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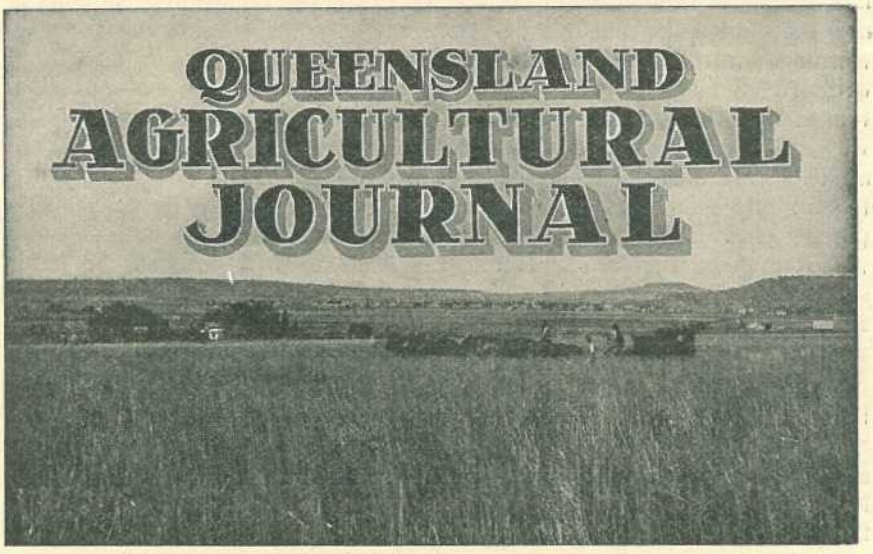

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Event and Comment

Protection for the Farmer.

IN the course of a recent announcement the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, stated that the question was frequently raised: How do farmers of other countries supplying the British market at parity succeed in remaining solvent while our farmers say that solvency under these conditions is impossible? The reasons were not hard to discover, he remarked. Many of the countries supplying Britain with dairy produce had an exceedingly low standard of livelihood in comparison with that established in the Commonwealth, and it was no exaggeration to say that the production in those countries was frequently the production of people who were little better than serfs.

In addition, tariff policies increased the Australian farmer's cost of production, and if the producer were compelled for national reasons to purchase in a protected market, was it not reasonable to assume that he could not afford to sell in an open market?

Continuing, Mr. Bulcock said that without protection Australia would be a dumping ground for the products of cheap and exploited labour countries, and our industrialists would soon be out of work. The referendum would ask that the same protection should be applied to the farmer as was extended to other and larger sections of the community.

Practically every major agricultural country in the world was organising production and marketing, and Britain attached great importance to this activity. It was said that the House of Commons is now more agriculturally minded than has been the case during the past century; and Canada and the United States of America are associated with orderly marketing, because they, in common with all other countries, realise that the soil is the source of all our wealth. Here in Australia, we, too, are recognising this elementary truth very clearly, and, in addition, are also realising that the producer is a consumer. In order to build up our industries the farmer must have adequate purchasing power. In other words, if he cannot purchase industries languish and unemployment increases. But the farmer cannot purchase if he is singled out for adverse economic treatment.

The Farmer's Purchasing Power.

IF the referendum is carried the farmer's purchasing power will be strengthened, and all sections of the community will therefore benefit. If it be not carried the farmer's purchasing power will wax and wane, in response to overseas price movements, and the first essential of economic progress—stability—will be missing," added the Minister. He then proceeded to examine the position in the event of the people of Australia refusing to give the producer stabilisation and a domestic price.

For a brief period they would remain on their present level of production, but slowly and surely uneconomic prices would drive many producers out of agriculture. Then there would be a rise in prices, production would increase to a point, where uneconomic prices again intervened, and production would again decline.

Organised marketing sought to prevent this happening. Nationally it was disastrous, and the consumer over a number of years gained nothing. But we as a people could not afford to yield our fate to uncontrolled economic force, and as development and yet more development was necessary, we must concede to the producer that which was esesntial, not only to his wellbeing but to the security and solvency of the Commonwealth.

Lack of Close Agricultural Organisation.

AGRICULTURE is, generally speaking, the one major activity of mankind which is not satisfactorily organised, said Mr. Bulcock. Industry and labour had entered into national and, in some cases, international alliances for their protection. It was clear that the benefits accruing to an organised section might be paid for by an unorganised section, and it followed that, so long as farming was an unorganised occupation it would be compelled to make a contribution, not only to its own maintenance, but also to the maintenance of other enterprises.

Obviously, that was a condition that should not be perpetuated, but we had heard from time to time of an opposition developing to the proposed referendum. So far as could be seen, the Governments of three States of the Commonwealth favoured the referendum. Within those three States was produced 90 per cent. of the total of Australia's agricultural exports. The other States, representing only 10 per cent. of export production, had it in their power to prevent the farmers' achieving that degree of economic stability which was their due.

Price Movements.

AN interesting phase of that question presented itself if one studied price movements in Queensland and similar movements in the Southern States, Mr. Bulcock continued. It was generally conceded that the farmer in Queensland is far better off than the farmer in any other State of the Commonwealth, the chief reason being that farming in Queensland is organised to the limit of the State's resources.

This, of course, was not the condition in any other State of our Federation, but, strangely enough, the cost of living in Queensland is the lowest of any State in the Commonwealth. It was clear, then, that organised marketing, properly regulated, does not make a levy on the family budget, but does relieve the taxpayers in the final analysis of maintaining people who are engaged in an industry made unremunerative by an adverse economic structure.

In these days, when it is popular to talk about tax reductions, it is well to look at the volume of assistance that the taxpayers of Australia have given the primary producer. Bounties in many directions are becoming established axioms of our agricultural life, and I know of no more inadequate way of permanently assisting farming than to levy the taxpayer to provide a bounty to buoy up an industry that can only be solvent when organised. Organised marketing very reasonably can mean a reduction in the sum total of taxation levied by the Commonwealth.

Babel or Pentecost?

CONCLUDING, Mr. Bulcock expressed the opinion that the farmers of Queensland would, without doubt or hesitation, vote for the referendum. "I am convinced," he said, "that the consumer will not inflict any restriction on his purchasing power by supporting it. Where, then, does the opposition arise? A study of the organised marketing movement in Queensland will show that, as this type of organisation was achieved, it met with the hostility of certain interests who, until the advent of organised marketing, had been successful in intercepting the commodity as between the producer and the consumer, and levying tribute upon it, which was paid, of course, by the consumer and producer.

"Commonwealth marketing would mean in many instances that this intermediate levy would not be possible of collection by interested parties, and consequently the matters associated with this referendum cannot be expected to receive the blessing of the individual who prefers to farm the farmer rather than farm the land.

"In conclusion, I would say that there are three unassailable reasons why this referendum should be supported:—

(1) Because it has a basis of natural justice;

(2) Because Australian solvency depends on the organisation of our primary production.

(3) Because the future of Australia is so intimately wrapped up with our agriculture that everything possible must be done in order to conserve and expand primary undertakings."

Citrus Diseases.

J. H. SIMMONDS, M.Sc., Senior Plant Pathologist.

THE extent to which citrus is affected by disease in Queensland varies greatly with the location in which it is grown. In the drier inland districts, with the exception of certain physiological troubles such as mottle leaf, disease is not an important factor. On the coast, however, where warm moist conditions normally prevail during spring and summer the presence of diseases, especially those affecting the fruit, makes it difficult to produce citrus of satisfactory appearance and quality. When spraying is necessary, Bordeaux mixture has been found efficacious. However, this spray possesses the disadvantage that its continued application has a detrimental effect on citrus trees as well as promoting an increased scale insect infestation. For this reason it has been the practice to add 1 per cent. of emulsified red oil to the Bordeaux. In addition to acting as a spreader the oil is believed to check scale development to some extent and so minimise the ill effects of the Bordeaux in this respect. However, if more than one application of Bordeaux is made it is usually necessary to take special precautions later in the season for the control of the scale. For this purpose the resin-soda-fish oil spray is recommended, the use of which is described in Bulletin No. 10, "Queensland Scale Insects and their Control." Recent experiments indicate that colloidal copper may prove a useful substitute for Bordeaux mixture on citrus since it is an effective fungicide and yet does not tend to increase scale infestation to nearly the same extent. In those districts where scale insects are a serious problem it is recommended that a trial be made of this spray.

The control of some Queensland citrus diseases is still under investigation, and in these cases it has been possible to make only preliminary recommendations.

BLACK SPOT.

Black spot is probably the most common and destructive disease of citrus in Queensland. Most commercial varieties are subject to its attack.

The disease is almost entirely restricted to the fruit, and does not usually appear before the latter is colouring or approaching maturity. Minute reddish-brown spots appear scattered over the surface of the rind on the side exposed to the sun. These develop into circular areas one-sixteenth to one-eighth of an inch in diameter, and the central portion becomes shallowly depressed and may assume a greyish colour. On fruit which has fallen or which has been stored for some time, a brown and somewhat shrunken area may extend out from the initial spots and cause serious blemishes. (Plate 41, figs. A and B.) Black spot is much more prevalent on exposed fruit on the sunny side of the tree. Affected fruit will not hang on the tree when ripe, and loss is occasioned by the fruit falling off before picking as well as by the actual disfigurement.

Black spot is caused by a fungus (*Phoma citricarpa*). Unlike the organisms causing most other diseases of citrus, this fungus is restricted to Australia and some Eastern countries. The spores which spread the disease are contained in small flask-shaped receptacles imbedded in the rind. These may be seen as minute black points studding the centre of the spots.

Control.

(1) As with other citrus diseases, the incidence of black spot can, to a certain extent, be lessened by keeping the trees in a healthy, vigorous condition by satisfactory manuring and cultivation. Dead and sickly wood should be pruned out.

(2) Fallen fruit should be picked up and destroyed by fire or burying.

(3) Experiments have shown that black spot may be controlled by spraying with Bordeaux mixture. This work is not yet completed, but until further results are available the following schedule can be recommended.

It should be realised that most of the infection takes place when the fruit are very young and probably little or none later than six months after setting, although the actual spotting does not appear until the fruit are approaching maturity and changing colour.

Spray with Bordeaux mixture (3-2-40), to which 1 per cent. (approximately ½ gallon to 40 gallons) red oil well emulsified in its own volume of water has been added as a spreader at the following times:—

(1) When the greater part of the blossom has fallen (i.e., more than 75 per cent.);

(2) About two months later in December.

If infestation by scale becomes too heavy, special precautions will have to be taken for their destruction as recommended in the introduction. Growers are advised to try the substitution of colloidal copper for the Bordeaux mixture.

MELANOSE.

Melanose is a trouble which is to be found most frequently in old or neglected orchards. Leaves, twigs, and fruit are all affected, though it is on the last that the disease is most conspicuous. Here the lesions consist of small brown specks or dots rarely exceeding one-fiftieth of an inch in diameter, which are scattered sparsely or abundantly over the surface of the rind. (Plate 41, fig. D.) These appear at first as a surface stain only, but later they become slightly elevated and somewhat fissured diagonally or round the margin, so that a melanose-affected fruit is decidedly rough to the touch. Examined microscopically, the lesions are seen to consist of two or three layers of brown, gum-filled cells which, in later stages, become elevated by the development of corky tissue beneath. The spotting in the leaves and twigs resembles in general appearance that on the fruit, except that it is black rather than brown in colour.

When the spots are so numerous as to coalesce, melanose is sometimes mistaken for maori or exanthema. The brown discolouration of the typical maori orange, however, is not broken up into distinct spots and is quite smooth to the touch. On a fruit affected with exanthema the spots are less uniform in size. There is a tendency for the formation of a blotchy condition rather than distinct spots, and the skin is more definitely hardened.

It is a fungus (*Phomopsis citri*) which is responsible for melanose. This organism, however, does not develop on the living part of the tree, but on dead twigs. Here it forms its spores, which become washed down

over the young fruit and foliage. If wet weather occurs when the tree is in the susceptible stage, these spores will germinate and affect the young growing tissue just sufficiently to cause the spotting described above.

The dependence of the melanose fungus on the presence of dead wood for its existence explains why it is the older or neglected orchards that suffer most from this disease. It is only young shoots and fruit which are susceptible to infection. As the growth hardens off it becomes progressively more resistant. Hence, in any spraying programme, it is necessary to provide for protection at the critical period.

Control.

(1) So far as is practicable, remove all dead twigs and branches. Practise a system of fertilizing and good cultivation, with a view to promoting strong, healthy growth.

(2) Immediately all the petals have fallen, spray with Bordeaux mixture of 3-2-40 strength, to which has been added 1 per cent. of well-emulsified red oil, to act as a spreader and help keep scale insects in check.

If it is desired that this spray should also act as a control for scab—as, for example, when lemons or mandarins are to be treated—the spray may be applied as early as half petal fall, but it should never be later than the time given above.

SCAB.

Only lemons and mandarins are subject to this disease, the young leaves, shoots, and fruit being affected as in the case of melanose. The scabs are quite characteristic of the disease, and consist of irregular, light-brown, corky outgrowths. These may be no larger than melanose spots, or may be distinctly wart-like projections. On the leaf there is often a small conical depression of the blade bearing a mass of cork tissue at its apex. Considerable distortion and stunting of the leaf may occur if the scabs are numerous. On the fruit, especially of the lemon, large scab-covered projections may be formed by an outgrowth of the surrounding rind tissue. (Plate 41, fig. E.)

Scab is due to the presence of a fungus (*Sporotrichum citri*), whose fruiting stage appears as a delicate greyish mould covering the surface of young scabs. As in the case of melanose, the fungus can infect only young growth. Rain at the time of a new flush of growth is essential for scab development.

Control.

Spray with Bordeaux mixture, 3-2-40 strength, plus 1 per cent. of well-emulsified red oil, at the middle of the spring flowering period—that is, when about half the petals have fallen.

It is important that this application should be made at the time stated and not delayed until later. The lemon normally has more than the one fruiting period, and, consequently, it may be advisable to spray again at a similar time with respect to other main blossomings.

The remarks made previously with reference to scale infestation apply to a certain extent to melanose and scab control also.

A

B

C

D

E

F

Plate 41.

Citrus Fruit Diseases.

A. Black spot on orange.
B. Later stage of black spot infection.
C. Exanthema on orange.
D. Melanose on orange.
E. Scab on lemon.
F. Brown spot on Emperor mandarin.

BROWN SPOT OF THE EMPEROR MANDARIN.

This is one of the most serious citrus diseases of this State, though, fortunately, the Emperor of Canton mandarin is apparently the only commercial citrus variety which is susceptible, and the disease is not widely distributed. Every care needs to be taken to ensure that there is no spread to fresh centres.

The symptoms take the form of dark-brown spots on the leaves, fruit, and younger branches. These can be distinguished from the lesions of black spot, in that they are larger and are a uniform brown colour without a lighter centre; also, the fungus pustules characteristic of the latter disease are absent. (Plate 41, fig. F.) On the leaf the browning may extend out along the veins to give a characteristic streaking. On the branches small cankers may develop from the original centres of infection as the wood matures. Small beads of gum exudate are often associated with these. Affected leaves and fruit drop readily when once attacked, and it is in this way that most loss is sustained. The falling of the younger leaves is often accompanied by a dieback of the young shoot, which is then spotted and blackened in appearance. The spots may appear on young tissue of fruit and foliage as soon as they are developed should other conditions be favourable. The cause of this disease is still unknown.

Control.

For the past four years experiments have been carried out to determine the best spraying programme to control brown spot, and although the work is still in progress the following can be recommended:—

(1) When about half the blossom has fallen spray with Bordeaux mixture (3-2-40), with 1 per cent. well-emulsified red oil as a spreader.

(2) About four weeks later spray with colloidal copper (3 gallons stock solution to 40 gallons water).

(3) During mid-December spray again with colloidal copper.

(4) During late February spray again with colloidal copper.

As in the case of black spot control, an application of resin-soda-fish oil spray may be used to overcome any excess scale development, in which case it should be made as late as practicable. Growers may try substituting colloidal copper for the Bordeaux in the above schedule.

BLUE MOULD.

Blue-mould rot of citrus fruits is caused by one of two allied fungi —*Penicillium digitatum*, which forms a powdery spore mass, olive-green in colour, on the surface of the rotting fruit, and *Penicillium italicum*, considerably less common, in which the spores are blue.

The rot commences as a soft, water-soaked spot on the rind almost invariably associated with some form of injury, slight or otherwise. As the softening extends, the surface of the affected area soon becomes coloured with the blue or green covering of spores, which are dislodged in a cloud when touched. Finally, the fruit is reduced to a soft, watery mass.

Most of the loss occasioned by blue mould occurs when sweating or during transport. The reason for this development has been investigated in various countries for many years. The conclusions arrived at should be carefully studied, as they have an important bearing on control. They are as follows:—

(1) The blue-mould fungi are relatively weak parasites, and are unable, as a general rule, to penetrate perfectly sound fruit.

(2) The wounds occasioned during picking, carting, and packing serve as the centres of infection for the blue-mould spores, which are always present in the air of the packing-house unless strict sanitation is practised. Common forms of injury are case bruises and cracks, stalk punctures, scratches from the finger-nail or other agencies. Insect damage, growth cracks, thorn pricks, and other injuries occurring in the orchard may sometimes result in fruit becoming infected while still on the tree.

(3) Loss can, to a large extent, be overcome by cleanliness and careful handling of the fruit.

Control.

Keeping the above facts in view, the value of the following recommendations should be obvious:—

(1) Collect at frequent intervals all waste fruit in the orchard and packing-house and destroy by burning or burying.

(2) Take care that no injuries are given by the clippers or finger-nails during picking. Fruit should be cut, not pulled. Long stalks must be avoided, and a second cut made if necessary, while the fruit is still in the hand. Avoid picking during wet weather or when dew is present.

(3) Collecting boxes must be smooth and the fruit placed in them carefully. Packing-cases should be of smooth wood. Careful and accurate packing is essential to avoid bruising and cracking, especially in the case of mandarins. Wrapping the fruit is helpful in reducing case-bruising and in localising the centres of infection.

(4) Citrus fruit is best allowed to cure for three to seven days before packing. During this period and when grading, all rotting and blemished fruit should be discarded.

(5) Passing the fruit through a wash water containing 5 to 7 per cent. borax and other disinfectants helps to minimise the loss, but it is generally conceded that cleanliness and careful handling are of first importance, and except in certain exceptional cases are all that is required.

BROWN ROT AND STEM END ROT.

Brown rot caused by either of the two fungi *Phytophthora citrophthora* or *P. parasitica* and stem end rot due to two other organisms (*Phomopsis citri* or *Diplodia natalensis*) appear at sporadic intervals in Queensland, when they are mainly responsible for storage losses. In the northern part of the State brown rot caused by the first-mentioned organism has resulted in heavy loss of fruit and foliage in the orchard. These diseases are characterised by a dull brown rot extending over large areas of the skin. The rot is usually firmer than in the case of blue mould and the blue spore mass characteristic of the latter is absent. In the case of stem end rot the brown decay usually extends down from the button both externally and through the centre.

So far diseases of this type have not been sufficiently prevalent to warrant the investigation of special control measures. In the case of brown rot it is advisable to spray with Bordeaux mixture prior to the period when the disease is expected. For the stem end rots the precautions recommended for melanose control should be taken. It will be noticed that the fungus *P. citri* is also the cause of the latter disease, and *D. natalensis* has somewhat similar habits.

COBWEB OR PINK DISEASE.

Pink disease is found in the more tropical citrus-growing countries, and in Queensland is most common in the warm, wet, coastal belts, especially in the North. Many other crops, including rubber, coffee, tea, and mango, may also be attacked.

The presence of the disease is usually first indicated by the wilting of one or more small branches. A closer examination will usually show that there is a silvery growth of cobweb-like threads extending over the bark of the affected branch near where it joins healthy wood. (Plate 42, fig. C.) This cobweb growth belongs to the fungus *Corticium salmonicolor*. Some of the threads penetrate the bark and wood, and so cause the wilting and death of the branch as first observed. If not checked the fungus will extend down the branches, involving the destruction of larger limbs in its path.

During wet weather the fungus may develop a conspicuous salmon-pink encrustation over the lower, shaded and damp sides of the dead branches. This is the spore-bearing region, and is responsible for the common name of pink disease.

Control.

The essential factor in controlling this disease is not to delay treatment. Examine carefully any wilting or dead branch, and ascertain whether cobweb disease or an insect borer is present. If the former, remove the branch at least eighteen inches below the last point at which the fungus or discoloured bark can be seen. Burn the affected wood and paint the cut end of the branch for another eighteen inches back with Bordeaux paste or tar.

Examine the tree later to make sure that eradication has been complete, otherwise the process will have to be repeated.

PSOROSIS.

Psorosis was first recorded in Queensland in 1927, and has since been located in most of the citrus-growing districts. As the disease is slow to develop, there should be no difficulty in keeping it in check, provided that it always receives prompt and thorough treatment.

Psorosis is found on the main limbs and branches of trees six or more years old. The sweet orange, the mandarin and the grape fruit are susceptible, whereas the sour orange and the lemon are resistant.

The earliest symptoms are the appearance in localised areas of inconspicuous pimples or blisters and the formation of scales by the pushing up of small segments of the outer bark. Some gum formation is often associated with this. The flaking off of the bark extends out slowly, and after several years the wood beneath becomes affected and decays, with the result that the limb may be lost. (Plate 42, fig. B.)

Plate 42.

A—*Armillaria mellea* on orange root.

B—Citrus psorosis.

C—The cobweb stage of pink disease.

The cause of psorosis is not definitely known, though it is now thought that it may belong to the class of virus diseases and not be due to any fungus or bacterium. A satisfactory control is, however, available if treatment is commenced in the early stages.

When a localised area of scaling or pustular bark is observed treat it in the following manner:—By means of a tool with a sharp scraping edge carefully scrape off the outer bark over the affected area and for about six inches all round outside it. The scraping should take off the dark-coloured outer tissue and the green layer immediately beneath it, so that about one-third of the thickness of the bark is removed. The scraped area can then be treated with a one-in-six (approximately 3 per cent. polysulphide content) lime-sulphur solution.

Within three to six months after treatment the outer layers should slough off and expose new and healthy bark. All trees should be examined at intervals for the extension of old lesions or the development of new ones and be promptly treated if necessary.

When the lesions on a tree are large or numerous it is likely that the disease has become systemic, and scraping cannot then be expected to effect a complete cure. In this case it is best to remove and burn the affected tree.

EXANTHEMA.

In pronounced cases exanthema shows up with a flush of new growth, the branches of which are sometimes curved at the ends and bear abnormally large dark-green leaves. Later a dark-brown deposit of a resinous material appears along the twigs, and the shoots gradually turn yellow and die back. Blister-like gum pockets, multiple buds, and very angular stems are other characteristics associated. In less definite cases there may be a multiplication of the terminal branchlets and a shortening of the internodes to give a bunched appearance to the tree as a whole. The crop from a diseased tree is usually poor, as a result of the fruit dropping while immature, and from the development of dark-brown superficial spots or blotches accompanied by a hardening of the skin, which often leads to cracking. (Plate 41, fig. C.)

Exanthema is apparently not dependent on the presence of parasitic organisms for its development. The exact cause remains undetermined, although recent work suggests that it may be due to an insufficient supply of copper to meet the normal needs of the tree. In Queensland the disease is usually associated with very light, sandy soils lacking in humus. It is aggravated by poor drainage and hard pan.

Control.

Remove all dead and dying wood. Improve the soil conditions by manuring, with a bulky farmyard manure if procurable, and by ploughing in green crops. Drain the land if necessary. A relatively quick cure may often be obtained by the application of bluestone (copper sulphate). This may take the form of a Bordeaux spray, for which the normal melanose and scab spray applied at blossoming time is suitable, or the bluestone crystals may be chipped in round the tree, using from 1 to 2 lb. per tree, depending on size. Results should become obvious twelve months from the date of application.

MOTTLE LEAF OR FOLIOCELLOSIS.

As the name suggests, this disease is characterised by a mottled condition of the foliage. This is due to the development of irregular, yellow, chlorotic areas between the main veins of the leaf. These areas vary greatly in size and in some cases the normal green colour is

entirely absent except in the immediate vicinity of the large veins. According to the severity of the disease the foliage may be otherwise normal or there may be a marked stunting in growth with the formation of a small narrow type of leaf. The fruit produced on branches affected in the latter manner are often greatly reduced in size and tend to yellow prematurely.

There is still doubt as to the exact cause of mottle leaf. It is apparently, like exanthema, a physiological disease brought about by a disturbance in the normal nutrition of the tree. Recent work on mottle leaf and on an allied disease of deciduous fruits suggests that it may be due to a shortage in the amount of zinc available to the plant. This is probably connected with the intimate relationships existing between the smaller citrus roots and certain microorganisms of the soil. In Queensland the disease is most serious in the light sandy soils of the drier inland districts.

The control of mottle leaf is still in an experimental stage, the subject being under investigation both here and abroad. Best results have so far been obtained by applying zinc sulphate either as a soil dressing or a spray or by a direct injection of zinc or zinc compounds into the branches. Owing to the present lack of knowledge, and a danger of injury to the treated trees, the spray method is the only one which can be suggested for trial at present. A spray consisting of 10 lb. zinc sulphate, 5 lb. hydrated lime, in 100 gallons water should be applied in the early spring and again, if the disease is severe, in the autumn.

The production of an extensive and efficient root system by correct manuring, especially with bulky organic manures, and whenever possible by irrigation in dry periods, is an important adjunct to the above treatment.

COLLAR ROT AND GUMMING.

The lemon or lemon stock, especially in coastal districts, is particularly subject to collar rot and gumming, as are, to a less extent, the mandarin and sweet orange. The first indication of the presence of this disease is a yellowing or unhealthy appearance of a section of the foliage accompanied, perhaps, by excessive flower formation. Examination of the base of the trunk or one of the main branches discloses a dark, water-soaked area, from which gum drops are often exuding. The bark over this region can be readily lifted, and between it and the wood is a slimy, gum-like substance. Extension of this lesion will gradually ringbark the trunk or branch affected. Less frequently the lemon may develop gumming areas even on the smaller branches.

To lessen the risk of infection the soil should be kept well pulled away from the base of the tree, and care should be taken to avoid injury during cultivation. If noticed before it has advanced too far, the disease may be cured by surgical methods. If the crown and main roots are affected, open them up to the sun and air. Carefully remove the whole of the diseased bark and wood by cutting or scraping well back into sound tissue with a sharp instrument. Collect and burn the scrapings. Paint the wound with Bordeaux paste.

If a lemon is neglected until most of the limbs are affected it may be necessary to consider replanting. When soil or locality are unsuitable this state usually eventuates after some years.

When collar rot is the result of the use of a susceptible stock, inarching with one less susceptible may be considered worth while.

ARMILLARIA ROOT ROT.

The tree affected by this disease exhibits symptoms similar to those associated with collar rot. That is to say, there is a yellowing of the foliage of the whole tree, or one of its branches, together with some dieback. If, on examination, no gumming is found, the larger roots should be opened up and examined. If Armillaria root rot is present, shiny, black, string-like, fungal strands will be seen twining themselves about the roots or lying partly embedded in the bark, which is soft, easily stripped off, and has a strong mushroom odour. (Plate 42, fig. A.) The black strands belong to one of the mushroom-like fungi (*Armillaria mellea*), which grows on rotting stumps or roots left in the ground after clearing, and from these passes to a living citrus root should one come in contact.

The disease may be largely prevented by having all stumps and roots removed from land which is to be used for orchard purposes, and, if time is not a factor, by growing an annual crop for a year or more prior to planting trees.

Expose the main roots to the beneficial action of sun and air for as long as the absence of frosts will permit. Remove any badly-rotted roots and treat those partly affected by carefully scraping and painting, as advised for collar rot.

Remove and burn the original stump or root from which infection started if this can be located.

The affected area is best isolated to prevent further spread of the fungus to healthy trees by digging a trench two feet deep round the outside of the furthest root extension of the ones attacked, throwing the soil to the inside.

SOOTY MOULD.

Sooty mould is a conspicuous, though in itself relatively unimportant, disease of citrus. The black, sooty deposit covering the foliage and often the fruit of affected trees is well known to most citrus-growers. An examination of the leaves will show the sooty appearance to be due to a thin, black, superficial film, which may be easily scraped off in flakes. This film is formed by the close interlacing of the dark threads of various fungi, of which the chief are species of *Capnodium*. These fungi are not plant parasites, but live on the sugary secretion of certain scale insects, of which the more important ones concerned are the pink and white wax scales and the lecanium or soft scales.

The fungus is entirely superficial in its growth, and does not directly injure the tree, although the presence of the film of mould may tend to weaken it by the exclusion of light and air.

Control.

To rid a tree of sooty mould, it is necessary to destroy the scale insects, on whose secretion the fungus is dependent for its existence. Specimens of the scale insects present should be forwarded to the nearest entomologist in order that advice may be obtained on the best method for their control. If it is desired to remove the mould quickly after destroying the scale, spray the tree with a thin paste made by boiling flour in water. When this dries it will flake off, carrying away the mould in the process.

SMOKY BLOTCH.

Smoky blotch is the name given to a disease which has become prevalent in coastal citrus orchards during recent years. A diffuse smoky discolouration on the skin gives a dull, dirty appearance to the fruit as it approaches maturity. In contrast to sooty mould this discolouration is light-brown rather than black and consists of a very thin surface film which can be rubbed off only with difficulty. It is formed by the fine interlacing threads of the fungus *Leptothyrium sp.* Local aggregations of these threads to form resting and fruiting bodies may produce scattered black specks over the rind. This has given rise to the name of fly speck in some countries, but it is a stage not commonly in evidence here.

The application of fungicides for the control of other citrus diseases should check smoky blotch as well. The resin-soda-fish oil spray is also reported to exercise some control.

QUEENSLAND SHOW DATES FOR 1937.

February.

Pittsworth's Bushmen's Carnival	1st
Stanthorpe	3rd to 5th
Warwick	8th to 10th
Killarney	12th and 13th
Clifton	23rd and 24th

March.

Allora	3rd and 4th
Amiens	6th
Goombungee	11th
Milmerran	19th
Pittsworth	23rd and 24th
Tara Show and Campdraft	24th and 25th
Boonah Campdraft	29th

April.

Oakey	7th and 8th
Toowoomba Royal	12th to 15th
Dalby	21st and 22nd

May.

Longreach	3rd to 6th
Beaudesert—	
Show	5th and 6th
Bushmen's Carnival	7th and 8th
Wallumbilla	6th and 7th
Nanango	6th and 7th
Dirranbandi	6th to 8th
Ipswich	11th to 14th
Wowan—	
Show	13th and 14th
Rodeo	15th
Crow's Nest	12th and 13th
Biggenden	20th and 21st
Gympie	20th to 22nd
Warrill View	22nd
Kilkivan	24th and 25th
Maryborough	25th to 27th
Charleville	25th to 27th

May—continued.

Maryborough	25th to 27th
Gin Gin	28th and 29th
Toogoolawah	28th and 29th
Kalbar	29th
Childers	31st May and 1st June

June.

Bundaberg	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone	9th and 10th
Rockhampton	22nd to 26th
Marburg	18th and 19th
Mackay	28th June to 1st July

July.

Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th and 21st
Laidley	21st and 22nd
Cairns	27th and 28th
Gatton	28th and 29th
Caboolture	30th and 31st
Maleny	22nd and 23rd

August.

Royal National, Brisbane	16th to 21st

September.

Imbil	3rd and 4th
Rocklea	11th
Innisfail	17th and 18th

Principles of Botany for Queensland Farmers.

C. T. WHITE, Government Botanist.

[*Continued from page 48, January, 1937.*]

CHAPTER XXIV.

Dicotyledons.

Subclass Metachlamydeæ or Sympetalæ.—Perianth in two whorls or series, the inner (corolla) is gamopetalous and the stamens are often epipetalous, i.e., attached to the corolla and appearing as outgrowths from it.

FAMILY SAPOTACEÆ.

A family of trees often with a milky juice. Leaves simple, alternate. Flowers usually hermaphrodite, borne in the leaf-axils or on the older wood below the leaves, sometimes solitary, usually clustered. Calyx of 4-8 segments or sepals. Corolla divided into lobes or teeth, which may be the same number as or double the number of sepals. Stamens the same number as the petals or twice as many, often, in addition alternating with staminodia and scales. Ovary superior. Fruit a berry or drupe.

The family is widely distributed over the tropics and sub-tropics of the world. About twenty species are natives of Queensland. These include two known as Milky Plum (*Niemeyera*) and the Black Apple (*Sideroxylon australe*), Cairns Pencil Cedar (*Lucuma galactoxyla*), and the Wongi (*Mimusops Browniana*), the last an important native fruit to the natives of Torres Strait.

A cultivated fruit sometimes seen in Queensland is the Sapodilla (*Achras Zapota* or *Sapota*), a native of Tropical America. It is also the chief source of the chicle gum from which chewing gum is manufactured. Other fruits belonging to this family but which I have not seen here are the Mammee Apple (*Calocarpum mammosum*) and the Star Apple (*Chrysophyllum cainito*), both natives of tropical America.

FAMILY EBENACEÆ.

A family of trees closely allied to Sapotaceæ, but with a watery, not milky, sap, and the flowers mostly unisexual, not hermaphrodite. Leaves simple, alternate. Flowers axillary, the males in cymes or clusters, the females usually solitary. Stamens 8-20 in the males, fewer and sterile in the females. Ovary superior. Fruit a berry.

The family is a small one widely spread over the tropical and sub-tropical regions of the world. It is represented in Queensland by about fifteen species, mostly small or medium-sized trees. The wood of trees of the *Ebenaceæ* is often hard and black, as in the commercial Ebonies, *Diospyros Ebenum* and *D. melanoxylon*, of India. The Queensland Ebony (*Diospyros humilis* or *Maba humilis*) possesses a wood equal in quality to the imported ebonies, and can be used for billiard cue inlay, piano keys, chess men, and general turnery.

The family includes a few cultivated fruits, the most important being the Persimmon (*Diospyros Kaki*), a native of China and Japan. Another is the Mabolo (*Diospyros discolor*), a native of the Philippines,

sometimes seen in cultivation in North Queensland; it possesses a brownish, hairy outer rind and a white or brownish pulp.

Family Oleaceæ (Olive Family).

A family of trees or shrubs or woody climbers chiefly characterised by simple, opposite leaves, and flowers with only two (very rarely

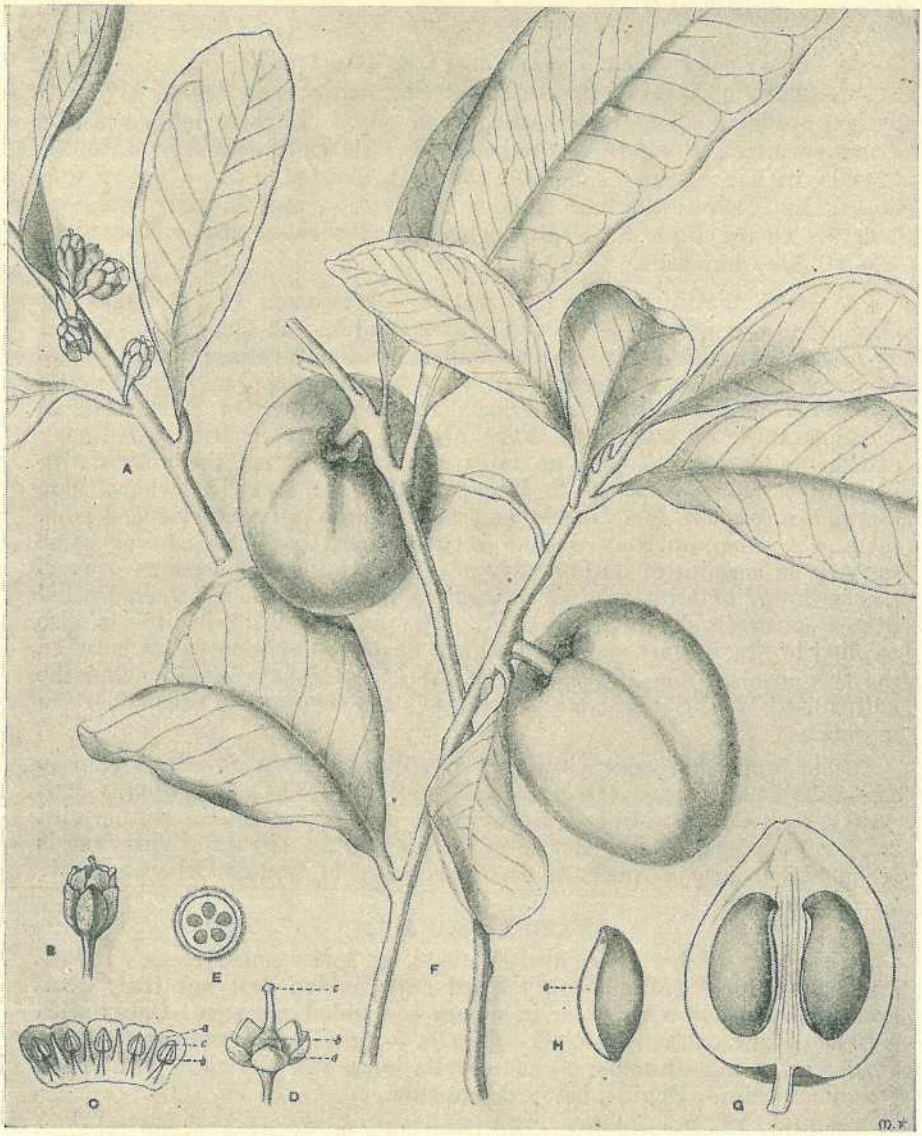

Plate 43.

Black Apple (*Sideroxylon australe*)—Family Sapotaceæ.

A. Flowering twig. B. A single flower. C. Corolla and stamens laid open—*a*. Corolla lobe; *b*. stamen; *c*. staminode. F. Fruiting branches. G. Fruit in longitudinal section. H. Seed; *a*. Hilum.

four) stamens. Flowers mostly in panicles. Calyx composed of 4-5 sepals, teeth, or lobes. Corolla with 4 to sometimes numerous lobes. Ovary superior. Fruit mostly a drupe.

A family widely spread over the world. It is represented in Queensland by eighteen native species, none of any particular economic importance. Among cultivated trees the most important is the Olive (*Olea europœa*). Several Jasmines (genus *Jasminum*) are grown in Queensland gardens.

FAMILY LABIATEÆ (THE LABIATES).

A family of herbs or shrubs, usually aromatic, branches mostly more or less 4-angled. Leaves opposite or whorled. Flowers in cymes, the cymes arranged in whorls in the leaf-axils. Calyx 5-toothed or 2-lipped. Corolla with a distinct tube and the limb divided into an upper and lower "lip," rarely the limb more or less regular and 5-lobed. Stamens 2 or 4. Ovary 4-lobed. Fruit enclosed in the calyx and composed of 4 small, seed-like nuts.

A large family finding its greatest development in the temperate regions of the world. It is well represented in the Queensland Flora by about forty-five native species and several naturalised weeds. Two of these latter, the Stagger Weed (*Stachys arvensis*) and Dead-nettle (*Lamium amplexicaule*) are known to cause staggers or shivers in working stock or stock that have been driven or excited. Ordinary resting paddock stock such as dairy cattle seem to eat the plants with impunity. Strange to say, in Europe and North America, where these plants are common farm weeds, no trouble seems to be experienced from them. A comparatively recent introduction that has caused some concern on account of its difficulty of eradication and poisonous properties is the Wild Mint (*Salvia reflexa*), a native of the Western United States naturalised in Queensland. The name "Wild Mint" is also applied to *Stachys arvensis*, and a good deal of confusion exists between the two weeds. The native Pennyroyal (*Mentha satureioides*) and the naturalised Wild Salvia (*Salvia coccinea*) are reported to cause abortion in cattle.

The family includes a number of culinary herbs as—Sage (*Salvia officinalis*), Marjoram (*Origanum Marjorana*), Thyme (*Thymus vulgaris*), &c. Garden Mint or Spear Mint is *Mentha viridis*, peppermint is *Mentha piperita*, and Bergamot Mint *Mentha citrata*. This last is frequently grown in Australia under the name of Eau-de-Cologne Plant.

FAMILY SOLANACEÆ.

A family of herbs, shrubs, climbers, or soft-wooded trees. Leaves alternate, simple (often deeply lobed and divided, but not truly compound). Flowers solitary or in cymes or 1-sided racemes. Calyx with 4-10 sepals, or toothed or lobed. Corolla 5- (rarely 4-) toothed or lobed. Stamens the same number as the corolla lobes and alternate with them. Ovary superior. Fruit a berry or capsule.

A large family widely spread over both the temperate and tropical regions of the world. It is represented among native plants by almost sixty species, the vast majority of which belong to the genus *Solanum*. Among native plants members of the genus *Duboisia* attain tree size. *D. myoporoides*, the Poisonous Corkwood, is a small soft-wooded tree. The leaves are very poisonous, and cases are on record of children being

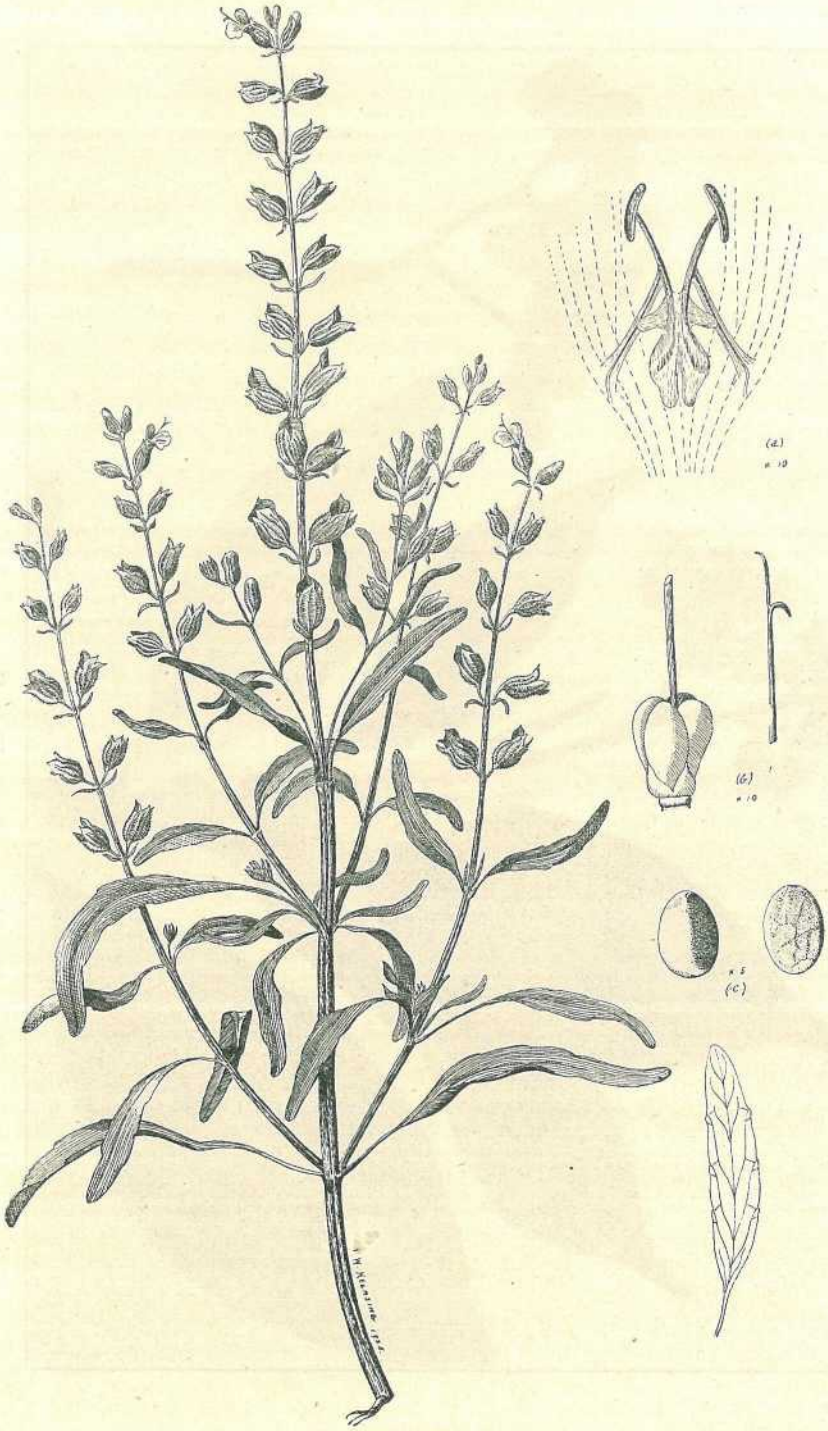

Plate 44.

SALVIA REFLEXA.—Narrow-leaved Sage, Wild Mint, or Mint Weed (Family Labiatæ). A.—Stamens showing the broad and lobed nature of the lower connective (a character of the species). B.—Pistil showing 4-lobed ovary and 2-lobed style (one lobe much longer than the other). C.—"Seeds."

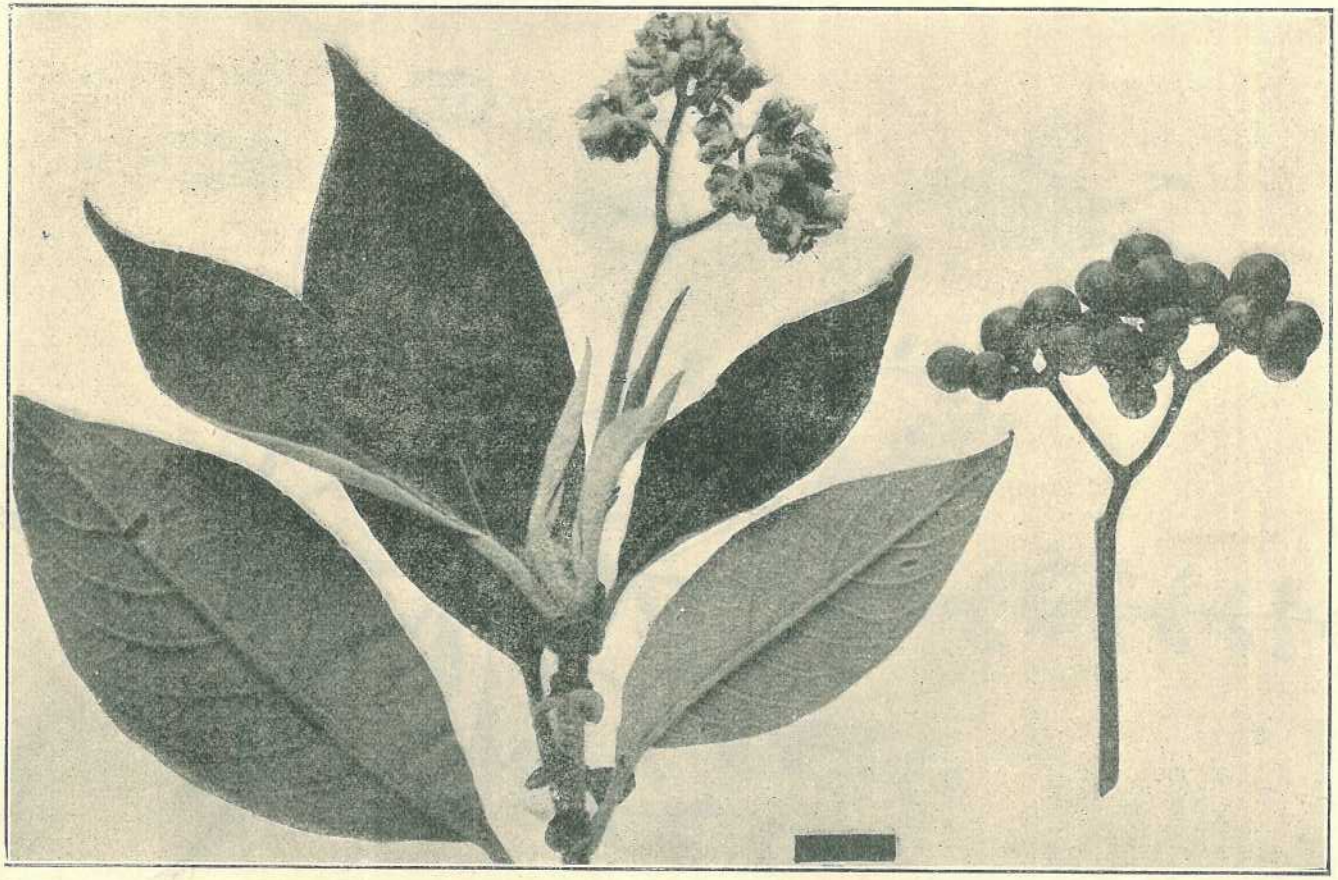

Plate 45.

SOLANUM AURICULATUM—Wild Tobacco (Family Solanaceæ). A very common second-growth weed in coastal Queensland.

fatally poisoned through sucking a few of the leaves. The leaves contain a mixture of midriatic alkaloids, on which account they have been exported to Germany and England. The demand for the leaf, however, has been erratic. *D. Leichhardtii* is an allied species very common in parts of the Southern Burnett District, particularly between Kingaroy and Nanango. The third species, *D. Hopwoodii*, is the Pituri, well known as a narcotic in use among the aborigines. It is only found in Queensland in the extreme south-west . It is abundant in Central and Western Australia, and is fairly common along parts of the Trans-Australian Railway.

The family contains several imported weed-pests, some of which are poisonous to live stock. A frequent weed of cultivation is *Datura stramonium*, the common Stramonium or Thorn Apple. It has rather a nauseating odour and taste in the green stage, and the living plants are rarely eaten by stock. Several cases, however, are on record where the plants have been cut and chaffed with the standing crop and subsequently fed to animals with fatal results. The leaves are dried for use as a tobacco by sufferers from asthma. Several other weeds of the same genus are naturalised in Queensland, and all possess similar poisonous properties.

The family contains some very important economic plants. Among them are the Potato (*Solanum tuberosum*), Egg-fruit (*Solanum Melongena*), Tomato (*Lycopersicum esculentum*), Capsicums or Chillies (*Capsicum annum*, annual species and *C. frutescens*, shrubby, perennial species), and Tobacco (*Nicotiana Tabacum*). It includes several important drug plants as Belladonna or Deadly Nightshade (*Atropha Belladonna*) and Henbane (*Hyoscyamus niger*).

Family Rubiaceæ.

A family of trees, shrubs, herbs, or climbers. Leaves opposite or sometimes whorled. Stipules interpetiolar (see p. 227). Flowers mostly arranged in cymes, sometimes solitary. Calyx-tube adnate to the ovary, limb entire or with several teeth or divisions. Corolla 3-5-toothed or lobed. Stamens as many as the corolla lobes and alternating with them. Ovary inferior. Fruit various—a drupe, berry, capsule, or indehiscent nut.

A large family widely spread over the world but finding its greatest development in tropical regions. It is well represented in the Queensland flora, though none of the species are of particular economic importance. It contains the coffee (*Coffee arabica* and to a less extent *C. robusta*) and Quinine (*Cinchona* spp.).

Family Compositæ (The Composites).

A family mainly of herbs, sometimes shrubs or climbers, rarely trees. Leaves simple but sometimes very much cut and divided, opposite or alternate. Flowers arranged in heads, surrounded by an involucre of bracts either in a single or in several series (see Plate 155, page 362, figs. 2 and 3). Calyx wanting or converted into a *pappus*, usually consisting of plumose hairs, sometimes of scales or barbs. Corollas tubular or ligulate. (In Plate 46, fig. A represents a ligulate and fig. B a tubular corolla, respectively). Stamens 5 (rarely 4), the anthers united in a sheath round the style.* Ovary inferior. Fruit a small, seed-like nut or achene, crowned by the pappus or naked.

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* In the Noogoora Burr and Bathurst Burr (genus *Xanthium*) and in the Wormwood and Rag Weeds (genus *Ambrosia*) the anthers are distinct. These plants are regarded by some botanists as constituting a distinct family—the Ambrosiaceæ—apart from the Composites.

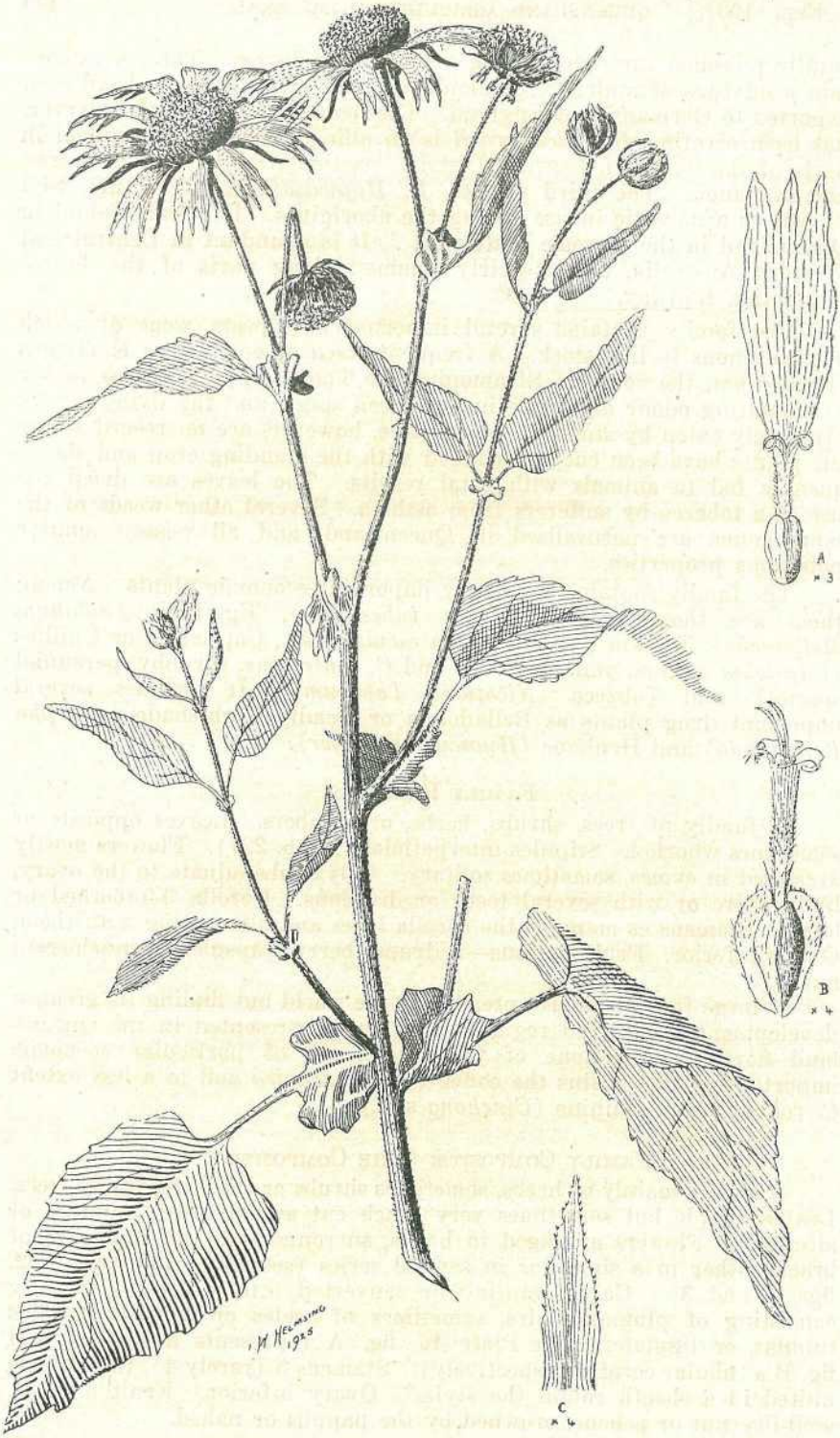

Plate 46.

WILD SUNFLOWER OF AMERICA OR DOGWEED (*Verbesina enceliodes* Benth. et Hook). Family Compositæ. A.—Ray floret. B.—Dish floret. C.—Involucral scale.

A very large family widely spread over the world. It is strongly represented in the Queensland flora by over 200 species. Many are common naturalised weeds—*e.g.*, Billy Goat Weed (*Ageratum conyzoides*), Mist Flower (*Eupatorium riparium*), Horse Weed (*Erigeron linifolius*), Cobbler's Pegs (*Bidens pilosa*), Noogoora Burr (*Xanthium spinosum*), Federal Weed (*Erechthites valerianæfolia*), Jo Jo Burr (*Soliva sessilis*), Stinking Rodger (*Tagetes glandulifera*), Milk Thistle (*Sonchus oleraceus*), Flat Weed (*Hypochæris radicata*), Dandelion (*Taraxacum officinale*), &c.

Part V.—PLANT GEOGRAPHY AND ECOLOGY.

Plant Geography has for its study the distribution of plants over the surface of the earth. *Ecology* is a branch which has come much to the fore in recent years, and concerns itself with the study of the individual plant or of particular groups of plants in relation to their environment.

CHAPTER XXV.

The Plant Associations of Queensland.

The vegetation of the world has been roughly classified by botanists into the three main divisions of Grassland, Woodland, and Desert. Of these only the first two occur in Queensland. We have, it is true, country popularly called desert, but in reality this is a form of woodland, as it not only contains various grasses and herbage, but small trees and shrubs. What is called desert in Queensland, as a matter of fact, possesses a varied flora, and is extremely interesting country from the point of view of the botanist.

The Grass Lands or Pastures.

Natural grasslands of very extensive range are represented in Queensland by the rolling downs formation and covered by Mitchell, Flinders, and other grasses and herbage characteristic of Western parts of the State.

These pastures are of a sufficiently high standard to be famous throughout Australia. Of the grasses composing the pastures the best known are the Mitchell Grasses, Flinders Grasses, native Panic Grasses, Blue Grasses, better-class Star Grasses, Love Grasses, &c. Here and there on the Darling Downs and in the Granite Belt Danthonia Grasses, such as *Danthonia pallida*, *Danthonia racemosa*, and *Danthonia longifolia*, are of some importance, though not nearly to the same extent as they are in the colder places further to the south, such as the New England Tableland. Annual herbs following the summer rains are a feature of much of the grass land. These belong to a great range of families, the Amaranths, the Saltbushes, the Legumes, and the Mallows being among the most valuable.

Mitchell Grasses.

Now, to deal with some of the grasses individually. Undoubtedly the grasses most associated with Australia, both in the country itself and abroad are the Mitchell Grasses. The Barley Mitchell Grass (*Astrebla pectinata*) was found by Sir Thomas Mitchell near Condobolin and on the plains of the Bogan in New South Wales in 1836. These were described at the time by the great English botanist, Charles

Lindley, as *Danthonia pectinata*, and are to be found preserved at the present time at the Museum and Herbarium of the Department of Botany of the University of Cambridge, England. Though Mitchell is generally regarded as the discoverer of Mitchell Grass, specimens had already been collected by both Cunningham and Fraser as early as 1817, though, apparently, they remained undescribed and, indeed, unrecorded at all until C. E. Hubbard, when monographing the genus, found the specimens at the British Museum of Natural History, London. The Mitchell Grasses are widely spread over the heavy blacksoil plains of Northern Australia, Central Australia, Queensland, and New South Wales, but find their greatest development in Queensland. The genus is confined to Australia. Four distinct species are to be recognised:—

1. *Astrebla pectinata*, often known as the Common Mitchell, is the commonest form in New South Wales, but is comparatively rare in Queensland. It has a wide distribution through Central Australia to Western Australia, but in the lastmentioned State is, I understand, very rare.

2. *Astrebla lappacea*, known as the Wheat-eared or Curly Mitchell. This is the form most abundant in Queensland. Like the Common Mitchell, it has a wide distribution, but is nowhere so abundant as in Central Queensland. It has a long, wheat-eared seed-head, and is probably the most important species of the genus from an economic standpoint. In the older literature it is referred to as *Astrebla triticoides*, but this excellent specific name has, unfortunately, to give way on account of priority to *Astrebla lappacea*. This latter name was used by Lindley as far back as 1848, when he named the grass *Danthonia lappacea*, based on specimens collected by Sir Thomas Mitchell, near Mitchell, Queensland, in 1846.

3. *Astrebla squarrosa* is the Bull Mitchell, moderately common in parts of Central and North Queensland, also found in the Northern Territory and the north-west of New South Wales. It is a coarse species not occurring in such quantities as *Astrebla lappacea*, and not regarded as the equal of the common *Astrebla lappacea* as a stock grass. It yields a very large seed-head and a correspondingly large grain.

4. *Astrebla elymoides*.—This is variously known as the Hoop Mitchell, Wire Mitchell, and Weeping Mitchell. It is very distinctive looking from all the others, and has a wide distribution through the north-west of Western Australia, Northern and Central Queensland to New South Wales. It is quite a good fodder grass, very drought-resistant, but suffers in comparison with its better relatives.

FLINDERS GRASSES.

Ranking next in importance to the Mitchell Grasses in the eyes of the pastoralists of Northern and Western Queensland are the Flinders Grasses, of which seven distinct kinds have now been recognised. They all belong to the genus Iseilema, which is composed, so far as known, of twelve species, five of which are found in tropical Asia and seven in Australia. Until recent years all the Australian kinds were looked upon as forms of one species. During the summer months of 1909-1910, the Czecho-Slovakian botanist, Dr. Karel Domin, botanised extensively in Queensland, and he paid special attention to the grasses, making extensive collections. He recognised four distinct species among the grasses known collectively as Flinders Grass. Later, C. E. Hubbard, an English botanist, and probably the leading grass systematist of the world, spent

twelve months' work in Queensland. He has recently monographed the genus and recognised seven distinct species. The value of Flinders Grasses lies in their peculiar habit of growing extremely palatable and nutritious in the form of standing hay, in this respect differing from practically all other grasses. The nutritive value is due to the amount of grain produced and the peculiar way in which it is borne among small leaves over almost the whole plant. The Flinders Grasses are extremely brittle when dry, but all stock greedily lick up the broken

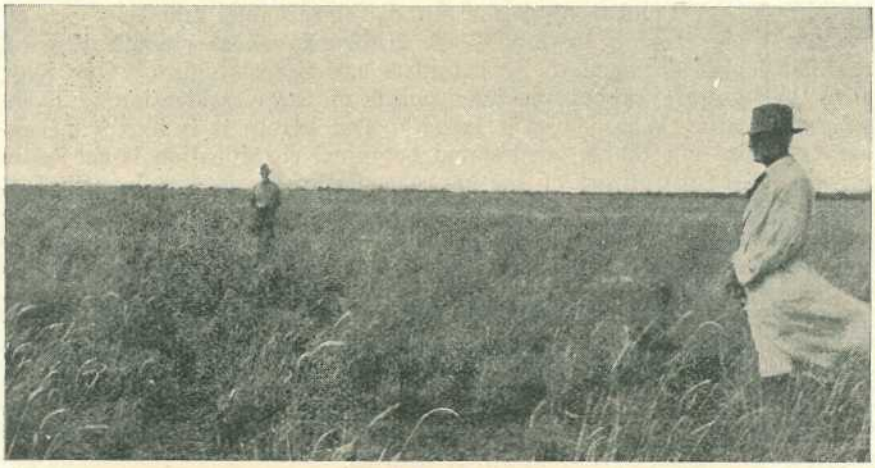

Plate 47.

