, and distinctly three-nerved; fruiting glume hardened, and very faintly three-nerved, or the central nerve alone perceptible.

This creeping, rapid-growing, perennial grass is found generally in swampy places, or on moist land, and sometimes in water, but always in the coastal districts, and sometimes close to the sea. It is exceptionally well adapted for covering waste moist lands, the banks of rivers and dams, which it binds very firmly once its underground stems get well established in the soil. Periodical inundations will not destroy it, but it is injured by frosts. This grass yields a great quantity of valuable herbage, which stock of all descriptions are remarkably fond of. It is a poor grass, however, for making into hay, as it turns black in drying. Butter made from the milk of cows fed exclusively on its herbage is quite white, but in no other way is it affected. Under ordinary circumstances this species remains beautifully green throughout the summer months, and some persons have been tempted to plant it on lawns, with rather serious consequences, however, for to keep it in anything like order during the summer months, it requires cutting two or three times a week, and it is as bad as the ordinary couch to get out of cultivated land. It produces an abundance of seed, which ripens in January, February, and March. There is a variety (*var. littorale*) of this grass, which is found only in or near brackish swamps, and only differs from the one described last by its narrower leaves; with these exceptions, its qualities are very much the same.

Baron von Mueller and L. Rummel give the following chemical analysis of *Paspalum distichum* (Linn.), made during the spring time of the year:—Albumen, 2·20; gluten, 7·71; starch, 1·56; gum, 1·64; sugar, 5·00 per cent.

Reference to plate.—A, a portion of the spike, showing the arrangement of the spikelets on the rhachis; B, a spikelet, showing the outer glumes, fruiting glume, and palea; C, grain, back and front views. All variously magnified.



Paspalum distichum. Linn.

(Water Couch.)

Datura Stramonium. Linn.
(Thorn-apple, Devil's Trumpet, Stink Weed.)

The Weeds of New South Wales.

(*Continued from Vol. II, page* 175.)

BY F. TURNER, F.R.H.S.,

Botanist to the Department of Agriculture, New South Wales.

DATURA STRAMONIUM, *Linn.* "Thorn Apple," "Devil's Trumpet," "Stink Weed."

A COARSE, weedy annual, sometimes attaining a height of 3 or 4 feet. The leaves are very unequal in size—the larger ones often 8 or 9 inches long, ovate in outline, rather flaccid, the margin undulated, and deeply indented with large, irregular incisions, forming unequal spreading teeth. Flowers, solitary, and shortly stalked, corolla funnel-shaped, white, 3 to 4 inches long, and about 2 inches wide at the mouth, with five spreading or recurved lobes. Stamens, five, inserted in the corolla tube, and included in it. Fruit, about 2 inches long, thickly set with unequal, sharp, rigid spines. The thorn-apple is considered by De Candolle to be indigenous to the countries bordering the Caspian. It is now spread as a weed nearly all over the warmer and temperate parts of the earth. In this Colony the seedlings generally spring up in September or October, and continue growing till April or May, when the plants usually die out, although I have seen them growing occasionally in winter, but only in very sheltered situations. In many places—but principally in the coastal districts—the plant may be seen growing plentifully during the summer months. When growing in pastures it is really a dangerous weed, for I have known it to poison milch cows that have partaken of it, and no pains should be spared on the part of any one who keeps cattle to exterminate it from grazing lands. When it is allowed to grow undisturbed for a time it produces a phenomenal quantity of seed, which will, when ripe, germinate readily any time during the summer months, whilst there is moisture in the soil, so that the area of its occupation gradually widens from year to year. The very same thing takes place with many other introduced weeds, especially those from the northern parts of Europe and America; and, although they may be strictly annual in those countries, often, in a good season here, they will produce three or four successional crops from seed ripened at different times in the same year, so that our cultivators sometimes have to war against annuals, almost as much as if they were perennials.

I have very often given the leaves of the "thorn-apple plant" to persons suffering from asthma, and recommended them to smoke it—but with caution, and not too often—as they would tobacco, and when they have done so it has given them great relief. When used for this purpose the leaves should be partially dried in some place away from the influence of the sun's rays. Bailey and Gordon (Queensland) include the "thorn-apple plant" in their "Plants Reputed Poisonous and Injurious to Stock," and say that "the plant is decidedly poisonous." Much comment was made in this and the adjoining colonies about a notice of the thorn-apple plant published in the *Sydney Mail*, 5th April, 1890, by J. H. Maiden, of the Technological Museum, Sydney. The writer said, amongst other things, that "the plant has a disagreeable taste, and cattle will not touch it, so that stock-owners need have no anxiety about it." To this statement Mr. P. R. Gordon, Chief Inspector of Stock, Queensland, wrote the following letter to the Editor, *Sydney Mail*, and it was published on the 19th April, 1890:—"In the notice of the abovenamed plant in your issue of 5th April, Mr. J. H. Maiden says 'that cattle will not touch it, so that stock-owners need have no anxiety about it.' In this Mr. Maiden is entirely wrong. Quantities of this plant grow in the neighbourhood of Toowoomba, and there have been many deaths in cattle from eating it. These deaths have not been mere cases of surmise. When the Board of Inquiry into 'Diseases of Live Stock and Plants' (of which I was *ex-officio* secretary) was in existence in this Colony, the stomachs of several cattle that had died in paddocks close to Toowoomba were forwarded to the Board, and analyzed by the late Karl T. Staiger, then Government Analyst, and in each instance the analysis showed death to have been occasioned by the animals having eaten the thorn-apple plant. It may be remarked that in each instance the poisoning was confined to quiet milking cattle, and it will be found, as a rule, that mortality from poisonous plants is confined to quiet milkers, or their progeny. These pet animals will nibble at and eat plants that ordinary bush cattle will not touch, unless forced to do from sheer starvation."

The following extract is from Bentley and Trimen's *Medicinal Plants*:—"The activity of both the leaves and seeds of *Datura stramonium* are due to the highly-poisonous alkaloid *daturia* or *daturine*; and although we have no chemical proof of the existence of this alkaloid in the other species of *datura* alluded to under the head of substitutes, its presence in them can scarcely be doubted . . . . . according to Schroff, *atropia* has twice the poisonous energy of *daturia*; whilst Jobert, again, regards *daturia*, when applied to the eye, as about three times as powerful as *atropia*, and more constant and lasting in its operation . . . The properties of *stramonium* are regarded as anodyne and antispasmodic, and, in overdoses, a powerful poison. It has been found useful in neuralgic and rheumatic affections, in gastrodymia and other painful diseases, and some have regarded it as a very valuable remedy in mania and epilepsy, but in these diseases it not unfrequently produces injurious effects. When used during paroxysms of spasmodic asthma it commonly gives temporary relief, and facilitates expectoration. In the latter disease, and also in dyspnœa, catarrhs, and in other cases, the leaves are generally smoked, like tobacco, or inhalation from their infusion in warm water is resorted to. But its use in these ways requires caution, as it has proved highly injurious, and, in some instances, fatal. In Cochin China a strong decoction of the leaves is regarded as a very efficacious remedy in hydrophobia."

The Rev. Dr. Woolls, F.L.S., informs me that a child died near Richmond from swallowing the seeds of stramonium.

Reference to plate.—A, a flower, laid open to show the arrangement of the five stamens and pistil; B, the fruit, showing the leathery pericarp, dehising by four valves; C, a seed, which is somewhat kidney-shaped, and covered with large, shallow, pits.

Glycyrrhiza glabra. Linn.
(Liquorice)

New Commercial Crops for N. S. W.

(*Continued from Vol. II, page* 242.)

By FRED. TURNER, F.R.H.S.

The Cultivation of the Liquorice Plant (*Glycyrrhiza glabra*, Linn.)

The liquorice of commerce is obtained from the roots of a perennial plant indigenous to Southern Europe, Central Asia, and Northern Africa. It is cultivated extensively in Spain and Italy, more sparingly in America, France, Germany, Russia, and China, and also forms an important crop in some parts of England. There are a few well-marked varieties of the plant, but the roots, which are the commercial article, have the same principles pervading them. In the typical form the plant usually grows from 3 to 4 feet high, and is clothed with pinnate leaves. The leaflets are ovate, rather retuse in outline, and somewhat clammy beneath as also are the branches. The flowers are pale blue, and are arranged in spikes, or racemes, on peduncles, but shorter than the leaves. These are succeeded by small pea-shaped pods containing about four small seeds. I have seen acres of the liquorice plant under cultivation, and, in my schooldays, I have made many small investments in the roots, at the time of year they were being lifted out of the ground. The liquorice plant might be cultivated successfully in the colder parts of the Colony, but I do not think that its cultivation would be attended with any great success in the warmer parts of New South Wales. I tried to grow the plant in Southern Queensland, but it did not prove a success. The climate seemed too hot for it, and, although the plants lived and grew for many years, yet they never looked happy. The roots, too, were small and fibrous in texture, but sweet to the taste, and no one who had tasted the liquorice root, as grown in Europe, could have mistaken them as belonging to any other plant. In hot and dry situations the leaves of the liquorice plant are terribly subject to the attacks of an insect known to cultivators as red spider and to entomologists as *Tetranychus telarius*, Linn. When this pest gets the upper hand the leaves fall off; consequently, the growth ceases at a time when the plant ought to be in vigorous health, if good results are looked forward to, and this is the aim of all intelligent cultivators.

The soil best suited to the growth of the liquorice plant is a deep, rich, rather sandy loam, which must be thoroughly drained, if not naturally so situated, because the roots penetrate the earth for 5 or 6 feet in suitable soils, and where bad drainage exists the roots would show signs of decay, which, of course, would deteriorate their value from a commercial point of view. The land should be worked deeply with the plough and subsoiler a few weeks before it is time to plant, so that the sun and air will have free access to the soil, under which influences it will sweeten and be rendered more friable. If the land is not naturally fertile it should be well enriched with manure (farmyard manure is the best, if it can be obtained, but it must be thoroughly decomposed). This should be ploughed in some weeks previous to planting. A few days before the latter operation takes place the land should be well harrowed down.

Propagation of the Liquorice Plant.

This is effected by seed, and by portions of the creeping underground stems cut into 4 or 6 inch lengths. Each cutting must have two or three buds on it, from which will develop the future plant. The cuttings should be taken in the late autumn or winter months, whilst the parent plant is at rest, and be packed away in sand or earth in a cool place until it is time to plant them in their permanent quarters. It may be considered a rather tedious process to raise the plants from seed; but where root cuttings cannot be obtained in sufficient quantities, as is often the case in introducing a plant to a new country, this means must be resorted to. The seed should be sown in the month of August or September. Choose a piece of rich sandy loam, and bring it to a fine tilth; on this strike out some shallow drills 1 foot apart; in these sow the seed very evenly and thinly, and do not cover them too deep, ½ an inch will be quite sufficient. If the seeds are old and very hard, they should be steeped in water for several hours before sowing; this will soften them, and germination will take place more rapidly. Under ordinary circumstances, the seedlings will appear above ground in about three weeks from the time of sowing. Under favourable conditions the seedlings will be strong enough for removal to their permanent quarters when they are twelve months old. If left in the nursery rows, however, until the second year's growth is completed, they will make a number of roots from which cuttings can be made. The only attention that the seedlings require is to keep the soil stirred occasionally with the hoe, and clean of weeds between the rows, and in the winter months cut the tops off close to the ground. There is a decided advantage in raising liquorice from seed, although it does take a little longer for the seedlings to develop into plants, because they would sooner become acclimatised in a new country than plants would do from imported roots. The seed can be sown to suit our seasons, but the roots are at rest in Europe in the height of our growing season. If roots were imported from Great Britain, they would land here in February or March, and if planted (which they should be on arrival) would begin to grow, and, after a short time, be suddenly checked by our winter coming on. Having had a great deal to do with the importation of roots of various kinds of plants from many countries, especially antipodean ones, I can say from experience that great care and attention has to be paid to them until they get acclimatised. Of course, I would not recommend seed to be sown after the first lot of plants had been raised, for then a sufficient number of acclimatised cuttings could soon be obtained to plant large areas.

Planting.

The best time of the year to plant liquorice in this Colony is in August or September. The cuttings should be planted in rows 3 feet apart, and 18 inches apart in the rows. After the latter are marked out, a man should follow on with a number of roots rolled up in a piece of wet bagging, to prevent them drying up while the planting is going on, then with a spade dig out small holes at distances of 18 inches apart. Into each hole place a cutting in a perpendicular position, press the earth round it firmly, and leave it covered over to the depth of 2 or 3 inches. Under ordinary circumstances, the young growths will appear above ground in about a month or five weeks after planting. If the land is in a good fertile condition, such dwarf-growing crops as French beans, lettuce, onions, turnips, &c., may be planted between the rows of liquorice during the first year of its growth. Such crops would serve the double purpose of keeping down weeds, and return some profit to the farmer, whilst the liquorice was occupying the land.

Cultivation.

Whilst dwarf crops are growing between the rows of liquorice, cultivation will have to be done with the hoe, but after these crops are worked off the land it can be accomplished with a one-horse scarifier. With the exception of keeping down weeds, and the soil in a loose condition between the rows, the liquorice will require no further attention during the summer months. Every winter, however, when the sap has gone down, the leaves of the plant will turn yellow. Then the stems should be cut down with a pruning-knife to the level of the ground. The stems should then be carried off the ground and burnt. If any cuttings are required for making a new plantation, or extending an existing one, they may be procured at this time, by forking up the numerous spreading roots that grow near the surface of the soil, and cutting them off close to the main stems. They may then be cut into lengths for cuttings as previously mentioned, and stored in a cool place in sand or earth for future planting.

Digging up the Roots.

It will be nearly three years from the time that the cuttings are put into the ground until they are ready for lifting. The operation should be done in the winter time, when the sap is down, because at that period the roots have stored in them all their valuable constituents. A trench about 3 feet deep should be taken out at the end of each row, and continued up the row. as each root or roots are opened up a rope should be fastened round the tops of them and pulled up, after which they may be stored in sand, or if there is a large quantity, they may be put into pits, like potatoes, taking great care, however, that they do not sweat. The downward running roots, as well as the long horizontal ones, which they throw off below the surface of the earth, are all saleable after they are sorted. If the farmer wants to turn his produce into a marketable commodity without further delay, the roots, after being dug up, may be washed, trimmed, and sorted, and then either sold fresh in their entire state, or cut into short lengths and dried in the sun or in kilns. It enhances the value of the roots if they are care-carefully peeled before being dried. Liquorice is usually sent to the market in bales, bundles, or bags. In a fresh state the liquorice root is of a bright, yellowish brown colour when washed, flexible, easily cut, internally yellow, and juicy. The principal constituents of liquorice roots are glycyrrhizin, a peculiar sugar, asparagin, starch, and a little tannic acid.

Manufacture.

The way to make the extract from the root is a very simple process, and might be done by any farmer who is possessed of a good copper boiler. First of all the roots are thoroughly cleaned, and, after being partly dried by exposure to the air, are sliced up into small pieces, and boiled in water until the liquid is thoroughly saturated with the sweet juice. It will require a little experience on the part of the operator to know what proportions to use and how long it should be boiled. If boiled too long it loses some of its sweetness. After the mass has been boiled a sufficient length of time the liquor should be allowed to rest, to allow everything to settle. The liquor is then strained, and allowed to evaporate until it becomes of a proper consistence. The extract is then run into boxes, or made into rolls about 5 or 6 inches long, about the thickness of a man's thumb, which are partly dried in the air, and then packed in the leaves of sweet bay (*Laurus nobilis* Linn.), when they are ready as a marketable commodity. What is called refined liquorice is simply the common liquorice dissolved in water, and again evaporated. Liquorice powder is made by pulverising the dried root, and it is used in the preparation of pills. Liquorice is used for a great many purposes; medicinally, as a flavouring adjunct to nauseous medicines, and also as a demulcent in catarrhal affections, &c. As an ingredient in the brewing of porter it is extensively employed in England, and also in the preparation of tobacco for chewing and smoking. The world-renowned Pontefract lozenges, or as they are called in Yorkshire "pomfret cakes," are made from the refined form of liquorice. If the liquorice root was grown in this Colony there it no doubt but what it would be used by our cordial manufacturers, brewers, confectioners, druggists, &c., in preference to the imported article. If we must believe some authorities, liquorice is subject to much adulteration, such admixtures as barley, cane sugar, chalk, gelatine, potato flour, rye, rice, starch, wheat, &c., are frequently employed for this purpose.

Accum says, that "Spanish liquorice is frequently nothing else than a mixture of the worst kind of gum-arabic imported for such inferior use as that of assisting in the manufacture of shoe-blacking. A solution of the genuine liquorice is mixed with a solution of the gum, and the mixture, after being evaporated to a proper consistence, is again made up into cylindrical rolls, which, while still moist, are covered with bay leaves, and repacked in chests to resemble in every respect the genuine Spanish liquorice imported from Catalonia. It is difficult to detect this fraud. Genuine Spanish liquorice should be perfectly black, brittle when cold, and break with a smooth and glassy fracture. It should not become sensibly clammy or damp when exposed in a dry place; it should be sweet, without any flavour of burned vegetable matter; and be soluble in water without leaving any residue."

Christy says that the market value of the liquorice root in London is from 16s. to 18s. per cwt. The wholesale market value of liquorice root in Sydney is £2 6s. 8d. per cwt. The wholesale market value of the manufactured article in Sydney is £5 12s. per cwt.

Reference to plate.—Which shows a part of the root, and an upper growth of the plant, with two spikes of flowers, arranged in the leaf axils; A, a single flower; B, a seed-pod; C, seed.

The Cultivation of Manila Hemp (*Musa Textilis*, Nees).

By F. TURNER, F.R.H.S.

Manila hemp, or abaca of the natives of the Phillipine Islands, is made from a species of banana or plantain, known to botanists as *Musa textilis*, Nees. The following description of the plant is given by M. Perroutel, a French botanist, in the *Annales Maritimes et Colonailes de France*:—"The abaca of the Phillipines differs essentially from all the varieties of bananas known. Its stem is 15 to 20 feet high, of a dark green colour, and very smooth on the surface. Its leaves are of the same colour, long, straight, with strongly-marked nerves. The fruit is small and triangular, resembling abortive bananas, and scattered here and there near the extremity of the fruit stem. It is full of black seeds, almost round, similar to those of the gombo. The seeds fructify readily after planting, and the young plants are strong and vigorous, attaining the dimensions already indicated within the short space of eight or nine months. The plant requires a rich, humid soil, and flourishes in thick forests at the base of the mountains, where it acquires, in a short time, an extraordinary development."

The Manila hemp plant is a native of the Phillipines, where it is cultivated extensively for its fibre; in fact, at the present time these islands are the principal source from which the world's supply of this article is obtained. The exports from Manila to various parts of the world amount to some thousands of bales annually, and great quantities of the raw material arrive in this Colony every year. Messrs. Forsyth & Co., rope manufacturers, Sydney, alone use 600 tons annually. As there is an increasing demand for the fibre, and already a good home market for the produce, there is no reason why its cultivation should not be started in the north-eastern portion of the Colony. The Manila hemp plant is, or was a short time ago, growing in Australia, and it proved quite as easy to cultivate as any other kind of banana. As there is a great deal of confusion amongst English-speaking people about what species of *Musa* should bear the name plantain, and what species should bear the name banana, I shall adopt the latter in this article, as being the least likely to lead to confusion. *Musa paradisiaca*, Linn., is commonly known as the plantain, and *Musa sapientum*, Linn., as the banana, but many learned authorities regard the latter one of these two plants only as a variety of the former, therefore, it would not seem right to give the name plantain to the species and banana to the variety. Moreover, the name plantain is the common one of some species of plantago, and the ubiquitous *Alisma plantago*, Linn., is known as the water plantain.

Besides the *Musa textilis*, there are several other kinds of bananas which yield a good fibre, and it has often occurred to me that it was a somewhat unfortunate circumstance for our farmers that the stems (which are formed of the united stalks of the leaves) of the bananas which are at present cultivated in this Colony could not be turned to profitable account after the fruit had been gathered from them. The stems are usually cut down after this to make room for the suckers, which supply the successional crops of fruit, and are left on the ground to decay—sometimes they are dug in for manure—or are carted off the land to rot in some out of the way place. In this way there must be some thousands of tons of stems left to rot annually in Australia, the fibre from which might serve some industrial purpose, such, for instance, as making into paper, if a simple mechanical contrivance were invented to separate it in a cheap and efficient manner. The paper manufacturer is often asking for raw material to carry on his work, and many kinds of things are suggested, and some of them brought into use. But from the banana an unlimited supply could be obtained, which is only waiting improvements in machinery to treat it in a rapid and cheap way. Of course the fibre contained in the stems of the bananas, which yield us such luscious fruit, is not so strong, nor yet so valuable, as that obtained from *Musa textilis*. It cannot be expected that good fruit and the best of fibre could be obtained from the same plant.

Although the banana that produces the Manila hemp is a robust growing plant, still it cannot be grown successfully as a commercial product much further south than the Clarence River, but between this river and the northern boundary of this Colony it should grow admirably in suitable situations.

The Site for a Plantation.

The site should be a north-easterly one, and on the side of a hill, or on a gentle slope, well sheltered against westerly and southerly winds. Nothing harms any of the banana tribe of plants so much as stagnant moisture and strong winds. The leaves are torn to shreds when the plants are grown in exposed situations. The soil best suited to the growth of the Manila hemp plant is of a fairly rich volcanic nature, and of fair depth. Some time previous to planting the land should be well broken up, cleared of all rubbish, and brought to a good tilth.

Propagation of the Manila Hemp Plant.

This is effected by seeds and by suckers. Once a plantation is formed, however, the latter mode of propagation is the most expeditious one, because the offsets, which form readily at the base of older plants, are easily detached with a few roots to them, and can be transplanted with the greatest ease during the autumn or spring months. If the plant is raised from seed October is the best month to sow it, but some little care and attention is required during the early stages of growth of the seedlings. Having been very successful in raising a great many bananas from seed, I may here mention how it was done. First of all, I had a number of 60-sized (3-inch) earthenware pots (but bamboo ones will do) prepared with about half an inch of charcoal put in the bottom for drainage. The pots were then filled nearly to the rim with a light open soil. In the centre of each pot one seed was placed, and just enough soil put on to cover it over. The pots should not be left too full, or they will not allow the plants to receive the water they require. After the seeds are sown, the pots should be removed to a warm corner, or in a frame, if one is at hand, and set on ashes, which will prevent worms entering them. They should be kept shaded from the hot sun during the middle of the day, and regularly watered. Under these conditions the seeds will not be long before they germinate, and the seedlings will grow at a rapid rate. By the end of December the plants will be getting too large for the pots they were raised in, and to have some vigorous plants for planting out when the season comes round, they should be transferred singly to some extemporised wooden boxes, about 1 foot square and 1 foot deep. Drain the boxes well (after boring a few holes in the bottom to let out the superfluous water), and nearly fill them with a similar compost to that the seedlings have been grown in. Water the plant regularly, but with discretion, and shade the plants until they have made new root action. With ordinary care and attention, the plants will be in first-class condition for planting out in March.

Planting.

The most favourable seasons of the year for planting are spring and autumn. Provided there is a sufficient amount of moisture in the soil, the best months for planting are September and October in spring, and February and March in autumn. The proper distance to plant is 15 feet apart between the rows, and the same distance between the plants. At this distance it will take 193 plants to the acre. When everything is ready, and the season has arrived for planting, if suckers are to be had, they should be carefully taken from the old stools, so as to preserve as many roots as possible. Before planting make the holes wide enough to allow the roots to lie in an horizontal position, and deep enough to allow the young plant to be put down as low in the soil as it was when attached to the parent plant. The finest of the soil should be placed over the roots, and when the hole is filled in, it should be made firm about the plant with the foot. The seedlings will require a somewhat similar treatment when planting them. The plants will require no further attention until the stems are ready for cutting, except, of course, to keep the plantation free from weeds, which can be done with the scarifier. During the first year, a crop of maize, or any other dwarf-growing annual crop, may be planted between the rows without the slightest interference to the well-being of the bananas; besides, the produce would help to pay the working expenses until the stems were ready for cutting down, which will be from ten to fifteen months (this is my observation on the plant as grown in Australia), according to the strength of the plants when they were planted. The first crop will consist only of one stem to each plant that was set out, but successional crops will be heavier, and in large plantations the cutting can be carried on during a great part of the year, for, when the plant gets established in good soils, new suckers are produced very plentifully, and they soon develop into matured stems. To obtain the best and strongest fibre, the stems are cut down to the ground the moment they evince signs of flowering.

Simmonds says:—"The abaca has very little care bestowed on its cultivation, being grown only for its stalks, and it is an advantage rather than otherwise that its fibres should retain their natural coarseness and tenacity. Nor does it require so rich a soil as the edible varieties. It is usually planted on the slopes of mountains, where the land has been newly broken up. The ground is carefully and frequently cleared of all obnoxious weeds during the growth of the young plant, and the stalk is cut when the fruits first make their appearance. At the end of the first crop they have, monthly, good suckers springing up, and that, too, during the whole time that the plantation lasts, which is from five to seven years. The duration, of course, varies with the nature of the soil, the fertilising properties of which this crop exhausts very rapidly, especially as no manure is applied. The textile material is obtained in the following manner:—The stems are cut down and stripped of their leaves. It is next divided into long strips of two fingers in breadth, then passed between a thick plank, placed in a horizontal position, with a knife resting edgewise. The material is then drawn through with one hand, whilst the other presses heavily on the back of the knife, and in this manner the pulpy matter is scraped and cleared off, leaving the textile fibres bare. These are put to dry in the sun, care being taken to protect them from rain and moisture. They are then beaten lightly with sticks, again exposed to the sun, and lastly the filaments are separated according to their degrees of fineness. In this manner three sorts of fibre, of varying quality, are obtained; the first, called *bandala*, from the outer sheaths of the stem, which is the strongest and coarsest, and from which ropes, &c., are made; the second, known by the name of *lupis*, which is the finest, is procured from the inner layers; whilst the third, the *tupoz*, comes from the intermediate layers of the tissue, and from this last fabrics and gauzes are manufactured. Two men employed at this work, one in separating the outer coats, the other using the knife, can prepare from 24 lb. to 26 lb. avoirdupois a day. If the process be properly conducted, at least 1 lb. of thread, or, taking the produce of 2¼ acres for a whole year, 3,520 lb. of abaca will be obtained, worth at Manila about £20. The abaca intended for weaving is bruised in a mortar, and thus reduced into a kind of ball, about the size of a child's head. This operation has the effect of rendering the threads more flexible and resistant. These threads, having been joined together by women or children, are woven after the manner of cotton, and the texture is immersed in water, with a little shell lime for a day and a night; afterwards they are cleaned in fresh water, and left to dry. If mixed with silk or cotton, a beautiful texture is produced, very fine and valuable, and applicable to a variety of purposes. Machines have been invented to remove the fibre from the pulp, but few are used. One was exhibited at Manila about three years ago, very simple in its construction, and apparently producing results vastly superior to the ordinary mode I have described of manual labour. The exhibition of this machine produced a great excitement, and it was proposed, and countenanced by the Captain-General, to give a large premium to the inventor. The subject died away, however, and the machine disappeared from public view. It is probable that the criticisms of experienced people formed some drawbacks to the perfection generally ascribed to the invention; but, without possessing the slightest mechanical knowledge, the impression which its structure and effect made on persons capable of judging was extremely favourable. There was no intricacy in its machinery, wood was its only material, and a buffalo its moving power; a village carpenter could make one from a model, and its results were tenfold or more greater than by the ordinary course. I cannot affirm that the model has not been applied; but there are circumstances or influences in regard to the natives here and the culture of this production, and, indeed, of all others unfavourable to the extensive adoption of machinery. The imports of Manila hemp into the United Kingdom for the year 1888 were 695,579 cwt., valued at £1,230,742."

Another authority says:—"As to tenacity, compared with English hemp, it stands as follows:—A rope of Manila, 3¼ inches in circumference and 2 fathoms long, stood a strain of 4,669 lb. before giving way, while a similar rope of English hemp broke with 3,885 lb. A second test of rope, 1¾ inch in circumference, and the same length, gave 1,490 lb. for the Manila, and 1,184 lb. for the English hemp."

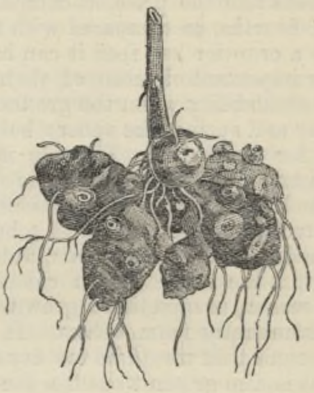
At the London sales, in March last, Manila hemp changed hands at £40 and £41 for good marks, £39 for current, £35 for seconds, and £33 for brown.

The Jerusalem Artichoke.

By J. A. DESPEISSIS, M.R.A.C.

The Jerusalem artichoke is a perennial plant of the sunflower genus, with erect stems 5 to 8 feet in height, but producing year after year underground shoots, which are swollen into genuine tubers, of a violet-red colour, about 2 inches in diameter, marked with hollows and scale-like enlargements. Its area of cultivation extends from the south of France and Italy to Norway.

Like the potato, the tubers (*Rhizomes*) are used for culinary purposes, whilst, as a fodder, they increase the milk of cows to an extraordinary degree, and are preferable in many respects to potatoes for feeding pigs. Horses, cows, and sheep eat them too with a relish, preferring them even to corn. The illustrations refer to the aspect and the habit of growth of the plant, and the way the tubers are attached in cluster to its roots.



Jerusalem artichokes under the name of *Topinambour*, are extensively cultivated in France for distilling purposes, as are potatoes and beet roots, yielding as much as 7 to 9 per cent. of absolute alcohol.

According to Payen, the average analysis of the tubers of Jerusalem artichokes is as follows:

Water		76·04
(1) Glucose and crystallisable sugar	14·70	
(1) Inulin	1·86	
Cellulose	1·50	
Pectic acid and pectin	1·29	23·96
Albumine and N. matters	3·12	
Fatty matters	0·20	
(2) Mineral salts	1·29	
		100·00

(1) *Inulin* belongs to the amyloid group of the carbo-hydrates and occurs in the roots of some plants, among which may be mentioned the dahlia and the Jerusalem artichoke. It is intermediate between gums and starch, and yields fermentescible sugar by prolonged boiling with dilute acid.
(2) Of the *mineral salts* more than one-fifth is potash.

The composition of these tubers varies very much, according to the time they are pulled up. The percentage of *crystalline* sugar is largest during the cold season, while, during the summer, the starch-like, inulin, gummy matters and glucose prevail. The tubers form very late, and should not be dug before the stems have nearly ceased growing, viz., in the autumn.

The plant is propagated from the smallest tubers and planted like the potatoes, in the spring, but they are not cut or divided previous to planting, and they are also put at greater distances apart, viz., 3 feet between the rows and 2 feet in the lines. It sprouts rapidly and is allowed to grow unchecked without being earthed up. It flourishes in a wider range of soils and climate than the potato, and may with considerable advantage be grown in rotation with maize.

With regard to the nutritious value of the tubers of the Jerusalem artichoke, as compared with potatoes and beet root, the former contain considerably more nitrogenous substances, or flesh formers, and about the same quantity of carbo-hydrates, or heat-producers, and it is estimated that feeding with the tubers of Jerusalem artichokes bring the pound of meat to about half the price, as compared with feeding with beet root, and about three-fourths, as compared with feeding with potatoes.

As a crop for hog feed it can hardly be excelled.

An important element of their value for swine and cattle feeding is in their availability when the ground does not remain frozen during the entire winter and spring, the tubers being dug as they are wanted, without any cost for harvesting. They do not stand storing in pits or silos like beet roots and potatoes and are little susceptible of frost.

The leaves of Jerusalem artichokes, besides, constitute a very good fodder for stock; the stalks grow to a height of 6 to 9 feet. The plant does best in good soils and in the open, but it is also in a peculiar manner fitted to grow in the shade, and it can therefore be cultivated in woods, and, for this reason, is sometimes grown as cover for game, being left to reproduce itself annually from tubers. It is very often planted on gravelly pieces of ground that would be too dry for other crops, such as knolls and mounds, and it is also grown to utilise the space along the sides of hedges and in shady places.

They do remarkably well in all sorts of soils, from the light soils, too sandy for corn and "hot enough to roast an egg," to swampy soils, where beet roots could not be grown.

An average yield in fair soils, in which 14 tons of beet roots would be raised, would be about 8 tons of Jerusalem artichokes, while, in the case of potatoes, the yield would be 6 tons.

In good soil, well manured, that would produce 75 bushels of maize to the acre, the yield of Jerusalem artichokes has been found to reach 1,600 bushels or about 30 tons.

In a good average season, however, and in soils of medium quality 800 bushels, or 12 tons to the acre, is of common occurrence.

One of the best varieties of Jerusalem artichokes is the one known as *Red Brazilian.* On the table it is often served boiled, but is excellent baked, the flavour being richer and better this way.

As this crop removes from the ground a notable quantity of mineral salts, the farmers should only grow it in rotation with maize and other crops. It is sometimes grown for several years in succession in the same field, care being taken to plant each season the space between the lines, provided some manures, such as nitrogenous and potassic manures, be applied to the ground to make good the loss entailed on the ground by the removal of the crop.

In a future number of the *Gazette* I purpose comparing the feeding value of maize, roots, potatoes, and Jerusalem artichokes to stock.

Wine Fermentation.

By J. A. DESPEISSIS, M.R.A.C.

The following lecture was delivered recently by the Inspector of Agriculture before the Fruit-growers and Wine-growers' Associations at Albury and at Corowa, on the Murray, and it is published in this issue of the *Agricultural Gazette*, with a view of bringing it to the notice of wine-makers in other parts of the country :—

It has been my privilege to visit our chief wine-producing districts during this vintage, and to add to the store of practical information I have been collecting for the last year on the wine industry of the country.

Allow me to express the opinion, before proceeding further, that in general the fermentation of wines is not yet very well understood in these colonies, and all reasonable wine-makers who have met with grape must difficult to handle, will bear out this statement.

The vintage is just over, and we all have fresh in our minds the circumstances that have attended the fermentation of wine this last season. In the following paper you may find facts which will create a desire to watch more closely the progress of fermentation in your cellars, and will convince you that you cannot have better guides in this matter than your thermometer and saccharometer. Convenient methods and contrivances may suggest themselves to you for controlling, in subsequent vintages, the degree of temperature in your cellars and fermenting vats; and, in fact, design all sorts of methods for reaching the object aimed at, namely—the production of a good, sound wine, thoroughly fermented, and of good keeping qualities.

It is generally accepted as a principle, that the ultimate character of wines is in a large measure dependent on the first fermentation to which it has been subjected.

In the same manner that bad weeds and poor grass will never make good ensilage, or compare with succulent and nutritious fodder well fermented in the silo ; so, to make good wine, it is essential to have good must. The comparison, however, can hardly be upheld, as worthless weeds can be utilised with profit after having been subjected to a slow fermentation in the silo ; the result of a well-conducted fermentation is lost on bad must, and, moreover, how many tens of thousands of gallons of good must have been ruined without remedy through recklessly-conducted fermentation ?

With good must and proper fermentations, good wine is certain to be made, which clears and matures without trouble.

I may safely state that, considering the length and breadth of the Continent of Australia, its variety of climate and soils, the still imperfect method of fermenting and of maturing and casking the wines generally pursued, nowhere else do I know of an equivalent extent of country that can boast of producing wines so uniformly palatable as the pure natural wines produced in Australia.