Bull Mitchell Grass (*Astrebla squarrosa*) in a slight depression on plain at Claverton, between Charleville and Cunnamulla. The tussocks are evident. In the foreground seed-heads of the grass are seen.

[*Photo. by W. D. Francis.*

Plate 48.

The stock route on the Ward Plain, about 12 miles north-west of Charleville. The vegetation shown in the foreground consists of low-growing Salt Weed (*Threlkeldia procoriflora*) and two low-growing burr-bearing plants (*Bassia echinopsila* and *B. anisacanthoides*).

[*Photo. by W. D. Francis.*

pieces and do well on them. As a hay crop for dry tropical and sub-tropical regions with a short summer rainfall season, the Flinders are probably unequalled, making up in high nutritive value what they lack in bulk.

BLUE GRASS.

Extremely important on the Downs country of Queensland and New South Wales, and particularly in this State, is the Blue Grass *(Dichanthium sericeum),* in its typical form distinguishable in the field by its bluish-green colour, luxuriant appearance, and soft silky seed-heads. A number of forms are distinguishable, and they are at present under review by Mr. C. E. Hubbard, whose classification of them is looked forward to by botanists and agrostologists. One may say: "Why worry about the finer points of the classification of these grasses at all? Where does it lead?" But surely it is hardly necessary to point out that a good sound botanical classification is the basis on which all future work on the improvement of the grasses by selection and hybridisation rests. Blue Grass has an exceptionally high reputation as a fodder among pastoralists. It is usually one of the earliest grasses to shoot in response to spring and early summer rains, but is not particularly drought-resistant. It makes one of the best hays possible, and as it produces an abundance of seed it is worthy of study from the agrostologist and plant breeder. E. Breakwell, in his excellent book on "The Grasses and Fodder Plants of New South Wales," states that it has been found that the smallest and plumpest spikes produce the best seed.

PANIC GRASSES.

Forming a very large percentage of the bulk of the average native mixed pasture are the various sorts of Panic Grasses. These were all included in the earlier works on Australian grasses under the genus Panicum. This genus has now, however, been divided into numerous smaller genera, the genus Panicum itself, in a restricted sense, being comparatively small, and including, for the most part, grasses with wide-spreading, much-branched seed-heads, such as *Panicum decompositium,* often referred to as Native Millet, *Panicum trachyrachis,* Coolibah Grass, *Panicum prolutum,* Coolah Grass, and a number of others, common enough in the pasture but lacking distinctive local names. As at present understood, twenty different kinds of Panicums, or Panic Grasses proper, are found in Queensland.

PASPALIDIUM GRASSES.

Of the grasses split off from the Panicums by modern botanists are those forming a group now known as the Paspalidium Grasses. Paspalidium is a small genus of about sixteen species, of which ten are found in Australia, all the Australian species being found in Queensland, though many extend to New South Wales and the Northern Territory. They are remarkable for the great amount of grain they carry in narrow, spike-like heads. Most of them are extremely palatable. The largest is *Paspalidium globoideum,* known as Shot Grass or Sago Grass in Queensland. It grows 3 feet to 4 feet high or more, is extremely palatable to stock, and bears a sago or tapioca-like grain. This grain is borne in great abundance, and is one of the staple foods of the grain-eating birds in the West; in fact, one pastoralist, Mr. J. Garvey, of Fernlees, Central Queensland, in sending specimens of this grass along with other Paspalidiums stated that that the budgerigars

fed so heavily on the seed that the grass did not get a chance to establish itself properly. This does not, of course, apply only to this particular grass but to others, including the Mitchell Grasses, &c. Among the smaller growing Paspalidiums are several known as Brigalow Grasses. A good deal of prominence has been given to one of these (*P. cæspitosum*) in the Queensland Press, and following this a good deal of interest has been focused on this particular grass and its allies.

Paspalidium flavidum is a large species intermediate between the smaller Brigalow Grasses and the Shot Grass or Sago Grass (*Paspalidium globoideum*). Of the Brigalow Grasses proper we can now, I think, recognise at least three distinct species, namely:—*Paspalidium gracile, Paspalidium distans,* and *Paspalidium caespitosum.* At the present stage of our knowledge I do not care to state which is the best. Probably the values are more or less similar; but, in any case, they represent a very fertile field for intensive work by agrostologists in the future.

Many other grasses go to make up the mixed native pasture—Love Grasses, Kangaroo Grasses, Oat Grasses, Star Grasses, &c.—but time does not allow to deal with these in any detail. However, farmers, pastoralists, and others are invited once more to forward specimens of grasses and herbage to the Department for identification and report.

Forest Grasses.

Though scarcely grassland in the strict botanical sense, but rather an undergrowth in the open or savannah forest, it might be convenient to treat the forest grasses and herbage here. Excellent cattle pasturage exists along much of the coastal portions of the States. Typical tropical savannah forests, consisting of low eucalypts, wattles, Proteaceae, and other trees with an undergrowth of grasses and herbage, are found over much of the Cape York Peninsula, improving as one comes south to the Gulf country, where a great mixture of grasses and herbage occurs in the pastures, grass genera represented being *Andropogon, Aristida, Arundinella, Alloteropsis, Chloris, Chrysopogon, Cynodon, Ectrosia, Eragrostis, Eriachne, Panicum, Pappophorum, Paspalum, Rottboellia, Setaria, Sorghum, Themeda,* &c.

Southward from Ingham, through Townsville to Proserpine, there is a " dry " belt; the native pastures are mostly coarse in appearance, and, in a lot of the open forest country, Blady Grass *(Imperata)* and Spear Grass (*Heteropogon*) predominate. During the wet season some of the larger grasses, such as the Tall Spear Grass *(Heteropogon triticeus)*, the native Sorghums (*fulvum, australe,* and *laxiflorum*) grow to a great height—8 to 10 feet—or even more. Some of the best pastures in the open Eucalyptus are composed of Kangaroo Grass *(Themeda)* almost in a pure stand.

Of recent years anywhere near a settlement, *Chloris barbata,* noticeable on account of its purple heads, has become the outstanding grass in the native pastures. It has been highly spoken of, but it is rather doubtful if it has any very great value.

The common tropical weed *Stylosanthes sundaica* (Wild Lucerne) has spread everywhere, greatly improving the pastures. Cattle are very fond of this leguminous plant, and analysis shows its feeding value to be high. Unfortunately it is only of annual duration, and dies out on the approach of the dry winter months.

Plate 49.
Typical grass-land forest (Savannah forest or park-land), Taabinga. Beef cattle in foreground.

From Proserpine southwards to Koumala the rainfall is high, but this is essentially sugar country and stock-raising is of little consequence; but from Koumala southwards to about Gladstone is another "dry" belt. In the more northern portions the pastures are much the same as those between Ingham and Proserpine, except that conditions are a little less tropical, and *Stylosanthes* is not a predominating feature in the summer pastures. As one comes south the pastures differ considerably, carrying in many cases a very heavy mixture of species, though they suffer severely from continued dry spells, particularly in the winter and spring months. The principal grasses composing the pastures are *Dichanthium* spp. (Blue Grasses), *Themeda* (Kangaroo Grasses), *Alloteropsis* (Cockatoo Grass), *Chloris* spp. (Star Grasses), *Cynodon* spp. (Couch Grasses), *Eragrostis* spp. (Love Grasses), *Eriochloa* spp., *Panicum* spp. (Panic Grasses), *Pappophorum* spp. (Whiteheads), *Sorghum* spp. (Native Sorghum), *Setaria* spp. (Native Millets), *Sporobolus* spp., &c.

In some parts of Central Queensland, such as the Dawson Valley, native pastures are those of the coastal type, except that some of the better Western grasses such as the Mitchell Grasses *(Astrebla* spp.) Flinders Grasses *(Iseilema* spp.), and some of the better Panic Grasses intrude.

From Gladstone southwards the native pastures vary in quality from good to very poor. In the better pastures Kangaroo Grass (*Themeda*), Blue Grass (*Dichanthium*), *Chrysopogon* spp., Love Grasses (*Eragrostis* spp.), and Native Panic Grasses (*Panicum* spp.) predominate. In the poorer pastures, particularly those on sandy or clayey soils, Spear Grasses (*Aristida* spp.) and a general mixture of varying poorer sorts compose the bulk of the pasture.

In the Burnett, Lockyer, and Brisbane Valley areas, the better open Eucalyptus country supports native pastures for the most part of a high order, consisting of a general mixture of Blue Grasses, Panic Grasses, Kangaroo Grasses, &c. Herbaceous plants comprising a fair number of legumes are also a feature of these pastures. A good deal of the country has suffered badly from overstocking, with the consequence that the better mixtures have been eaten out, leaving in many cases almost a pure stand of the Bitter Blue Grass (*Bothriochloa decipiens),* a very inferior species. The poorer pastures consist mostly of Blady Grass (*Imperata*), Barb-wire Grass (*Cymbopogon refractus*), Spear Grasses *(Heteropogon* and *Aristida* spp.), Burr Grass *(Cenchrus),* &c.

An interesting feature has been the alteration in some localities—particularly near Brisbane—of the composition of the native pasture. In most cases this has deteriorated through overstocking, but in many cases, especially in the better forest (Eucalyptus) soils, the original mixture has given way to pastures almost entirely composed of the Blue Couch (*Digitaria didactyla*) and here and there in similar areas the Common Couch (Cynodon), and this possibly has improved the carrying capacity of the pastures. Both Couches are regarded as native grasses, but it is only of comparatively recent years, about the last twenty, that the Blue Couch seems to have come into any prominence.

Fresh Water Grasses.

A distinct type of pasture in coastal Queensland are fresh-water swamp pastures of a high grazing value. In these the following grasses

are the most important:—Water Couch *(Paspalum distichum)*, White Water Couch *(Panicum obseptum)*, Rice Grass *(Leersia hexandra)*, *Hemarthria compressa*, Native Millet *(Echinochloa)*, and a few others of less consequence.

Salt Water Meadows.

Grasslands of a relatively small extent, but important in some areas, are pastures near the sea composed of salt-loving grasses. In some places the salt meadow consists of almost a pure stand of Saltwater Couch (*Sporobolus virginicus* var. *minor*). In other areas the Maritime Rush *(Juncus maritimus* var. *australiensis)* may form almost a pure stand of several acres in extent though it is generally associated, particularly on the edge of the swamps, with various sedges and allied plants. Succulents are typical of the salt-meadow, the commonest being Glasswort *(Salicornia)*, Sea Blite *(Suaeda)*, a Salt Bush (*Enchylaena*) and a creeping plant, *Sesuvium portulacastrum*.

Woodland Areas or Forests.

The Woodland areas or forests can be divided along broad lines into several distinct types:—(1) The Littoral or Coastal forests; (2) the Sub-Littoral forests; (3) the Open Eucalyptus forests; (4) the Vine Scrubs or Jungles (known to the botanist as rain forests); (5) the River forests; and (6) the Inland scrubs.

Littoral or Coastal Forests.

Mangrove Forests.

The Littoral forests are of two main types. The forest below high-water mark (mangrove forests), and those above high-water mark (beach forests). The mangroves are extremely interesting trees, showing a wonderful adaptability to the conditions under which they grow. Their roots not only act as a means of anchoring the trees firmly in the muddy substratum in which they grow, but the parts above water also act as breathing organs. They are covered by breathing apertures known as lenticels, are of a spongy nature, and through the lenticels communication with the atmosphere is maintained. This is very essential, as the trees are growing in a very badly aerated soil, and unless communication between the subterranean roots and the atmosphere was established in some way the trees would become suffocated. The fruits are also peculiar from the fact that germination takes place while still on the tree, and the young plant is ready to anchor itself in the mud as soon as it drops from the parent tree; if this did not happen the seeds would become washed about from place to place and difficulty would be found in finding a footing.

Common mangroves of the Queensland coast are the Red Mangrove *(Rhizophora)*, the Black Mangrove *(Bruguiera)*, the small Mangrove *(Ceriops)*, the White Mangrove *(Avicennia)*, and the Milky Mangrove *(Excaecaria)*. The first two are of some importance as tanning agents, but they have not found general favour amongst tanners in Australia owing to several disadvantages. These disadvantages can be overcome, but the expense of doing so does not compensate tanners for the trouble involved.

The White Mangrove is one of the few species of mangroves that extends outside the tropics, being common all round the Australian coasts, and extending to New Zealand. The bark of this tree has no

value for tanning purposes, but the leaves are of use as a fodder, and in times of drought in coastal areas the White Mangrove has saved many head of stock.

The Milky Mangrove is poisonous and possesses a milky sap with strong blistering properties. If it gets into the eye it causes intense pain and temporary blindness.

An interesting member of the mangrove flora in some parts of North Queensland is the Nipa Palm *(Nipa fruticans)*. The Nipa Palm is at present confined to a few parts of North Queensland, the Pacific Islands, and tropical Asia, but at one time evidently had a wide range over the regions of the world, as nuts in a good state of preservation are commonly found in the Tertiary deposits at the mouth of the Thames in England. Where it grows the leaves of the Nipa Palm are preferred above all others as thatch for native houses.

Beach Forests.

The Littoral forests above high-water mark are of two types—those of the dry land, and those of the swamps. Those of the former are again divided into two types—(1) Those of the ocean foreshores, and (2) those of the bay foreshores. The two outstanding trees of the ocean foreshores or sand dunes of Eastern Queensland are the Coast Oak *(Casuarina equisetifolia)* and one or two species of Pandanus. The latter show great adaptability to their environment, for they are provided with prop roots, which anchor the trees very firmly in the loose sandy soil in which they grow. These prop roots are essential, as the large leaves and the large heavy heads of nuts are borne at the extreme ends of the branches, and but for these roots the trees would very easily be blown over by the high winds which prevail on the coast.

Another tree often seen on the foreshores immediately behind the dunes is the Sand Cypress *(Callitris columellaris)*. When growing in such situations it is usually rather dwarfed, and the tops cut off in an oblique direction by the prevailing winds, giving the crown a sloping appearance.

Common trees on the bay foreshore often just above the mangrove formation are the Cotton tree (*Hibiscus tiliaceus*), and the Cupania (*Cupania* or *Cupaniopsis anacardioides*).

Trailing sand-binders are characteristic plants of all coastal sand dunes. Along the sand dunes in Queensland are found the universal *Ipomoea Pes-caprae* (the Goat's-foot Convolvulvus), *Vigna lutea* with yellow and *Canavalia obtusifolia* with rather purplish-pink flowers respectively; *Acacia longifolia* var. *Sophorae,* common on the more southern beaches, has prostrate stems 10 or 12 feet long trailing over the sand. *Stephania hernandiæfolia* is common just behind the sand dunes, as is *Hibbertia volubilis;* these last two plants seem to be equally at home on the sandy beaches as in the rich tropical and sub-tropical rain forests, two habitats the opposite of one another as far as conditions for plant life are concerned. Sand-binding grasses are represented by *Spinifex hirsutus, Zoysia pungens* (Coast Couch), *Ischæmum triticeum, Lepturus repens, Thuarea sarmentosa,* and *Stenotaphrum subulatum.*

Succulent plants are characteristic of coastal floras. Along the sand dunes in Queensland succulent plants are represented by *Mesembryanthemum aequilaterale* (Pig Face), *Tetragonia expansa* (New

Plate 50.

Noosa Beach from top of Paradise Caves, showing Pandanus (*Pandanus pedunculatus*) and She-Oak (or Sheoke) trees (*Casuarina equisetifolia*). [*Photo., Queensland Government Tourist Bureau.*

Zealand Spinach), *Cakile maritima, Scaevola suaveolens,* and the two spurges *Euphorbia atoto* and *E. eremophila. Oxalis corniculata* (Wood Sorrel) and *Sonchus maritimus* of a less succulent nature are also common on many beaches. *Sesuvium portulacastrum,* sometimes found on the dunes, is more abundant on the saltpans.

SUB-LITTORAL FORESTS.*

I have applied the term sub-littoral forests to two types of woodland—(1) Coastal swamps or tea-tree swamps, and (2) the country known universally in Queensland as "wallum"; these are essentially coastal types, though they may continue inland for about 10 miles, or in more isolated patches for even more.

COASTAL FRESHWATER SWAMPS.

Lying close in from the beach in much of coastal Queensland are very large freshwater swamps. The outstanding tree of these swamps is the common Paperbarked or Broad-leaved Tea-tree *(Melaleuca viridiflora* and its allies). Where this tree grows the ground is often covered with a thick growth of the Bungwall Fern (*Blechnum serrulatum*), and its rhizomes sometimes climb up the trees through the outer layers of the papery bark for quite a considerable distance. Another fern often so common as to be an outstanding feature of the vegetation is the so-called Climbing Maidenhair (*Lygodium scandens*). In some parts the Tea-tree is displaced by the Swamp Oak *(Casuarina glauca).* Other trees present in these coastal swamps are *Eucalyptus robusta* (sometimes called Swamp Mahogany), *Tristania suaveolens* (the Swamp Mahogany), and to a lesser extent Eucalyptus umbellata (*Synonym Eucalyptus tereticornis),* the Queensland Blue Gum.

The trees of these coastal swamps have to withstand conditions very unfavourable to plant growth—*i.e.,* periods of inundation alternating with those of comparative drought—so that they are mostly xerophytic in habit, with tough, leathery, commonly vertically placed leaves, and some, such as the Blue Gum, Swamp Mahogany (*Tristania*), and Tea-tree, can adapt themselves to ordinary dry forest conditions. *Melastoma malabathricum* is a common shrub of the coastal swamps. It is known to Queensland children as Blue-tongue, as the fruits when chewed stain the mouth bluish black all over.

In the wetter parts where the water is more permanent aquatic plants as the Water Lilies (*Nymphæa* spp.), of which the commonest is the Blue Water Lily (*N. gigantea*), Swamp Lily (*Ottelia*), the Fringed Water Lily (*Limnanthemum*), Bur-reed (*Sparganium angustifolium*), Bulrush (*Typha angustifolia*), and various sedges and allied plants are found growing.

Water grasses are represented by the Dutch Millet *(Paspalum orbiculare),* the Water Couch *(Paspalum distichum),* Wild Millet (*Echinochloa*), Rice Grass (*Leersia*), Common Reed (*Phragmites*), and others.

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* The Latin prefix "sub," meaning under or below, is very frequently employed in botany in compound words, and implies an approach to the condition indicated; *e.g.,* sub-littoral forests are forests close to the sea but not actually on the shoreline; sub-tropical forests are forests not actually growing in the tropics but approaching the tropics or tropical richness very closely; leaves sub-opposite means that the leaves are not quite but nearly opposite, and so on.

"WALLUM."

The term "Wallum" is applied in Queensland to barren country in the coastal belt covering large areas, particularly in the Moreton Bay, Wide Bay, and Hervey Bay districts. It consists largely of peat swamps, in some places very wet, alternating with sandy ridges covered with a fairly dense woodland consisting of low, stunted eucalypts, *Banksia*

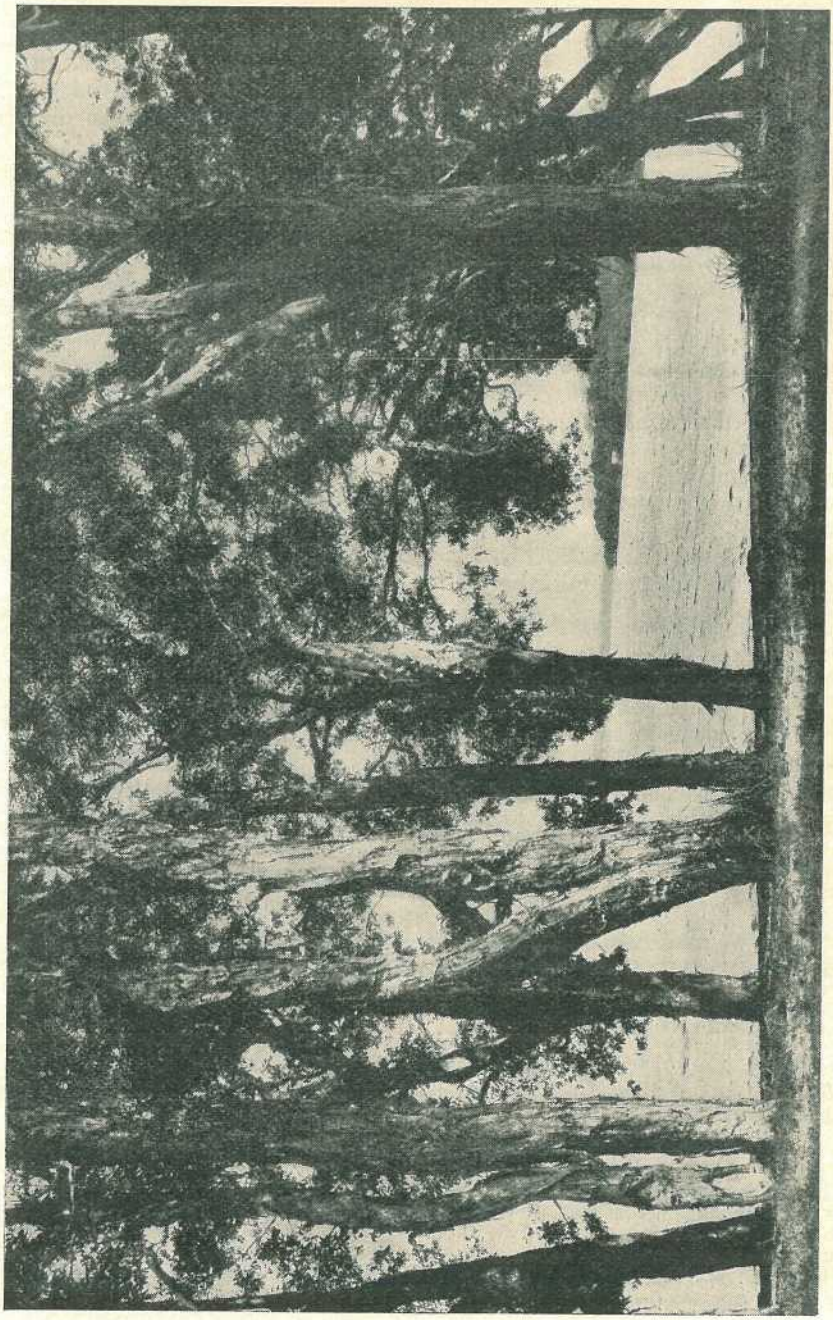

Plate 51.

LAKE COOTHARABA.—The trees in the foreground are Broad-leaved or Paper-barked Tea Trees (*Melaleuca viridiflora*). This species often forms pure stands of many acres in extent in freshwater swamps near the sea.

[*Photo., Queensland Government Tourist Bureau.*

aemula, &c. This latter is the characteristic tree of much of the sandy tracts and is itself known as "Wallum." In the peat swamps *Sphagnum* moss may occur, though it is not so characteristic of this formation as it is in colder countries, and other plants enter mostly into the formation of the peat. The peat swamps of South-eastern Queensland possess a great many flowering shrubs and undershrubs, and during the spring months are usually gay with wild flowers. These include more particularly many Leguminosae, Myrtaceae, Epacridaceae, and Proteaceae endemic in Australia. The Sedges and their allies are also usually well represented. Insectivorous plants, always more or less characteristic of peat swamps (" high moors ") in all parts of the world, are represented by several Sundews *(Drosera* spp.). Grass-trees *(Xanthorrhaea* spp.) are common in most of the " Wallum." Lycopods or Club Mosses to be found there are *Lycopodium cernuum* and *L. laterale*, and in some places the Coral Ferns *(Gleichenia circinnata* and *G. dicarpa)* are very abundant.

The sand hillocks in the " Wallum " contain a very rich mixture of Australian types—Epacridaceae or Australian Heaths, Leguminosae, Myrtaceae, Proteaceae, and Rutaceae predominating.

Open Eucalyptus Forests.

The open Eucalyptus forest (savannah forest), as in the other States of Australia, is the main forest type of Queensland. It varies a good deal in composition of species according to whether coastal or inland, northern or southern, whether occurring on rich deep soils or barren siliceous ones, &c.

Though the Eucalypts in themselves form a very natural group, they present many difficulties at any attempt to arrange the species into natural groups, each group possessing a number of characters in common. As far as the Queensland species are concerned, for the purpose of giving a brief account of the genus, the species can be most conveniently divided into five groups, according to their bark characters, viz.:—

(1) The smooth-barked trees or gums proper with a trunk normally smooth, the bark coming off in scales or strips leaving a clean, smooth barrel; bark commonly persistent at the base of the trunk and very rarely persistent for some time almost up the entire trunk. Characteristic trees of this group are *Eucalyptus saligna* (the Flooded Gum), *E. tessellaris* (the Moreton Bay Ash or Carbeen), *E. maculata* (the Spotted Gum), *E. micrantha* (the Scribbly Gum), *E. Seeana* (Narrow-leaved Grey Gum), *E. propinqua* (the Grey Gum), *E. Torelliana* (Cadagi), *E. platyphylla* (Poplar Gum), and *E. papuana* (Cabbage Gum).

(2) The Boxes with dark-grey, fibrous, much interlocked bark, often shed on the upper part of the trunk and main limbs in strips or patches. Characteristic trees of this group are *Eucalyptus albens* (White Box), *E. conica, E. hemiphloia* (Gum-topped Box), *E. melliodora* (Yellow Box), *E. populifolia* (Bimble Box), *E. pilligaensis* (Ribbon Box), *E. microtheca* (Coolibar), *E. quadrangulata, E. Cambageana* (Mountain Coolibar), and *E. leptophleba* (North Queensland Box).

(3) The Stringybark trees with a very fibrous bark, persistent on the trunk and branches. Typical trees of this group are *Eucalyptus resinifera* (Red Stringybark), *E. capitellata* (Brown Stringybark),

E. eugenioides (White Stringybark), *E. acmenioides** (Yellow Stringybark) and *E. Planchoniana,* &c. Less typical but placed in this group for the purpose of convenience are *E. Baileyana* (Rough Stringybark), *E. microcorys* (Tallow-wood), and *E. exserta* (Peppermint).

(4) The Ironbarks possess a hard-furrowed, black or dark-grey persistent bark, rather friable and the interstices often carrying a dark red kino ("gum"). Typical trees of this group are *Eucalyptus melanophloia* (Silver-leaved Ironbark), *E. paniculata* (Grey Ironbark), *E. crebra* (Narrow-leaved Ironbark), *E. siderophloia* (Broad-leaved Ironbark). The Mugga or Red Ironbark *(E. sideroxylon)* is common along parts of the New South Wales-Queensland border; the bark is often of a more friable nature than the other ironbarks.

(5) The Bloodwoods are trees with a persistent bark, commonly inclined to be spongy and friable and roughly and irregularly tessellated, the outer layers lamellar and the inner layers sub-fibrous. Typical trees of this group are *Eucalyptus corymbosa* (Red Bloodwood), *E. trachyphloia* (White Bloodwood), *E. terminalis* (Western Bloodwood), *E. dichromophloia* (Northern Bloodwood), and the various trees known in Queensland as Yellowjacket—*e.g., E. peltata, E. Bloxsomei, E. Watsoniana, E. similis,* &c.

The Marlocks and Mallees are not represented in Queensland, though a species of mallee-like growth, *E. Bakeri,* occurs in fairly considerable areas in some interior parts along the New South Wales-Queensland border, and in parts of the Burnett District and Central Queensland.

In parts of coastal North Queensland large areas are covered with Broad-leaved Tea Trees (mostly *Melaleuca Leucadendron* var. *Cunninghamii)* at times forming pure stands, but usually mixed with Eucalypts.

A genus allied to Eucalyptus and very much abundant in the open forest is *Angophora,* the best known members of which are the Rusty Gum *(A. lanceolata)* and the Apple-trees *(A. intermedia* and *A. subvelutina). A. melanoxylon* is very common about Charleville, Western Queensland; *A. Woodsiana,* common in South-east Queensland, is popularly known as Apple-tree Bloodwood.

Another genus allied to Eucalyptus is *Tristania* with two species, viz., the Swamp Mahogany *(Tristania suaveolens)* and the Scrub Box *(T. conferta),* very common in forest country. The former, as its name implies, is commonly found in swampy country, but is certainly not confined to it, being found in the ordinary open forest; its timber is preferred above all others for piles and fender posts for wharves, being especially resistant to the attacks of the marine worm or teredo. The Scrub Box, as its name implies, is often found on "scrub" (rain-forest) edges. Its timber is very little cut in Queensland, due probably to its tendency to warp in small sizes.

The Turpentines *(Syncarpia laurifolia* and *S. Hillii)* are timbers that are in great demand for piles, also for fender posts for wharves. They are rarely cut in Queensland, due to their tendency, like the Scrub Box, to warp in small sizes, but are highly useful, very much underrated hardwoods.

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* *E. acmenioides* and the two allied species, *E. carnea* and *E. umbra,* known in Queensland as Yellow Stringybarks, are not regarded in New South Wales as typical of the Stringybark group, and are universally known as Mahoganies.

An interesting member of the open forest is the Sandalwood *(Santalum lanceolatum)*, parasitic on the roots of other trees. The Sandalwood is common throughout Western New South Wales and Queensland. The main port of export for Queensland is Thursday Island. It is not always found in the open forest, and in the more southern parts of the State grows mostly in the inland scrubs. A tree that commonly goes under the name of Sandalwood in Western New South Wales and Queensland is *Eremophila Mitchellii*, also known in the former State as Buddah. The wood is very strongly scented, but is of no value as a "sandalwood," and attempts to get it on the market have always failed. It belongs to a very different family from the true Sandalwoods. When the Sandalwoods were cut out from the Hawaiian Islands, attempts were made to substitute the wood of a tree allied to the Australian Buddah, and like it with a strong scent, but the Chinese buyers would have none of it. It is possible, however, that it will have some value for wood distillation, as the oil it contains should be valuable for use in the manufacture of scents and perfumes, possessing as it does a desirable, heavy, "oriental" odour. Another Santalaceous tree with a faint sandalwood odour is *Exocarpus latifolia* found in varying quantities along the whole coastal belt.

Other trees making up the open forest are various Wattles *(Acacia)*, *Albizzia* (commonly called Acacia), Honeysuckles (*Banksia*), She Oaks (*Casuarina*), Red Ash (*Alphitonia*), Geebungs (*Persoonia*), Cypress Pines *(Callitris)*, Native Cherry *(Exocarpus cupressiformis)*, Kurrajong *(Brachychiton)*, Swizzle *(Timonius Brownii)*, *Grevillea* spp., *Hakea* spp. (Needle Bushes), &c.

RAIN FORESTS.

The vine scrubs or jungles (rain-forests) reach their greatest development in Australia in coastal Queensland. They consist of heavily dark-foliaged trees, and an abundance of climbers; many of the trees produce huge plank buttresses at the base. Queensland genera in which plank buttresses reach their greatest development are *Ackama* (Pink Marara), *Cedrela* (Red Cedar), *Dysoxylon* (Red Bean and Spurwood), *Elaeocarpus* (White or Blue Quandong), *Eugenia* (Water Gum), *Ficus* (Figs), *Geissois* (Red Carrabin), *Sloanea* (Yellow Carrabin), and *Tarrietia* (Booyongs, Tulip Oaks or Stave Woods).

It is rather unfortunate that in Queensland the name "scrub" should have become attached to this rich type of jungle, as the term "scrub," not only in other parts of Australia but in other parts of the world, as well as in botanical terminology, refers to low, stunted vegetation, the direct opposite to that which occurs in the so-called vine scrubs of Queensland. Rain-forest, as the name implies, is dependent on a high rainfall for its luxuriant development, and in Queensland rain-forest of the more luxuriant type is not found in areas possessing a rainfall under 50 inches (1,275 mm.) per annum. Rain forests of an increasingly drier type, the trees smaller, undergrowth less, and of a more general xerophytic type, occur in areas with a rainfall down to 35 inches (about 900 mm.) per annum. Rain forest is a purely coastal type and does not occur more than 100 miles inland. Mostly it is a narrow fringing belt along the coast.

In the southern (extra-tropical) parts of the State many of the trees, including the rain-forest species, are common to New South Wales and Queensland, but in the tropical parts of the State most of

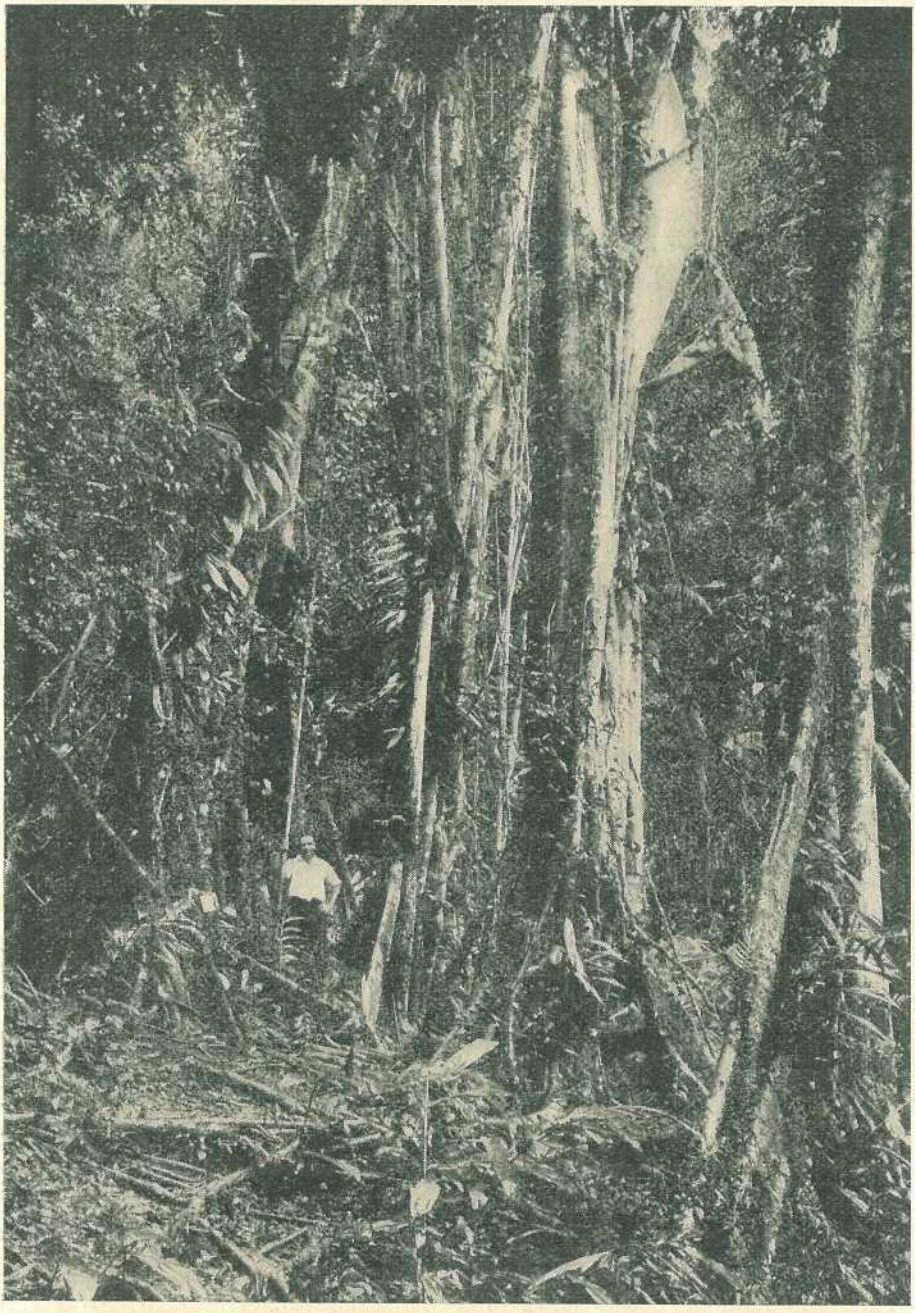

Plate 52.

Tropical rain-forest or jungle with large Banyan Tree (*Ficus* sp.) in foreground, Malanda, North Queensland. [*Photo., Queensland Government Tourist Bureau.*

the species are endemic or if not confined to Queensland spread to either Polynesia, Melanesia, or the Malaysian region, some of them spread over the whole of these areas or with an even wider distribution.

The number of actually Australian types found in the vine scrubs is small, the majority of plants belonging to families, a good few to genera, and a few to species that are cosmopolitan in the tropics and sub-tropics, Malaysian types predominating. Interesting Asiatic types occurring in Queensland are *Rhododendron* and *Garcinia* (the Mangosteens); the former reaches its southernmost limit of distribution in North Queensland, but the latter genus extends to New Caledonia.

An objection is sometimes made to calling many of our rain-forest or jungle plants Malayan types, but the reason for it is that many of the groups such as the Figs, Eugenias, Mangosteens, &c., are found in the Malayan region in far greater abundance than in Australia.

Even in the rain forests, though the Malaysian element may predominate as regards families and genera, the degree of endemism developed among the species is high enough to support the contention of Dr. E. D. Merrill, one of the foremost living authorities on the flora of the Malaysian region, that Australia and Asia have remained separate since the epi-Mesozoic interval or Eocene, a time when the flowering plants had already reached a dominant place in the vegetation of the world. A peculiar feature of the flora of the North Queensland rain forests is the development of a number of small (in some cases monotypic) genera. These are especially numerous among the Proteaceæ, or Silky Oaks, of North Queensland, *e.g., Austromuellera, Buckinghamia, Cardwellia, Carnarvonia, Darlingia, Hicksbeachia, Hollandæa, Musgravea* and *Placospermum.*

The Malaysian tropical element reaches its southern limit in coastal Queensland and New South Wales, and on the other hand, the so-called Antarctic element reaches its northern limit in Queensland rain forests. An interesting example of this latter is the so-called Antarctic Beech or Niggerhead *(Nothofagus Moorei)*, which is abundant on the Macpherson Range.

It is in the rain forest that the most important coniferous softwoods of the State occur, viz., the Hoop Pine *(Araucaria Cunninghamii)*, the Bunya Pine *(Araucaria Bidwillii)*, and the Kauri Pines *(Agathis)*; of the last, three species occur in Queensland, of which the one most commonly cut at the present time is *A. Palmerstonii*, of North Queensland. Fortunately the native coniferous timber trees do well under silvicultural conditions and make rapid growth. Podocarps (see p. 757) in the rain forest are represented by the She Pines or Brown Pines, *Podocarpus elata, P. amara,* and *P. disperma; P. Ladei* is a rarer species, so far as known confined to Mount Spurgeon, North Queensland.

The genus *Flindersia* (commemorating the name of Matthew Flinders, the famous navigator) is a genus of about twenty species, all except a few found in Australia, and all the Australian species are found in Queensland. It is an interesting exception as forming a large Australian group found in the rain forests. After *Eucalyptus* and *Araucaria, Flindersia* is probably the most important genus of Australian timber trees. It contains the Crow's Ash or Teak *(F. australis)*,

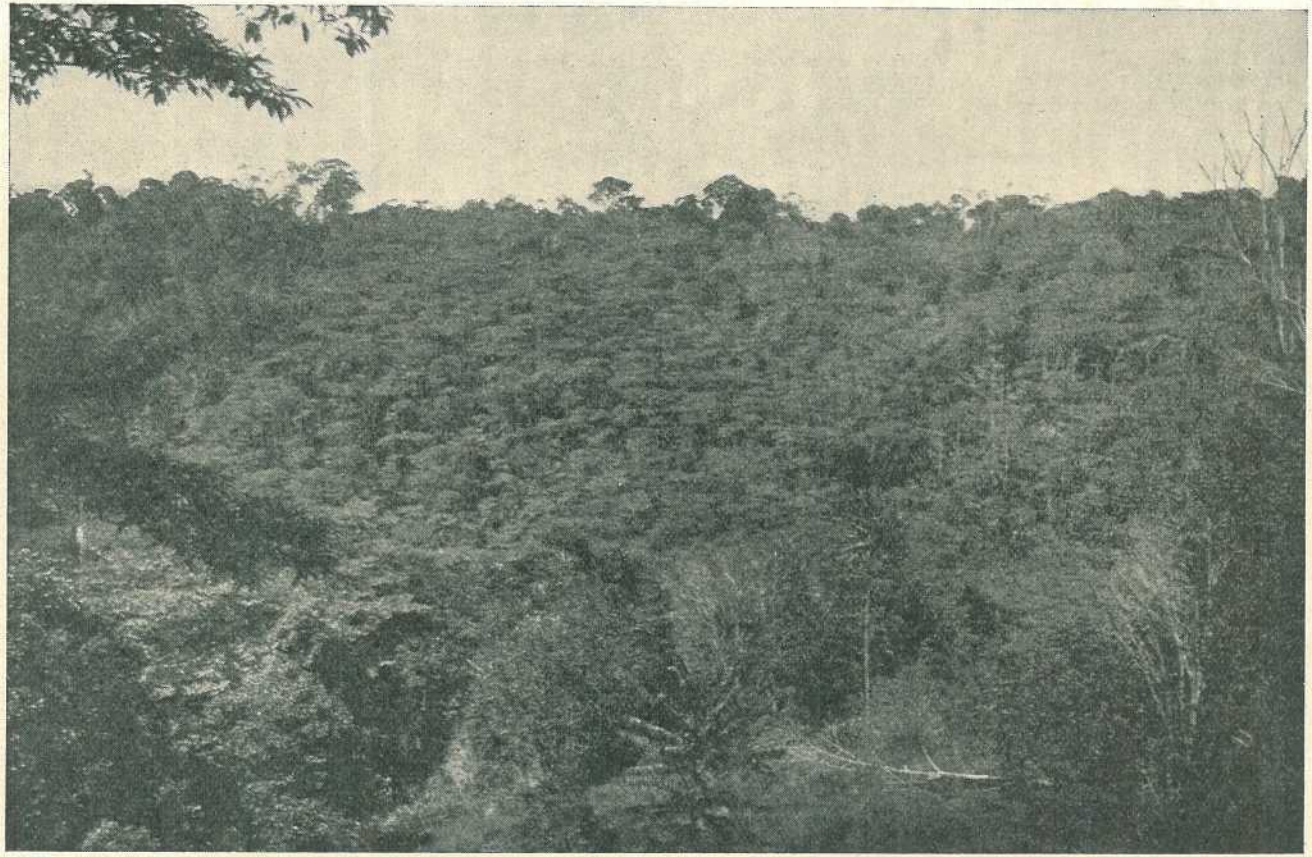

Plate 53.

Second-growth forest composed mostly of Sarsaparilla or Red Ash (*Alphitonia Petriei*), Atherton Tableland, North Queensland. The trees in the foreground with large pinnate leaves are *Polyscias Murrayi*, popularly known in North Queensland as Palm Tree. It is a very characteristic regrowth species. [*Photo., Queensland Government Tourist Bureau.*

Yellowwood *(F. Oxleyana)*, Cudgerie *(F. Schottiana)*, Silkwood *(F. Pimenteliana)*, Maple *(F. Brayleyana)*, Cairns Hickory *(F. Ifflaiana)*, and other timber trees.

Other cabinet woods of the Queensland rain forests are the various species of Silky Oaks (Proteaceæ), of which *Cardwellia sublimis* is the most abundant and at the present time the common species of the trade, Red Cedar (*Cedrela Toona* var. *australis*), White Cedar (*Melia dubia*), Red Bean (*Dysoxylum Muelleri*), Black Bean (*Castanospermum australe*), Acacia Cedar or Red Siris (*Albizzia Toona*), Yellow Siris (*Albizzia xanthoxylon*), Booyongs (*Tarrietia* spp.), Red Carrabin (*Geissois Benthamii*), Yellow Carrabin (*Sloanea Woolsii*), Calophyllum (*Calophyllum costatum*), the White Beeches (*Gmelina Leichhardtii* and *G. fasciculiflora*), Rose Walnut (*Cryptocarya erythroxylon*), Tulip Wood (*Harpullia pendula*), Queensland Walnut (*Endiandra Palmerstonii*), Burdekin Plum (*Pleiogynium Solandri*), Daintree Maple or Cairns Pencil Cedar (*Lucuma galactoxylon*), Yellow Hickory, (*Nauclea Gordoniana*), and a number of other timbers not cut to any extent.

On some parts of the Downs and a few other inland localities there is a type of "scrub" which, in addition to trees that also occur on the coast, contains several distinctive ones; the most outstanding is the Bottle-tree (*Brachychiton rupestre*). Trees such as the Lignum-vitæ (*Vitex lignum-vitæ*), Crow's Ash (*Flindersia australis*), *Booyong* (*Tarrietia argyrodendron*), &c., are usually much smaller than the same species in the coastal belt.

Rain-forest or Jungle Regrowth.

When the rain forest is felled and burned it is usually followed by a more or less dense secondary growth. These may consist of imported or native weeds such as Wild Tobacco (*Solanum auriculatum* and *S. verbascifolium*), Ink Weed (*Phytolacca*), Lantana (*Lantana camara*), Thistles, etc., or of trees such as Red Ash or Sarsaparilla (*Alphitonia*), Wattles (*Acacia*), Bleeding Heart (*Homalanthus*), &c.

River Forests.

Along many of the Australian freshwater rivers, both inland and coastal, a number of trees occur that always follow the watercourses, being rarely found anywhere else, such as the River Red Gum (*Eucalyptus rostrata*), Red Bottle-Brush (*Callistemon viminalis*), River Tea-Tree (*Melaleuca bracteata*), Weeping Tea-Trees (*Melaleuca leucadendron* vars.) River Oak (*Casuarina Cunninghamiana*), Weeping Myrtle (*Eugenia Ventenatii*), Water Gum (*Tristania laurina*), Gutta-percha (*Excœcaria parviflora*), &c. Other trees such as the Bean-tree (*Castanospermum*), Blue Gum (*Eucalyptus tereticornis*), Lilly Pilly (*Eugenia Smithii*), Creek Cherry (*Eugenia paniculata*), &c., occur along the rivers, but are also found in the vine scrubs or open forests as the case may be.

In the mountain rain forests of the coast characteristic moisture-loving plants growing between boulders in the rocky watercourses are species of *Elatostemma* (Urticaceæ) and *Helmholtzia* (Philydraceæ).

In Western Queensland, as the watercourses dry up the beds may be clothed with a growth of annual herbs of which species of *Centipeda* (Sneezeweed), *Chenopodium* (Goosefoot), *Commelina* (Scurvy Grass), and *Mollugo* (Carpet Weed) are prominent members.

INLAND SCRUBS.

Many scrubs in the western and northern parts of the State are often formed by pure or almost pure stands of particular species of Wattles (*Acacia*), such as the Brigalow (*A. harpophylla*), Mulga (*A. aneura*), Boree (*A. homalophylla*), and Lancewood (*A. Shirleyi*) scrubs respectively. Another tree forming large inland scrubs and usually associated with the Brigalow is the Beelah (*Casuarina lepidophloia*).

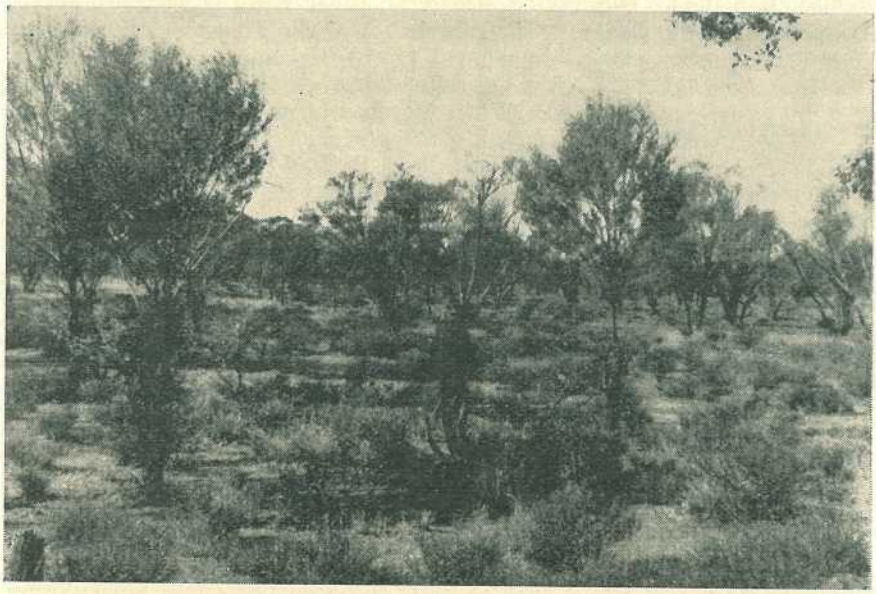

Plate 54.

Mulga (*Acacia aneura*) scrub with an undergrowth of Turkey Bush (*Eremophila Goodwinii*), between Bollon and Cunnamulla, South-West Queensland.

[*Photo. by S. L. Everist.*

Associated with the various species of Wattles and Beelah are other trees such as the Wilga (*Geijera parviflora*), Emu Apple or Gruie (*Owenia acidula*), Mustard tree (*Apophyllum anomalum*), Supple Jack (*Ventilago*), Native Pomegranate or Bumbil tree (*Capparis Mitchellii* and other species), Whitewood (*Atalaya hemiglauca*), Western Rosewood (*Heterodendron oleæfolium*), Western Lime (*Eremocitrus*), &c. A remarkable feature about many of the Western trees is the high fodder value of their leaves, cattle being carried over long periods of drought on "scrub" feed.

[CONCLUDED.]

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Chloris Grasses in Queensland

S. L. EVERIST, Assistant to Botanist.

PART III.*

THE RHODES GRASS GROUP.

THE four species dealt with in this part belong to what we may term "the Rhodes Grass group." They all bear a resemblance to the well-known Rhodes Grass, and are characterised by the presence of a large number of branches in the seed-head, vigorous leaf growth, and a tendency to spread by means of surface runners.

PURPLE TOP GRASS (*Chloris barbata*).

Botanical Name.—*Barbata,* from Latin *barbatus*—bearded, referring to the hairs on the spikelets.

Common Name.—The names Purple Top Grass and Purple Top Rhodes Grass have been applied to this grass. Purple Top Grass is shorter and aptly describes the plant.

Botanical Description.—Stoloniferous perennial; stolons flattened, stout and fairly long. Shoots flattened. Culms erect or geniculated at the base, flattened and striate, unbranched or sparingly branched from the lowermost nodes. Nodes and internodes glabrous. Leaves distichous, green. Leaf sheaths glabrous, striate, flattened and strongly keeled. Auricles small, with tufts of long white hairs. Ligule a small ciliolate rim. Collar small and inconspicuous, glabrous. Leaf blades up to 20 cm. long, folded and strongly keeled; 5 cm. broad at the base, tapering to a fine point; base of blade with a few scattered long hairs on the upper surface. Flowering culms erect. Spikes 5-20, usually 9-16, fasciculate, closely congested and not spreading, up to 8 cm. long, rather weak. Rhachis slender and scaberulous, tomentose at the base. Spikelets very numerous, closely imbricate, subsessile, in two rows on the lower side of the rhachis. Lower glume membranous, lanceolate, acute, 1-nerved, 1·5-1·7 mm. long. Upper glume membranous, elliptic or elliptic-lanceolate, acute or shortly mucronate, 1-nerved, 2·5 mm. long. Lower floret hermaphrodite; lemma firm in texture, obovate in outline, irregularly elliptic in profile, 3-nerved, lateral nerves close to the margins, margins in the upper part long, bearded; lemma 2-2·5 mm. long, folded and bluntly keeled, glabrous on the back except for a tuft of hairs near the middle close to the keel, apex with very short, acute points, awned from the sinus, awn slender, scaberulous, 4-5 mm. long; palea equal in length to the lemma, obovate or almost spathulate, 2-keeled, glabrous, thin in texture; lodicules 2, small, clavate, glabrous; stamens 3; stigmas 2, slender; ovary glabrous; caryopsis pale straw-coloured, shining, elliptic, obtusely triquetrous; embryo large, occupying half the caryopsis. Second floret consisting of an empty lemma only; lemma broadly cuneate in outline, narrowly cuneate in profile, 3-nerved, truncate at the apex, 1·2 mm. long, glabrous or sometimes hairy; awn

* Part I. of this series was published in May issue, 1935 (Vol. XLIII., page 474, "Queensland Agricultural Journal"), and Part II. in July issue, 1935 (Vol. XLIV., page 18, "Queensland Agricultural Journal").

slender, scaberulous, up to 5 mm. long. Third floret also an empty lemma only; lemma much inflated and almost globose, orbicular in outline, 3-nerved, truncate at the apex and upper edges inrolled, 1 mm. long; awn slender, scaberulous, about 3 mm. long.

Popular Description.—A rather robust grass with stout creeping stems, similar in general appearance to Rhodes Grass, but usually somewhat smaller. It is readily distinguished by its purple seed-head and by the smaller spikelets, which are also different in shape.

Distribution.—In Australia, *Chloris barbata* is almost confined to the tropics. Its chief occurrence in Queensland is along the coastal strip from Port Curtis northwards, though it has been found as far west as Julia Creek, on the Great Northern Railway. It also extends to Northern Australia. It is doubtful whether this grass is a native of Australia, as it is a widespread weed in the tropics of both hemispheres.

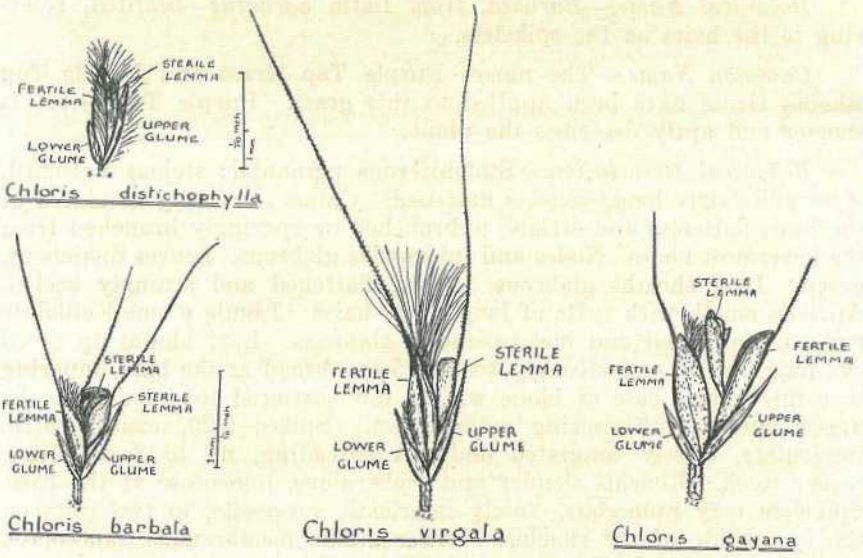


Plate 55.

Habitat.—In general, Purple Top Grass favours such situations as roadsides and old cultivation paddocks. It is seldom seen in undisturbed pasture lands.

Fodder Value, &c.—The general opinion concerning the fodder value of this grass seems to be that it is of little consequence. It looks inviting enough, but stock are apparently not at all fond of it. Possibly if the grass were kept short it would be eaten to a greater extent.

Reference.—Chloris barbata (Linn.), Sw. Fl. Ind. Occ. 1, 200 (1797).

FEATHER TOP GRASS (*Chloris virgata*).

Botanical Name.—virgata, from Latin *virgatus*—made of twigs. This probably refers to the much-branched stems, though it does not seem to be particularly applicable.

Common Name.—In Australia this grass has received a number of names. It was introduced by Col. Sylvester Browne, of Singleton, New

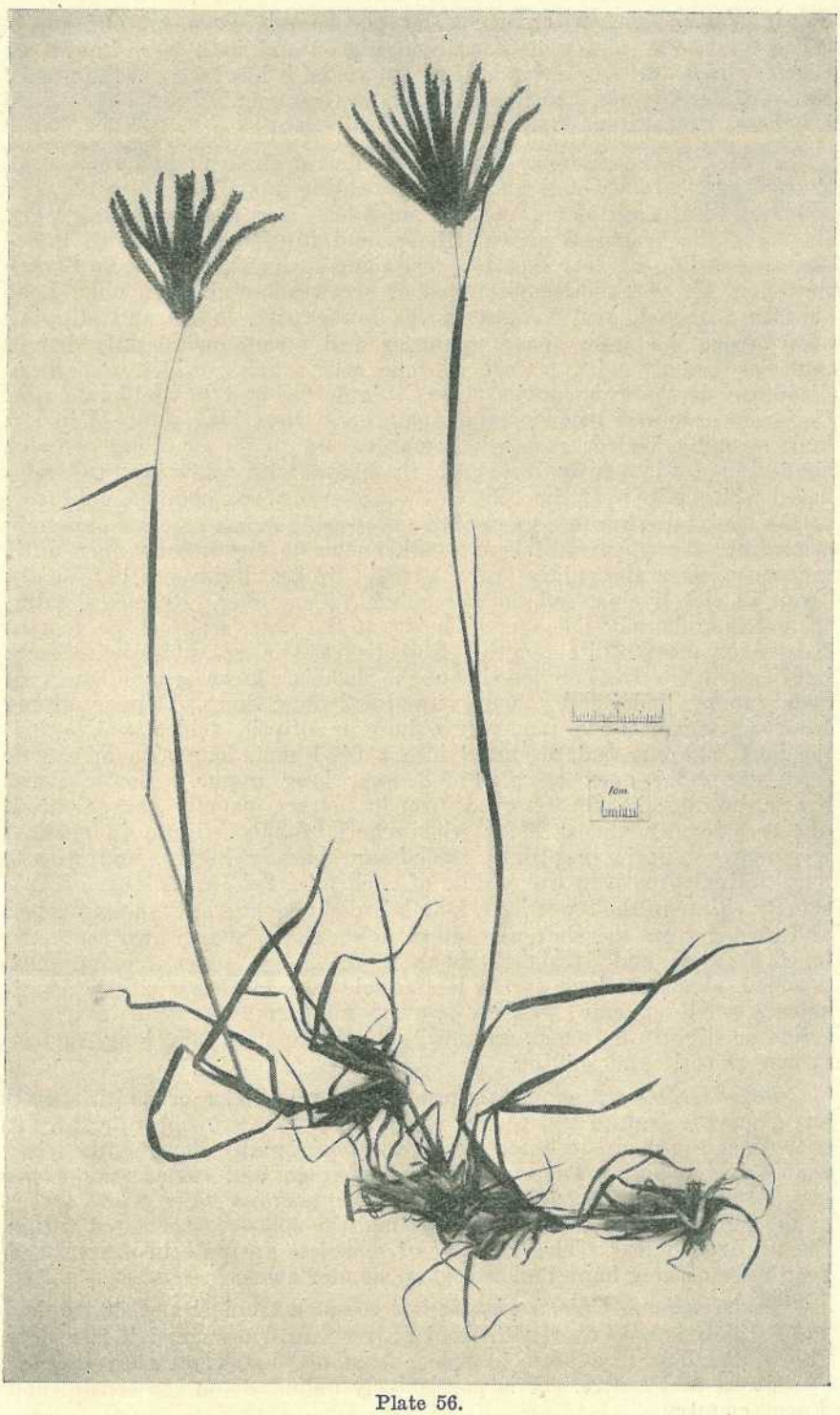


Plate 56.
Purple Top Grass (*Chloris barbata*).

South Wales, along with Rhodes Grass (*Chloris Gayana*), and for a while the two species were not distinguished and both were known as Rhodes Grass. In Queensland, of recent years, it has received the names Native Rhodes Grass, Feather Top Rhodes Grass, and Feathertop Grass. Of these, Feathertop Grass seems to be the best.

Botanical Description.—Annual. Culms decumbent and rooting at the nodes, eventually geniculate, and ascending sometimes up to 120 cm., sometimes less than 15 cm. Culms much-branched and producing leafy shoots at the branched nodes. Nodes and internodes glabrous, internodes exceeding the leaf sheaths, striate and somewhat flattened. Shoots flattened. Leaves distichous, green or straw-coloured when old. Leaf sheaths flattened, keeled tight in the lower part, looser and slipping away from the culm above, glabrous and striate or slightly hairy. Auricles usually with a tuft of long white hairs, which sometimes disappear as the grass grows older. Ligule reduced to a ciliolate rim. Collar narrow and inconspicuous, glabrous. Leaf blades folded in the bud, strongly keeled, even when mature, up to 50 cm. long, usually about 20 cm. when fully developed; the blades with a few long tubercle-based white hairs near the edge on the upper surface, about 5 cm. broad at the base, tapering to a fine point. Flowering culms erect or obliquely ascending, the uppermost leaf sheath enclosing the inflorescence until maturity, when the spikes are exserted. Spikes digitate, 6-14, usually about 12, closely clustered, not spreading, 3-9 cm. long. Rhachis slender, triquetrous, densely but shortly hairy at the base, scabrous or shortly ciliate for most of its length. Spikelets sessile or subsessile, closely imbricate in two rows on one side of the rhachis. Lower glume 1-nerved, membranous, lanceolate, acute, up to 2 mm. long. Upper glume 1-nerved, membranous, narrowly oblong or elliptic, folded and keeled, the keel scabrous and produced into a 0·6-1 mm. long awn or mucro from the bifid apex of the 2·5-3 mm. long glume. Lower floret hermaphrodite; lemma 3-nerved, firm in texture, usually pale-coloured, but occasionally almost black when ripe; broadly elliptic in outline, irregularly elliptic in profile, folded and bluntly keeled, and with a longitudinal groove in the middle of each face, 2·5-3 mm. long. Edges shortly ciliate in the lower half, long-bearded near the apex, apex 2-lobed and awned from the cleft, the lateral lobes short, acute; awn scabrous, long, slender, and straight, about 2 cm. long; palea membranous, 2-keeled, almost as long as the lemma, obovate or almost elliptic; lodicules 2, small, cuneate; stamens 3; ovary glabrous; stigmas 2; caryopsis terete or slightly flattened, narrowly elliptic, up to 2 mm. long, surface brown, smooth, and shining.