In many cases, however, the average Australian wine-maker can hardly be made responsible for some of the really good wine he turns out. Nature should be credited for it.

His must in the first instance is generally good; as good, in fact, as can be found in most of the best wine-producing countries of the world, except, perhaps, small districts specially favoured by nature, such as the Médoc and the Sauterne districts of the south-west of France, or certain well-exposed slopes of the Hermitage and the Burgundy districts. Then, if with good must, he is favoured with a mild and even temperature during vintage time, his wine turns out almost perfect.

Most of the defects that we find in Australian wines are of the class that can be remedied; they are all defects due to the *excess of qualities*, and not defects arising from any hopeless *deficiency* in the ingredients of the must.

Ingredients of Must.

A clear understanding of the composition of the must, and what function it performs in the process of vinification, will be found of great assistance in following its metamorphosis into wine during the course of fermentation.

Water.—At the head of the list, so far as quantity goes, stands water, which, in must of average composition, enters for about three-quarters to eight-tenths of its weight. It acts as a vehicle of the other constituents of must, diluting them to the required degree, and bringing them all intimately together.

Sugar, for instance, produces alcohol in fermenting, but in order to ferment it must be considerably diluted, as, if too much concentrated, it acts on the reverse as an anti-ferment, as is illustrated in the case of fruits preserved in syrup. No liquid will ferment that contains more than half its weight of sugar.

Sugar.—Next to water sugar is the ingredient found in largest proportions in the grape mash. It enters for about one-fifth to a quarter of its weight, and sometimes more, running up in dry seasons in the Murray Districts to nearly a third of the weight of the must.

That sugar is of a peculiar kind called "glucose," and consists of a mixture, in about equal proportions, of grape and fruit sugar.

The chief characteristic of glucose, or uncrystallisable sugar, compared with cane sugar, or saccharose, is that the former can ferment, whereas cane-sugar, in order to ferment, has previously to be turned into glucose.

Another characteristic is that while cane-sugar can be turned into glucose this latter form of sugar has never yet been changed into crystallisable sugar. The inventor of a process that would achieve this would be worth more than all the mines of New South Wales put together.

During the process of fermentation the constituents of glucose, properly diluted, are broken up into substances differing from it, both in their physical and in their chemical properties, the products of fermentation being—*Carbonic acid* gas and *alcohol*, besides other bodies such as *glycerine* and *succinic* acid, which occur in small quantities, and which vary in some measure with the temperature in the vat during fermentation. The glycerine giving mellowness to the wine while the succinic acid gives it that peculiar taste known as "vinosity."

Acids.—Besides these two important ingredients, viz., water and sugar, the must of the grape contains small proportions of acids, such as tartaric acid, which occurs to a large extent in the vegetable kingdom; malic acid, or the acid found in apples, and tannic acid or "tannin."

In good must, for giving wines of the *claret* type, the acids should range from 4 to 6 *pro mille.*

The best must for producing wines which it is intended to turn into *brandies* should contain 6 to 9 of acids *pro mille.*

In *sweet* wines an acidity of 3 to 4 *pro mille* is the best.

I may add that the Murray wines contain from 3 to 5 *pro mille* of acids, and the Hunter wines from 4 to 6; the first producing sweet wine, especially Muscat and the wines of the Port type, of great value, and the second yields, under proper fermentation, a light, pleasant and healthy wine of the Claret and Chablis type.

Without the acids wine would be a mere mixture of spirits and water, of a dull, leaden colour, without any flavour or bouquet, and almost tasteless to the palate. The presence of natural acids in wine gives it, on the other hand, a brilliant and sparkling appearance, owing to their action on the colouring matter in wine; besides, by combining with the spirits, it creates those penetrating and delicate ethers which have very appropriately been called the "bouquet" of the wine. Finally, as they gently stimulate the very sensitive expansion of the nervous bundles that line the roof of the palate, they freshen up the mouth and prepare it to appreciate all the good qualities of the wine.

The presence of acids in the must exercises, besides, a wholesome effect on the progress of vinous fermentation. It must be understood that all creatures thrive best when the surroundings in which they live are congenial to their natural taste and requirements. We will see in the course of this lecture that the *yeasts*, which are the active agents of vinous fermentation, may be considered as creatures. Unlike the microbes which cause lactic and putrid fermentations, and that do best in an alkaline or a neutral liquid, the yeast fungi require, in order to perform their full amount of useful work, a slightly-acid liquid.

It is to a great extent to this simple question of the natural acidity in the grape mash that it is far more easy to make good wine than to turn out indifferent beer, and the brewer who would attempt to ferment his mash by following the same happy-go-lucky methods which find favour with many wine-makers, would produce the most unpalatable concoctions.

Saline substances are also found in musts, as potassium salts, under various states of combinations, and chiefly among these is acid tartrate of potash. That salt, commonly known as "argol" or "tartar," adds to the acidity of the must and of new wine; it is less soluble than tartaric acid in water, and its solubility decreases while the percentage of alcohol goes on increasing. It precipitates in large quantities in the lees after fermentation, and after the first drawing off it deposits slowly, under the form of crystals, on the inside of the casks.

It often happens that young wines, possessing a raw and unpleasant acid taste, improve considerably on maturing, and lose that excess of acidity which is due to the tartar.

Although that salt precipitates gradually in a liquid which contains alcohol, that precipitation is further accelerated under the influence of a cool temperature; hence the practice of maturing wine completely fermented, especially light wines, with a low percentage of alcohol, and with a marked degree of natural acidity, in cool, underground cellars. The French have a characteristic word for depicting that gradual process of precipitation of the tartar and the lees. They call it *dépouiller*, which means to eject, or excrete the dregs.

It is that tartar which is found to line the inside of casks in which wines have been stored for some time.

When in convenient proportion, it is not only a useful ingredient to wine, but also indispensable to its proper maturing.

Tartar, moreover, communicates to wine, in some measure, a peculiar character of vigour and tonicity, which not only adds to the pleasantness of its taste, but also gives it highly digestive and hygienic qualities.

Colouring matters and *essential oils*, such as produce the "aroma" in wines, are other ingredients of the must. Both are contained in cells which line the inner surface of the skin, and their extraction is made more active and more complete under the influence of heat, and the production of alcohol during the course of active fermentation.

Albuminoids or nitrogenous substances, resembling the white of egg, also occur in minute quantities, viz., 1 to 4 per cent., and are important, as entering largely into the making up of the tissues of the ferments of wine. To a certain extent, therefore, they are essential to fermentation, but when constituting a surplus their presence in wine is highly undesirable, and even dangerous, as they are very unstable bodies, easily decomposed, causing many of the accidents and diseases which occur in wines.

Certain grapes, such as the Riesling, various white grapes, and also Muscats, often contain a surplus of these albuminoid bodies, and especially so in grapes that mature very quickly, as in hot climates, and this is the case generally with grapes grown in Australia.

Such surplus albuminoid substances should be removed by all possible means, in order to insure the safe keeping of wines, and in a subsequent paragraph I shall review the modes of doing so.

Ferments.

Lastly, we must not forget the activeand primary agents of fermentations, namely, the yeast (*Saccharomyces*). These are organised cells, ovoid in shape, which contain no chlorophyll. The number of species of these interesting fungi is very great indeed, and they are found in endless varieties in the bloom which covers almost any ripe fruit which is apt to develop alcoholic fermentation. The growth of these vegetable cells—that is to say, the peculiar methods of nutrition and of multiplication by budding in a liquid containing sugar, is the primary cause of alcoholic fermentation.

M. Pasteur, to whom we are indebted for knowing so much about these active agents of fermentation, has abundantly demonstrated that the yeast fungi come from the external surface of the berries, and not from the interior, hence the necessity of crushing the berries previous to fermenting, for they must be placed into actual contact with the juice of the grape in order to perform the work assigned to them.

Some micro-organisms are coloured green and other colours, and are thus enabled to act like plants, taking their nourishment from the air. The colourless ones, like the yeast fungi, cannot do this, and are more like animals, requiring for their food some already formed organic substance, such as sugar, &c.

Like animals, they digest that food, and during that process change its nature, or split up its component parts into bodies different in their chemical as well as their physical characteristics. As we have just seen, sugar is changed through their agency into alcohol and carbonic acid, and other minor products, such as glycerine and succinic acid.

Being so small, they do not, however, like animals, take their food into their inside and digest it into their stomach, but of necessity they proceed otherwise, and get into their food, multiplying in numbers that cannot be expressed, acting upon it, and absorbing the products of digestion, using some of it to build up their own tissues, and excreting at the same time a good deal of waste of various chemical composition, until the food in which they are swarming gets so much impregnated with it that they cease to multiply, and gradualy get weakened till they finally die.

Their life history, and the temperatures they prefer, as well as the critical temperatures which affect them, have been well threshed out, and no one who has anything to do with alcoholic fermentation should ignore them.

They live within certain limits of temperature, which range, according to species, from nearly 2 degrees up to 50 ar 60 degrees C. (35 degrees F. to 122 or 140 degrees F.)

The temperature, however, which is most congenial to their healthy growth ranges from 6 to 12 degrees C. (43 to 54 degrees F.) for yeast fungi, which are the agents of "low fermentation," as in the case of Munich or Austrian beer, and from 20 to 35 degrees (68 to 95 degrees F.) for those of "high fermentation." The saccharomyces of the wine belong more properly to the second category, as do those cultivated in distilleries, and in the manufacture of stout and of English ale.

The microbes of alcoholic fermentation begin to get weak when the must they live in contains 12 per cent. of absolute alcohol. When the proportion of 14 per cent. is attained they cease to multiply to any great extent, and are altogether paralysed when the percentage reaches 15. In some cases, as for instance when the must is fermented at a high temperature, 16 to 17 per cent. of gradually formed alcohol are necessary to paralyse their action, and this is the case sometimes in the Murray wines.

Two main causes concur to check the progress of fermentation in a liquid containing alcohol in solution.

1st. The antiseptic property of the alcohol itself, and of the glycerine, owing to which specimens of animal life are enabled to be preserved in glass jars in Museums of Anatomy and of Natural History.

2nd. It must be borne in mind that alcohol is a produce of the secretion of the yeast fungi, that is to say, it is a waste matter excreted from the tissues of the minute organisms called "yeast," and cast away from their organs, as being useless, and even more, as being injurious to their healthy life.

How alcohol, carbonic acid, glycerine and succinic acid are formed in the fermenting vat, during the process of fermentation, will be easily understood after considering the analogous manner in which the higher and more completely organised animals dispose of their food.

Take for instance a horse, or even a man, and shut them up in a closed room with suitable food. They will at first eat that food with great relish, utilising part of the materials it is made of, to build up their own tissues, and also to keep themselves warm. The remainder which is not needed, is excreted:—

1st. Through the pores of their skin, as sweat.

2nd. Through the tissues of their lungs or carbonic acid which is breathed over.

3rd. Through their kidneys.

These animals if left for a sufficient time in that uncongenial atmosphere, without renewing it by the introduction of fresh air, and the purging away of the excreted products offensive to them will gradually get weak, then be paralysed as it were, and finally die.

In a similar manner, the yeast fungi, feed on the sugar properly diluted, and on the nitrogenous matters, as well as small quantities of mineral salts, such as are found in the grape mash.

As we have seen previously, owing to their minuteness and peculiar form of structure, they cannot take their food into their inside, so they get into their food, moving through its mass, where, under the influence of suitable temperature, they multiply to an enormous degree, breaking up that sugar, albuminoid matters and mineral salts into :—

1st. Substances of which their tissues are made.

2nd. A certain number of degrees of heat, which always accompany the chemical combinations of two or more substances, of which oxygen (one of the chief constituents of air) is one ; and this explains why a vat in full fermentation always marks a higher temperature than the surrounding air.

3rd. Substances which are cast away from their minuscule little bodies, such as :—

(*a.*) Carbonic acid gas, which bubbles through the mass of the liquid.

(*b.*) Alcohol, which goes on increasing gradually, as fermentations proceeds.

(*c.*) Glycerine } in small quantities.
(*d.*) Succinic acid } in small quantities.

Now, each one of these four excreted substances possesses in itself antiseptic properties, *i.e.*, is unfavourable, when present in varying proportions, to the life of animals, and we are thus able to understand how, when the alcohol gradually reaches a certain percentage in a liquid in fermentation, it begins at first to weaken the micro-organisms which have excreted it from their bodies. It then prevents them from multiplying, and finally it paralyses them, and even kills them altogether when added in still greater proportions.

The yeast fungi belong to the group of microbes M. Pasteur has called "æroby"—requiring air or oxygen to perform their functions, in contradistinction to others known as "anæroby" or not requiring air.

The micro-organisms, which produce acetic fermentation and mouldiness in wine, belong also to the first group, so that it is easily understood why it is so essential, after the fermentation has been completed, to keep the casks always full up to the bunghole. No air is thus allowed to come in contact with the wine and further fermentation is prevented, as is also the spread of the noxious agents of acetic fermentation, and of what is called "flowers" in the wine.

That proportion of 15 to 17 per cent. alcohol does not, however, absolutely kill the microbes of vinous fermentation, it simply prevents them from turning more sugar into spirit, and they remain in the cask in a latent state.

A strong heavy wine, for instance, still containing more unfermented sugar is apt, when its strength is reduced by the process of blending with a thinner and a lighter wine, to develop a fermentation and to go dry, the character of the blend being of course somewhat altered after a few weeks time owing to this dilution. This is why it is always safer and more reliable in blending wines to use only those that are dry and well fermented, in preference to the sweetish sorts in which the fermentation has "stuck," owing to excess of temperature or excess of alcohol.

We have seen that a proportion of alcohol, ranging from 14 to 17 per cent. in a liquid, stops the further change into spirits of any sugar that may be left in that liquid.

Temperature has a similar effect upon a liquid in fermentation, and when that temperature is raised to 60° C. (140° F.) the yeast fungi, as well as the other micro-organisms which may be present in the liquid soon die. On this fact is founded the method of sterilisation or of "Pasteurisation," from the name of the scientist who suggested it, and which is now so largely used in the rapidly-progressing industry of fruit canning, and also in protecting wines from the deteriorating influence of the microbes, which are the agents of certain diseases in wines.

Normal Fermentation.

The fermentation of the grape mash, under favourable circumstances, starts and goes on almost naturally, without the need in many cases of incessant intervention on the part of the wine maker, in order to correct it, watch it, and attend to it. When the grapes have reached the proper state of maturity, they are crushed, thrown into the vats, and the germs of vinous fermentation floating in abundance in the air of the wine cellars, as well as those which are on the grapes themselves, are thus brought into contact with the must, in which they find a suitable field for their development; they then live upon the sugar and the albuminoid matters it contains, and when they have transformed all the sugar into alcohol and carbonic acid gas, they cannot any longer live in that alcoholic mixture, and they deposit at the bottom of the vat together with the lees. The considerable stir and violent bubbling produced in the mass of the liquid, through the action of the ferments, gradually subsides; the high temperature in the fermenting vessel cools down, the density of the liquid grows less and less; the liquid clarifies; the wine is made.

That transformation, however, does not proceed according to the simple and regular manner just described. The ingredients of the must we have already reviewed are not always found in the normal proportions, or else external circumstances may not be favourable to the carrying through of a regular fermentation, as for instance, the temperature in the fermenting house or vats does not answer to the conditions required for the proper functions of the yeast fungi.

Varieties of Ferments.

All ferments are not alike in their requirements as to food, just as some animals are herbivorous, some carnivorous, and others granivorous and produce musk, honey, milk, cochenille, or venomous poisons, so do we find under the powerful lenses of our microscopes a variety of microbes, some useful, as our friend the yeast of vinous fermentation, and others highly undesirable when present in our wine casks, such as the dreaded "mother of vinegar," or the agent of milksourness in wine.

In the course of his researches on beer, Pasteur has shown that several fermentations cannot proceed simultaneously and with an equal intensity in a liquid, and that the most energetic always masters and subdues the others and even destroys them. This constitutes one of the standard experiments I have often practised when studying Fermentation at the Pasteur Institute. It consists in sowing in a vessel containing must which has been previously sterilised by heat, small quantities of ferments of acetic and lactic fermentations, and a greater quantity of ferments of alcoholic fermentation. Now, these different ferments thrive best at temperatures which differ for each species. If three such vessels are prepared and put on three different shelves of a stove :—

1st. The coolest shelf, being the uppermost, and corresponding to a temperature of 65 to 75 degrees F. (18 to 24 degrees C.), vinous fermentation will soon set in and hold its own, destroying the other microbes of acetic and lactic fermentation which require a higher temperature to thrive, and *wine* will be made.

2nd. If the next vessel is put on the second shelf in a temperature varying from 85 to 95 degrees (30 to 35 degrees C.) the vinous fermentation will first lead, but after it has subsided acetic fermentation will take hold of the liquid and turn it into *vinegar*.

3rd. Lastly, if on the first shelf heated to a temperature of 105 to 125 degrees F. (41 to 52 degrees C.) vinous fermentation will not even set in, and there will be a contest for mastery, for a short time, between the microbes of acetic and those of lactic fermentations, the victory remaining to the latter, and the result being "sour sweet" or "milk-sour" wine.

The practical inference from this interesting experiment is that the must and the air of wine cellars being known to contain microbes of vinous, acetic and of lactic fermentations, it is of good policy to add to the must in a newly filled vat—imitating in that the practice followed in breweries—some fermenting must in full activity from the vat next by, so as to give to the fermentation a fair and an early start. Having done that, the wine-maker has to watch that the surrounding temperature, and the temperature in the vat are within that range that suits the microbes of vinous fermentation, and is not high enough for those of vinegar or of milk-sourness, viz., the temperature should be kept within 65 and 90, or at the utmost 95 degrees F.

Several kinds of Yeast.