Popular Description.—An annual grass, the stems of which spread out along the ground and root at the joints before growing upright. It sometimes grows up to 4 feet high, and occasionally flowers when less than 6 inches high. The leaves are long, green, and folded; the shoots are flattened. The seed-head consists of numerous fluffy white spikes at the top of a short stalk. When young, the spikes are enclosed within the uppermost leaf. The "seeds" or spikelets are pale in colour, and bear tufts of long hairs and two long, slender awns.

Distribution.—*Chloris virgata* is a common tropical and subtropical weed widely spread over both hemispheres. In Queensland it is widely distributed, and has been recorded from all districts except the far south-west and centre. It is particularly abundant on the coastal and downs country.

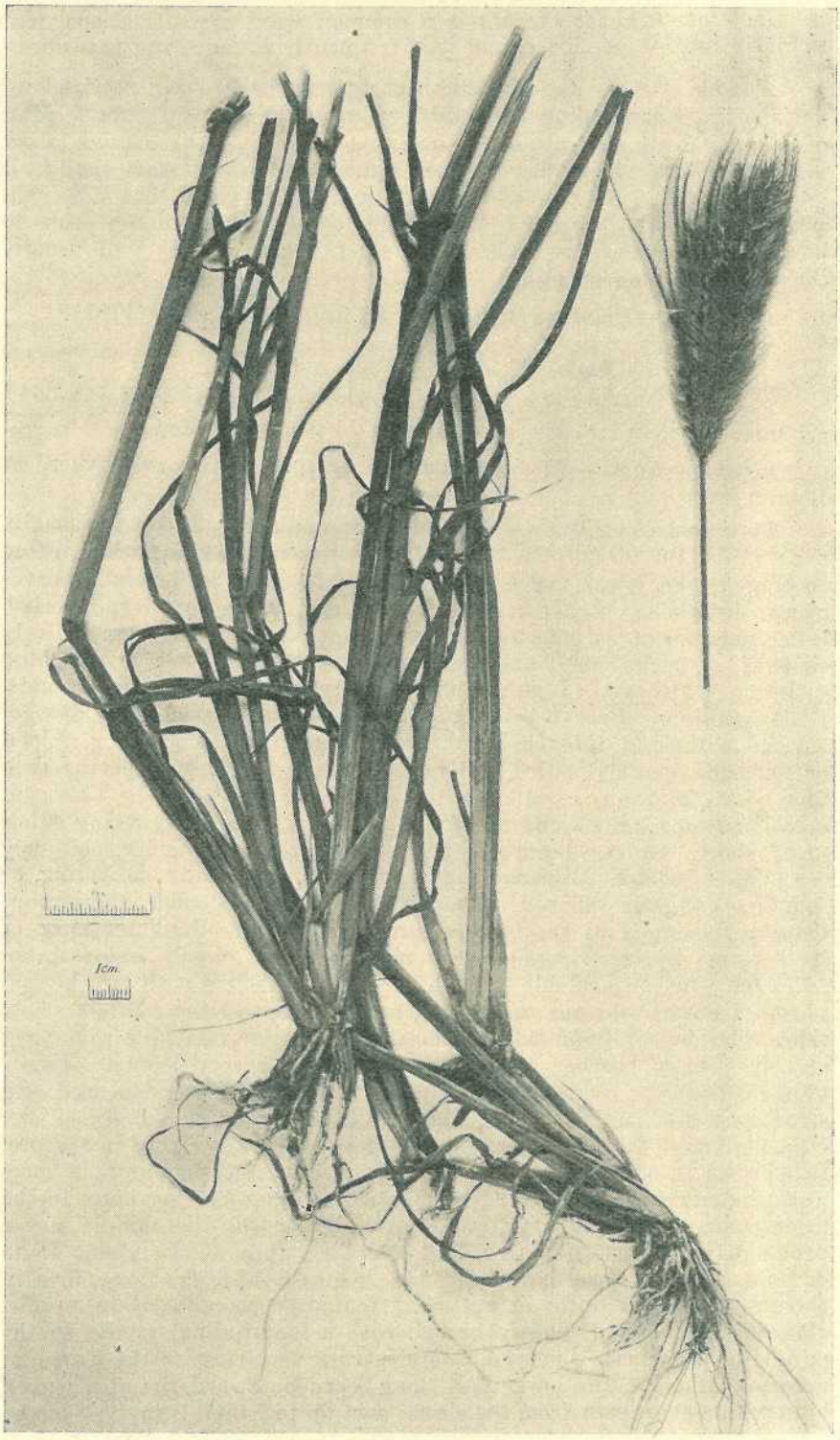


Plate 57.
Feather Top Grass (*Chloris virgata*).

Habitat.—Chloris virgata is a common weed of cultivations, particularly lucerne paddocks, and it is frequently found along roadsides.

Fodder Value, &c.—Conflicting reports have been received at various times concerning the fodder value of Feathertop Grass. Most of them indicate that although the grass looks tempting enough, stock will not eat it when other feed is available. Others state that it is liked by stock in all stages of growth, and others again that stock will eat it when made into hay. The general consensus of opinion seems to be that its presence is undesirable, since better grasses will usually thrive in the same situations.

Reference.—Chloris virgata, Sw. Fl. Ind. Occ. 1, 203 (1797).

RHODES GRASS (*Chloris Gayana*).

Botanical Name.—Gayana, apparently named after a Mr. Gay. I can find no record of the exact person to whom it refers.

Common Name.—In Australia this grass is known everywhere as Rhodes Grass.

Botanical Description.—Annual or perennial; in Australia usually a perennial up to 120 cm. high. Culms procumbent, branched, often rooting at the lower nodes and emitting fascicles of leaves. Leaves green, distichous. Leaf sheaths glabrous, striate, flattened and keeled, lower ones about as long as the internodes, upper ones comparatively shorter. Auricles small and inconspicuous, long-bearded or becoming glabrous with age. Ligule small, membranous, the edges ciliolate. Collar glabrous. Base of leaf blade immediately above the ligule densely covered with long, tubercle-based, white hairs. Leaf blade long, folded or flattened, acutely keeled, 3-5 mm. broad at the base, tapering to a fine point; glabrous except for the upper surface near the base and occasional long hairs along the edges, edges scabrous. Flowering culms erect, short. Spikes digitate, 7-17, usually 12-15 in number, obliquely erect when young, ultimately more or less horizontally spreading or sometimes slightly reflexed. Rhachis of each spike slender, shortly but densely tomentose at the base, scabrous or shortly ciliate for most of its length. Spikelets sessile, very numerous and closely imbricate in two even rows on one side of each rhachis. Spikelets with two hermaphrodite florets and one or two male florets above them, though sometimes there is merely an empty lemma above them. Rhachilla prolonged and frequently bearing a very much reduced empty lemma. Lower glume elliptic or ovate-elliptic, obtuse or shortly acute, 1-nerved and strongly keeled, up to 2 mm. long. Keel scabrous or shortly ciliate. Upper glume 3-3·5 mm. long, elliptic in outline, rather thin in texture, pale-brown in colour except for the thin transparent membranous margins, the edges of the brown portion with a fringe of long hairs in the lower part; glume 1-nerved and strongly keeled, the middle nerve prolonged into a short mucro, keel scabrous; apex of the glume acute or bifid. Lowest floret hermaphrodite, lemma 3·2-3·5 mm. long, firm in texture, broadly elliptic in outline, irregularly rhomboidal in profile, glabrous, folded and bluntly keeled, with a longitudinal groove in the middle of each face; 3-nerved, lateral nerves very close to the margins; margins ciliate in the lower half, long-bearded toward the apex; apex bifid with a short awn from the sinus; awn up to 7 mm. long, base of the

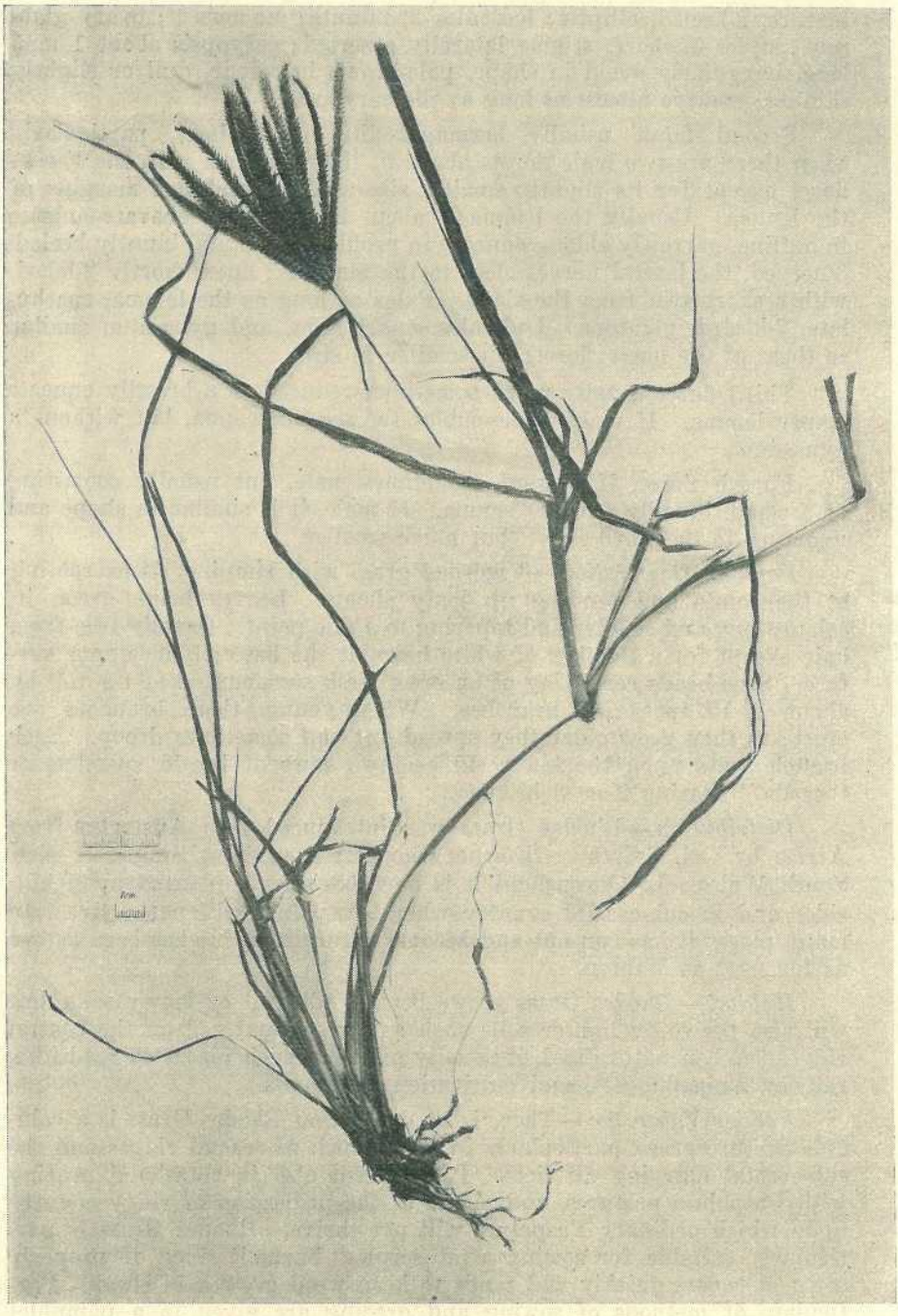


Plate 58.
Rhodes Grass (*Chloris Gayana*).

lemma with a ring of long hairs; palea as long as the lemma, thin in texture, 2-keeled, elliptic; lodicules 2, minute; stamens 3; ovary glabrous; styles 3, short; stigma laterally exserted; caryopsis about 1 mm. long, irregularly ovoid in shape, pale-brown in colour, dull or slightly shining; embryo almost as long as the caryopsis.

Second floret usually hermaphrodite. Sometimes, particularly when there are two male florets above it, it is identical with the lowest floret except for its slightly smaller size and the glabrous margins of the lemma. Usually the lemma is about 2 mm. long, obovate-cuneate in outline, narrowly oblong cuneate in profile, folded and bluntly keeled, 3-nerved, the lateral nerves close to the margins; apex shortly 2-lobed, with a short awn from the sinus. Palea as long as the lemma, spathulate, 2-keeled, glabrous. Lodicules, andræcium, and gynæcium similar to those of the lower floret, but smaller in size.

Third floret usually male, sometimes reduced to a broadly cuneate empty lemma. If male, it resembles the second lemma, but without a gynæcium.

Fourth floret, if present, sometimes male, but usually consisting of a small, broadly cuneate lemma. If male, it is similar in shape and structure to the third floret, but much smaller.

Popular Description.—Vigorous grass with running stems rooting at the joints and sending up leafy shoots. Leaves bright-green in colour, long and slender and tapering to a fine point. Usually free from hair except for a number of white hairs at the base on the upper surface. Seed-heads consisting of an erect stalk surmounted at the top by about 12-15 spreading branches. When young, these branches are erect; as they grow older they spread out and sometimes droop. Each branch bears upon the lower surface two rows of brown spikelets or "seeds" bearing 2 or 3 bristles.

Distribution.—Rhodes Grass was introduced into Australia from Africa by Col. Sylvester Browne, who first grew it at Singleton, New South Wales. In Queensland it is now extensively planted upon hillsides and in sub-coastal country where Paspalum will not thrive. In many places it has run out and become naturalised. It has been grown as far west as Winton.

Habitat.—Rhodes Grass grows best on alluvial or loamy soils, but will also thrive on lighter soils such as are encountered on the coastal ridges. When naturalised, it usually grows in such places as roadsides, railway embankments, and cultivation headlands.

Fodder Value, &c.—There is no doubt that Rhodes Grass is a valuable pasture grass, particularly in places such as coastal ridges and the sub-coastal dairying districts. It is useful also in rotational grazing with Paspalum pastures, and allows of the utilisation of ridgy country upon which ordinary Paspalum will not thrive. Rhodes Grass is particularly suitable for sowing after scrub "burns," since, if properly sown, it covers quickly and tends to keep weed growth in check. Particulars of methods of sowing and grazing are given in a pamphlet issued by the Department of Agriculture and Stock.

Reference.—*Chloris Gayana* Kunth., Rev. Gram. i. 89, ii. 293, t. 58 (1829).

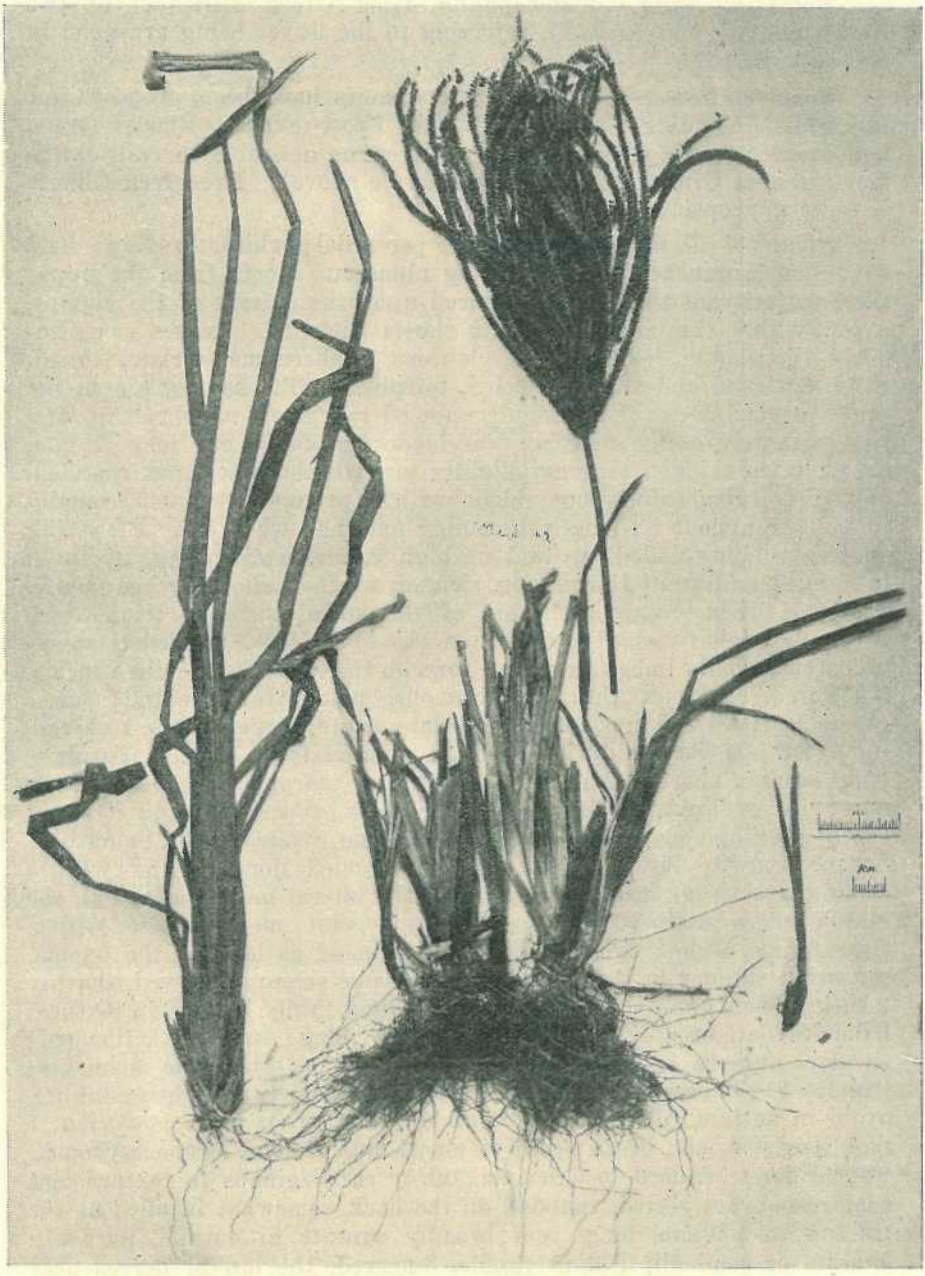


Plate 59.
Evergreen Chloris (*Chloris distichophylla*).

EVERGREEN CHLORIS (*Chloris distichophylla*).

Botanical Name.—*distichophylla,* from Greek *distichos* (of two rows), and *phyllon* (a leaf), referring to the leaves being arranged in two opposite rows.

Common Name.—Several common names have been proposed for this grass, including Evergreen Chloris, Frost-resistant Rhodes Grass, and Winter-growing Rhodes Grass. It seems desirable to restrict the name Rhodes Grass to *Chloris Gayana* (see above). Evergreen Chloris is quite appropriate.

Botanical Description.—Tufted perennial; rhizomes short and stout, much-branched and producing numerous shoots from the upper side; majority of the shoots produced upon the outside of the clumps, a few within the clumps. Young shoots flattened. Leaves conspicuously distichous; leaf sheaths glabrous, scaberulous, striate, broad, rigid, flattened and sharply keeled, purplish at the base, green in the upper part, 5-20 cm. long; ligule reduced to a short membranous ring with minutely ciliate margin; leaf blades up to 50 cm. long, 7 mm. broad in the middle, tapering slightly towards the base, apex rounded, obtuse, margins scaberulous; blade with a prominent midrib, usually folded throughout its length, becoming flattened when old. Flowering culms erect, few-noded, up to 1 m. high, branches numerous, up to 45 in number and about 15 cm. long, slender, weak, semi-erect when young, drooping when mature; rhachis of the spikes slender, triquetrous, scaberulous above, shortly ciliate on the lower side. Spikelets small, numerous, closely imbricate in two rows on the lower side of the rhachis, 2-flowered. Glumes thin, membranous, pale straw-coloured; lower glume 1-nerved, 1·5 mm. long; lanceolate, acute; upper glume 1-nerved, up to 2·2 mm. long, elliptic-lanceolate, mucronate or shortly aristulate, point always shorter than 0·5 mm., lateral margins inrolled. Lower floret hermaphrodite; lemma usually dark-brown at maturity and thinly cartilaginous in texture, 2·5 mm. long, ovate-elliptic in outline, not or scarcely laterally compressed, rounded dorsally and with a shallow groove on each side, 3-nerved, the lateral nerves marginal, the middle nerve produced into a short blunt point; margins beset with a close fringe of long white hairs; palea almost as long as the lemma, somewhat thinner in texture, but of the same colour, 2-nerved, sharply 2-keeled, keels minutely ciliate; inrolled edges thinly hyaline in texture; lodicules flat, broadly cuneate, 0·1-0·2 mm. long; stamens 3, filaments slender, anthers broadly linear, slightly shorter than the filaments; stigmas 2, plumose; caryopsis dark-brown when ripe, slightly shining, ovoid in outline, plano-convex or almost triquetrous in cross-section, 1 mm. long, 0·5 mm. broad; embryo about half as long as the caryopsis. Sterile floret reduced to a lemma, thinly cartilaginous in texture, not compressed, not keeled, rounded on the back, somewhat inrolled at the tip, up to 1·5 mm. long, very broadly cuneate in outline, narrowly cuneate or semi-elliptical in profile, 3-nerved, the lateral nerves near the margins better developed than the middle nerve, which vanishes before reaching the apex; lemma awnless, apex inrolled, obtuse.

Popular Description.—Grass forming dense, leafy tufts sending up long seed stalks with numerous radiating branches at the top. Young shoots very flat, purplish at the base; leaves long, stiff, and usually

folded throughout their length. Seed stalks bearing numerous brown "seeds" or spikelets, each with a fringe of long white hairs.

Distribution.—Evergreen Chloris is a native of South America. It has been naturalised in Queensland for a very long time, but has never shown any tendency to spread. In Queensland it is naturalised chiefly in the Moreton and Wide Bay districts, though it is now cultivated in many parts of the State.

Habitat.—The grass, when naturalised, is usually found in waste places, on roadsides and embankments and other places where the ground has been disturbed. It is usually cultivated on soils similar to those suitable for Rhodes Grass.

Fodder Value, &c.—Until recently, little notice was taken of this grass from a grazing point of view. Of late years considerable attention has been paid to it because of its frost-resistant qualities. The grass is said to be palatable to stock and quite nutritious. However, tests made by the Agricultural Chemist indicate that Evergreen Chloris contains a prussic-acid-yielding glucoside. Because of this it would be wise to exercise care in feeding the grass to stock. Apart from its economic importance as a fodder, the grass is of value for ornamental purposes.

Reference.—*Chloris distichophylla*, Lagasca Gen. et Spec. Nov. 4 (1816).

[TO BE CONTINUED.]

TABLE OF UTERO-GESTATION.

Animal.	Average Period.	Early Period for Young to Live.	Late Period.
Mares	335-345 days (11-11½ months)	307 days (10 months)	365 days (12 months)
Cows	275-287 days (39-41 weeks)	242 days (34½ weeks)	312 days (44½ weeks)
Sheep and Goats	149-151 days (21-21½ weeks)	140 days (20 weeks)	160 days (23 weeks)
Sows	112-119 days (16-17 weeks)	105 days (15 weeks)	126 days (18 weeks)
Bitches	63 days (9 weeks)	55 days (8 weeks)	70 days (10 weeks)
Cats	55 days (8 weeks)	50 days	64 days
Rabbits	28-30 days (4 weeks)	..	..

The Estimated Age of Some Queensland Trees.

W. D. FRANCIS, Assistant Government Botanist.

Introductory Remarks.

IN parts of the Northern Hemisphere, such as Europe and North America, it is well known that many kinds of trees produce annual rings in their wood. These annual rings are so well marked that the age of many trees can be accurately computed from them. Annual rings are especially well developed in Pine trees and their allies. A very large amount of work has been done on the Big Trees (*Sequoia gigantea*) of North America. These trees have special features which facilitate investigation. They are very large trees, and their wood rings are conspicuous when the stems are sawn or cut across. The writer saw a section of one of these very large trees which is exhibited in the Natural History Section of the British Museum in London.

The American investigators have calculated the ages of some of the specimens of the Big Tree and found that in some cases the trees were living 1,000 years B.C. In addition, some of the American investigators have used the growth rings of these trees as indicators of the climate of the past. These fascinating studies of the gigantic American trees have led some Queensland residents to hope that some of our trees may provide data of the climate of the past.

Queensland Studies.

About nine years ago the writer undertook a preliminary study of the growth rings in some native coniferous trees of this State. The purpose of the study was chiefly anatomical. It was also considered desirable to find out if our coniferous trees formed annual rings. A brief account of this work will be given in this article. In addition some observations made since will be outlined.

Cross sections of stems of the Hoop Pine (*Araucaria Cunninghamii*), Bunya Pine (*Araucaria Bidwillii*), and Queensland Kauri Pine (*Agathis robusta*) were prepared and examined. Fine microtome sections of the wood of these trees were also prepared and photographed under the microscope. It was found that there are growth rings in the trees examined. But it was soon realised that the growth rings are not so well marked and are not nearly so regular as those of European and North American trees. This result is not surprising in view of the character of our climate in comparison with the climate of Europe and North America. The regular yearly occurrence of low temperatures in which plant growth is suspended is characteristic of the North European and North American environment. These conditions obviously do not occur in Queensland—at least in the areas where the trees which were investigated by the writer grow.

Microscopic Features of Growth Rings.

Apart from their less regular and distinctive character, the growth rings of the trees investigated do not differ microscopically from those of Europe and North America. The principal features of growth rings

in the microscopic view are the size of the internal cavity of the wood cells and the thickness of the walls of the cells. In the outer or dark-brown portion of the growth ring, which is formed in the autumn or late summer, the internal cavity of the wood cells is smaller and the walls of the wood cells are thicker than those of the cells in the part of the ring formed in the spring or early summer.

In studying wood rings it is essential to distinguish between rings constituted as just described and the fine zones of soft tissue (or wood parenchyma) which are found in the wood of many trees, such as the Rosewood (*Dysoxylum Fraseranum*), Red Bean (*Dysoxylum Muelleri*), and Moreton Bay Fig (*Ficus macrophylla*). These are native trees.

Annual Rings in Queensland Trees.

The growth of rings of the Hoop Pine, Bunya Pine, and Queensland Kauri Pine consist of two portions which are distinguishable to the eye by their colours. The lighter-coloured portion corresponds to the spring or early summer wood. The darker portion, mostly dark-brown in colour, corresponds to the autumn or late summer wood. The writer observed that the boundaries of the growth rings are more sharply defined in mature or old trees than in young, quickly growing trees.

It was definitely established that two or perhaps more rings are sometimes formed in one year in the Queensland trees examined. On the other hand, there were fairly definite indications that in the Hoop Pine there were varying numbers of rings, each of which was produced in a single year. These could be called annual rings. They are characterised by their comparative uniformity and their occurrence in connected series of two or more rings.

Method of Estimating the Age of Queensland Trees.

The writer suggested that these comparatively uniform rings, which are apparently annual, could be used to estimate the age of a tree in which they occur. These apparently annual rings can be measured throughout the section of the stem and the average width of them calculated. The measured radius (or half-diameter of the stem) when divided by the average width of the apparent annual rings gives an estimated age for the tree.

Results of Estimating Age of Queensland Trees.

Using this method, the writer estimated the age of a Hoop Pine tree which was growing in the Gympie district. This tree was 117 feet (35 m.) in total height, and had a stem diameter of 21 inches (53 cm.). Its age was estimated at 135 years. The age of a Kauri Pine tree which grew in the Kin Kin district was estimated in the same way. This tree measured 120 feet (36 m.) in total height, and had a stem diameter of 54 inches (135 cm.). Its age was estimated to be 228 years. In this case, however, only the outer part of the section of the stem was available, and consequently the data for estimation were meagre. Some of the larger Kauri Pines which grew in the same district attained a height of 160 feet (48 m.), and a stem diameter of 8 feet (240 cm.). If these larger trees grew at the same rate as the one from which the partial section was taken, their age could be estimated at about 400 years.

Applying the same method, the age of a large Eucalypt, which is lying on the ground at Eagle Heights, Tambourine Mountain, was estimated. This tree presumably was a Flooded Gum (*Eucalyptus saligna*). It was apparently well over 120 feet (36 m.) in height and about 6 feet (180 cm.) in stem diameter. The age of this tree was estimated as between 150 and 200 years. Large Flooded Gum trees are a feature of the landscape of Tambourine Mountain. These trees have large, smooth, pale, column-like stems. At first sight the age of 150-200 years seems slight in comparison with their size and impressiveness. But the writer is convinced from observations of the growth of young trees of the species that this Eucalypt is an extremely fast grower.

The Reputed Age of other Queensland Trees and Plants.

Botanists are frequently asked about the age of the Antarctic Beech (*Nothofagus Moorei*). This species is confined to the mountain ranges of extreme South-eastern Queensland and the highlands of Northern New South Wales. The writer has no knowledge of any investigations which indicate even approximately the age of these trees. In many cases it would be difficult to form any idea of the age of these trees. The stems frequently branch out from a common base. The older stems die out. This produces a complicated position which is not met with in the usual case. Trees usually produce only one stem, and this persists from the beginning of the life of the tree.

The recent destruction of the large Cycad (*Macrozamia Denisonii*) on Tambourine Mountain has aroused interest in the age of these plants. It has been stated that the large specimen which was cut down was estimated to be 15,000 years old. The authority for this estimate is not known to the writer. Judging from Professor C. J. Chamberlain's statement in his book, "The Living Cycads," the procedure for estimating the age of a Cycad is scarcely so trustworthy as the annual ring method applicable to some trees. In the case of Cycads, observations extending over a period of years are necessary. In this periodic observation the number of leaves formed in a single year is ascertained. Next the leaf bases on the trunk of the Cycad are counted. The number of the leaf bases is then divided by the average number of leaves formed in a year. The result of this division gives the estimated age of the Cycad. Up to the present the writer is not aware if this procedure has been carried through on Tambourine Mountain.

Conclusion.

It is regretted that the investigations, so far as they have been prosecuted, do not provide any substantial basis for interpreting the climate of the past. It is realised that meteorologists and those who are concerned with the development of weather-forecasting would be materially assisted if native trees formed more regular rings. It is as well to remark, however, that the subject is still open for further investigation.

Photographs and photomicrographs of some of the sections of stems investigated in the earlier work are given in the places cited in the references below.

REFERENCES.

Francis, W. D.: The Growth Rings in the Wood of Australian Araucarian Conifers. Proc. Linn. Soc. N.S.W., Vol. 53, p. 71, 1928.

Francis, W. D.: Australian Rain-forest Trees. Pages 52-54, 1929.

Scattered storm rains have fallen over a wide area of the State, but up to the time of writing no soaking general rains have been received, and owing to the dry subsoil, the rains registered can only be regarded as giving temporary relief. Conditions are somewhat more favourable in the North-West, Atherton Tableland, Calen, Granite Belt, and South-West tobacco lands, but the main agricultural areas from Bundaberg to the Border are still in need of seasonal rains. The recent heat wave has also affected the position adversely, rapidly drying out the young green pastures and summer crops that had become established after the early January rains. Fortunately, water supplies in creeks, tanks, and dams have to some extent been replenished.

Fodder Crops.

A large area has been sown with various summer crops in an endeavour to provide for immediate requirements, and to supplement reserves depleted during the prolonged dry spell. Where conditions are suitable, the provision of early winter feed should now be receiving attention. The more popular varieties of sweet sorghum, such as saccaline, imphee, and white African are quite suitable for this purpose, particularly in the coastal areas where heavy frosts are not experienced. February sowings will provide a large bulk of palatable and nutritious fodder, which may be cut as required or utilised as silage. Unlike maize, which dries out rapidly after reaching maturity, the sorghums retain their succulence for a considerable time, even after light frosts have checked growth. Drilling the seed in rows approximately 3 feet apart is recommended in preference to broadcasting.

Millets, such as Japanese, white panicum, giant setaria (or giant panicum), and dwarf setaria (Hungarian or liberty millet), may also be sown during the present month, and are recommended where an early maturing crop is desired.

Potatoes.

The autumn crop usually planted during February produces heavier yields than the early or spring crop, and provides the bulk of the State's expanding production of this commodity. Owing to the partial failure of the early crop many growers will be obliged to purchase seed potatoes

at the prevailing high rates, a factor which may reduce the area ultimately planted. The use of sound seed and the rotation of crops are important factors in the control of Irish Blight, but the principal control is effected by the maintenance of a protective covering of Bordeaux spray solution. Seed treatment with the formalin solution is also advised, full particulars of which are obtainable on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Tobacco.

Weather conditions in the State during the past six months have been very unfavourable for the tobacco crop, and in many districts the period under review was one of the driest on record. Good rains during December and early January relieved the position, proving most favourable to the growth of the early crops, and to the fertilization and planting of the late crops. Present indications are that the area planted will represent an increase over that for the past season.

It is estimated that of Queensland's 1935-36 tobacco crop (approximating 2,000,000 lb.) at least 90 per cent. was sold at auction sales, and growers generally have expressed satisfaction with the values received. The new import duties imposed by the Commonwealth Government have had the effect of causing additional buyers to operate, thus creating greater opposition and brisker bidding.

Sugar.

Highly favourable growing conditions prevailed in all cane areas from Mackay north, during the month of January.

The Southern districts have received further scattered rains, and although the crop is making slow progress, it is decidedly backward; soaking rains are urgently needed to stimulate vigorous growth.

Cotton.

The cotton crops have made fairly satisfactory progress during the month. Late December rains were sufficient to promote good growth of plants in the earlier sowings and provide a nice start for subsequent plantings. Dry weather ruling through most of January steadied all growth, however, which has resulted in nicely developed crop prospects in most districts. Good rains are now required to assist the plants in further crop production.

The plantings as a whole have been free from serious insect attack. If favourable conditions occur from now on it is possible that any delay in planting will be largely overcome, with a resultant satisfactory crop production.

USES OF SODIUM SILICATE ON THE FARM.

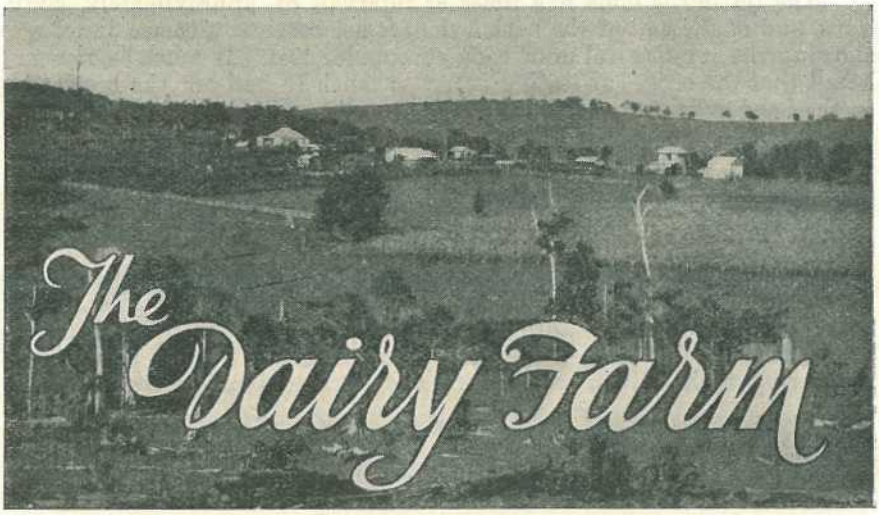
Sodium silicate, under the name of waterglass, is well known on farms as an egg preserver. In its different forms it has a variety of uses.

A hot one per cent. solution (1 lb. to 10 gallons) of alkaline sodium silicate is a powerful detergent, and is consequently used widely in cleansing floors, utensils, cream cans, bottles, &c. It is also used to remove grease and dirt from clothes.

Colloidal sodium silicate is used in proofing casks and rendering concrete floors, feeding troughs, holding tanks, &c., resistant to the acids that arise from bacterial action on fats, molasses and other fermentable substances.

Timber and fabrics may be impregnated with sodium silicate to render them fire proof. The solution is capable of acting as a vehicle for pigments and fillers so that two jobs may be done at once.

The Department of Agriculture and Stock will arrange for any enquiries on this subject to receive prompt attention.—Dr. M. WHITE.



ECONOMY IN DAIRY PRODUCTION.

G. H. E. HEERS, Director of Dairying.

A MEASURE of economy which involves the dairy farmer in very little extra work is to increase production by systematic herd testing and culling, and breeding only from the best producers.

Far too many herds include cows whose production falls far below average, and the dairy would be run far more economically if these cows were fattened for the butcher. They belong to the "boarder" class, and usually consume more fodder than a heavy producer. Too many animals of this class impair the efficiency of the farm.

No matter how close a watch is kept, it is almost impossible to pick the lowest producers without systematic testing over the whole lactation period. If the farmer is prepared to do this himself well and good, but he requires to have an accurate knowledge of testing and the principles involved in calculating results.

The Department of Agriculture and Stock offers a herd-testing service which involves the dairyman in no monetary expenditure whatsoever. In other States and countries up to 6s. per cow is paid for a similar service. Surely it is impossible to believe that dairy farmers in other parts pay for something that is valueless.

In Queensland many dairymen have availed themselves of the services offered, and the results achieved by those who have tested and culled over a number of years have proved that it is well worth while. Nevertheless, there are very many more who could do so to their own advantage.

To obtain this service it is only necessary to make application to the Department. Sample bottles in a box are sent to the farmer, and all he has to do is to weigh each cow's milk and place a sample in a bottle, as directed. Then, if the factory he supplies is co-operating with the Department, he forwards the box of bottles containing the samples to that factory. Otherwise he may send his samples direct to the Department of Agriculture and Stock, which pays the rail freight.

The testing is done five times at intervals of, approximately, sixty days, and at the end of the period the farmer receives a complete return showing the relative value of each cow under test. It must be remembered that the object of testing is not so much to find out the best cows in the herd as to find out the worst and least profitable.

Testing is only half the job, and the Department depends on the good sense of the farmer to see that he does not keep feeding unprofitable cows indefinitely. Testing is of no value in raising the standard of production of the herd unless the low producers are culled regularly.

It is a poor farm that cannot afford to dispose of the two least profitable cows each year. Remember the first loss is the least. The longer the "boarders" are kept the more expensive they become. They eat the feed of a good milker and much time is wasted, frequently, in rearing their calves, which turn out no better producers than the dams.

UNPROFITABLE COWS.

L. VERNEY, Instructor in Dairying.

ONE has heard the subject of marginal and submarginal profits and marginal and submarginal land discussed frequently. Marginal land may be described as land that returns about enough to pay its way. The return from submarginal land, however, is less than that.

Applying these terms to dairy cows, the records show that dairymen are feeding and milking many marginal and submarginal cows; in other words, cows which barely pay their way and those which are actually milked at a loss. The owner of submarginal land is a slave to his land, and the owner of submarginal cows is a slave to his dairy herd. One is land poor and the other is cow poor.

The question might be asked by those concerned: At what production level does a cow become submarginal? That depends on many things. To the man who relies on the family cow for milk and butter for his family, there may be no apparent marginal production level; but to the man who owns and milks a dairy herd for his livelihood the marginal production level should be comparatively high. Even for the commercial dairy herd, the marginal production level is not constant. It varies much from time to time and from place to place. It is influenced by cost of feed and labour, by price of product (butterfat), and by the distance from the manufacturing centre; yet in a general way each dairy farmer should establish a production level, or a standard below which no cow in his herd can fall and still remain in the herd. On the average the dairy cows in this State produce yearly about 2,500 lb. milk, containing 125 lb. butterfat. That being the average, it may safely be assumed that one-half of the dairy cows of this State produce less than that. Do these cows produce a profit? Do they earn enough to pay for labour and overhead expenses? Can it be true that half our dairy cows are submarginal? The answers can only be given by dairy farmers. In some of our pure-bred herds there are cows that are certainly producing quantities very much in excess of the figures quoted.

A very earnest endeavour must be made to raise our standards by a comprehensive system of herd testing. It behoves all connected with dairying to give more serious thought to this aspect of the industry.

It must be acknowledged that unless this great industry is built on a sound basis all the system and efficiency methods which may from time to time be introduced will never give it the stability so necessary to make it what it should be, not only to the State, but to every individual dairy farmer. The ultimate success of dairying depends largely on a satisfactory production per cow being established throughout the State. So let the dairyman's slogan be "Breed from the best and cull the rest."

AGRICULTURE ON THE AIR.

RADIO LECTURES ON RURAL SUBJECTS.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by Officers of the Department of Agriculture and Stock.

On Friday of each week a fifteen minutes' talk, commencing at 12.45 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures until the 30th April, 1937.

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Friday, 5th February, 1937—"The Importance of Type in Queensland Merino Flocks," by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 12th February, 1937—"Fat Lambs in Queensland," by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 19th February, 1937—"Increase your Return from Eggs. How it can be done," by P. Rumball, Poultry Expert.

Friday, 26th February, 1937—"With the Flock in February. Points for the Poultry Farmer," by J. J. McLachlan, Poultry Inspector.

Friday, 5th March, 1937—"The Harvesting of Cotton," by R. W. Peters, Cotton Experimentalist.

Friday, 12th March, 1937—"Plant Nutrition," by E. H. Gurney, Agricultural Chemist.

Friday, 19th March, 1937—"Sheep Management under the Varying Conditions in Queensland," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 26th March, 1937—"The Care of the Flock," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 2nd April, 1937—"Winter Pastures," by C. W. Winders, Assistant (Agronomy).

Friday, 9th April, 1937—"Pork Products as Regular Items on the Menu," by E. J. Shelton, Senior Instructor in Pig Raising.

Friday, 16th April, 1937—"Some Poultry Farmers' Problems. What to Breed and How to Breed," by J. J. McLachlan, Poultry Inspector.

Friday, 23rd April, 1937—"Strawberry Planting and Other Seasonal Fruit Hints," by H. Barnes, Director of Fruit Culture.

Friday, 30th April, 1937—"Wheat Improvement in Queensland," by R. E. Soutter, Agricultural Research Officer.

FEEDING BACON PIGS.

E. J. SHELTON, Senior Instructor in Pig Raising.

OWING to conditions associated with the prolonged dry spell of weather in Southern Queensland, and to the fact that the price charged for pig foods of all descriptions is at a higher level than usual, many pigs arriving at bacon factories are not in the primest of condition. When slaughtered their carcasses dress out soft, slightly discoloured, and, on grading, are classed as of other than the choicest grade; in fact, some are very fat and too heavy.

In some instances the fat is soft and oily, and in others it is of a slightly yellowish colour and will not " firm up " during the chilling process. If used for small goods, this soft, oily, discoloured meat still carries objectionable features. The loss to the industry through this trouble, plus the lower condition of many of the pigs that kill out to advantage, must be very heavy, for it is impossible to expect factories to pay top prices for second or third grade carcasses.

The Department of Agriculture and Stock, therefore, offers the following advice to farmers, especially in districts south of Rockhampton:—

Soft Oily Pork.—Although several foods may be responsible for this soft condition, all the evidence points to the fact that the chief cause of the trouble is the feeding of peanuts to pigs which are being finished or topped up for the market. Maize and other grain foods are, at present, relatively scarce and high priced, and as peanuts produce particularly fast growth in pigs, farmers are naturally tempted to use them in place of grain. The position could be relieved if pig raisers would concentrate their peanut feeding on the breeding stock and young store pigs, which will make very good use of surplus peanuts, and then other foods available could be kept for the pigs from the store stage until they reach bacon weights. Separated milk, root crops, pumpkins, lucerne (either as green fodder, hay, or chaff), and small quantities of pollard, meat meal, and pasture can be used to make up good rations in the absence of maize.

Yellowish-coloured Pork.—It is known that the probable cause of this condition is an excess of carotin, a colouring matter in plant life, and which is present especially during the early life of the plant and at the stage when (as in the case of pumpkins) the crop is fully ripe or over-ripe. The feeding of an excess of green wheat, oats, or barley, in the absence of, or short supply of, milk may also be responsible; so also may the continuous use of grass or of lucerne as the principal food.

Low-conditioned Pigs.—Lack of condition is, of course, invariably due to lack of sufficient nutritious food. When pigs are in such a condition they become more liable to infestation by internal and external parasites, which irritate the animal and cause much restlessness, especially at night.

It is better to keep fewer animals and to feed them properly than to attempt the keeping of more than the number for which food is available, and it is better to market the pigs when light and prime than to carry them on to heavier weights with loss of condition. Where milk is in short supply meat meal may be used as a substitute, and in all cases the pigs should have clean drinking water and charcoal.

Bruised and Damaged Pigs.—Where pigs are weakened as a result of lack of condition and where they are soft in texture—the result of improper food—they bruise more rapidly, and tend to be more discontented. The only way to avoid bruising is to have the animals in the primest of condition (not over-fat) and to treat them kindly and not force or beat them when loading or unloading. Avoid knocking them or forcing them through narrow gateways or over rough stony yards.

Over-fat Pigs.—Despite dry weather and high priced foods, there is still an abnormal proportion of over-fat and very heavy weight stock coming forward. Pigs should not be fed too heavily on grain, but be kept growing and be given abundant exercise in grassy pastures. It is a mistake to keep pigs penned up continuously in small sties and bare yards. The use of flesh-forming foods like milk, meat meal, lucerne, greenstuff, &c., and mineral matters will tend to overcome any tendency to over-fatness.

THE ZEBU CROSS.

The experiment of the Zebu cross now being carried out in the Central District is reputed to be pleasing to those who made the venture, and although another year or two must elapse to allow the progeny to reach maturity and the beef to be placed on the English market, the results are awaited with keen interest.

Previous experiences indicate that the progeny mature earlier than any other breed or cross, and from birth will increase in weight much more quickly; thus it is possible for the beef to reach the market months in advance of other beef.

Other factors in its favour are that it is not no susceptible to diseases and tick infestation; it is a better "doer" in times of drought, being a quick mover "on the leg," which enables the Zebu cross to reach feed and water in much less time than ordinary cattle, and so retain condition for a longer period. The Zebu cross-bred animal never loses the wild or natural instinct, which probably accounts for its grazing when other animals are resting.

Some thirty years ago a number of Zebu bulls were imported into Queensland and mated with Shorthorn cows, and the beef was highly commended on the English market. The progeny should be crossed back to herd bulls—preferably with Shorthorns, because they are more docile, throw off better colours and conformation.—M. J. B. ASHE, Inspector of Stock.

SOME TROPICAL FRUITS.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

No. 14.—THE STAR APPLE.

THIS tree is one of strikingly ornamental foliage, but in spite of its decorative value it seems to have been very infrequently planted in places beyond its native habitat. In North Queensland only one specimen is known to the writer.

The tree originates in Central America and the West Indies, where it is stated to be of frequent occurrence in the natural forests, as well as being commonly cultivated in home gardens. It grows to 30 to 50 feet in height, and is of open, rather straggling habit. The foliage is peculiarly striking, the upper surface of the leaves being dark olive green and glossy, and the under surface reddish-brown with a satiny sheen. The young shoots are of similar appearance to the under side of the leaves, and all the satiny portions are heavily pubescent.

The tree breaks into young growth during the winter months and makes a rapid growth. Flower buds are then immediately produced on this new growth and are usually plentiful by the end of July. They are, however, very small and may be easily overlooked. The flowering period extends over a month or two. The fruit is bright-green with a smooth glossy skin while it is growing. When ripe it may be either green-skinned or dull purplish. The colour of the ripe fruit seems to be the sole distinguishing mark between two races or varieties of this tree. Flavour and other characteristics of the two races are reported to be the same. When fully grown the fruit reaches about 3 inches in diameter and is round to oblate in shape. On cutting the fruit transversely, the half-section demonstrates the origin of the common name. Radiating from the central axis of the fruit some eight segments of whitish translucent pulp are arranged. These segments, each of which normally contains one seed, form the characteristic star from which the

fruit is named. It usually happens that several segments are abortive, and consequently they are smaller than their two or three neighbours, which carry fully developed seed. The seed is commonly ovate or elliptic in outline, is rather flattened, and about ½ inch in length, and has a hard brown shell or skin.

Plate 60.
The Star Apple Tree.

Surrounding the segments mentioned above and between them and the skin of the fruit is a layer of rather dry flesh of similar colour to the skin. Both this flesh and the flesh of the segments is edible, and both have a sweet flavour, with acidity entirely lacking. Like other sapotaceous fruits, the Star Apple contains a milky latex when immature, and consequently must be allowed to mature fully before it is harvested. In fact, the flavour of the fruit is really at its best if the fruit is allowed to ripen on the tree. In Queensland the ripening season is January and February. The Star Apple is primarily a dessert fruit, but occasionally is preserved or made into sherbert.

The tree is commonly raised from seed, which germinates best when sown in a light sandy loam. Unlike the seed of many tropical fruits,

those of the Star Apple retain their viability over a period of several months, and consequently may be easily transported from one country to another. Considering this, it is indeed remarkable that the tree is not more widely distributed through the tropics than is the case. As seedling trees vary considerably in productivity and other desirable characteristics, asexual methods of propagation are preferable. P. J. Wester has demonstrated that shield budding may be successfully practised on them by using non-petioled budwood, cutting the buds 1½ to 2 inches long and inserting them in that portion of the stock having a similar appearance to the scion. Well-ripened cuttings of the tree are also reported to root successfully if bottom heat is used.

Plate 61.
Star Apple Fruit About Half Grown.

As the Star Apple is in active growth during the greater part of the year, it is necessary that it should be grown in a climate having a fairly high temperature throughout the year. Cold winters are definitely deleterious. Humid atmospheric conditions are most favourable. As regards soil, the tree seems to have cosmopolitan tastes, as Popenoe reports that it thrives well on both shallow sandy soils and deep clayey loams in America. Probably good soil moisture is one of the main factors of the soil aspect.

Star Apple seems to be the common name of the tree in all English-speaking countries. Spanish countries use the specific botanical name "Caimito." The botanical title is *Chrysophyllum caimito* L., and the tree is of the order Sapotaceæ.

PASSION FRUIT GROWING ON THE SOUTH COAST.

J. McG. WILLS, Fruit Branch.

ALTHOUGH passion fruit growing may not attain the same importance as banana growing on the South Coast of Queensland, it certainly offers prospects of a reasonably profitable return to those who are prepared to give close attention to the cultivation of the passion vine.

Considerable interest is being evinced by many landowners in the possibilities of passion fruit as a payable crop on land which has been used for banana growing, thus preventing its return to unproductiveness or pasture.

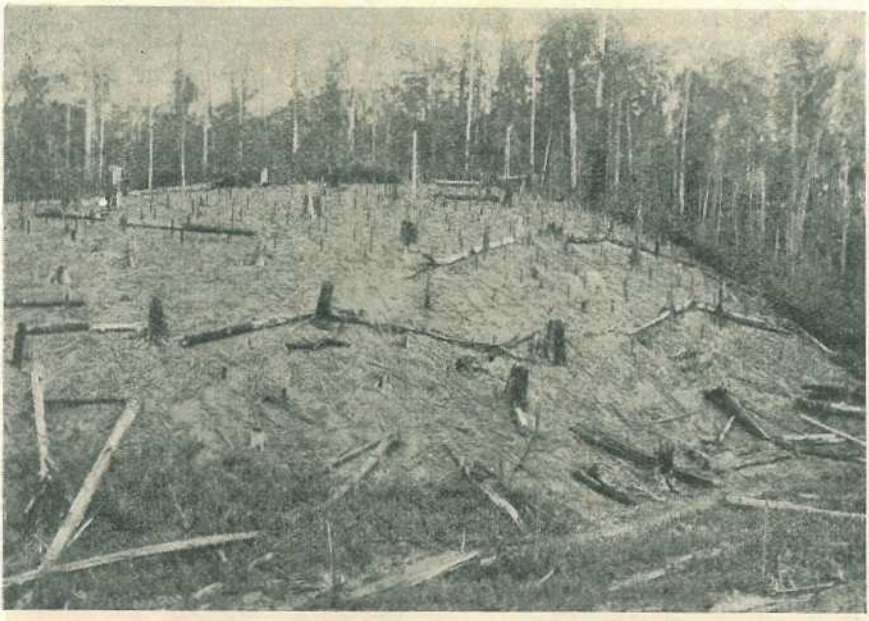


Plate 62.

Rain forest or "Scrub" land cleared for planting. Note the use of logs to assist in conserving surface soil.

The common purple passion fruit (*Passiflora edulis*) is the principal variety grown and has been cultivated commercially in Australia for over forty years, but its cultivation in most other countries has not become one of great commercial importance, due mainly to natural climatic difficulties. It cannot be grown in Britain or Canada, while in California its cultivation is negligible. Outside Australia the largest cultivated areas are in South America.

There is a regular demand for passion fruit products. Its delicious flavour has secured for it a wide demand as a dessert fruit, and its suitability as an addition to preserves, jams, and fruit salads has earned great popularity for it within the Commonwealth, and the demand is increasing. The increasing use of pure fruit juices in the manufacture of cordials has created such a regular demand that future market prospects are very encouraging.

Large areas of land are being put under passion vines with the object of processing the pulp for export overseas; while the prices paid for passion fruit on the fresh fruit market can be described, by comparison with other classes of fruitgrowing, as highly satisfactory.

Progress should be moderately slow and soundly based. The prospective grower is recommended to commence with a small area, which may be increased when he feels competent to handle an increased acreage. The best results are obtained by those who are willing to specialise in passion fruit growing, and only those who are prepared to apply the energy the industry demands are recommended to engage in it. Disappointment and possibly disaster will result from hit-or-miss methods. Four or five acres of vines is the maximum area one man can attend to if horse-drawn or mechanically driven cultivators are to be used. On less accessible sites where cultivation must be all accomplished by hand, for efficient working the area must be substantially reduced; and an area of two or three acres will be found quite large enough to occupy the full time of the grower.

Plate 63.
Another view of a "Scrub" clearing with trellis posts in position.

Departmental bulletins dealing with the very important subject of passion fruit diseases and their control are obtainable free on application to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane, B.7.

Climatic Conditions.

The South Queensland coastal climate is eminently suitable for passion fruit growing, as the vine grows and thrives in warm humid conditions, such as are experienced in the coastal area. Unfortunately,

fungus diseases, such as brown spot, which attack the aerial parts of the vine, also thrive under similar climatic conditions.

Under normal seasonal conditions, the general heavy rainfall assures sufficient soil moisture during the greater part of the year, the exception being perhaps in early spring. However, by proper cultural methods provision may be made whereby the vines can withstand dry weather without appreciable loss of vitality.

In this region frosts occur on flat and low-lying land, but severe frosts are rarely experienced on higher country. When selecting land for passion fruit growing this fact should be kept in view. Light frosts will do little harm to the vines, but a severe cold snap may affect this plant so badly asto kill all the top growth.

Plate 64.

Sloping land prepared by hand labour. Note the logs laid across the face of the hill. to minimise soil erosion.

Coastal winds and their effect on the plant must also be considered. for a heavy blow may cause appreciable damage to vines, fruit, and trellis. Cold winds affect the blossoms and the setting of the fruit, while hot dry winds promote excessive transpiration, resulting in the shrivelling, marking, or bruising of hanging fruit, lessening its attractiveness when ripe and reducing it in grade. In some localities strong winds accompanying heavy rain may also cause a collapse of trellis with consequent loss of fruit, expense of re-erecting the trellis, and increased spraying costs in respect of the control of brown spot, which spreads rapidly when the vines are lying on the ground.

Cropping Habit.

The passion vine bears its fruit on the current year's growth. This growth is produced mainly from year-old wood. Under average conditions, vines flower during August, September, and October. The blossoms are formed at consecutive nodes along the new growth on young leaders and laterals. The age at which the vine commences bearing depends on its strength and vigour; also on the season of planting. Vigorous plants commence to bear earlier than the less robust ones, and may bear a few fruits at from five to six months. As a general rule, however, when the vines are planted in early spring the first crop of any commercial importance will be harvested in from twelve to fifteen months from the time of planting. If planted late (in March and April) profitable crops may not be harvested until after 18 to 24 months have elapsed. Ordinarily the vines reach maximum production in from two to two and a-half years. From then onwards they decline gradually, yielding less each subsequent year until at from four to five years old the vines become unprofitable commercially. The old vines should then be removed and the area rested, replanted, or used to produce alternative crops.

Plate 65.

Young seedlings two months after planting. Observe the width between the wires on the trellis, and the solid wind-break at the rear.

As it takes approximately ten weeks from the time the fruit sets to the time of harvesting, marketing of the summer crop commences from about October and may extend to January, with the heaviest pickings during November and December. The subsequent crops produced —intermediate and winter crops—depend on the amount of new growth put out by the vines. This growth is influenced by seasonal conditions, health of the vine, and the quantity of fruit produced by the previous crop.

Heavy cropping retards the production of new growth, as the energy of the vine is absorbed in supporting fruit until it reaches maturity. More or less continuous growth, however, has been known during some seasons, with its consequent production of a certain amount of flowers and fruit throughout the whole year. Such habits are not normal, however, and have the effect of preventing the production of a definite seasonal crop. Provided the summer crop is normal and allowed to mature, and seasonal conditions have been suitable, new growth is likely to appear during November and December. The production of this growth is particularly noticeable immediately following the removal of the summer crop. This new growth is more often produced on young vines up to two years old than on older vines. On the new growth blossoms appear which provide the intermediate crop. If the summer

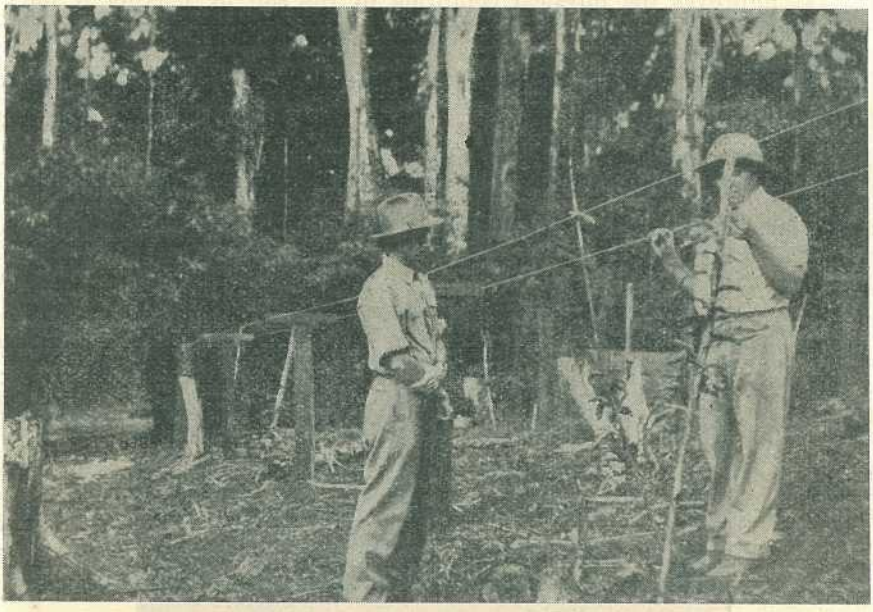


Plate 66.

A horizontal trellis having 2-ft. spreaders. Note the development of twin stems.

crop has been normal and allowed to mature, this intermediate crop is, however, rarely very heavy. If the summer crop is removed or pruned while still immature the vines will then put forth vigorous new growth in November and December, and a larger and more satisfactory intermediate crop will result. Winter crop fruit is set when the vines blossom in February and March, and this crop should be harvested during the latter end of May, on to July. The season at which the vines blossom, and the length of time the fruit takes to mature are influenced greatly by warmth of locality and site, as well as altitude.

Fruit produced under warm growing conditions is less subject to woodiness or "bullet disease"; consequently the fruit is of better quality, and production and market returns higher.

[TO BE CONTINUED.]

CITRUS CULTURE IN QUEENSLAND.

R. L. PREST, Instructor in Fruit Culture.

[*Continued from p. 92, January, 1937.*]

Cultivation.

Differences of opinion which occur concerning the best method of cultivation for citrus fruits may be partly explained by the fact that soils vary in character and in the amount of moisture and fertility they contain. The systems adopted must, therefore, necessarily vary somewhat in order to meet the requirements of the particular soils.

In Queensland cultivation is an essential orchard operation, and is beneficial in the following ways:—

It improves the physical condition of the soil by making it finer and increasing its depth, thus presenting greater feeding areas to the roots.

The effects of extremes of temperature are reduced, as air is permitted to penetrate to the roots.

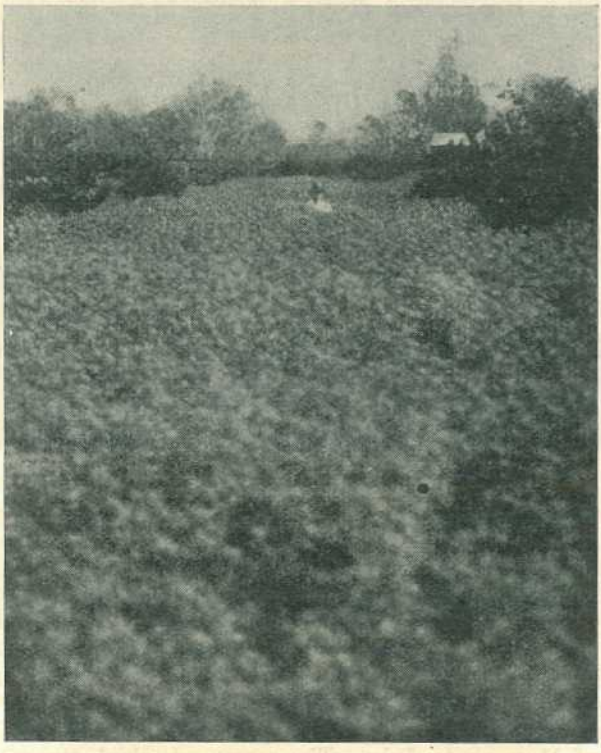


Plate 67.