Innumerable species of ferments causing alcoholic fermentations are known to exist, and it may be said that almost all sweet fruits susceptible of fermenting possess on the surface of their rind, skin, or stalk, various species of yeasts, moreover, the same varieties of fruits growing under different climates are very often covered with different yeasts, which vary as much in shape, size, or as regards the produce they yield, as for instance cows of the shorthorn, Ayrshire, or Jersey breeds, and every dairyman knows how widely the milk from these three useful breeds of animals differ—although to all outward appearances exactly similar, as compared to each other, and the kind of dairy produce they are best adapted for.

The brewers are familiar with the respective value of the different yeasts they use for starting fermentation in their vats, and they are aware that the yeasts which are the agents of fermentation in Bass Beer, or Guinness' Stout, and those found in the vats of the Munich Lager Beer, differ more in their appearance or the produce they elaborate than do a shorthorn and a Jersey cow. They differ in shape, they differ in size, and the temperature most congenial to them varies to a very great extent.

It is a well known fact, that the yeast from the most noted breweries is much sought after by other brewers, and in some cases, large sums of money are made out of the sale of that yeast to rival establishments as well as to distilleries and to bakers.

Some of these species of yeast, like the different races of bees, Italian or Ligurian, Black English and Carniolian, which evince varying aptitudes as honey workers, produce during fermentation, alcohols varying in quality as well as in quantity.

Mr. Kayser, Director of the Laboratoire de Fermentations in Paris, under Mr. Duclaux, in an interesting monograph of the different races of yeast, has recently brought to light some important facts in connection with each species of yeast under observation.

I had myself at the time the advantage of helping Mr. Kayser to a slight extent while studying the phenomena which accompany the process of fermentation, and I do certainly think that no more important investigations could have been carried out with a view of helping at the same time, the cider and the wine-maker, the brewer and the distiller.

The experiments, in a few words, consisted in finding out:—

1. The amount of work done by each kind of yeast.
2. The quality of the produce elaborated by each of these kinds of yeast.
3. Their respective power of endurance to cold and heat.
4. The temperature most congenial to each kind.

For this purpose a large quantity of cider apples were obtained, pressed, and the juice or must put in about twenty glass jars, holding about 1 gallon each, only half the jar being filled with the liquid. Then all these jars were closed by means of a plug of cotton, so as to permit the air to pass through, but not any particle of dust or any microbe floating in the air.

These jars, with the identical apple must in them, where then heated in a stove to a high temperature, so as to make sure to kill any microbe which might be in the liquid or on the glass bottles, or, in laboratory parlance, the must was "sterilised."

After cooling down, each one of these glass jars received a small quantity of a pure yeast true to its kind.

I should say, that in view of this experiment, a great quantity of yeasts from varied sources were collected from the Champagne, the Burgundy, the Bordeaux districts, also from Normandy and Brittany (noted for cider), from the best German and Austrian and English breweries, and each one cultivated apart and kept absolutely pure by means of devices practised in biological laboratories, and too minute as well as too long to describe.

This done, the glass jars, with the same sort of must in them, but with different sorts of yeast, were put in a room heated to a constant temperature varying from 18 to 24° C (65°, 75° F.), which is the average temperature of the air in cool climates during vintage time, and the progress of fermentation closely watched.

After the fermentation was over, we tasted each sample of cider made, and were wonderfully surprised to notice the very striking difference, both in taste and flavour, of each one of the samples under observation. Not two of them were alike in every respect, some possessing an extremely pleasant taste and flavour, while others were flat and insipid, and a few unpleasant both to the organs of smell and taste.

In a series of most elaborate researches, Mr. Kayser brought out also the peculiarities of each kind of yeast, and found that, other things being equal, temperature has a very marked influence on the yeasts in general and each species in particular.

Thus he proved that the temperatures at which they die vary from 50°–65° C (120°–150° F), and that the best varieties of yeast are often those most affected by excess of heat—still more, that at a temperature of 40° C (104° F) their action is often paralysed, and they only recover with the greatest difficulty even when the temperature of the liquid in which they are is brought down to the congenial degree of 25° C (77° F).

There are some varieties of yeast that can live and work at a temperature of 38°–46° C (100°–115° F), but it appears they are not possessed of the same capacity for work, and are not able to convert into alcohol and Carbonic acid all the sugar contained in the liquid in which they exist; hence the explanation of some wines although sound and containing originally a moderate quantity of sugar, which, after a *hot fermentation*, remain sweetish still, and are always apt to symptoms of secondary fermentation.

I have recently had for perusal the results of some highly interesting experiments carried on in America by Professor Hildgard, with must from the same grapes, but subjected to different methods of fermentation. These experiments refer to the temperature at which the vinous fermentation stops, although a notable proportion of the sugar contained in the must may not have been transformed into alcohol and carbonic acid.

They also refer to the influence of temperature in reference to the extraction of tannin, of colouring matter, of the acids of the grape and also on what constitutes body or extract, and lastly on the general quality of the wines turned out.

For this purpose, tanks filled up with the same must were set to ferment at different temperatures, some ranging between 62 and 65 degrees F., others between 70 and 75 degrees, and a few at the high temperature of 90 degrees F.

These investigations, I may add, not only confirm the results of old established practices in the great wine making districts of Europe, but also furnish a reasonable explanation for such practices which have received the sanction of centuries of experimentations.

They also illustrate and establish the importance of investigating all questions related to fermentation in the different vine-growing districts characterised by peculiarities of climate and soil, and, besides, show the usefulness of a fully-equipped viticultural laboratory to determine, by means of systematic experiments, all questions bearing on this interesting and important subject.

Starting Fermentation.

Now that we know what the ingredients of must are, and what the word "ferment" conveys to our mind, we will rapidly consider one or two points which it may be useful to understand during the process of wine making. It is essential first of all that the casks should be well prepared, and that also the utmost cleanliness should be observed in all the apparatus employed during the operation of wine making, and that no pail, tub, or vat, should be used which is in the least mouldy, as the wine is very readily tainted, and very apt to develop troublesome diseases due to the presence of micro-organisms.

Æration.

Although the must absorbs much air during the operation of crushing it is often considered advisable to further ærate it previous to setting it to ferment.

The influence of æration in quickening the starting of fermentation, is now well understood by the wine makers of the Old World, and various designs, as well as special appliances, are employed in carrying out that process, both in the making of red and of white wines.

Among the advantages which result from the æration of the must, or mash of grapes before it is turned into wine, the following may be mentioned:—

1. The cooling down of hot must obtained from grapes picked during the hottest hours of the day.
2. A greater regularity in the progress of fermentation.
3. Its earlier completion, and therefore less exposure to the air, as in every case the made wine should be kept from the direct influence of the air; at the same time, less risk of the microbes which cause wine diseases and float in great quantities in the air, gaining access to the newly-made wine.
4. The quicker clearing of the young wine. This is brought about by the æration or oxydation of the white of egg-like or albuminoid matters in the must, which precipitate down with the lees, and thus leave a clearer liquid, containing less of these dangerous matters, which decomposing rapidly and being a source of food for other microbes, are the frequent causes of diseases in wine.
5. Wine obtained from ærated must is much superior in quality to wine made from the same must which has not been subjected to the process of æration, being more easy to keep in condition and possessing besides a finer bouquet and more odoriferous ethers than the sample which has not been ærated.

As an instance of this, I may just mention that in the Department of Meurthe, in the north-west of France, where the grapes contain much albuminoid matter, æration is carried on systematically as one of the processes of wine-making. For this purpose the must is thoroughly stirred by means of shovels, till the air gets well incorporated through its mass, with the result that such wine, which is known as *vin de pelle* (shovel-made wine), by reason of its superior quality, sells for 20 per cent. higher price than wines made from similar must, but according to the ordinary methods of vinification. The cost of this very simple operation is reckoned at barely 1d. more per gallon.

It has been observed that the proportion of these albuminoid matters in the must always increases in localities where the interval between the setting of the flowers and the ripening of the grapes is shorter, as, for instance, in the cooler vine-growing parts of France, where the growing season is short and hot.

In a similar manner, in hot countries, where the grapes mature very quickly, and more especially on rich alluvial land, the percentage of these nitrogenous matters increases very much, and it is of great importance that any of the surplus, beyond what is necessary for the use of the yeast fungi, should be removed. Some grapes are exceedingly rich in these bodies, and notably the Riesling.

Various means have been devised for ærating the must, and among the simplest I may cite—Stirring rods made for the purpose; iron or wooden shovels; wicker-work baskets, plunged into the mash and then hoisted up so that the juice of the grape is allowed to drip down in the form of a shower back into the vat.

Influence of Temperature in Fermentation.

We have all heard of good sound wines having been made in some old hogshead, under the shelter of some tree, or even in the open air, and we may well imagine that, given a must with all its constituents combined in a happy proportion, and under the influence of congenial weather, excellent wine may accidentally result, but it does not stand to reason that we should, from that fact, draw the conclusion that an old hogshead, filled with crushed grapes, and purposely left out in the open air, is the readiest and the best method for fermenting wines, and even go so far as to condemn all cellars, in which we are able to control the temperature and regulate it according to requirements.

One of the most important articles in the equipment of a wine cellar, just as in that of a brewery or of a dairy, is a thermometer. It, in fact, ranks in importance almost next to the fermenting vat itself, or the churn, and it should be made, in conjunction with the saccharometer, constant use of, guide every process of manipulation, and a warning against any danger or accident arising out of excess of temperature.

I would imagine that on the Murray, considering the rich must produced in that district, a uniform temperature of about 70 to 75 degrees F. in the fermenting house, and varying as little as possible during the day or the night time, and a maximum temperature not exceeding 95 degrees F. in the vats, would give a far steadier and more complete fermentation, extending over about five or six days, and would produce a choicer wine.

On the Hunter, a constant temperature in the fermenting house of 70 to 72 degrees F., and a maximum temperature in the vats of 90 to 92 degrees F., would, I feel certain, still add to the quality of the wine produced.

The temperature on the Hunter, however, about vintage time is generally higher than during the picking season on the Murray, the grapes ripening about three weeks earlier in the zone north of Sydney, and I have seen in the fermenting houses there, the thermometer reading between 75 and 80 degrees F. during the hottest part of the day, and according to the materials used in the construction of the cellars, while the maximum temperature in the fermenting vats very often goes over 95 degrees F., and in some cases I have seen it reaching 105 degrees F. There is no question that in hot seasons the temperatures in the vats go even much higher with the small vine-growers, who ferment their own grapes. On the Murray the extremes of temperature stand very far apart during vintage time. During the last season, which has been a particularly good one, so far as temperature is concerned, for a complete fermentation of the must, the minimum during the night has on several occasions been as low as 44 degrees F., being on an average about 58 degrees F., while the maximum in the day time averaged about 70 to 74 degrees, and the highest temperature I have noticed in the fermenting vat reached only 88 degrees F.

This is quite an exceptional year, however, and in an average vintage season on the Murray, the night temperature varies generally between 60 and 65 degrees F., while the temperature in the day time goes as high as 80 degrees, and the vats very frequently get "stuck" with sometimes a considerable proportion of the sugar still unfermented, through excess of temperature.

If, during fermentation, cool weather should set in, and the temperature fall below 60 degrees F., the fermenting cellars should be warmed by a stove.

The great inconvenience with fermenting houses with a very low temperature in these colonies—viz., 58 to 65 degrees F., with a maximum temperature reaching only 85 degrees F. in the vats, is that the period of fermentation is too much lengthened, and the wine, as a consequence, exposed to greater risks of contracting diseases and turning unsound.

The temperatures, therefore, which appear most convenient, and, considering it under its various aspects, give most satisfactory results as regards early termination of fermentation, coupled with soundness and quality of produce, seem to be those ranging to a maximum of 90 to 92 degrees for wines of the Claret type, and 95 to 96 degrees for wines of the Port type.

It is remarkable to note the narrow limit that separates the temperature at which the fermentation is accelerated, viz., about 90 degrees F., and that at which it is almost totally stopped by the paralysis or death of the active yeast, viz., 100 to 105 degrees, with the result that the wine won't "go dry," and the fermentation is "stuck."

Revival of Fermentation in the Hot Fermented Mashes.

The following experiment, which I have many times proved while studying the question of fermentation at the Pasteur Institute, occurs every day in the course of many vintage seasons, and illustrates in a typical manner the influence of the setting temperature and the surrounding air on the ultimate result of fermentations.

A quantity of juice is pressed from grapes. They both receive an equal quantity of active yeast, but half of it, which we will call A, is set to ferment at the temperature of 60 degrees in a stove in which the thermometer reads 70 degrees F. The progress of fermentation is gradual, and the must, except if it contains more than 30 per cent. of sugar, soon "goes dry," the fermentation has been complete and perfect.

Now, the other half (B) of that must is gently heated to the temperature of 75 to 80 degrees F., and set to ferment on another shelf of the stove, where the temperature is about 80 degrees. The fermentation will be very active for a time, and the temperature in the liquid will soon rise to 105 degrees F., and even more, and after a few days the fermentation will be found to have "stuck," with a notable proportion of sugar yet unfermented in the mash.

This experiment is easy to make, and the lesson it conveys is of great importance.

The temperature of grapes picked in the morning in the vineyards is about the same as that of the mash in sample A. When fermented at a moderate temperature it does not give any trouble, and soon goes dry. The temperature of grapes picked in the afternoon, on the other hand, often reaches the degree of heat of sample B, and if set to ferment in badly constructed cellars, the must soon gets "stuck," and secondary fermentations are always apt to occur.

Now, that you know these facts, it will be no longer a matter of surprise to you that, more especially after a succession of hot days such as those you experience when the westerly winds blow, and particularly when operating with concentrated musts, your fermenting vats should be found stuck when half the sugar is still left unconverted into alcohol.

This experiment besides shows the great value of frequently using the thermometer, in conjunction with the saccharometer, to ascertain how far it is safe to allow the vats to get heated, or what degree of heat the liquid in the vat has actually attained.

Whenever you happen to be troubled by sluggish fermentation, caused by excess of temperature in the vat, some simple and timely manipulation of the must will soon restore its healthy progress and ensure its completion.

Among other methods the ingenious wine-maker might devise in order to overcome these difficulties, I would suggest:—

1. The cooling down below 80 degrees F., by means of frequent æration of the must, which will soon revive the paralysed agents of fermentation.
2. Cooling down of the must in the vat, by letting cold water circulate through a tin coil placed in the vat.
3. If the tank has cooled down altogether, and the fermentation has stopped for some time, either run hot water in the tin coil, or mix it with some hot mash from a vat in full fermentation, and then ærate it.
4. In every case it is advisable to favour the reformation of the active yeast, by the addition either of sound newly-crushed grapes or of fermenting must from another vat.

The æration can be done either by the methods already described in the course of this paper, or else by drawing off the must from one vat and filling up another vat, or again by drawing off the mash from the bottom of the vat and pouring it in again from the top.

It is always a good plan, whenever there is a very marked difference between the temperature outside at night-time and during the day, to equalise the temperature of the mash in the vats by only partially filling them with the morning grapes, and adding on to them the grapes picked under the fierce midday sun, and then stirring them thoroughly by any of methods described in treating of the ærations in the must.

These few simple matters connected with the fermentations of wine will account for the fact that at some vineyards, and during certain seasons, each tank almost shows some difference from its neighbour, filled up with the must from the same grapes, but perhaps set to ferment at a temperature of 15 to 20 degrees more, according to the time of the day the grapes were picked.

It is most essential, during the process of wine-making, however simple in themselves the methods of keeping the temperature under control or of ærating the must are, not to neglect them on any occasion.

The extension of the wine industry in this country, as in all other wine-producing countries, depends essentially upon minute attention being paid to every detail in connection with it, from the pruning of the vines to the fermentation of the grape-mash; even more, to the bottling of the matured wine, and I might say, to the care with which the old wine should be transferred from the dusty-looking, stained bottles, to the cut-glass decanter.

What the future methods of rational wine-making will be it is possible even now to fortell:—All the must or mash will be sterilised, *i.e.*, deprived of all living ferments in it, and adequate quantities of pure yeasts, cultivated especially for the purpose in view, will then be added in the vats, while the degrees of temperature most congenial to each yeast, and to the object of the wine-maker, distiller, or brewer, will be scrupulously and constantly maintained. As a result, a greater quantity of wines and fermented liquors of better quality, true to the type aimed at, will be produced, and less of the unpalatable, and often unwholesome concoctions, now too commonly manufactured.

Just as Jersey cows are kept in dairies, where butter is the speciality, Ayrshire cows, where cheese is the main industry, or Shorthorns, for all round purposes, and the selling of fresh, pure milk, so in the wineries and breweries of the future, distinct and well-defined races of yeasts will be cultivated, and employed in the manufacture of clarets, hocks, ports, sherries, champagne, ale, or good old Irish stout.

In a country like New South Wales, where viticulture is yet a newly established industry, and an industry that holds promises of the most encouraging nature, laboratory experimentation, aided by chemical analysis and instrumental measurements, will have to be depended upon for solving, within a relatively narrow space of time, problems which, in older vine-growing countries, have received the sanction of hundreds of years of blind experimenting before the methods best adapted to the kind of grape and the peculiarities of climate could be safely ascertained and systematically propounded.

As a first step towards that direction, the formation of experimental stations in various parts of the Colony suitable for viticulture, as well as other branches of agricultural pursuits, has now been decided upon, and the creation of a fully equipped central viticultural laboratory, while saving the winemakers falling into costly mistakes, and furnishing some indication as to how to treat the must from the various grapes grown in different localities, would likwise be hailed with satisfaction.

Rational Principles of Feeding.

III.

From the explanation given on a former occasion, it will appear that muscle flesh, not fat, is the essentially valuable part of the food supplied to us by our domestic animals. To produce that, the food which the animals consume must contain plenty of nitrogenous matter. This is changed into albumen, the principal substance of which most organs of the body are built up. Albumen, dissolved in water, is contained in the blood and lymph, as well as in the other watery fluids which permeate the whole animal body by osmosis. We shall now consider the circumstances under which albumen may be absorbed into the body or be voided from it.

To understand this more fully we shall have to make a short digression. It has been taught by some physiologists that the animal body is constantly undergoing a process of renovation (anaphytosis or moulting). Older portions of the tissues are thrown off by gradual elimination of dead particles, and their places are taken up by new ones coming fresh from the blood. To make use of a homely comparison, this "anaphytosis," or this process of moulting within the tissues of the body, is not unlike a progressive system of repairs carried on in a building. A brick or a stone is taken out here and there, and a fresh one is put into its place; until, after a time, there is not one particle, windows and doors not excepted, which has been there originally, although the building itself is, to all intents and purposes, the same as it was when first built. The structure may not have changed in outer appearance, yet it has been most thoroughly renovated right through. Anaphytosis] may be promoted or retarded by various means. The first expounder of this theory, Professor Schulze, in Berlin, believed that health and longevity chiefly depended upon a regular and speedy exchange between old and new materials. There are good reasons to believe that a regeneration of tissue really takes place, but it is doubtful whether it does so to such an extent as to become an important factor in the process of storing up nutritious elements in the body, &c. With regard to muscle flesh, the fibrous structure itself is probably of great stability, and the increase or decrease in the size of a muscle chiefly depends upon the supply of albumen in the food. Lean working bullocks, put on good grass, speedily put on far better flesh than that got from cattle that have been in fair condition for some time. There would be ample room for theoretical speculation had it not been proved by the results of many experiments that, whatever process of regeneration may take place in some parts of the body, it is so slow as to be of no importance in the question of feeding animals for practical purposes, especially for that of producing the most valuable animal food in the most economic manner. From that point of view we may safely consider the structure of most parts of the animal body almost as stationary, and we have here to deal more directly with the circulating fluids as vehicles of albumen. The chemical changes which have a direct influence on the proper nutrition of the body do not, principally, take place within the tissues of the organs themselves, but within the fluids that permeate the body by circulation and osmosis. This has been proved in several ways, of which one instance will be sufficient. Blood, which has been transferred from one animal to another, by transfusion into the veins, is far more slowly assimilated than the same quantity of blood consumed as food. This seems to prove that albumen is not so easily disintegrated as soon as it has taken an organised form. The chemical changes important in nutrition refer principally to that portion of albumen dissolved in the several circulating fluids, especially to that moved about by osmosis. This albumen is liable to be "split up," as Wolff expresses it, into its elements, viz., oxygen, hydrogen, carbon, and nitrogen. The first three substances are used up in the process of respiration, in the formation of fat, and portions of oxygen and hydrogen also, in the formation of water. The last name, viz., nitrogen, passes through the kidneys as urea. It is this loss of albumen which has to be made up by fresh supplies from the food. Judicious nutrition thus consists in supplying an amount of albumen equivalent to that decomposed or "split up" into its elements, and no more. As soon as the supply of albumen becomes less than that wasted by decomposition, the system has to draw upon the albumen in circulation, and later on upon that stored up within the tissues. Some organs (the muscles probably more than any other organ) give up part of their albumen to be "split up," so that the elements of it may be used for other purposes. Starving animals thus become, as Wolff says, carnivorous, in so much as they live upon parts of their own bodies. The emaciated condition of animals after the period of hibernation, points to the same fact.

The amount of albumen decomposed and eliminated depends upon the species to which the animal belongs, the state of nutrition in which it is, and some circumstances of minor importance. A dog, for instance, weighing 1 kilogramme (about 2 lb.) in a state of starvation will eliminate 1·2 grammes (1 gramme=about 15½ grains) of albumen within twenty-four hours, whilst a bullock will eliminate 0·30–0·50 grammes only. The same dog in a fair state of nutrition will eliminate 3·0 grammes, a milch cow 1·8 grammes, a full-grown healthy man 2 grammes, a full-grown bullock at rest 0·75 grammes, a sheep 1·12 grammes. In the case of high nutrition the amount of albumen destroyed or split up is very much larger. In the case of cattle or sheep five times, in that of a dog fifteen times as much as in low condition. The quantities of albumen wasted by animals when in a state of starvation are a criterion of the quantities usually eliminated in a moderate or normal state of nutrition. It has been found that about two and a half times as much will be split up by a fairly-well fed animal as by one that is starving. After a short period of normal nutrition the quantities of albumen eliminated will stand on an equilibrium of those consumed. As soon as that state has been arrived at, very moderate and equal quantities of albumen in the food are sufficient to keep the animal in good order. It is thus clear that the animal body cannot take up albumen to an unlimited extent. In the progress of generous nutrition, therefore, a moment will arrive when the storing up of albumen has reached its height, so that the largest quantities of food consumed will not cause any further increase of albumen in the body. At the same time it is the object of the farmer to increase by any possible means the speedy, absorption of albumen within the organs of the body, once taken up into them it is much less liable to be split up and wasted, than that contained in the circulating fluids, and because it contributes a considerable share to the weight of the animal. There are several ways of economising albuminous matter, *i.e.*, of turning to the highest account that which is given in the food, and of reducing the waste of it. The former is principally accomplished by giving large quantities of nutritious food, by so doing the quantities of albuminous matter consumed are stored up in quantities, not only absolutely but also relatively larger. For instance an increase of food from 17·86 lb. to 19·46 lb. given to oxen caused an increase in the absorption of albumen from 18 to 32 per cent., an addition of 4 lb. of clover hay daily to oxen caused an increase in the absorption of albumen from 9 to 14 per cent., and from 11 to 15 per cent. respectively, before and after the increase of food given. It is important, therefore, for the purpose of fattening, or more correctly of increasing the living weight not to stint the supply of nutritious food.

Purely nitrogenous food, on the other hand, without being aided by hydrocarbons must necessarily cause a considerable quantity of albumen to be split up and changed into fat. A rather wasteful application of nitrogenous food. It is easily understood, therefore, how fatty deposits in the body, and the starchy, fatty, and saccharine matters in the food must help to prevent any excessive splitting up of albumen. In this respect the value of starch and sugar is greater than that of any fatty matter consumed along with albuminous food—a subject which will be considered in our next article.

J. S. H. SCHMIDT.

Exporting Apples to England.

THE Goulburn Branch of the Fruit-growers' Union having applied to the Department for information regarding the export of apples to England, the reply sent to that body by the Director will doubtless prove interesting to growers in other parts of the Colony.

"In compliance with your wishes, I have pleasure in forwarding the first instalment of the required information. You will find upon reference to Bulletin No. 1, 'Report of the Conference of Vine and Fruit-growers,' held in June last year, that the improved methods of packing and transport of fruit was one of the subjects of discussion, and I have pleasure in referring you more particularly to pages 162, 163, 166, 170, 171, 173, 189, and 191, for information which directly bears upon the subject under notice.

"The orange is the fruit which has been mostly exported from this Colony, but you will notice various references to the forwarding of apples.

"The export of apples has been more extensive from Tasmania, and endeavours will be made to obtain information from that quarter as to their packing, &c.

"You will notice the delegates to the Sydney Conference laid special stress on the necessity for careful picking and packing. Indeed I may quote an opinion of Mr. Morson, Manager of the Fruit-growers and Market Gardeners Association in Victoria, who says:—

"'In all cases the handling of fruit in gathering is the principal secret, it must be collected when perfectly dry, and on no account be wiped with any kind of cloth. Neither should the fruit be gathered between the hours of 12 noon and 3 p.m. if the weather be hot and the temperature high. When gathered, the fruit should be gently and carefully laid out near to the packing table for one night, and it can be packed the next day. After fifteen years successive trials of various methods, nothing superior has been found to the simple plan of wrapping each specimen in tissue paper, and packing each layer in the case firmly, filling the insterstices with white paper shavings, and placing a sheet of white blotting paper over each layer of fruit as the packing proceeds; the case being well filled with white paper shavings over the last layer of fruit before nailing down the lid. When the case is shaken there should be no indication of loose packing.'

"The experience obtained by the Victorian Department, in connection with the consignment of apples and pears forwarded from England in November, 1888, led to the following conclusions:—

1st. Avoid too great quantity of packing material.
2nd. Allow sufficient ventilation to each case.
3rd. Confine the exports to long keeping and popular varieties.
4th. Do not use pine or soft wood for the cases, as in the present instance the fruit was so impregnated with the taste of the wood, that the best varieties after ten days exposure still retained it.

"As to the varieties which will carry best, our orchard manager, Mr. W. Stieme, recommends the following:—

Adam's Pearmain, Red Baldwin, Golden Reinette, Bedfordshire Foundling, Blenheim Orange, Reinette de Canada, Triomphe de Luxemborg, Winter Pearmain, Five Crown Pippin, Ward's Seedling, Red Warrior, Mère de Ménage, Kentish Pippin, Boston Russet, Claygate Pearmain, Gloria Mundi, Newtown Pippin, Stone Pippin, Red Streak, Royal Russet, and Striped Beefing.

"Regarding the kinds of cases to use it seems to me pretty evident that soft pinewood cases are not to be recommended. Some authorities give it as their opinion that the most economic case is the Tasmanian bushel case, made of stringybark palings. The inside of the case, however, should be made smooth to prevent abrasions of the fruit which has always been a source of complaint. The method of strapping two or three cases together, or the use of too much paper packing is not regarded with favour, the fruit in the middle case showing a tendency to decay sooner than would otherwise be the case. Mr. Cairns, of Parramatta, has taken great interest in the export of fruit, and has designed special cases for the conveyance of oranges, but how far these will meet requirements for apples need some further inquiry.

"Cases should not be air-tight. In some instances they have been lined with brown paper, and instead of paper packing, sawdust and rice husks have been used.

"The names of some agents in London are Messrs. Keeling and Hurst, and J. Solomon & Co. of Piccadilly. . . . The fruit should be cut from the trees."

From inquiries made of the P. and O. and Orient Shipping Companies, it has been ascertained that in each case the freight charge is 90s. per ton measurement, consisting of 40 cubic feet; and also in each case it is necessary to engage the whole of the cool chamber. These chambers vary in capacity from 200 to 1,250 tons measurement in the case of the Orient, and 125 tons in the P. and O. Company. The shipment must be consigned to some agent in England, and the Orient Company recommend March and April as the best months for shipping.

A communication has been addressed to the Principal Under Secretary, asking him to communicate with the Agent-General in London with a view to obtaining for the benefit of our orchardists the latest and most reliable advice on the subjects of packing, markets, agents, and others interesting details in connection with the trade.

Mr. F. W. Wood, now in London, has also been commissioned by the Minister to make a complete report as to methods of packing, most suitable varieties, and all other details of interest to those intending to export.

Chicory (*Cichorium intybus*, Linn.)

By GEO. VALDER.

A hardy perennial, belonging to the natural order *Compositæ*. Is a native of Great Britain and most parts of Europe of similar or greater temperature, where it is found growing by the roadside, and in waste places, generally in calcareous soils. In this plant the leaves spread on the ground, and from the centre of these the flower-stalk (which is slightly hairy, branched, and clothed with sessile leaves) rises to a height of from 2 to 4 feet, bearing heads of bright blue flowers. It is cultivated largely both for its root and as a forage plant in France, Germany, Italy, United States, and Flanders, and in small quantities in other parts of Europe and America.

There are four varieties in cultivation, viz. :—

1. Common.
2. Brussels, or Large-rooted.
3. Improved.
4. Variegated.

Of these, No. 1 is the variety generally grown as a forage plant and for salads. No. 2 is cultivated for its root, which is dried, roasted, and ground, and then mixed and sold with coffee. Nos. 3 and 4 are improved varieties of No. 1. No. 3 is a large-leaved variety, having the leaves pressed together so as to form a sort of heart. The leaves of the variegated variety have dark red veins, which change to a beautiful bright red in blanching.

It was first cultivated in England about 1780 by Arthur Young, who stated that it was of such consequence for different purposes of the farm ; that on various sorts of soil the farmer could not make a satisfactory profit without its use. Where it is intended to lay a field to grass for three, four, or six years, in order to rest the land, or to increase the quantity of sheep food, there cannot, he thinks, be any hesitation in using it.

In France, it forms a considerable proportion of the best meadows, besides being used very largely for salads under the name of *barbe de capucin*. It is also largely grown on irrigated farms in Italy. In Brussels the leafy heads are cooked whole, and eaten with cream sauce, and in Bruges the roots are boiled and eaten with potatoes. Cattle, sheep, and pigs eat it with great relish, and thrive well on it.

Chicory is used extensively as a substitute for, or an admixture in, coffee, and while it is condemned by some as being entirely destitute of those properties which render it wholesome for constant use, others maintain that it is one of the most harmless substances that has ever been used for the adulteration of coffee, and that the combination of a little chicory gives a richness of flavour, which many persons prefer to the pure article, when mixed at the rate of 2 oz. pure chicory to 1 lb. of coffee. It has also been tried as ensilage with great success.

Cultivation.

The culture of chicory is the same as that of the parsnip, carrot, &c. It thrives best in a rich light soil (rich loam, sandy and calcareous soils are best), and should in every instance have an open situation allotted to it. The soil should be deeply worked and well pulverised. Sowing for main crop in New South Wales lasts from September to November, according to locality. The seeds should be sown in drills, 1 inch deep, 2 feet apart, and the plants should be carefully thinned out to 9 inches in the drills. 2 lb. or even less seed per acre is ample when sown in drills. When the plants are about an inch high, or when weeds appear, the process of hoeing commences. This operation should be carried out about once a month, or as the weeds appear. The crop commences to ripen in April, the harvest lasting from the beginning of April until July.

Digging.

The great objection to chicory is that, like horse radish, every particle of root left in the ground will grow. Therefore, it is necessary to be very particular in taking up all the roots of the crop from a good depth. This is the most troublesome work connected with the growth of the crop. In America the roots are generally ploughed up, men following the plough armed with a long hook, taking up any roots that have been left in the ground, but as a rule it will be found much better to dig up the roots with strong forks. The roots are thrown into heaps, carted from the fields, and thoroughly washed. Revolving root-washing machines will be found to answer best for the purpose, and this operation finishes their preparation for market.

As a forage crop, chicory is generally sown broadcast at the rate of 5 lb. to the acre, the time most suitable being from September to November, and for winter feed in February or March. When the plant is coming into flower (about four months from sowing), cut and feed to cattle, sheep, and pigs, &c. For small farmers and dairymen it cannot be too strongly recommended. It is said that it will produce, on poor sandy soils, a larger quantity of green food than any other plant in cultivation.

For Salad.

The main crop requires a rich light soil, and for the earlier sowings a moist soil. Sowing should be annual, for although it is a perennial, yet after being cut from two to three times, the leaves become bitter and worthless. When the plants begin to cover the ground, thin to 9 inches apart, and those removed plant out at similar distances. If the leaves grow very luxuriantly, and shade the roots much, they must be cut off within an inch of the ground. Water must be given moderately in dry weather. Allow the plants to grow freely until they are nearly full grown, then trim away all their leaves so as not to injure their hearts, and cover over thickly with sand, ashes, or long litter. By this treatment those fresh leaves which are produced are blanched and crisp, losing their bitterness. If the roots are vigorous, they will bear cutting two or three times, after which they are unproductive. Another method often adopted in France is as follows:—The seed is sown in a rich light mould, either on a hot-bed or in pans or boxes placed in a heat of from 55 degrees to 60 degrees; air is given at every opportunity, and a gentle watering early in the day, as often as is required. The chicory may be cut in ten days or a fortnight after sowing, and the same plants will afford a second cutting. Another mode of blanching consists in boring holes in a cask, with an augur, in rows, 3 inches apart, and filling with alternate layers of sand and roots, with the crowns protruding through the holes. The cask is then placed in a dark cellar, and the sand moistened if it becomes too dry. In this way several cuttings of blanched leaves may be obtained till the roots are exhausted. This plan is often adopted on board ship. The plants can also be blanched by means of inverted tubs, flower pots, &c.

Preparation of the Root.

The American method is as follows:—As the roots are brought from the field, they are washed and then passed to the cutter, a knife-armed cylinder, which, revolving rapidly, cuts them into strips 2 or 3 inches long by a quarter of an inch or more in thickness and width. They are then raised to a large drying platform, where they are spread in layers 2 inches thick and stirred daily for a week, at the end of which period they are sufficiently cured for roasting and storing. The roaster is a sheet iron cylinder, 4½ feet long by 2 feet in diameter, supported by shafts and revolving in a brick oven. Five bushels constitutes a charge for the roaster, and two hours is required for roasting. When this is completed, the chicory is poured out, cooled, and passed on to the mill for grinding. The chicory is then sifted, the coarse portions reground, and the rest passed through a fine sieve before packing in barrels.

Methods in New South Wales.

The roots are prepared as soon after pulling as possible. They are first thoroughly washed, then placed in the cutter and cut into the thinnest possible slices, after which they are slowly dried in kilns, having preferably revolving floors and automatic turners. It is then passed through sizing, sorting, and sifting machines, after which it goes to the roasters, where it is carefully roasted to the proper degree. After that it passes on to the nibbling machines, then through the grinding mills, and from thence through wire or silk dressers, after which it is promptly packed into soldered air-tight canisters, and again packed into cases ready for market.

Chicory has not as yet received much attention from farmers in New South Wales, although it has been cultivated in small quantities as a forage plant for many years. It is now being grown for its root (principally in the Blayney district) for the Sydney market. Good washed chicory roots are worth on an average about £5 per ton delivered in Sydney. The yield per acre ranges from 8 tons in favourable seasons to as low as 1 ton in dry seasons, with irrigation from 6 to 8 tons per acre, can be produced. In California, as much as 15 tons per acre has been produced on rich loamy soils, and with irrigation, the crop rarely averages less than 10 tons per acre. Chicory is much more extensively grown in New Zealand and Victoria than in New South Wales, the average price in Victoria ranges from £4 to £6 per ton for washed roots. The amount of roots consumed in New South Wales averages about 1,000 tons yearly (equal to about 160 tons of prepared chicory). The usual plan in New South Wales is for the merchant to contract with the grower to take the produce of a stated number of acres. In bad seasons large quantities of root are imported from Melbourne, but as there is a very heavy Customs duty this would not be done if the root could be obtained here.