NEW ZEALAND LUPINS.—Tops wet:—36 tons to acre. Roots:—4.8 tons to acre.

In cultivated soils decomposition and nitrification go on more readily, and if materials are present from which nitrogen can be set free, its liberation takes place more rapidly than if the soil is uncultivated.

It increases the water-holding capacity of the soil and conserves moisture.

Plate 68.
New Zealand Lupin—Note Root Nodules.

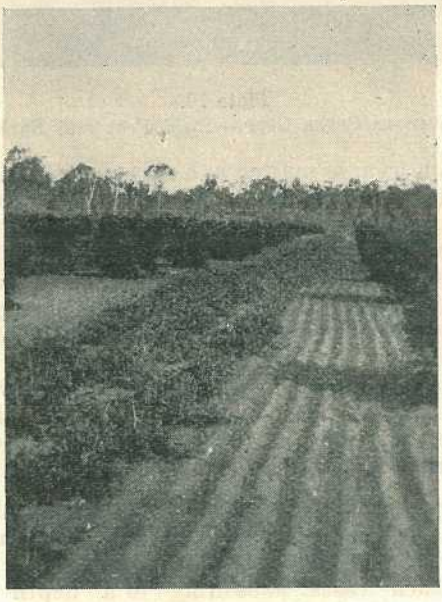


Plate 69.
An Orchard Cover Crop.—Note the cultivated strip along each side of the tree row.

On the other hand, the fact must not be lost sight of that cultivation may cause injurious effects. Unless care is used, plough-sole may result, and greatly hinder proper water penetration. Also, continous cultivation causes the destruction of the organic contents of the soil, and a decrease in the bacterial life. If cultivation is continued throughout the whole season year by year, such soil will soon become depleted of its natural fertility, and the trees will show the effects by their unhealthy condition.

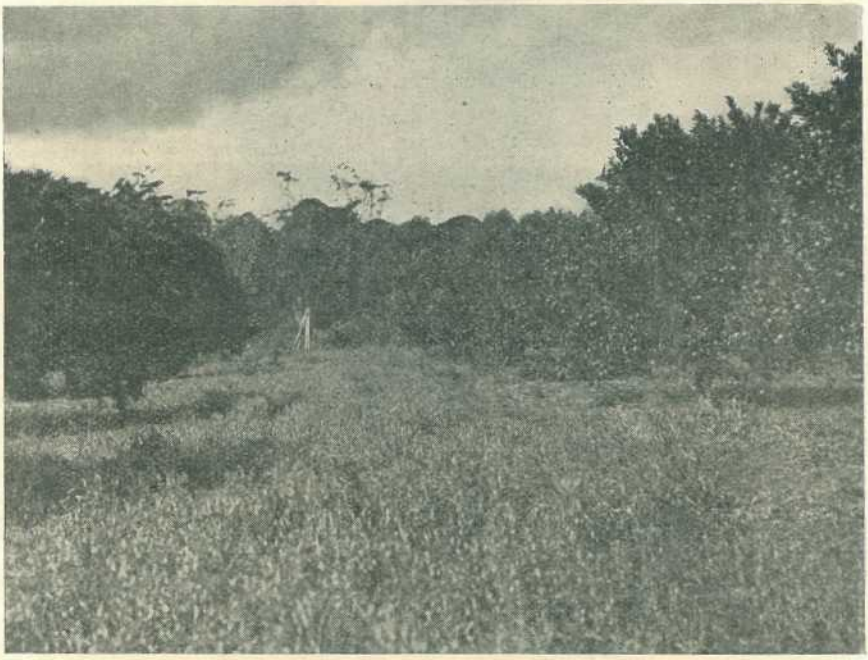


Plate 70.
A WINTER COVER CROP.—Field Peas and Barley.

The loss of soil organic matter is a major problem in tropical agriculture in all parts of the world, and is particularly severe in many of our citrus plantations. Therefore, when considering cultivation programmes, the improvement of the humus content of the soils must be of primary importance. Where young trees are concerned, deep cultivation is advisable in order that large quantities of organic matter, such as manure and green manure crops, can be deeply incorporated with the soil There should be no danger of injury to the roots of young trees in cultivation to a depth of 10 or 12 inches. However, as the trees become older, their rooting systems extend widely in all directions, and, therefore, as deep cultivation will be liable to cut too many feeding roots, shallower cultivation will probably be more satisfactory.

In order to prevent the formation of plough-sole, cultivation at varying depths is frequently practised. However, plough-sole will form in many soils even though the depth and direction of the ploughing is varied, and in such cases subsoiling to a depth of from 18 to 20 inches may have to be resorted to in order to break up any hard pan that may be present. Such work should only be done when the soil is dry, and the subsoiler should be run only in the middle of the rows,

otherwise severe root-cutting will result. Subsoiling should not be carried out either just prior to or just following the blossoming period.

Green Manuring.

Humus, the product of the decay of organic substances, is one of the most important ingredients in any fertile soil, and, generally speaking, is present in only inadequate amounts in most of our citrus soils. Except in alluvial lands periodically improved in fertility by floodings, the orchardist must consider the maintenance or improvement of the soil fertility if he wishes to harvest good crops. In the absence of

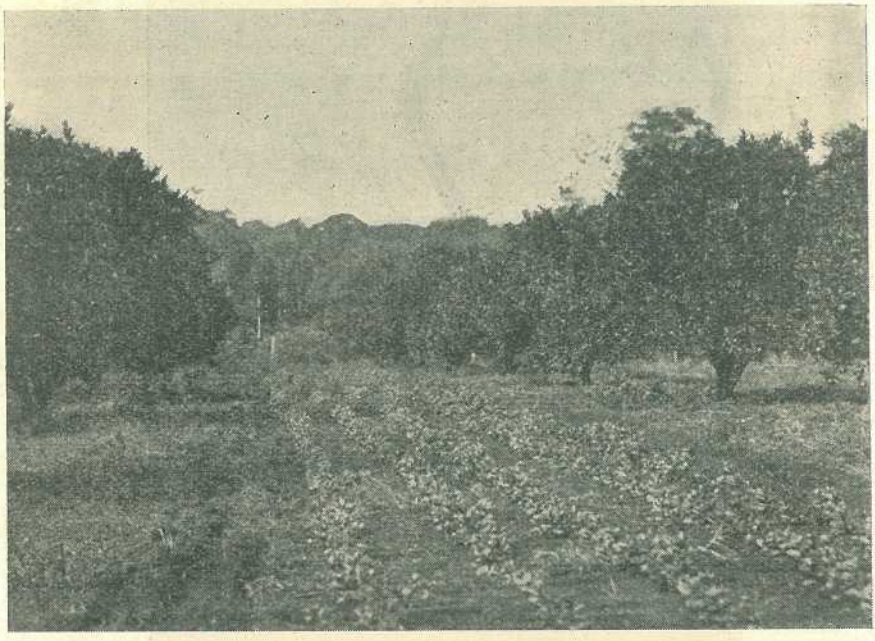
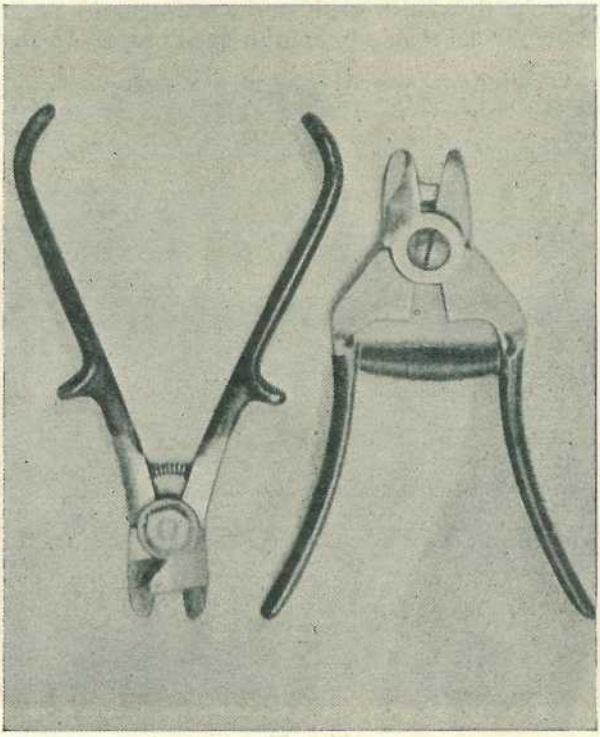


Plate 71.
Winter Cover Crop.—Young Tick Beans.

bulky organic farmyard manure, the maintenance and improvement of the soil fertility may be carried out by the growing and turning-under of green manure crops. Not only do such crops build up the physical condition of the soil, but their presence reduces soil losses by erosion during periods of heavy rainfall. When green manuring, particularly in the coastal districts, the general practice has been to utilise the summer rainfall, planting such crops as black cowpeas, Poona peas, and Crotalaria during November and December, and turning them under about the following March. Winter green manuring with crops such as beerseem (Egyptian clover), vetches, field peas, tick beans, lupins, rape, and mustard could in many instances be practised with advantage particularly in young orchards, and in orchards on the lighter, sandy soils, and where irrigation is practised. For winter crops planting should take place during March and April, and turning-under in July. Citrus trees up to four or five years of age occupy a relatively small proportion of the total area on which they are planted, and their roots do not

extend so far from the trunk nor take up the amount of space occupied by those of old-established trees. Thus during the early years of a citrus orchard an excellent opportunity is afforded for building up a reserve of vegetable matter in the soil. At this stage cultivation, even early in the season, may be confined to the immediate vicinity of the trees, and by far the greater amount of space down the centres of the tree rows occupied by growing and turning under summer and winter green manure crops.



[From photograph by H. Clarke Powell in "The Culture of the Orange and Allied Fruits."

Plate 72.
Clippers designed to minimise injury to the fruit.

Fertilizing.

In reasonably fertile lands the addition of artificial fertilizer to the soil either before or at the time of planting is unnecessary, but in land that has been previously cropped or which would not be classed as fertile, assistance to the growing plants in this direction is required. No matter what fertilizer is applied, it should be incorporated with the soil so that the young roots in traversing the soil may come in contact with it. However, it should not be brought into direct contact with existing roots at the time of planting.

As the trees develop, the quantity of fertilizer required for each will correspondingly increase, and when fully developed an evenly-continued, regular supply is necessary. As crops are produced, so the natural fertility of the soil is being depleted, and where it has not

been restored by the application of such fertilizer as is available, the effect is shown by impaired vigour of the trees and poorer quantity and quality of the fruit produced. General observations made from field trials indicate that nitrogen is one of the main constituents required to maintain healthy and vigorous citrus trees, but at the same time phosphoric acid and potash have their place. At least 6 cwt. of ammonia to the acre, with 3 cwt. of phosphoric acid and 2 cwt of sulphate of potash, would be a basis for a fertilizing programme for mature bearing trees. The nitrogen is best supplied so as to be available during the spring, as such practice tends to increase the crop and improve the quality. Whether or not an autumn application will be necessary will depend upon the vigour of the trees, as it must be remembered that the promotion of too much vigorous growth at this period is detrimental to the production of high-grade fruit. However, it will be found that a light dressing of nitrogen, with rather increased quantities of phosphoric acid and potash, will assist in maturing autumn growth and future fruiting wood, and will also benefit the crop.

The value of lime in citrus culture may be viewed from two angles, —its influence on the trees, and its effect on the soil. The presence of lime appears to aid the vigour of the trees, and improve the delicacy of the fruit, while in the soil it corrects acidity, improves the physical condition, aids the decomposition of organic matter, stimulates bacterial activity, and generally assists in improving soil fertility. Lime should be applied in the autumn in the form of agricultural lime, as its action in the form of powdered quicklime or air-slaked lime is too rapid and powerful.

Harvesting.

The subject of careful handling of fruit has been so frequently stressed that further details here seem superfluous. The chief points to be remembered are that the fruit should be cut from the tree as close to its base as possible (an orange clipper specially made for the purpose is available at a nominal cost), and that it should be treated as fragile during the first and all subsequent handlings, and carefully stored and graded before packing. Various grade sizers are obtainable, and selection can be made according to the output of the orchard. Wrapping the choicest fruit when packing enhances its appearance and increases its value, besides having other advantages, such as prevention of the spread of storage and transit diseases. Fruit should be gathered only under the driest possible atmospheric conditions, and never, as is often done, during showery weather. It should be sweated for at least seven days, and then carefully graded for blemishes and disease, sized, and packed.

Colouring.

No fruit should be gathered from the trees until it has reached maturity. The maturity standards for citrus fruits are as follows:—

In the case of oranges, grape fruit, and mandarins, the weight of the hand-pressed juice must be not less than 30 per centum of the total weight of the fruit.

With regard to the juice, in the case of navel oranges and mandarins, 10 cubic centimetres of the juice shall be neutralised by not more than 26 cubic centimetres of deci-normal (N/10) alkali; and in the

case of oranges (other than navel oranges and mandarins) 10 cubic centimetres of the juice must be neutralised by not more than 30 cubic centimetres of deci-normal (N/10) alkali.

As citrus fruits are only sold to their best advantage when they are mature, full-flavoured, and showing an unblemished skin with its normal ripe colour, assistance by colouring to such fruit as lack normal colour but possess the other qualities will enhance its market value. Citriculturists who have had experience in various citrus-growing localities will agree that certain varieties of oranges and mandarins growing in the cooler regions have ample colour long before they attain sufficient sugar to make them desirable for eating purposes, while those produced in warmer climes are sweet and luscious for some time prior to their attaining a normal ripe colour.

The colouring or forced curing, a practice known in California as "sweating," was formerly done by gaseous products generated from kerosene stoves. In 1924 Denny found that ethylene gas in small quantities was capable of producing the same results. He also found, however, that a very high percentage of gas (for example, 80 per cent.) delayed colouring. Colouring was also delayed by temperatures as high as 92 degrees Fahr. and as low as 45 degrees Fahr. A temperature of between 60 and 70 degrees Fahr., with a humidity of from 70 to 75 per cent. was found to be satisfactory.

Ethylene gas can be obtained in metal cylinders under a high pressure, with regulator valves attached to the cylinders. When released from the regulator valve the gas is conveyed by tubing into the colouring chamber. The quantity of gas passing into the room is recorded by the valve on the cylinder, so that the correct charge according to the size of the chamber can be readily determined.

It has been found that a very small quantity of acetylene gas (1 part in 2,500 to 1 part in 1,875) satisfactorily colours mature citrus fruits. In order to determine the dosage required, the air space remaining after the chamber has been loaded must be known. One ounce of carbide generates sufficient gas for every 75 cubic feet of air space. For all practical purposes it is sufficient to allow $1\frac{1}{4}$ cubic feet displacement for each bushel case of fruit. For example, the following table illustrates the dosages required for a chamber of 200 cubic feet capacity with a varying number of cases:—

No. of Bushel Cases.	Air Space.	Dosage.
40	150 cu. ft.	2 oz. Carbide
20	175 cu. ft.	$2\frac{1}{3}$ oz. Carbide
10	$187\frac{1}{2}$ cu. ft.	$2\frac{1}{2}$ oz. Carbide

In order to satisfactorily colour citrus fruits, they must have reached maturity, as if too green or immature they will not develop a normal ripe colour, but will shrivel and become dull and dirty in appearance.

All fruits to be coloured require to be treated with special care in handling. Bruises will show up as greenish areas; oil liberated from the rind may cause spotting; while if the residues of oil or Bordeaux sprays remain on the fruit, it will be found to come from the colouring room spotted and unsightly.

Any ordinary room lined with timber, provided it is air-tight, can be used for colouring citrus fruits. A convenient and economical size is one to hold from 40 to 50 bushel cases; allowing 5 cubic feet of air space to each bushel case, the chamber would require to be from 200 to 250 cubic feet in capacity. Even where large numbers of cases are to be treated, it will be found more satisfactory to build two medium-sized chambers than one large chamber.

For oranges, lemons, and mandarins an average temperature in the chamber of between 65 and 75 degrees Fahr. will prove satisfactory. If the temperature falls below 65 degrees Fahr. the colouring process will be retarded. On the other hand, high normal temperatures are not likely to affect the fruit, no ill-effects having been shown by temperatures up to 89 degrees. However, the humidity will require to be adjusted; in the case of a very dry atmosphere an open container of water may be introduced to moisten the air and prevent withering of the fruit; while when the humidity is high and likely to cause softening of the fruit, it may be reduced by placing sand, caustic soda, or quicklime on the floor of the chamber.

The fruit should be graded for colour and placed loosely in open cases having plenty of ventilation. Dunnage should be used in stacking so that a free circulation of air around each case is permitted.

The required quantity of carbide should be placed in a suitable container, and a second vessel containing water arranged in such a manner as to permit the water to drip slowly on to the carbide, thus generating the acetylene gas. This apparatus may be fitted either inside or outside the chamber; if the latter, of course, the gas will have to be led inside the chamber by means of suitable piping.

After closing the chamber and making sure that it is airtight, it should be charged and allowed to remain close for four hours. It should then be opened up and thoroughly aired for at least two hours, after which it may be charged again, and the performance repeated as often as is necessary. Between nine and fifteen charges should be sufficient to give mature citrus fruits their normal colour.

Picking and Curing of Lemons.

Lemons carefully handled and gathered at the right stage of maturity may be successfully cured and stored on the orchard for several months without deteriorating, but rather with improvement to their appearance and carrying qualities.

All fruits should be clipped, not pulled, from the trees just as they are turning colour. The fruit should be of normal size, and the dark-green colour just turning to a paler shade, generally termed "silvering." In order to avoid injuring or bruising, and thereby leaving the fruit open to the attack of moulds, it is important to remember that it must at all times be handled wih the very greatest of care.

After picking the fruit should be placed in shallow trays and allowed to remain for several days to sweat off excess moisture. When storing for any length of time, dipping for a period of one or two minutes in a bluestone solution, strength 1 in 500, is recommended. The fruit, after being thoroughly dried, is packed in bushel cases and stacked in a storing chamber in such a manner as to permit a ready circulation of air.

Such chamber should be so constructed as to lend itself to control of the relative humidity. A low relative humidity results in the shrinkage of the lemons, with a consequent loss of weight and an inferior colour in the fruit, accompanied by shrivelling, as well as the browning and dropping of the buttons of lemons held in storage for any period. These conditions are mostly apparent during late spring, a period of comparatively high day-time temperatures and low relative humidity. Satisfactory conditions may be obtained by controlling the humidity at from 85 to 90 per cent. For controlling the humidity a humidifier may be cheaply constructed by hanging a series of absorbent cloths from a frame, above which is fixed a small perforated iron water-pipe permitting water to drip when required, and circulating the air in the chamber by means of a small fan. Under such conditions lemons may be stored for several months.

Another method used in storing lemons is, after sweating, to pack the fruit loosely, either wrapped or unwrapped, in cases lined with paper, and stack in a cool dry shed in blocks of from 50 to 60 cases covered with canvas sheets or tents. Low open water containers may be introduced when necessary, always taking care to avoid as far as is possible extreme variations in temperature and humidity. The fruit should be examined at intervals of ten days, and any showing signs of decay removed.

Again the fruit may be stored, either wrapped or unwrapped, loosely packed in cases lined with paper and using straw as a filler. The bottom of the case is covered with a layer of straw, a layer of lemons placed thereon, the spaces between the fruits filled with straw, and the lemons covered with a layer of straw, and so on, using alternate layers of fruit and straw until the case is filled. The cases should be stacked, covered, and periodicaly examined as described in the previous method.

REFERENCES.

The following is a list of principal works consulted:—

H. H. Hume—"The Cultivation of Citrus."
H. Clarke Powell—"The Culture of the Orange and Allied Fruits."
R. W. Hodgson—"The Pruning of Citrus in California."
G. Quinn—"Handbook for Fruit and Vine Growers."
Fawcett and Lee—"Citrus Diseases and their Control."
Lyon and Buckman—"Nature and Properties of Soils."

CROWN LAND FOR GRAZING HOMESTEAD SELECTION. CUNNAMULLA DISTRICT.

174,931 ACRES OF SHEEP LAND—PART OF THURRULGOONIA RESUMPTION.

This land has been surveyed as portions 5, parish of Cotton, 1 and 2, parish of Magie, and 1 and 2, parish of Kumbogan, and will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 8th March, 1937, at 11 a.m.

Each selection will be for a term of 28 years.

The annual rentals for the first period of 7 years are from 1d. to 2¾d. per acre.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of 3 years.

The blocks are all good woolgrowing country and are artificially watered by bore drains, but more water may be required.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane; the Land Agent, Cunnamulla; and the Government Tourist Bureaux, Sydney and Melbourne.

THINNING AND SPACING OF COTTON.

W. G. WELLS, Director of Cotton Culture.

RESULTS obtained from the experiments testing the merits of different spacings of cotton plants, and heights at which to thin them, have indicated that soils and climatic conditions have an important influence in determining what is the best spacing of cotton plants. The habit of growth of the variety also has an effect; so it would appear that no one particular plant-spacing gives the best results under all conditions. It becomes necessary to consider, therefore, what spacing is the most satisfactory under a range of climatic conditions, for each variety on each soil type. This makes it advisable for each grower to carry out spacing tests over a series of years so that the best spacing for average conditions may be ascertained.

One point emerging from the experiments that have been conducted is that cotton must be spaced out to some extent, for the unthinned plants always tend to be more sensitive to climatic conditions. In wet seasons the unthinned plants, if on soils of a fertile nature and of a high nitrate content, grow very tall and spindly, which causes the suppression of the lower fruiting branches, with a consequent delay in the setting of the bolls. The crop thus tends to form rather late and, in addition, is subjected to the sucking insects that occur generally in greater numbers during the latter part of the season, particularly if showery weather prevails then. The lint produced under such conditions is frequently of a rather wasty nature, containing a considerable amount of stains and yellow spots. In dry seasons where the plants are left unthinned, the competition for plant food and moisture soon becomes so acute as to cause the loss of the flower buds, then the small bolls, and finally it restricts the development of the bolls that remain on the plant. This lowers the quality of the fibres contained in the affected bolls, for they do not reach full development, thus resulting in weak, wasty, and shortened fibres.

Although much more data is required in all districts to allow of a decision to be arrived at as to what is the most satisfactory plant-spacing for each variety and soil type, the results obtained indicate that for alluvial soils with varieties like Indio Acala, Miller, New Boykin, Ferguson, and Half-and-Half, spacing to 12 to 15 inches when the plants are 5 to 8 inches tall, can be relied upon to yield about as well as any over a series of years; and the quality of fibre produced is less likely to be affected by adverse climatic conditions. The Durango variety, with its tendency to develop more of a top crop on the large vegetative branches, appears to require wider spacing, particularly in seasons in which wet conditions in the second half are experienced. Spacings of 20 to 24 inches when the plants are 5 to 8 inches tall are, therefore, recommended for it.

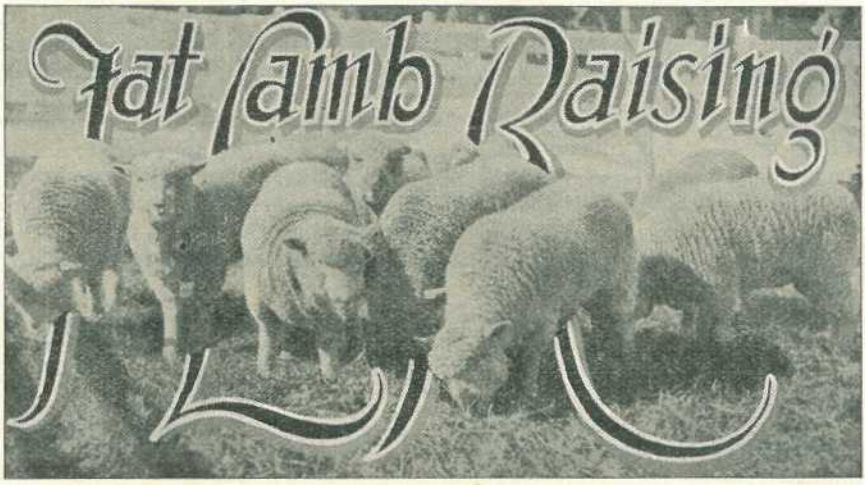
On the harder, less fertile clays and clay loams of the forest slopes —particularly in the drier districts—more drought-resistant, vigorous-growing varieties like Lone Star and Mebane are required. These varieties have produced satisfactorily over a series of years when spaced out to 20 to 24 inches. In a season of late planting, such as the present one, it is possible, however, that around 15 to 18 inches may be more advisable for December-sown plants, as fewer bolls per plant will likely be borne, so that having more plants per acre will tend to overcome the deficiency. The plants should not be left much closer than this in an attempt to compensate for the fewer bolls per plant, for the late plantings of these varieties will tend to grow very tall and spindly if left in a crowded condition, unless on soil of very low nitrate content, or unless rather dry conditions occur for the next two months.

The results of time of thinning experiments indicate clearly that it is best to thin when the plants are 5 to 8 inches tall, as this arrests the tendency for the plants to grow spindly and reduces competition for moisture and plant food; also, if the field has been cultivated and cross-harrowed to eliminate weed growth, the thinning operations can be performed easily and rapidly when the plants are at this stage. These are all important factors in late-planted cotton, which will grow very rapidly at this stage of the season if wet conditions are experienced.

COMFORT IN THE COWYARD IN WET WEATHER.

On many farms the cow yard becomes very boggy in the wet season, and conditions are then anything but pleasant for the milker, as well as the cow. The dairyman has to walk through mud and slush, sometimes up to or over his ankles, and the cows often drag their udders through the mud when walking into the bail from the yard. Consequently, the mud adheres to legs, udder, and belly, entailing a considerable amount of work in washing both teats and udder. If this cleansing job is not done correctly and thoroughly cream of inferior quality is delivered at the butter factory, for which only second-grade price can be paid.

To ensure comfort in the cow yard in wet weather, a small enclosure, 36 feet long and 36 feet wide, may be constructed. This small yard should be concreted. Sand and stone can be obtained quite handy to the farm as a rule, so the work can be done by the farmer at the cost of the cement. Dairy farmers who have adopted this idea declare that they wonder why they did not build such a " draining yard " before. It makes all the difference in the comfort of wet weather milking. A yard 36 feet by 36 feet will hold twenty cows quite comfortably.—D. A. LOGAN, Inspector of Dairies.



FAT LAMB BREEDING.

J. L. HODGE, Assistant Instructor in Sheep and Wool.

RECOGNISING that Queensland generally lags behind other States in the production of fat lambs, the Minister for Agriculture and Stock some time ago inaugurated a scheme for the encouragement of this branch of the sheep industry. Rams of British breeds were purchased in the South and distributed to farmers who had cultivation or promised to cultivate. The necessity for cultivation was urged on all farmers, it being thought by officers of the Department that fat lambs off grass country, even if prime, were more or less in the nature of a fluke. The breeds purchased were Border Leicesters, South Downs, Dorset Horns, Shropshires, and Romney Marsh.

In certain cases where a farmer owned a stud ram of particular breed, stud ewes were supplied with the idea of fostering the breeding of pure stock.

All sheep supplied to farmers are on loan, and remain the property of the Department. The progeny and wool, however, are the property of the farmers concerned.

The interest taken in the scheme, and the results to date, have been highly gratifying, and it is now no uncommon sight to see a pen of true sucker crossbred lambs on sale at Cannon Hill. Prices, too, during the period under discussion have been generally profitable.

The greatest drawback to the production of fat lambs on the Darling Downs in quantity has been in the past and still is the difficulty of purchasing good crossbred ewes as the mother flock.

If a start has to be made with Merinos the best for fat lamb raising is bred by the introduction of one of the longwools, such as Border Leicester, Lincoln, or Romney Marsh into the strong-woolled, robust type of Merino ewe. The ewe lambs of this drop should then be retained as the future dams of the lamb-raising flock.

As to suitable ewes for the fat lamb industry, it is believed that graziers on the fringe of the Darling Downs or further out would

find it profitable to join long-woolled rams of British breed with their cast-for-age ewes with the idea of selling the progeny annually as fat lamb ewes on the Downs. Into the crossbred ewe flock, as described, should be introduced a ram of the Downs type. Opinions necessarily differ in the matter of crosses. The South Down is the fashionable lamb at the present time, but it should be remembered that this cross must suffer no check from birth to block. The Dorset Horn gives a very nice lamb, early maturing and hardy. The use of the Border Leicester should be encouraged in every way. In addition to an early-maturing lamb filling every want, it must be remembered that the skin value of this lamb is worthy of consideration to a far greater extent than either the Dorset or the South Down.

Pure-bred Corriedale ewes are hard to come by, but should the opportunity occur a farmer would be well advised not to let it slip. Pure Corriedales are hard to beat, good mothers and heavy milkers, besides growing a profitable fleece.

Generally, the wool from a flock retained for fat lamb breeding is a secondary consideration when compared with the production of fat lambs.

CODLING MOTH CONTROL.

The overwintering codling moth grubs are now assuming the chrysalis form, and a general emergence of moths may be expected to commence shortly.

A final inspection of packing sheds should now be made, and as many grubs and chrysalids destroyed as possible. It is of course impossible to obtain anything like a 100 per cent. kill of the grubs that harbour in the packing shed, but by careful searching many can be found and destroyed.

Second-hand cases or any cases stored in the shed should be dipped in boiling water for a period of three or four minutes, and this will kill all the grubs harbouring in joints and nail holes.

Although it is generally recognised that the packing shed is an important source of moth infestation each season, quite a large percentage of grubs also overwinter in the trees in the orchard, and they may be found in all sorts of cracks and crannies under the bark at the base of the trees, and at the juncture of the larger branches and in the main crotch or fork of the tree, and the time spent in searching for and destroying these grubs is well spent.

All growers should now set out a few bait traps as indicators of moth activity, as in this way fairly reliable information as to when the eggs are being laid can be obtained. When the greatest number of moths are found in the traps, it can be safely assumed that the greatest number of eggs are then being deposited, and as the eggs hatch in from five to ten days, according to temperature, information in regard to the timing of sprays can be thus arrived at.

Bait pans should be of about 3-pint capacity, and they should, if possible, be covered with a wire mesh screen or cover made from ⅜ to ½-inch wire netting. This will prevent the larger moths, such as cutworm moths, from entering the trap and spoiling the bait.

Any wide-mouthed vessel can be used for the trap, the wider the better, and enamel pudding basins of about 7 or 8 inches diameter make very good traps and are easy to fix the hanging wire to, but any tin or glass vessel of a similar diameter will answer the purpose.

One of the cheapest and best baits is made as follows:—

Crude molasses 1 part, water 16 parts.

The molasses is dissolved in the water and the trap about two-thirds filled with the mixture.

The traps are hung as near to the top of the tree as possible, as more moths are caught in this situation.