Although the market for chicory is limited, there is no reason why a larger quantity should not be grown in the Colony. Besides the value of the plant and root for human food, it would be of great value to the farmers and dairymen of the South Coast and other cool parts of New South Wales as a forage crop. A statistical return shows that there was a total quantity of 167,043 lb., imported and valued at £1,533, and an export trade of 14,672 lb., valued at £163 from the Colony. In Victoria, during 1889, 148 acres were sown with chicory, producing 811 tons of the root.

Notes on Diseases of Plants.

By N. A. COBB.

Mouldy-Core.

This is a diseased condition brought about by the presence of common mould in the core of certain varieties of apple. Outwardly such apples often appear to be quite sound, but on cutting them in halves the core is found to be in a mouldy or half rotten state. This, however, is only the beginning of the trouble, for sooner or later the whole apple becomes rotten and worthless. The rot arising from this cause has an appearance different from that of the bitter rot, inasmuch as there are no concentrically arranged pustules, and, furthermore, this rot works from the centre outward, instead of beginning as a spot on the surface and working inward.

The way in which the mould gains an entrance to the core of the apple will be seen at once if one of the diseased apples be split in halves with a sharp knife. It will be found that the pip is open so as to form a passage leading to the core. Ordinarily, only the varieties with open pips are subject to this disease. The course of the disease is as follows:—The spores of common mould coming in contact with the surface of an apple with an open pip first adhere, then germinate, and send their threads into the pip-hole, and thence into the core-chambers of the apple. Here the threads grow and fructify until they finally attack the pulp of the apple, which they usually do at some point between the core-chamber and the pip-hole. The attack on the pulp is accompanied by a brownish rot.

A knowledge of this simple fact should prove of value to the apple-growers of the Colony. They are now endeavouring to place saleable apples on the English and other northern markets. Apples for that purpose must possess good keeping qualities. It is, therefore, a good thing to know that varieties with large open pip-holes are not likely to prove good keepers.

There is an apple of the pippin sort (I have heard it called the New York pippin) very common in the Sydney market in the late autumn, that is very subject to mouldy-core. It is of medium size and fine flavour, and a nice-looking apple for the table; nevertheless it gives great dissatisfaction, because so many on opening turn out to be worthless, or nearly so. Many Sydney hotel-keepers, caterers, and housewives will bear me out in these statements. The sooner such apples are put out of date the better, for there are equally good sorts not subject to mouldy-core which can be grown in their stead. They will soon be discarded if both growers and buyers will bear in mind that there is an easily and readily applied test that will at once detect them. Place the apple stem downward and cut it in halves exactly through the middle of the pip; if an open passage leading to the core-chambers is found, then the apple must be regarded with suspicion; if the core contains mould, then it is certain that before long the apple would have rotted. If among the first two or three apples of a case tried in this way one is found defective, it is certain that all will soon rot.

Remedy.

The treatment by spraying with modified eau céleste, as for bitter-rot, would probably be effective.

Eau céleste (modified).

(*a.*) Dissolve 2 lb. of copper sulphate (bluestone) in hot water.

(*b.*) Dissolve 2 lb. of sodium carbonate in another vessel of water.

Mix 1 and 2, and before using, add 1½ pints of ammonia, and then dilute to 30 gallons with water.

Another formula.

Ammonio-carbonate of copper.—To 1 quart of Aqua ammonia (22° Beaumé) add 3 oz. carbonate of copper; shake until a clear solution is produced, then dilute with 22 gallons of water.

Application.

Commencing before the fruit begins to ripen (say early in December), apply the spray three times, at intervals of ten days or two weeks. All parts of the fruit, especially the blossom end, must be thoroughly sprayed. With the proper apparatus the cost per tree need not exceed 1d. for each application, *i.e.*, 3d. for the season, provided as many as 100 trees are to be treated.

Another Vine Disease (*Glœosporium pestiferum.*)

Writing to the *Gardiner's Chronicle* recently, Mr. M. C. Cooke, the celebrated English fungologist makes the following valuable remarks:—"We have recently received from Brisbane some vine shoots and grapes suffering under infliction of a new vine disease, which, if it spreads, is likely to be of a very destructive character. The shoots, petioles, and peduncles present a shrivelled and miserable appearance, sprinkled, in some places densely, with small hemispherical knobs, about the size of a good sized pin's head, and of a rosy-pink colour. Subsequent examination proved that these knobs were a mass of hyaline fungus spores, which had oozed out of orifices in the cuticle, and hardened by exposure to the air into that form. The cells beneath the cuticle are without any distinct conceptacle or perithicum, and the spores are produced upon short delicate sporophores rising from the cushion-like base of the cells. The spores, or conidia, are cylindrical, straight and rounded at the ends, from 14 to 15 micromillimetres long and 3 to 4 broad, hyaline and colourless, with rather granular contents. When mature, they issue in a sort of gelatinous mass through orifices broken in the cuticle, and soon harden into the pin head knobs, which remind one strongly of some of the small forms of Tubercularia, so common in this country (England). On the application of moisture the spore masses dissolve, and the spores are carried away freely wherever the water trickles. In some respects this fungus resembles another of the same genus (*Glœosporium ampelosphagum*), common on vines in Europe and the United States; but it differs in the colour of the exuded spore-masses, and in the dimensions of the spores, which are double the length and broader than in the European species; besides which we have no knowledge that the mass of spores in *Glœosporium ampelosphagum* ooze out and form such tubercularia-like masses. The diseased fruit is stunted, shrivelled, and exhibits a few of the spore-pustules scattered over them. It is an unenviable addition to the fungi of Australia."

1

(1) Pine Case-moth, *Oiketicus hübneri*, Westw. Adult Male. (Enlarged).

2

(2) Antenna of Pine Case-moth. (Enlarged.)

4

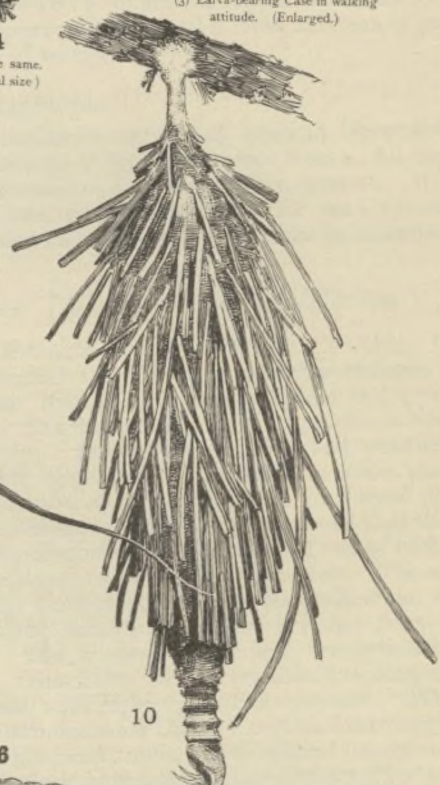
(4) The same. (Natural size.)

3

(3) Larva-bearing Case in walking attitude. (Enlarged.)

9

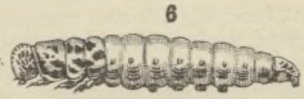
(9) Case of Female Insect, sectional view, showing Pupa. (Natural size.)



10

(10) Case of Male Insect, with the empty Pupa-shell protruding. (Natural size.)

6



(6) Larva. Natural size. (After Westwood.)

8

(8) Pupa of the Female, side view. Natural size. (After Westwood.)

5

(5) Young Larva, 6 mm. in length, extracted from Case. (Enlarged.)

5 A

(5a) The same. (Natural size.)

7

(7) Pupa of the Male. (Natural size.)

PINE CASE-MOTH *(Oiketicus Hübneri)*, WESTW.

Entomological Notes.

BY A. SIDNEY OLLIFF,
Government Entomologist, New South Wales.

THE PINE CASE-MOTH (*Oiketicus Hübneri*, Westw.).

IN 1854 Professor J. O. Westwood published a memoir on several Australian Case-moths or Psychidæ, illustrated by figures of the insects in all stages.* The paper contained descriptions of our commonest native species, and dealt with their life-histories in such detail that it remains to this day the most complete and satisfactory account that is available.

One of these species, the *Oiketicus Hübneri*, Westw., has proved a serious pest to the pine (*Pinus insignis*) in New South Wales. At the end of last year Mr. J. B. Martin, of Camden, forwarded a number of larvæ, of Psychidæ, with the information that they were committing serious havoc among pine-trees and fruit-trees in his garden. These larvæ proved to belong to more than one species, and it is unfortunate that I was only able to breed one of them. This proved to be *Oiketicus Hübneri*. It is by no means certain if this insect, which was fed on pine, is the same as that found by Mr. Martin on his fruit-trees, as several Psychidæ were obtained at the same time, but it is possible that this may be so. A number of specimens of a smaller and evidently distinct species died from the attacks of hymenopterous parasites. More recently I have received a number of the young larvæ of this species from Mr. A. S. Low, who found them attacking *Pinus insignis* near Granville. The larva, when young, is dark, brownish-black in colour, with the head and thoracic segments dusky white and irregularly mottled with small brownish spots; the head very broad, with minute, indistinct spots in the middle, and a series of short oblique stripes of darker brown on each side; the first thoracic segment marked with small brown spots on the disc and on the anterior margin, the second and third thoracic segments much shorter than the first, and furnished with large brown patches, extending longitudinally across the segments; the first abdominal segment slightly narrower than the third segment of the thorax; the second and third segments slightly broader; the succeeding segments gradually narrowing to the extremity; the anal segment dark chestnut-brown, rounded behind; the legs pale brownish-white; the prolegs dark reddish brown; nine pairs of stigmata.

At this stage the caterpillar measured 6 mm. in length, and inhabited a cone-shaped case, measuring half an inch in length, which it carried on its back in an almost perpendicular position. The case itself is composed of tough, whitish silk, covered with minute portions of triturated bark and leaves, to which a number of short portions of pine leaves are affixed. In moving from place to place the larva projects the head and the three thoracic

* Proc. Zool. Soc., London, 1854, pp. 219–241.

segments from the entrance of the case, which is supported by the upturned abdomen. The thoracic legs only are used in walking, the prolegs apparently being used to support the case. The appearance of the larva is most peculiar, especially when the body is held at right-angles to the head and thorax, as it frequently is.

The adult larva measures about 1½ inch in length, and does not differ materially in colour or markings from the stage just described. As the insect increases in size it enlarges its case, and attaches more pieces of pine leaves from time to time, and when the case becomes too heavy to carry in the perpendicular position the caterpillar drags it after it.

On attaining full growth the larva fixes its case by strong silken threads to a branch of its food-plant or some other convenient support, and after turning its head towards the slender and free extremity of its case, assumes the pupa stage.

If the insect is a male it leaves the case at the free extremity and takes wing, leaving the empty shell of the pupa protruding; but the wingless and legless female, during the whole period of its existence in the adult stage, remains within its case. It is visited there by the male, and lays its eggs within or about the opening. In due course the eggs hatch, and the young larvæ, after consuming the empty egg shells, wander away in search of food, and soon construct cases for themselves.

Numbers of the cases of the adult insects, with the protruding pupa-shell of the male, or containing the dried and dead remains of the female, may frequently be observed hanging to the pine trees upon which the young offspring are feeding. The male perfect moth measures 1¼ inch in expanse of wing, *i.e.* from tip to tip; the thorax and body are densely clothed with deep black hairs, the antennæ reddish-yellow, strongly bipectinate, and tapering towards the extremity; the wings are transparent and hyaline.

The female perfect insect, as already stated, is a wingless and legless creature, whose chief function is the laying of eggs.

With regard to remedies for this pest, I would suggest the application of arsenical poisons, such as London purple or Paris green, in the proportion of 1 lb. of poison to 50 gallons of water. It is desirable to collect and destroy the cases in the depth of winter, as the cases of the females then contain the eggs from which the spring brood of larvæ is produced.

A Walking-stick Insect destroying Eucalypts.

Mr. W. C. Browne recently noticed that the gum trees at Murphy's Creek, in the vicinity of Walcha, New England, were suffering from the attacks of a walking-stick insect. It appears that the insects were found in such enormous quantities eating the leaves and young shoots that a vast number of trees, extending over a large area, were destroyed.

The specimens submitted by Mr. Browne proved to be *Podocanthus Wilkinsoni*, Macl., a species which is recorded by Sir William Macleay, who states that it committed similar ravages among gum trees near the Binda Caves in 1881.*

Dr. Riley has given an interesting account of a very similar insect (*Diapheromera femorata*, Say), which occasionally does great harm to oak forests and various other trees and shrubs. It appears that with this species the eggs are merely dropped on the ground by the females, and that they can frequently be gathered in large quantities without much trouble. Dr.

* Trans. Linn., Soc. N. S. Wales, VI, p. 536 (1881).

Riley recommends the sprinkling of Paris green water on the undergrowth beneath the infested timber for the destruction of the newly hatched walking-stick insects whenever domestic animals, such as sheep, for example, can be kept away from the poisoned areas. He also urges that the eggs should be destroyed in winter, either by digging and turning them underground, or by burning the dead leaves and rubbish among which they lie. The life-history of our native species is at present unknown, but probably these measures will be found equally efficacious if they are adopted here.

Scale Insect (*Aspidiotus* sp.) on Hakea.

Mr. Molineux, of the Agricultural Bureau, South Australia, has been kind enough to forward a species of scale-insect found on Hakea, which is new to me. It is nearly allied to *Aspidiotus ficus*, Riley, which affects the fig and orange, and is generally known as the Florida scale. The specimens will be more fully investigated.

A New Coccid, or Scale-Insect, infesting Grass at Mulgoa.

During February last, Mr. D. Collins, of the Public School, Mulgoa, near Penrith, forwarded some singular scale-insects, with the information that they were found infesting grass. They proved, upon examination, to belong to the family *Coccididæ*, and as they appeared to differ from any known form, I asked Mr. Collins to procure a number of fresh specimens. These additional specimens arrived in due course, and a series was at once forwarded to Mr. W. M. Maskell for examination and description. As I had anticipated, the species proved to be new, and Mr. Maskell has been kind enough to send me the paper included in the present issue of the *Gazette*, in which he describes the insect under the name *Dactylopius herbicola*. As far as I have had an opportunity of observing, the scale-insect was only found on one kind of grass, the *Aristida vagans*, Car., a species of little or no economic value. I had, however, only a small supply of living grass under observation, and it is quite possible that the insect will be found to attack other species. A valuable forage grass, *Eragrostis leptostachya*, Stead., was growing beside the *Aristida* in the jar received from Mr. Collins, but not a single *Dactylopius* was found on this grass during the ten weeks I have had the plants under observation, although the *Aristida* was thickly infested with the insects. When first received, a large number of living female insects, enclosed in their cottony sacs, were attached to the stalks of the *Aristida*, and a large number of larvæ were actively wandering about the leaves of the grass and about the dead remains of the mother scales. If this scale-insect is found to confine itself to the *Aristida vagans*, it can scarcely be regarded as a serious pest; but if it should be found to spread to other and more useful grasses, it would be well to apply kerosene emulsion, in the form of spray, to the infested patches. It is to be hoped that Mr. Collins and other local observers will endeavour to settle this point in the interests of the farmer and grazier.

Description of a New Scale-Insect infesting Grass.*

By W. M. MASKELL, F.R.M.S.

DACTYLOPIUS HERBICOLA, sp. nov.

ADULT female, dark-brownish purple, slightly elongated, convex above and flat beneath, segmented; covered with thin white meal, and sometimes bearing several long-curling very fine threads; resting on a rather thin cushion of white cottony excretion, which seems usually to be a good deal longer than the body. From this cushion, in all the specimens observed, rises a band of cotton arching over the dorsum of the insect like a strap, as if to keep it in place. This band appears never to be wide enough to enclose the insect entirely. Average length of the insect about one-ninth of an inch. Antenna of normally eight joints, sometimes seven; the first and last the longest and sub-equal, the last fusiform; the sixth and seventh are usually the shortest. The feet are somewhat abnormal; they have rather the appearance of the feet of a Monophlebid than those of a Dactylopid, and the tibia, tarsus, and femur bear some rather strong hairs on the inner edges. The digitules are four fine-knobbed hairs, claw rather thick and short. Anal tubercles inconspicuous, each bearing several short hairs and a long seta; anogenital ring normal of the genus, compound, with six long hairs. Rostrum large; mentum dimerous, conical. There are a great number of spinnerets all over the body, interspersed with spiny hairs.

Larva dark-brownish purple, elongated, flattish, segmented, active. Antennæ of six joints, the first five shortish and sub-equal, the last half as long as the rest together, fusiform, with some rather strong hairs at the tip. Feet rather thick, tarsus as long as, or a little longer, than the tibia; tibia and tarsus bearing hairs on the inner edges, claw slender; digitules, fine hairs. Length of larva, about 1-45 inch.

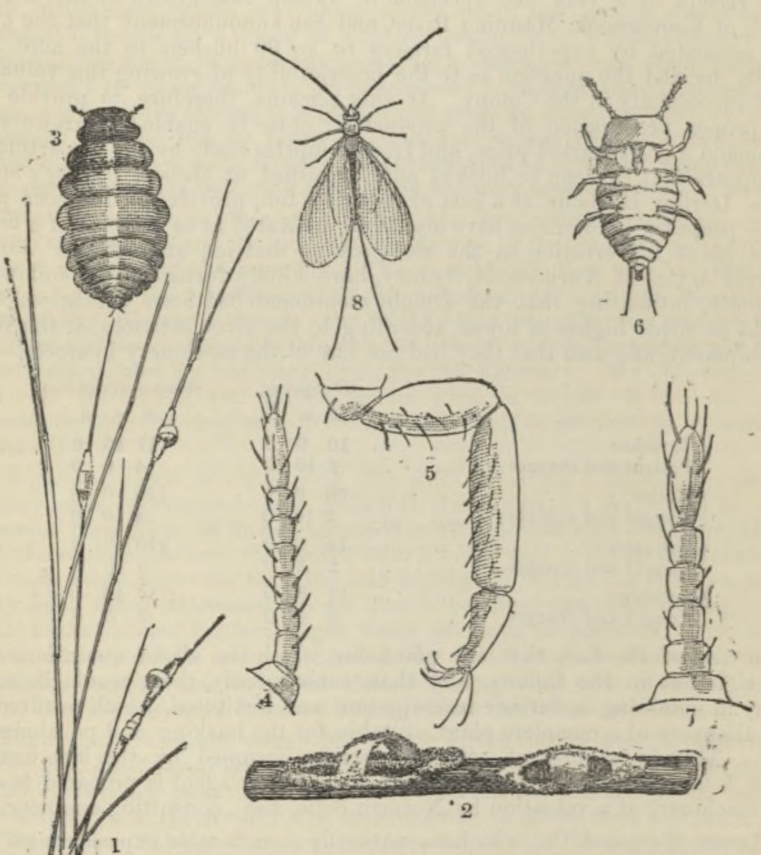
Adult male with dark purple thorax and abdomen; wings rather solid and perhaps shorter than usual in the genus. Antennæ normal, of ten sub-equal joints; dorsal eyes, two; ventral eyes, two.

Habitat.—In Australia, on stems of grass. My specimens were received from Mr. A. Sidney Olliff, who states that they were found on *Aristida vagans*, Car., at Mulgoa, near Penrith, N.S.W., by Mr. D. Collins.

This insect is undoubtedly Dactylopid, and I attach it to the genus Dactylopius, in spite of the form of the feet, which is a little abnormal. On first receiving the specimens I imagined that they might be the same as an

* The illustrations are from a pencil sketch by the author.

insect infesting grass in Natal, received some time ago through the kindness of Mr. J. W. Douglas, and which I propose to name *D. graminis.* In the mere outward appearance of the females themselves there is not a great difference, both being of a dark-purple colour, though *D. herbicola* is rather the larger of the two. But *D. graminis* constructs a more complete and more solid cottony sac, and, what is very much more important, the anatomical characters of the antennæ, feet, &c., of the two insects differ considerably. I am, therefore, obliged to separate them. The cushion and dorsal band of cotton of *D. herbicola* are quite peculiar. Mr. Olliff sent me about twenty specimens, and this character was the same in all, so that I believe I may venture to consider it specific. I confess that the object of the band, and its mode of construction, are not quite clear.



1. Grass with attached sacs of *D. herbicola* (natural size). 2. Sacs on grass: one empty, one with enclosed female (enlarged). 3. Adult female, dorsal view (enlarged). 4. Antennæ of adult female (enlarged). 5. Foot of adult female (enlarged). 6. Larva, ventral view (enlarged). 7. Antennæ of larva (enlarged). 8. Adult male, dorsal view (enlarged).

Notes on Economic Plants.

Swamp Rice.

The receipt of a very fine specimen of swamp rice, grown by Mr. Henry Juhl, of Coopernook, Manning River, and the announcement that the crop was estimated by experienced farmers to go 90 bushels to the acre has finally decided the question as to the practicability of growing this valuable food successfully in the Colony. It only remains, therefore, to provide for the proper preparation of the product, in order to enable the growers to command a good market price, and from inquiries made by the Department, it appears that rice can be husked and burnished at Messrs. Harper's spice mills, Darling Harbour, at a cost of 40s. per ton, provided it has been properly prepared. Inquiries have also been instituted as to the cost of a complete plant for erection in the rice-growing district, and Messrs. James Martin & Co., of York-street, Sydney, have kindly furnished the following estimate, intimating that the freight mentioned had been estimated, and might be either higher or lower, according to the circumstances at the time of shipment, and also that they had not any of the machinery in stock:—

	Hand-power.			Steam-power (horse).		
	£	s.	d.	£	s.	d.
Thresher ...	10	0	0	17	10	0
Freight and charges ...	2	10	0	4	0	0
Huller ...	30	0	0	110	0	0
Freight and charges ...	2	10	0	4	0	0
Separator ...	14	0	0	110	0	0
Freight and charges ...	2	2	0	3	10	0
Polisher ...	15	0	0	17	10	0
Freight and charges ...	3	0	0	5	0	0

In view of the fact that the plant, for which the above quotations are given, is not in the Colony, and that, consequently, there would be some delay in obtaining it, further investigation was instituted, which resulted in the discovery of a complete plant, suitable for the husking and polishing of rice. This is at present on the premises occupied by the late firm of Blair & Cameron, of Kent-street, Sydney, and their agent is prepared to sell the machinery at a valuation by Norman Selfe, Esq., consulting engineer.

Messrs. Harper & Co., who have naturally considerable experience on the point, have been kind enough to forward to the Department a sample of Java rice, which they state is the most marketable variety. This fact is an important one to growers, and well worth their consideration. It is also stated that the husks after being soaked for a day or two in water make capital feed for pigs and sheep.

As the credit of introducing the rice-growing industry, at any rate so far as the Manning River district is concerned, is due to Mr. Henry Juhl, of Big Swamp, Coopernook, a word or two on the subject of his operations will doubtless be read with interest. The *Grafton Argus* reproduces a very full report from the correspondent of a Manning River paper, so that a *resumé* of that report will probably convey the best idea obtainable of what has been done by Mr. Juhl in introducing rice growing as an additional crop to the products of the northern rivers. After describing the difficulties experienced by Mr. Juhl in connection with maize growing in wet seasons, and his consequent, although tedious, efforts to secure the most suitable rice seed, and the necessary information with regard to its cultivation, the report goes on to describe the land on which the rice is grown. That on which Mr. Juhl's crop stood was covered with water 3 to 6 inches deep, and it was ascertained that the rice appeared to thrive there, whether the land was wet or dry. A Mr. Ward, who had obtained some seed from Mr. Juhl, grows his rice on rich brush land, which was never under water, and he has also obtained successful results on a piece of drained swamp-land, which, although free from surface water, is, generally speaking, a damp soil. As other people in the district to whom Mr. Juhl gave some seed have been fairly successful on high, dry land, the inference is that it will grow on either wet or dry land; although it must not be forgotten that last season was an exceptionally moist one. It is certain, however, that thousands of acres of swamp-land on the northern rivers will grow rice in any ordinary season.

With regard to the time of planting, Mr. Juhl's first sowing was on the 20th October last, and the crop was nearly ripe at the time of the visit (10th April), and has since been cut. The second planting was on the 28th November, and this piece was in full ear, but green; third, on 29th December—just coming into ear in April. Mr. Ward's first planting was early in September, and was cut early in March; the second on 5th November, and fit to cut in April; and his last planting on the 9th February. Mr. Newton sowed early in November, and reaped second week in April. It will be seen, therefore, that the crop takes from five and a half to six months to come to maturity.

Regarding mode of cultivation, Mr. Juhl, who has conducted numerous experiments, recommends open drills 2 ft. 6 in. apart to a depth of 4 in., drop the seed from 15 to 18 in. apart, from 6 to 10 grains at each dropping, allowing the seed to scatter; then cover with 2 in. of soil. When the plants are up sufficiently high the thinning and hoeing will fill up the furrows, and a very light filling afterwards is all that is required until the reaping. Mr. Juhl soaks his seed for forty-eight hours previous to planting. Mr. Ward planted in rows 2 ft. apart, scattering the seed along the rows and filling right up, cleaning and hilling the same as for potatoes, Mr. Newton planted some in drills and some broadcast, and prefers the latter method.

The respective results were—Mr. Ward, at the rate of over 80 bushels per acre; Mr. Juhl's crop has been estimated by experienced farmers at from 80 to 90 bushels per acre; and Mr. Newton estimates his crop at 60 bushels per acre. As to the returns, the market price of Patna rice is from £14 to £17 per ton. Taking, therefore, the lowest yield (60 bushels) and the lowest price, and deducting freight off, &c., making £13 per ton, we have in return for a rice crop £19 10s. per acre, and, says the writer, "if this district is capable of growing Patna rice to such perfection I fail to see why it should not grow some of the better sorts, which are to-day worth £21 to £24 per ton."

Tea and Coffee Substitutes (*Chenopodium ambrosioides*, L.)

Under this title a number of contributions have appeared in the *Gardener's Chronicle* from the pen of Mr. John R. Jackson, Museum, Royal Gardens, Kew, and the following is of such an interesting character as to merit reproduction:—

"*Chenopodium ambrosioides*, L.—A native of North America, but naturalised in Southern Europe. It is known under the name of Culen, Yerba de Santa Maria, or Mexican Tea, where it is frequently used as a beverage, in consequence of its strong aromatic odour, and supposed beneficial effects in nervous diseases. It has more recently come under notice as a component part in a wonderful medicinal preparation known as Serkys tea, or 'Sultanas Imperial tea, preserver of health, youth, and beauty.' This tea was fully described in the *Gardener's Chronicle* for July 9, 1887, p. 39, and it will suffice here to give you a few quotations from that article. 'It is very refreshing, assists the digestion, hardens the flesh, clears the complexion, and gives it the transparency and freshness of the rose. The assiduous use of this tea night and morning will be followed with success in every case, even when used by ladies of advanced age. It has the advantage of possessing a most agreeable taste, which has rendered it the very favourite beverage of the Sultanas.' This wonderful tea is said to have been discovered by the dervish who first brought to light the qualities of Moka, and by him presented to the Sultan Osman I. It is further described as being 'made from some of the most refreshing and balsamic plants which grow at the foot of the mountains of Mecca and Lebanon. It has all the benificent qualities of the herbs of those countries, and the Sultanas, jealous of their youth and beauty, kept the secret for themselves alone.'

"The so-called tea, which has been made the subject of so much 'tall' writing, consists of finely broken leaves in which sage can be detected, as well as the seeds and portions of leaves of a *Chenopodium* probably *C. ambrosioides*."

In a future number of the *Gazette* an illustration of this plant will be given, as it is very common in the coastal districts of the Colony.

Brazilian Wine Palm (*Diplothemium maritimum*, Mart.)

The Hon. Dr. Norton, M.L.C., and the Hon. W. H. Pigott, M.L.C., have each brought to the Department for identification the fruit of a palm which the Botanist has identified as *Diplothemium maritimum*, Mart. It is commonly known as the Brazilian wine palm, and it is somewhat surprising to learn that this tropical plant has fruited at such an elevation as Springwood, the residence of Dr. Norton. Mr. Pigott, it appears, has several of these beautiful palms at Croydon, some of which bear fruit in abundance. This species of palm should be more extensively cultivated in the Colony, as it would lend a tropical effect to the surroundings. It is not only one of the most beautiful palms in cultivation (the graceful fronds being of a silvery grey colour), but it is of economic value, as the fruit is very pleasant to the taste.

Analyses of Commercial Fertilisers, etc.

Bone Manure.

The result is given below of an analysis of a sample of bone manure from the Riverstone meat-works:—

Moisture		6·91 per cent.
Substances volatile at red heat		12·22 ,,
Containing nitrogen	1·12 per cent.	
Equal to ammonia	1·36 ,,	
Substances insoluble in acid		12·82 ,,
Phosphoric acid (P_2O_5)		25·72 ,,
Lime...		35·90 ,,
Magnesia		1·51 ,,

It is hard to assign a value to this manure, because the phosphoric acid is in the form of coarse bones, jaw-bones and teeth, which would take a long time to decompose in the soil. If the bones were in the form of dust the manure would be worth 79s. per ton. It should be composted with dried blood, earth, muck, &c., and watered with urine and slops, which ought soon to reduce it. It is very good, as it is, for slow-growing crops like fruit-trees.

Dried Blood Manure.

A sample of dried blood manure from the Riverstone meat-works gave the following results on analysis by the Departmental Analyst:—

Moisture		11·30 per cent.
Substances volatile at red heat		80·93 ,,
Containing nitrogen	10·08 per cent.	
Equal to ammonia	12·24 ,,	
Substances insoluble in acid		4·31 ,,
Phosphoric acid (P_2O_5)		0·62 ,,
Potash		0·42 ,,
Lime...		0·87 ,,
Magnesia		traces

This manure is very valuable for the large amount of nitrogen it contains. The small percentage of phosphoric acid suggests the thought that probably some samples would contain much more bones than this one. It is worth £6 15s. per ton.

Poudrette.

The following is the result of an analysis by the Departmental Analyst of a sample of poudrette submitted to the Department for that purpose:—

Coke, rags, glass, etc.	17·6 per cent.

Analysis of the sifted portion.

Moisture		7·80 per cent.
Insoluble matter (sand, etc.)		40·92 ,,
Volatile combustible matter		30·96 ,,
Containing nitrogen	1·40 per cent.	
Equal to ammonia	1·70 ,,	
Potash		2·11 ,,
Phosphoric acid (P_2O_5)		3·09 ,,
Lime...		4·30 ,,
Magnesia		1·14 ,,

The "poudrette" is worth about 33s. 6d. per ton.

Sugar Company's No. 5 Manure for Vines.

At the suggestion of the Department, Mr. L. Frére, of St. Hilaire vineyard, Albury, conducted experiments with a view to testing the value of Sugar Company's No. 5 Manure for treating vines. The following are the results of the experiments:—The manure was applied by the end of October, 1890, on 200 vines of the White Shiraz, and the grapes were pulled and weighed on the 25th April, 1891.

50 vines at rate of 4 lb. to 10 vines' weight of grapes	91 lb.
50 ,, ,, 5 ,, 10 ,, ,, ...	120 ,,
50 ,, ,, 6 ,, 10 ,, ,, ...	132 ,,
25 ,, ,, 8 ,, 5 ,, ,, ...	50 ,,
25 ,, ,, 10 ,, 3 ,, ,, ...	84 ,,
50 vines without manure	86 ,,

The vines, in common with others not manured, suffered greatly from oïdium. In every case the yield of vines manured was greater than the yield unmanured. The difference, however, is not large enough to pay the cost of the manure, but as the vigour of the manured vines is far superior to those which have not been treated, Mr. Frére is confident that, without extra manure, they will bear larger quantities next year. Even the last season, had the manure been applied earlier, he has no doubt the yield would have been greater. The total increase on 200 vines amounted to 133 lb. of grapes. Although this increased yield would not pay for wine-making purposes, and with freight to Albury included, it would pay well for table grapes within a reasonable distance of Sydney, calculating only 2d. a lb. for them.

Bone Manure.

An inquiry, addressed to the Department as to the best way to put crushed bones on the soil, was replied to by the Director, who gave the following information:—From 10 to 20 cwt. per acre would be a good dressing, and should be spread over rough ploughed ground, and harrowed in during autumn, that being the best season, because they have to be decomposed in the soil before being available as plant food. Of course, the finer they are the sooner they become decomposed.

If, on inspection, the bone-mill does not come up to expectation, perhaps the following would be the easiest way of reducing the bones:—They may be softened by mixing in heaps with quicklime and loam, thus: a layer 6 in. deep of bones, on this a layer of about 3 in. deep of lime, then a layer about 4 in. deep of loam, and so on repeating until the heap is made of convenient height, when it is to be covered up with a thick layer of earth. Holes are then to be bored into the heap from the top, and water poured in to slake the lime. The mass will become hot and remain so for two or three months, after which the bones will be found friable, when the whole heap may be mixed together, and is ready for applying to the ground.

Megass.

Samples of megass having been received from Mr. Alexander Ross, of Palmer's Island, for analysis, in order to ascertain its value as a fertiliser, the following general information for guidance in its use has been prepared by the Director, pending the publication of the result of the analysis :—The better rotted the megass is, the more available it is as a manure. The application of salt water would retard the decomposition of the megass and act as a check, whereas lime would hasten decomposition, and make it sooner fit for plant food, besides itself furnishing valuable food for crops. Notice should be taken of the heat generated in the fermenting of the mass. Excessive heat injures manures, as burning is quite a different thing to rotting. The heat can be kept down by applying water—salt water if no other is available. If it is found by a farmer that he is unable to deal with it without risk of spoiling the manure, it would perhaps be best to spread the megass on the land and plough it in next season.

Guano.

A sample of guano from Messrs. Kauffmann and Son, of Adelaide, having been submitted to the Departmental Analyst for examination, that officer has arrived at the following results :—

Moisture (*i.e.*, loss at 95 deg. C.)		36·09 per cent.
Substances volatile in red heat		45·87 ,,
Containing nitrogen	4·48 per cent.	
Equal to ammonia	5·44 ,,	
Phosphoric acid (P_2O_5)		5·59 ,,
Potash		0·46 ,,
Lime		7·75 ,,
Substances insoluble in acid		1·20 ,,

From the above analysis it is evident that nitrogen has been largely washed out of the manure, which is not specially rich in phosphoric acid. Its value in Sydney would be from 78s. to 80s. per ton.

Ammoniacal Liquor from Gas-works.

The ammonical liquor which is obtained from gas-works has formed the subject of inquiries from different parts of the Colony, particularly by Messrs. Hilson and Staples, of Alstonville, Richmond River, who wished to know if the liquid was useful in the growth of potatoes, and how it should be used. In replying to these inquiries the Director recommended that the liquor should be used with sawdust or compost heap, and that care should be exercised in hot weather. It is best suited for vegetables and quick-growing things. If a little sulphuric acid be added (till red litmus paper is not turned blue) sulphate of ammonia is formed, and that will not deteriorate or evaporate like the volatile ammonia. The following remarks are made by Griffiths in his Treatise on Manures :—

"Ammoniacal or gas liquor obtained as a bye-product in the manufacture of gas is essentially an impure solution of carbonate and acetate of ammonia.

Gas liquor is of various degrees of strength; hence the amount of water to be added to it (before applying it to the land) also varies. As a rule, ammoniacal liquor should be diluted with four or five times its bulk of water. For grass lands the liquor can be applied by a water-cart, and will generally give increased yield. In very dry weather gas liquor 'burns up grass,' but on the first appearance of rain the 'herbage will again spring up with increased luxuriance.'

"Ammoniacal liquor has also proved a valuable fertiliser (applied by a water-cart) for cereal crops growing on clayey soils.

"For turnip and potato crops it is much better to absorb the ammoniacal liquor by means of sawdust, peat, or charcoal, and then to add bonedust to the mixture. This mixture, applied in drills, gives excellent crops.

"Ammoniacal liquor is said to destroy moss found in grass lands far better and more permanently than lime. The late Professor J. F. W. Johnston, F.R.S., found it an excellent remedy for the 'green fly' on rose-trees and other plants, and it is said also to destroy slugs.

"Gas liquor promotes the fermentation of sawdust, peat, and similar vegetable substances."

Analysis of Soil from Carlingford.

By A. HELMS, M.A., Ph.D.

The following analysis has been made of soil received from Carlingford, the geological formation of the surrounding country being Hawkesbury sandstone, the nature of the soil clay loam, and the subsoil clay and shale:—

Mechanical Analysis.

Stones of more than $\frac{1}{4}$-inch diameter	8·45	per cent.
Coarse sand of more than $\frac{1}{24}$-inch diameter	11·92	,,
Root fibres	0·33	,,
Fine soil	79·30	,,

Analysis of Fine Soil.

Moisture	4·43	,,
Sand	16·25	,,
Impalpable matter, chiefly clay	67·65	,,
Organic substances, and water of combination	11·67	,,

Determination of substances soluble in hot hydrochloric acid of 1·10 specific gravity:—

		General value.	
Lime (CaO)	... 0·2880 per cent.	...Good...	...Equivalent to 5,760 lb. (*a*) in an acre of soil 6-in. deep.
Potash (K_2O)	... 0·1552 per cent.	...Good...	...Equivalent to 3,104 lb. (*b*) in an acre of soil 6-in. deep.
Phosphoric acid (P_2O_5.)	... 0·1402 per cent.	...Satisfactory...	...Equivalent to 2,804 lb. (*c*) in an acre of soil 6-in. deep.
Nitrogen...	... 0·1624 per cent.	...Good...	...Equivalent to 3,248 lb. (*d*) in an acre of soil 6-in. deep.
(Equal to 0·1992 per cent. ammonia.)			
Magnesia...	... 0·1874 per cent.		
Ferric oxide	... 4·6580 ,,		

Note.—(*a*) This amount of lime would be supplied in 6,400 lb. of quicklime, or 8,457 lb. of slaked lime, or 11,428 lb. of chalk.
(*b*) This amount of potash would be supplied in 5,745 lb. of commercial sulphate of potash.
(*c*) This amount of phosphoric acid would be supplied in 6,121 lb. of commercial bone-dust, or 4,620 lb. of superphosphate.
(*d*) This amount of nitrogen would be supplied in 16,240 lb. of sulphate of ammonia, or 19,488 lb. of nitrate of soda.

The special points of value in this soil are the amounts of potash and phosphoric acid; there are no special defects, and its general character is good. The crops for which it is most suitable are fruit, especially vines and peaches, clovers and grass. If properly treated, however, it ought to grow any crop very fairly. For treating it lime is recommended—not as a plant food so much, but to break up the clay, liberate the potash, and make the soil more kindly and easy to work.

In remarking generally on this soil the Director of Agriculture points out that it is much richer than the majority of the soils in the county of Cumberland. Any general manure would, no doubt, benefit it in giving trees and crops a stimulus. The great drawback is the shallowness of the soil and the stiff character of both it and the subsoil. "I fear," continues the Director, "that oranges and lemons will be likely to suffer through coldness at the roots and bark-rot unless the ground is sub-drained. The ground is rich enough to grow these trees, as well as all other fruit trees, splendidly, but I should recommend pipe-drains, $2\frac{1}{2}$ feet deep, 30 feet apart."

Meteorological Notes.

Frosts.

In the March issue of the *Agricultural Gazette* a table was given, compiled from records kept at the Sydney Observatory of the earliest and latest frosts observed at different meteorological stations, and the personal experience of residents in various parts of the country was invited, with a view of obtaining the most complete additional information in this matter. The Department has since received from the Hon. W. H. Suttor, M.L.C., some interesting information with regard to frosts in the Bathurst district, and also particulars as to the highest and lowest thermometer records in the salt-bush country 60 miles west of Forbes.

"I desire," says Mr. Suttor, "to add my mite of information upon that subject, so far as the Bathurst district is concerned."

"In 1874, on December 22nd, a frost occurred so severe that on the low land it completely killed all the maize and some crops of wheat then in ear. I, from a long residence in the district, consider that we are never generally speaking free of frost until the 14th to 23rd November. Frosts at that time are common, and invariably follow hailstorms which have occurred during the previous afternoons. I have seen the thermometer on the grass in July and August go down to 14° and 16° F. at an elevation of some 160 feet above the lower valley of the Macquarie, and most certainly at the lower level it would have fallen several degrees lower. Some years ago, travelling through Orange, I saw a distinct frost early in March.

In 1889 we had no frost at Bathurst until June 22.

In the saltbush country, 60 miles to the west of Forbes, I for many years took meteorological observations. The highest degree of thermometer in the shade, *i.e.*, under a wooden verandah facing south, both ends enclosed with thick growth of vine, was 110°; inside the house, 105°; lowest temperature on grass, 22°, which did not affect injuriously orange trees growing there."

General Notes.

The Travelling Dairy.

The first visit of the Travelling Dairy was made to Bathurst on the 19th May last, when after a few slight hitches incidental to the working of perfectly new machinery, everything worked satisfactorily. A class of thirteen (five girls and eight boys) attended the course, and derived great benefit from the instruction imparted to them, while the farmers of the surrounding district, as well as the citizens, showed by their numbers the great interest which they took in this important adjunct to the Department of Agriculture. Local Agricultural Societies and Progress Committees are reminded that application should be made to the Director of Agriculture in order to arrange for the Dairy to visit their district, and as applications are dealt with in the order of their receipt no time should be lost in making them. Visits of the Travelling Dairy will in all cases be subject to the following regulations:—

Requirements to be provided by the Agricultural and Pastoral Association or Committee, under whose auspices the Dairy is in operation.

1. To provide for the carriage of the plant to and from the nearest railway station or wharf to the scene of operations, and also to and from any places where the plant shall work within the district covered by the operations of the Association or Committee.
2. To provide a building for housing the plant, which must be—for the complete installation—at least 30 feet long by 20 feet wide, with flooring. These dimensions are required for the plant alone, and do not allow for room for spectators; the building, therefore, to accommodate visitors, would require to cover a larger area.
3. To provide a daily supply of about 50 gallons of milk, the produce of which will be returned to the Committee, or as may be arranged.
4. To provide a labourer to assist in the rough work, such as cleaning up.
5. To provide fuel and a sufficiency of clean water for washing butter and cleaning up.
6. To supply a list to the Department, giving the names and addresses of the pupils nominated for a course of instruction with the dairy.
7. In such places where no Agricultural Society is in existence, a Committee must be organised, who will undertake the responsibility of these conditions being carried out.

Note.—There will be two installations of the travelling dairy—one fitted with engine and boiler on wheels, and a large 90-gallon separator, and heavy adjuncts, intended for exhibition at large centres of population near the railway line or near seaports; the other will be a much smaller installation, consisting of hand separators, and much lighter plant in general. This will be intended for small centres removed some distance from the railway or from seaports. The weight of the larger installation will be 2 tons, apart from the engine and boiler on its own wheels, which weigh 1 ton 15 cwt.; the weight of the smaller, 1 ton 15 cwt.

In return for the due compliance with the above requirements, the following privileges are accorded:—

1. The Agricultural Association or Committee applying for the services of the plant, will be entitled to nominate, for each place in which the dairy operates, at least 10 pupils—known as nominated pupils—either male or female, for a course of special instruction with the dairy.
2. Where the accommodation provided for the plant is sufficiently large to permit, and the Officer-in-Charge has no objection, an extra number of pupils will be allowed to receive a course of instruction precisely similar to that given to the nominated pupils.
3. The dairy will work for 10 days at each place where set up.

H. C. L. ANDERSON,
Director of Agriculture.

Differences Between a Young Hare and a Rabbit.

By E. STANLEY,
Government Veterinarian.

With a view to assisting those not accustomed to the animals to recognise the young leveret from a rabbit of the same size, the appended detailed statement has been prepared, which, it will be noticed, is confined to the exterior of the animals.

The points of difference are most marked by the texture of the fur, its colour, remarkable colours of the ears, growth of hair on the tips, and the measurements of the feet and limbs.

Comparative differences between a leveret and a young full-grown rabbit of about the same size and weight.

RABBIT.	LEVERET.
Fur.—Short, dense, smooth, straight, soft and often a patch of reddish colour on back of the neck.	Fur.—Coarse, open, curly, rough, and longer; no reddish patch.
Whiskers.—A few, weak and scattered.	Whiskers.—Long, strong, and clustered.
Incisor teeth.—Broad, well developed, white and hard.	Incisor teeth.—The same length, more narrow, light coloured, and softer.
Eyes.—Not prominent, iris, colour usually dark slate.	Eyes.—Very prominent, light brown iris.
Ears.—Measure from tip to tip across the head, 9¼ inches; breadth of ear, 2 inches; shape,—short, open, tips rounded as if clipped close.	Ears.—Same direction, 10½ inches; breadth, 2¼ inches; shape, larger, edges inclined to close together, tip ragged and covered with black hair.
Markings on the ears.—Colour of body, shading darker to black, evenly over outer side to the tip, *not over it*; no white buff or black markings.	Markings on the ears.—*Front* outer half, brown; *back* outer half lighter, colour, shading off towards the top to light buff and white, finishing with a triangular black patch, extending over the tip to the inner surface.
Fore limb from top of shoulder bone to end of toes measures 8¾ inghes.	Fore limb.—Same direction; measures 11¾ inches.
Hind foot measures 3¾ inches from hock to toes.	Hind foot measures 4¾ inches.
Girth of chest measures 8 inches.	Girth of chest measures 9½ inches.
Nose to root of tail measures 18 inches.	Nose to root of tail measures 18 inches.

India Rubber Trees.

In a communication received from the Secretary of the South Australian Agricultural Bureau (Mr. Albert Molineux), that gentleman mentions that in South Australia they have, growing luxuriantly, many of the rubber trees and plants referred to in an article on this subject which appeared in vol. 2 part 3 of the *Gazette*. Particular mention is made of a specimen of Ficus Elastica which was planted by the late Geo. Stevenson, Esq., as long ago as 1844, in his garden at North Adelaide.

STRANGLES IN HORSES.

INTIMATION having been received from the Tenterfield District as to the prevalence of strangles in horses which were not confined to the throat but broke out in other parts of the body, and if the animal had any sore that part was also affected; the following information was obtained from the Government Veterinarian, and is of course applicable to the disease in any part of the Colony:—Give nutritious and easily digested food. The tumors sometimes require blistering to hasten the formation of abscess; when open apply carbolic acid one part, sweet oil twenty parts every day until healed.

SUGAR BEET.

A BULLETIN has been issued by the Agricultural College of Michigan, United States America, on the improved cultivation of the Sugar Beet, in which certain lines are laid down for the conduct of experiments. In view of the articles which have appeared in parts 3 and 4 of vol. 2 of the *Agricultural Gazette* of New South Wales a short resumé of the directions to farmers will be of service to those who undertake to conduct experiments on behalf of the Department of Agriculture in the cultivation of Sugar Beet in suitable districts of the Colony. Two principal reasons are given for the financial non-success of many attempts to manufacture Beet Sugar in America, viz:—

(1.) The machinery for a sugar plant is very costly, can be used only a few months in the year, and requires great technical skill to run it profitably.

(2.) A very large amourt of beets must be furnished to stock and run a factory, of a good quality and at a price that manufacturers can afford to pay.

The question therefore which remains to be decided is whether growers can produce the right kind of beet with profit to themselves at the price which manufacturers can afford to pay. In America this price is 3 dols. or or about 12s. 6s. per ton delivered at the factory for beets containing 12 per cent of sugar, with an increase of 25 cents (about 6d.) for each per cent above 12. This important question can only be answered by experiments, and the Director of Agriculture will be glad to hear from farmers willing to undertake this important and responsible duty. Full instructions regarding the proper mode of preparing the ground together with the time for sowing the seed are given in an article which appears in the April number of the *Agricultural Gazette*, and at the conclusion of the experiments a form similar to the following will have to be filled in by all those who conduct them in respect to each kind of beet raised:—

1. Kind of soil.
2. Time of planting,
3. Name of beet.
4. Distance between rows.
5. Distance between beets in the row.
6. Time of harvesting.
7. Tons per acre of beet roots.
8. Cost per ton of raising the beets.
9. Name and address of farmer.

In view of the fact that preparations will have to be made prior to the seed being sown applications are invited as soon as possible. A piece of land should be set apart, say about 2 acres, and cultivated in accordance with the directions, and in the early spring the seed beet will be despatched. The Department will test the richness in sugar of specimens from each experimenter.

National Prizes—Vineyards.

Messrs. P. F. Adams, L. Frere, and J. A. Despeissis, the Judges appointed by the Minister for Mines and Agriculture (Mr. Sydney Smith), to determine the merits of vineyards entered in competition for the National Prizes for 1890, have completed their inspection and furnished their report. The recommendations made by them have received the Minister's approval, and are as follows:—

Vineyards, class I, under 10 acres (any part of the Colony).—1st prize of £50 awarded to Messrs. R. C. Pulver & Sons, of Wagga Wagga; 2nd prize, £25, Mr. W. Wyndham, Kulki vineyard, Inverell.

Vineyards, class II, over 10 acres (any part of the Colony).—1st prize, Mr. K. Wyndham, Bukkulla, Inverell; 2nd prize, £25, Mrs. S. A. Moyer, Middarro vineyard, Corowa.

Messrs. F. Offner, Wellington; J. F. Knauer, near Picton; and W. Jennings, Yambla, are to receive commended certificates for their vineyards.

National Prizes for Poultry Farms.

It will be remembered that Messrs. A. J. Gray, M. Nancarrow, and J. E. Pemell were the Judges appointed by the Minister for Mines and Agriculture (Hon. Sydney Smith), to determine the merits of the entries received last year for the National Prizes offered for the best managed poultry farms in any part of the Colony. Some delay has arisen in the submission of the Judges' report, because they were not unanimous in their opinions as to the most worthy entries. The Minister, however, has now received a report from the two first-named Judges (Mr. Pemell dissenting), in which the following awards are recommended, and they have received the Minister's approval:—

J. W. Pender, West Maitland, 1st Prize.
Walter Hope, Bonnyrigg, near Liverpool, 2nd prize.

The properties of the following persons are also well spoken of—

T. Hall, Fairfield, and A. Hallen, Toongabbie,

and they will each receive a certificate of merit. The former will receive a highly commended certificate, and the latter (who is totally blind), will receive a certificate for the industry and perserverance displayed in the management of his poultry farm.

Lemon Trees and Drainage.

It is worth the notice of citrous fruit-growers that information has been received by the Department, notifying a serious loss of Lisbon lemon trees in the Richmond district. Thorough drainage is absolutely necessary for the successful growth of the Lemon tree, such trees being very impatient of stagnant water.

Wrongly-named Grasses.

Another attempt to foist a useless grass upon the Colony has fortunately been frustrated by the prompt action of Messrs. Anderson and Co., of Pitt-street, the well-known seed merchants. This firm received a letter from New Zealand, offering to supply seed of a grass largely grown there under the name of *Alopecurus agrostis*, commonly called "Cat's tail." Having a doubt as to the name, Messrs. Anderson, at the suggestion of Mr. Turner, the Departmental Botanist, applied for a specimen, which on receipt was immediately identified as *Sporobolus indicus*, R. Br., a grass which would be anything but a blessing if introduced into the Colony. If every one who was doubtful as to the identity of seeds, particularly of exotic grasses, would only follow the course adopted by Messrs. Anderson, some thousands of pounds would be saved, and the Colony would be benefited far beyond the actual money saving.

The surplus Maize Crop.

Enquiries have been addressed to the Department of Agriculture from the Northern Rivers as to the amount of raw spirit obtainable from a standard bushel of maize, with a view to devising some means of utilising the over-production of this grain in good seasons. The information afforded by the Director is to the effect that much depends on the skill of the operators, the perfection of the apparatus, and the richness of grain, and that twelve experiments conducted in the laboratory have shown that on an average six and up to nine quarts of absolute alcohol can be obtained from a bushel (56 lbs). In forwarding this information, however, the Director of Agriculture pointed out that a far more commendable course, and one from which a payable industry might possibly develop, would be the utilization of the surplus maize in pig-raising, thus keeping a steady market for the supply of this grain, while for the balance of the yield probably not less than 2 per cent. would be obtained in the condensed form of pork, bacon, &c. The question of pig-raising is at the present time receiving considerable attention from the Department, and interesting articles dealing with the subject will be found in the April and May numbers of the *Agricultural Gazette.*

Nut Grass and Potatoes.

The proprietors of the *Lismore Chronicle* have kindly forwarded to the Department a potato, showing the ravages caused by nut grass. According to the communication accompanying the specimen the seed (potato) was procured from Sydney, and carried with them some seed of the nut grass. In reporting thereon, the Departmental Botanist (Mr. F. Turner) says:—"It is not an uncommon thing for the nut grass to penetrate sweet potatoes, but I never remember hearing of it having done so with the ordinary potato before. The couch or twitch grass of England (*Triticum repens*) has been known to force its underground stems through the ordinary potato." It is more probable that the nut grass was in the soil before the potatoes were put in than that it accompanied the seed potatoes, as the seed of nut grass is too large to be passed over in the operation of sowing potatoes.

[Six Plates.]

Sydney: George Stephen Chapman, Acting Government Printer.—1891.