The hanging is easily accomplished by screwing a couple of screw eyes into one of the large branches near the top, a piece of stout cord is fixed to the wire handle of the trap, and the other end of the cord is passed through the screw eyes, enabling the trap to be easily raised and lowered for daily inspection and resetting when necessary. The trap should hang clear of the branch, and fresh bait should be used about every ten or twelve days.—HUBERT JARVIS, Entomologist.

The Importance of Forests in the Circulation of Water.*

THE part which forests play in the circulation of water on the earth's surface is not yet fully understood. There are many meteorologists and engineers who deny altogether the effect of forests on the amount and distribution of rainfall. The old theory that the source of all our precipitation over the continent is evaporation from the surfaces of our oceans is still prevalent. According to this theory, the vapour from the oceans is carried by the wind to the continent, there condensed in the form of rain or snow, and later returned through rivers back to the ocean. The circulation of water on the earth's surface was thus considered as going on in a somewhat horizontal direction between the ocean and the land.

Bruckner's investigations on the circulation of water in the atmosphere dealt a serious blow to this theory, and threw in bold relief the evaporation from the earth's surface itself as the most important source of our precipitation. According to his calculations, the oceans contribute only two-ninths of the entire precipitation that takes place over the land areas draining toward the oceans; seven-ninths of the precipitation over the earth is derived from evaporation from the land itself.

If evaporation from the land surface is the chief contributor of moisture to the air, it is of interest to know which of the various earth coverings contribute most vapour to the air. Studies of the loss of water from the different earth coverings show that free water surfaces of lakes and streams contribute less vapour to the air than bare, moist soils. Land covered with grass or crops contributes through direct evaporation and through transpiration more vapour to the air than bare, moist soils.

Of all the vegetative coverings, a dense forest contributes most vapour.

Experiments conducted in Germany by Wollny and Ebermeyer, by Henri of France, and by Otozky in Russia, all agree that the ground water is near to the surface in fallow ground, somewhat depressed under agricultural crops, and is lowest under forest cover.

The French aptly call the forests the "oceans of the continent," and compare the vapour given off by them to clouds of exhaust steam thrown into the atmosphere.

The reasons for the tremendous consumption of water by forests are clear. To produce one pound of dry wood substance, from 500 to 1,000 pounds of water must pass through the body of the tree. A forest, if it is fairly stocked with trees, produces at least 100 cubic feet of wood per acre per year, including root and branch wood. A cubic foot

*Abstract of address by Raphael Zon, Director, Lake States Forest Experiment Station, Forest Service, United States Department of Agriculture delivered at a meeting of The Mayo Foundation Chapter of Sigma Xi, Rochester, Minnesota, Friday, 22nd March, 1935. Supplied by Dr. H. Poate, a Sydney surgeon who is also a very keen horticulturist, to "The Fruit World and Market Grower" (Sydney), and printed in that journal for January, 1936.

of coniferous wood weighs on an average 25 pounds, that of hardwood about 40 pounds. An acre of forest, therefore, produces on an average from 2,500 to 4,000 pounds per acre. To produce this amount of wood, from 2,500,000 to 4,000,000 lbs. of water will have to pass through the tree, and be given off into the air. If this water were distributed over an acre of land it would cover it to a height of 12 inches.

Forests, therefore, lying in the path of prevailing winds blowing from oceans to continents enrich the air passing over them with vapour and help in carrying this moisture farther into the interior of the continent. We have in the United States a clear example of this influence in the forests of the Coastal Plain and the Southern Appalachian Mountains. The prevailing southerly winds of the summer, on reaching the shores of the southern States, are drained of the vapour derived from the Gulf of Mexico. In further movement north, they would, therefore, become dry winds, if not for the presence of the forests over which they pass. Passing over large stretches of forest, they become alternately enriched with vapour and drained of moisture, and in such relays the moisture is carried into the central and prairie region, making summer the period of greatest rainfall there.

Lowdermilk, in his recent investigation of the influence of the forest upon rainfall, found that the increasing dryness of the interior of China is brought about by the decreased humidity of the air due to deforestation. This, together with erosion following deforestation, has caused serious disturbance to the entire circulation of water in China.

For the same reason the forests of the Scandinavian peninsula must be important in the distribution of moisture over northern Europe.

Whether the forests actually increase rainfall may be a question, but the part which they play in the distribution of rainfall over the land has a good foundation of scientific facts behind it.

STOCK WATERING FACILITIES.

On many grazing properties in Queensland there is sufficient surface water to last until June or July in a normal year, and possibly until August in a good year, when there has been a heavy wet season. There is a period between the time that the surface water dries up and the first storms fall in which it is necessary to provide water, either by well or bore.

When selecting a site for a well or a bore, the grazier should first make a survey of his country. A site should, if possible, be selected on a part of the property where cattle do not feed intensively when surface water is available. On a number of grazing properties the mistake has been made of putting down a bore in close proximity to the surface water. As the surface water dries up, the grass in the immediate vicinity is also eaten out, and when it is necessary to pump water for stock there is often no grass in close proximity to the bore or well. As a result, the stock are forced to travel a considerable distance out to grass.

When bores and wells are put down in places away from surface water, there will probably be grass near at hand in a dry time, and cattle will do better, drink oftener, and retain condition that they would otherwise lose through excessive walking.—D. A. LOGAN, Inspector of Stock.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Freisian Cattle Society, and the Ayrshire Cattle Society, production charts for which were compiled during the month of December, 1936 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Eveline of Alfa Vale	W. H. Thompson, Nanango	15,517·2	708·434	Reward of Fairfield
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Alfa Vale Gentle 2nd	W. H. Thompson, Nanango	15,186·9	695·151	Reward of Fairfield
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Sunny View Thelma	J. Phillips, Sunnyview, Wondai	12,310·65	520·374	Lovely's Commodore of Burradale
JERSEY.				
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
White Rose of Hamilton	J. Wilton, Junior, Raceview	11,035·75	663·178	Retford Mary's Victor
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Wyreene Creole	Mrs. M. Allom, Toowoomba	7,391·05	380·059	Lyndhurst Majesty
FREISIAN.				
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Ryfield Butterfly	F. C. Noller, Kumbia	10,043·95	407·812	Ryfield Monarch 2nd
AYRSHIRE.				
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Myola Lady Jean	L. M. Anderson, Southbrook	8,391·86	368·183	Fairview Combination

The Tropics and Man

HEAT AND THE HUMAN BODY.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M.,—Professor of Physiology, University of Queensland.

No. 2.

The Body as a Heat-Producer.

WHATEVER we like to think about the ultimate origin of life and the development of its forms through the ages, this much is certain, that when life was first evolved upon this earth it was committed irrevocably to two principles—the use of oxygen from the air in furnishing energy for work, and the wastage or dissipation, to use the technical term, of much of that energy as heat. Engineers will recognise this latter statement as part of a larger truth which is given the imposing title of the *second law of thermodynamics*, and which entails that energy cannot be transferred from one form to another without the loss of a certain proportion as heat. The human body can be regarded as an engine. It must be provided with fuel in the form of food; it must be supplied with the oxygen of air so that it can burn up that fuel and liberate energy; it has mechanisms for converting some of that energy into work. In many respects it is a peculiar engine in that the burning process is carried out quietly in each of the myriads of body cells without flame and flurry, and that an unusually large proportion of the energy liberated in this process can, upon occasions, be converted into work. Nevertheless, it is an engine, and calls for the same considerations as other more familiar types of engine. I have mentioned the supply of fuel and oxygen, I could add the replacement of worn parts and many other parallels, but the point I want to deal with is the inevitable liberation of heat by the body.

At rest, the average man would set free in twenty-four hours enough heat to raise four gallons of ice-cold water to boiling point. A navvy would produce about two and a-half dozen times this amount in twenty-four hours of his average life. Welcome as this fact is in temperate and cold countries, it becomes something of a burden in sub-tropical and tropical regions. To appreciate this we must consider some further peculiarities of the body.

Body Temperature.

Birds and mammals differ from other animals in keeping their body temperature at a more or less fixed level. For birds and mammals the production of heat is no longer an incidental in life, nor can they leave the opposite process of heat loss to the chance determination of their surroundings. A single man whose wants in life are few and simple may find it possible to live without considering either his income or his expenditure, but a man burdened with the full responsibilities of citizenship knows only too well that to maintain a steady level of affluence he must exercise the strictest control over both. Just so does the human body require to have control over both heat production and heat loss if it is to keep its temperature constant. Just why it is necessary and how it came about is another story, but we shall have to be

content, for the moment, with accepting the fact that the body, to work efficiently, must keep a fairly constant internal temperature of 99 deg. F.

Now, how does the body balance its income and expenditure in the matter of heat? It may seem strange at first if I tell you that, except in very cold weather, the body exercises but little control over heat production. Most of its attention is given to regulating the opposite process of heat loss. It is because of this concentration upon regulating heat-loss that the different climatic factors—temperature, humidity and wind velocity—are of such individual importance. If I am to make myself clear in succeeding articles I must take you a little way into the theory of heat loss.

How the Body Loses Heat.

Heat is lost from the body partly by *radiation*, and partly by *conduction* to surrounding objects cooler than the body. (The difference between these is that conduction requires some material connection with the objects concerned as by air, water, or touch, while radiation does not.) Still more heat can be lost if water is present on the surface of the body and if this can be *evaporated*. A fourth process of *connection*, or movements in the substance surrounding the body (e.g., air movements), helps conduction and often, also, evaporation.

It will be obvious to you that the body can lose heat by radiation and conduction only if the objects around it are cooler than the body itself, and it will appear reasonable to state that, the greater the difference in temperature the more rapid the loss. Thus in winter the body has no trouble whatever in getting rid of all the heat it is producing, just as you and I have no trouble in getting rid of the money we make; in fact, the difficulty is to keep enough in hand. In mild weather, as in good times, it is fairly easy to keep a reasonably steady balance. In hot weather, on the other hand, the body may encounter considerable difficulty in getting rid of all the heat it produces—I am told there are people who experience difficulty in getting rid of the money they make!

It is when the hot weather comes that the human body can make use of something it has kept up its sleeve, as it were—perspiration. At all times there is a certain amount of evaporation going on from the lungs and from the skin surface, but this does not constitute a very large proportion of heat loss in cold weather. As we all know, however, perspiration can be profuse in hot weather, and thus provide ample water for evaporation with consequent loss of heat. One is apt to forget, however, that it is not the sweat which forms big drops on our arms and face, nor the sweat that soaks the arm-pits that is losing heat for us. Visible sweat is largely wasted sweat. It is the sweat that is evaporated before we see it that is so useful. In technical terms, each gram of sweat evaporated gets rid of 540 calories of heat, while each gram of sweat that runs off the body gets rid of only 3 calories. In hot dry climates it is not the rule to see the limbs bathed in free sweat, while that is common enough in the humid tropics; yet simple weighing experiments will show that one loses twice as much sweat by evaporation in the hot dry as in the hot wet climate. One's thirst sensations confirm this.

Evaporation, however, can only take place into air that is not yet saturated with water vapour. In the dry climates, the air contains very little moisture, so that evaporation goes on very readily. It is just as well that this is so, since in those climates, heat loss by radiation and

conduction is reduced to a very low figure, if not actually reversed. In humid climates, evaporation is very much more difficult and the air in contact with the body is quickly saturated, so that it must be constantly changed if evaporation is to go on. It is in humid climates that convection or air-movement is so important.

I think you will agree after this little discussion, which, I hope has not been too technical, that the difficulty the body is up against in the tropics is that of losing heat as rapidly as it is producing heat, and that the difficulties are of three main kinds:—

(i.) The surroundings are not sufficiently cooler than the body to permit of sufficiently rapid heat loss by radiation and conduction (in fact, the flow of heat is at times reversed!).

(ii.) The atmosphere may be so humid that evaporation cannot take place at any great rate.

(iii.) The air in contact with the skin surface may not be replaced sufficiently often so that it becomes saturated with heat and moisture, preventing further loss from the body.

Now these three factors—temperature, humidity and air-movement—are the three cardinal features of tropical climate, and, in turn, of tropical hygiene in so far as it concerns climate. So important are they, and so necessary is an understanding of them, that I shall consider them carefully in the next two articles. I have largely finished with general technical discussions, and shall pass on to more practical points, but, unless you are already familiar with these things, it would be a good plan to put this article aside for reference should some point escape you later.

KEEP COWS IN CONDITION.

There is as much variation in the skill of men in handling cows as there is among cows or men. It is folly to expect improvement in the production of cows unless there is first an improvement in the practices of men who feed and care for the cows.

At this particular time it would be easy to pick out two classes of dairymen by the condition of their herds. One group has found by experience that it pays to keep cows in good condition, and especially to have them in good condition at calving time. The other group, not being alive to the necessity of supplying plenty of the right kind of feed at the right time, and, further, apparently thinking that cows need be fed only while they are giving milk, have cows whose condition is anything but satisfactory at the beginning of a new lactation period. These are the men who should make some improvement in their skill in feeding and caring for cows, if the cows are to make them as much money as they are capable of making.

Pastures have been unusually short in many parts of the State. This means that a lot of cows will not be in proper condition to calve and carry on their next lactation period. There is still time to give these cows a fair chance to make good before they actually settle down to their milk-making task.

Good dairy cows should have from six to eight weeks' rest between the close of one lactation period and the beginning of the next. More than this, they should be fed well enough to permit them to regain what condition they have lost on account of the short pasture. It is a very difficult matter to feed them back to condition after they have calved.

The advice given is:—Look over your cows now and pick out those that need some extra feed, and, most important of all, give it to them. Calving troubles, retained afterbirth, premature calving, are costly. A cow that has trouble in calving will be off at least a fourth for that lactation period. Many of these troubles are due to ill condition, and can be corrected by proper care before calving.—L. VERNEY, Inspector of Dairies.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Elephant Grass.

A.E. (Esk)—

It is rather difficult to be sure of grasses from a single leaf only, but the one sent by you seems to be definitely elephant grass, *Pennisetum purpureum*, a grass cultivated to a fair extent in Queensland and fed to cattle both as chaff and feeding off. We have no records of animals being poisoned by it, and tests by the Agricultural Chemist for the presence of a prussic-acid-yielding glucoside, as in the sorghums, have always given negative results. Perhaps your fowls are getting at some other green-stuff.

White Passion Fruit Vine.

J.H.G. (Woodford)—

Feeding experiments with the white passion fruit vine were carried out by the late Dr. Sydney Dodd at the Animal Health Station, Yeerongpilly. A feature brought out by the investigation was that the poisonous property of the vine is of a cumulative nature, and quite considerable quantities of it have to be eaten before any ill-effects are noticed. Most of the trouble occurs at times when grass is scarce, particularly towards the end of spring and the beginning of summer. Ordinary paddock stock running on well-grassed paddocks which may be infested with the vine do not seem to become affected, or at least not to any extent. It is the leaves that do the damage. It does not matter whether the plant is in fruit or not.

We have some other passion fruit vines possessing a prussic-acid-yielding glucoside, and which may cause the death of cattle that eat heavily of them very quickly. These, however, are not anything like so common as the ordinary white passion vine, the one experimented with by Dr. Dodd.

Scrub Panicum. Caustic Creeper.

"ENQUIRER" (Spring Creek Station)—

1. *Setaria australiensis*, sometimes called scrub panicum, a fairly common grass in parts of Queensland, mostly on the coast or near-coast and very common along scrub edges—hence the local name. It should be quite a good fodder, particularly in its younger stages, as it is very closely related to such well-known cultivated fodders as the giant setaria and the dwarf setaria.
2. *Euphorbia Drummondii*, the caustic creeper. This plant is very common at times in parts of Queensland, particularly on the Darling Downs country. It is reputedly poisonous to sheep, causing the head and neck to swell. If the swelling is pierced an amber-coloured fluid exudes and the life of the sheep may be saved. Most of the trouble occurs with travelling or freshly untrucked sheep; ordinary paddock sheep generally remain unaffected.

A Suspected Plant.

M.I. (Rockhampton)—

The specimen represents *Terminalia porphyrocarpa*. This plant as far as we know has not come under suspicion as a poisonous plant before, but an allied species known as yellowwood, namely *Terminalia oblongata*, which is very common in the Emerald district, has been proved by feeding tests to be harmful to sheep. Sheep fed on this species are said to become very poor in condition and to take fits, the symptoms being that the sheep drops in its tracks as though stunned, and lies trembling and rigid with extensor muscles of the neck and limbs strongly contracted. The sheep sometimes lies quite prone and sometimes props itself up and sways its head from side to side. The attack lasts from ten to forty seconds and the recovery is quick. The sheep struggles to its feet and stands for a few seconds swaying unsteadily, and then runs on to join the mob. The opinion is that when death resulted it was caused more by the indigestibility of the leaves than by any toxic character which produced the nervous disorder referred to.

Plants Suitable for the Upper Burnett.

S.G. (Mulgeldie)—

Following is a list of trees which should be worth while trying in your locality. The selection is confined to trees procurable through the ordinary nursery channels. The Botanic Gardens, Brisbane, are now under the control of the Brisbane City Council, and this Department has no young plants for distribution.

Celtis sinensis, Chinese celtis. This tree does remarkably well on the Darling Downs and is now being planted more or less extensively in the Burnett district. This tree is naturalised along the river at Gayndah, and you should be able to obtain seed from there. Seedlings often come up in such places under the parent trees. The leaves are good fodder for stock.

Bottle Tree, *Sterculia rupestris*.

Kurrajong, *Sterculia diversifolia*.

White Cedar, *Melia dubia*.

Camphor Laurel.

Figs.—Most of the varieties should do, particularly the Moreton Bay fig, or, preferably, the small-leaved Moreton Bay fig. The weeping fig is a fine tree, but if frosts are severe it may be badly cut back in winter.

Phytolacca (bellasombra). We notice you have tried this, but say it has not done too well. This is hard to understand, for in localities like yours this tree generally makes very rapid growth.

Silky Oak.

Coral Tree (*Erythrina*). Several varieties are in cultivation in Queensland.

A "Wild Lucerne."

T.C. (Chinchilla)—

The specimen represents *Psoralea patens*, a leguminous plant sometimes called wild lucerne, a vernacular, however, rather loosely applied in Queensland. Various species of *Psoralea* are very common in Queensland pastures, and are not known to possess any poisonous or harmful properties. Some are looked on as excellent fodder.

Wild Lettuce.

J.R. (Yeerongpilly)—

Your specimen represents a species of wild lettuce (*Lactuca*), probably *Lactuca scariola*, the prickly lettuce. The wild lettuces are sometimes regarded as poisonous to stock, but to what extent they are actually poisonous it is hard to say. Normally speaking, they are never eaten in sufficient quantities to cause trouble. In large quantities they are said to produce intoxication similar to that caused by poppy heads.

Two Common Herbs.

I.W.S. (Columboola)—

(1) *Euphorbia Drummondii*, caustic creeper, a very common herb in Western Queensland. It is reputedly poisonous to sheep, the symptoms given by experienced sheepmen being that the head and neck of affected animals swell very considerably. If the swelling is pierced an amber-coloured fluid exudes and the life of the sheep may be saved.

In New South Wales, where the plant also grows, a prussic-acid-yielding glucoside has been isolated from it, but the symptoms, as given by experienced sheepmen in Queensland, are certainly not those of prussic acid poisoning, and all tests with the Queensland plant so far have yielded negative or doubtful results. So far as we have observed, ordinary paddock or resting sheep are not affected by the plant, and commonly eat it freely without any ill effects following. Most of the trouble occurs with sheep that have been freshly untrucked, or are travelling, and have been allowed to eat large quantities of the plant.

(2) *Phyllanthus maderaspatanus*, a very common herb in Western Queensland, of which we have no particular knowledge as to its properties. It is probably eaten along with other herbage, but of its value or otherwise we are not very certain. Although it is a very common plant, we have not heard a local name for it.

General Notes

Staff Changes and Appointments.

Mr. J. W. Moy, Inspector of Stock, Toowoomba, has been appointed also an inspector under the Brands Acts.

Mr. C. W. Winders, B.Sc. Agr., Assistant (Agronomy), Department of Agriculture and Stock, has been appointed Assistant Agrostologist, Department of Agriculture and Stock.

Mr. A. R. Brimblecombe, Assistant to Entomologists, has been appointed Assistant Entomologist, Department of Agriculture and Stock.

Mr. C. G. Hughes, B.Sc. Agr., Assistant to Pathologist, Bureau of Sugar Experiment Stations, has been appointed Assistant Pathologist, Bureau of Sugar Experiment Stations.

Mr. L. Wood, Field Assistant, Department of Agriculture and Stock, Toowoomba, has been transferred to Brisbane.

Mr. R. J. Roache, Land Agent, Goondiwindi, has been appointed also an acting inspector of stock.

Mr. Percy Booth, "Yarrabine," Brooweena, has been appointed an hororary ranger under the Animals and Birds Acts.

Mr. A. M. Richardson, Inspector, Diseases in Plants Acts, will be transferred from Stanthorpe to Toowoomba.

Messrs. D. H. G. McIntosh (Tansey, via Goomeri), and H. Irving (Brandon), have been appointed Honorary Rangers under the Animals and Birds Acts.

Commodity Boards.

Regulations have been issued under "*The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1935," "*The Fruit Marketing Organisation Acts*, 1923 *to* 1934," "*The Dairy Products Stabilisation Acts*, 1933 *to* 1936," and "*The Wheat Pool Acts*, 1920 *to* 1930," prescribing the form of receipts and money forms issued in connection with the Council of Agriculture and commodity boards, the Committee of Direction of Fruit Marketing and other bodies, the Dairy Products Stabilisation Board, and the Wheat Board.

Animals and Birds Sanctuary.

Rita Island and the foreshores of the Burdekin River, and Ana Branch, near Ayr, have been declared a sanctuary under the Animals and Birds Acts.

Wandoan Tick Infested Area.

An Order in Council has been issued under the Diseases in Stock Acts declaring an area in the vicinity of Wandoan to be an infested area for the purposes of the Acts. For some years past, this particular country, which extends roughly from Wandoan to Clifford Holding, has been practically free from ticks, and stockowners in the area attempted to keep their stock tick-free. It is understood that the area is now thoroughly fenced, and by declaring it to be an effected area, stockowners will be protected as cattle will not be allowed to enter the infected area until they have been dipped at least twice and found free from ticks. By making this particular section an infected area, it will be an additional safeguard to the clean country on the Downs south of the Main Range.

Atherton Tableland Maize Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, extending the boundaries of the present district in North Queensland in which maize has been declared to be a commodity, namely, the Petty Sessions Districts of Atherton, Herberton, and Chillagoe (as defined at the time of the issue of the Order in Council constituting the Atherton Tableland Maize Board —31st August, 1923) to include all that locality which is contiguous to and is distant not more than fifty miles from a boundary of the said Petty Sessions Districts, and the Atherton Tableland Maize Board is extended to include the growers of maize in this additional locality.

Rural Topics

Entire Corn Cob as Stock Food.

The maize cob core has a very low feed value, and is digested with difficulty by animals, owing to its rubber-like consistency. In fact, if the cob core is not finely ground, animals will refuse to eat it, and if means for the grinding of the core are not available the feeding of the cob core with the corn grain is not advisable.

The grinding of the cob core requires considerable power and, therefore, cost of grinding has to be taken into consideration. The digestible crude protein content of the corn cob core is about 0.4 per cent., whereas the quantity of digestible crude protein in the corn grain ranges from 6 to 8 per cent. When the whole cob (core and grain) is ground to form what is called corn and cob meal the digestible crude protein of this meal will be considerably lower than that of the corn grain; the corn and cob meal may contain from 3.75 to 6 per cent. digestible protein. This variation in the digestible crude protein of the corn and cob meal is due to the fact that in different varieties of maize the proportion of core to grain ranges from 20 to 40 per cent.

In connection with the foregoing, it is considered that if there is a shortage of cheap roughage the grinding of the core of the cob with the grain will be of advantage; but when there is an abundance of roughage (hay, grass roughage, &c.) and an addition of concentrates (maize, &c.) is required to make a balanced ration with such roughage, it is then inadvisable to grind the core of the cob with the grain.—E. H. GURNEY, Agricultural Chemist.

Brigalow Foliage as Fodder.

Brigalow foliage, other than young shoots, has never been regarded as of value for stock in times of shortage owing to its unpalatability. There is, however, a variety which has not been separated botanically and which is not only acceptable to stock, but suggests, on analysis, a fodder value superior to that of mulga. This variety differs from the ordinary brigalow in leaf characteristics only. Its leaves are narrower and longer, and light green rather than silvery in colour. It occurs here and there in pure brigalow stands, as well as when the brigalow is interspersed with belah, but is thought to be more common in stands of less density where eucalypts also occur.

A sample for analysis was obtained at Chinchilla, close to the Condamine River. The analysis of mulga foliage is given for comparison, both being of water-free material:—

	Narrow-leaved Brigalow.	Mulga.
	Per cent.	Per cent.
Protein	13.9	11.1
Carbohydrates	54.6	55.9
Fat	2.5	3.2
Fibre	24.1	25.4
Ash	4.9	4.4

N. A. R. POLLOCK, Senior Instructor in Agriculture.

Essentials in Dairy Farm Lay Out.

There are two necessary adjuncts to a dairy farm which are often looked for in vain, namely, a crush and an isolation paddock.

A crush is necessary for the handling of bulls and young stock, but only a few farms are equipped with one.

An isolation paddock is a most necessary feature, but is conspicuous by its absence on nearly every dairy farm.

How many diseases could be checked if a farmer had a good isolation paddock in which he could place and watch a suspected animal, without any danger of the animal coming into contact with the rest of the herd?—S. E. PEGG, Inspector of Dairies.

Giant Setaria—An Attractive Crop.

The attention of farmers is once more called to the fact that certain crops offer attractive possibilities, and can be raised rapidly and at little cost, coincident with a change to normal seasonal conditions. At present *Setaria italica*, or so-called panicum seed, and preferably the giant variety, is proving an attractive crop for farmers who have land already prepared for sowing. The present price, *e.g.*, from £22 to £25 per ton, is very attractive, but naturally will recede as harvesting operations commence.

This is a crop which can be sown, with safety, up to the middle of January and probably even later, where suitable conditions obtain. The requirements of the Commonwealth, it is understood, for this class of grain are in the vicinity of 2,500 tons per annum.—A. E. GIBSON, Director of Agriculture.

Cream Supplies during Summer.

During the summer months when extreme heat conditions are common the necessity should be stressed for frequent and early deliveries of cream supplies to butter factories. Daily delivery of cream to the factories is an ideal difficult to attain in certain areas, but nothing less than four times a week delivery should be the rule from October to March, inclusive.

The practice of holding up supplies and delaying the cream carrier for the purpose of making certain that that morning's cream goes with the supply of cream obtained previously, should be discouraged. More harm than good is sometimes done to the cream supply through the practice of mixing the newly produced warm cream with the older and cooler cream. This practice is not infrequently the cause of cream being graded down on delivery at the factory platform.

Dairymen would be well advised to have their cream ready for the cream carrier on each morning of delivery. Should the morning's cream not be cooled down and ready on time, that particular cream should be held back for the next delivery, and, if this is done, better results will be obtained on arrival at the factory.

It has been reported that a number of dairymen make a practice of holding up the cream carrier for the purpose abovementioned, and even were this not detrimental to their own cream supply it is a selfish attitude to take up, in so far as neighbouring dairymen are concerned who desire their cream to arrive at the factory as early as possible.

With the advent of summer, the attention of all dairymen is directed to the necessity of supplying a cream with a butterfat content of not less than 38 per cent.

A sound slogan for all cream suppliers during the summer is: "Frequent and early delivery and test around forty."—A. HASSACK, Inspector of Dairies.

Sugar-Cane Varieties for Southern Queensland.

Those growers who have not yet experienced the benefits from growing the new gum-resistant canes, which have recently become so popular in Southern Queensland, are urged to include some in their present planting. The results from all trials harvested to date indicate that Co. 290 will far outyield all other varieties on practically all types of soil. It generally gives a fair c.c.s. value, while at times very good returns are reported. On damp alluvial lands it tends to maintain continuous growth, and with an "open" winter, heavy cane tonnages with low c.c.s. might result. Such conditions constitute but a small proportion of the lands on which the variety could be planted.

For all-round performance, P.O.J. 2878 is strongly to be recommended. For vigour of growth and drought resistance, it definitely excels, and as a standard cane it has no equal. This is a most important feature, as it enables the Southern grower, on frost-free areas, to revert to the "two-year cropping" methods, which were so popular before gumming disease took its toll, and which enable the grower to effect such a substantial lowering of costs of production. In these times, when excessively large crops demand that a proportion of the cane be stood over, no cane responds so satisfactorily in its second year of growth as a ratoon crop of this variety.

P.O.J. 2725 is a cane which has shown remarkable yields where moisture conditions are suitable, and it is definitely a valuable cane for irrigated land. Near the coast, it exhibits an unfortunate tendency to arrow early, which is a detriment if the farmer is obliged to standover the crop.—A. F. BELL, Bureau of Sugar Experiment Stations.

Orchard Notes

MARCH.

THE COASTAL DISTRICTS.

IF the weather is favourable, all orchards, plantations, and vineyards should be cleaned up, and the ground brought into a good state of tilth so as to enable it to retain the necessary moisture for the proper development of trees or plants. As the wet season is frequently followed by dry autumn weather, this attention is important.

Banana plantations must be kept free from weeds, and suckering must be rigorously carried out, as there is no greater cause of injury to a banana plantation than neglect to cultivate. Good strong suckers will give good bunches of good fruit, whereas a lot of weedy overcrowded suckers will only give small bunches of undersized fruit that is hard to dispose of, even at a low price.

Cooler weather may tend to improve the carrying qualities of the fruit, but care must still be taken to see that it is not allowed to become over-developed before it is packed, otherwise it may arrive at its destination in an over-ripe and consequently unsaleable condition. The greatest care should be taken in grading and packing fruit. Only one size of fruit of even quality must be packed. Smaller or inferior fruit must never be packed with good large fruit, but must always be packed separately as required by regulation.

During recent weeks there has been a marked increase in the banana thrips population in those districts in which this pest is well established. Growers who consider it necessary to deal with banana thrips are advised that so far nicotine dusts applied at weekly intervals have given the most promising results. The dusts may be applied by means of an inexpensive hand dust gun, or by a rotary duster to which a special flexible outlet pipe has been fitted.

The marketing of the main crop of pineapples, both for canning and the fresh fruit trade, will be completed in the course of the month, and as soon as the fruit is disposed of plantations, which are apt to become somewhat dirty during the gathering of the crop, must be cleaned up. All weeds must be destroyed, and if blady grass has got hold anywhere it must be eradicated, even though a number of pineapple plants have to be sacrificed, for once a plantation becomes infested with this weed it takes possession and soon kills the crop. In addition to destroying all weed growth, the land should be well worked and brought into a state of thorough tilth.

In the Central and Northern districts, early varieties of the main crop of citrus fruits will ripen towards the end of the month. They will not be fully coloured, but they can be marketed as soon as they have developed sufficient sugar to be palatable; they should not be gathered whilst still sour and green.

As blue mould is likely to cause heavy loss in coastal citrus, especially in long distance consignments, special precautions should be taken for minimising this loss. It must be remembered that the blue mould fungus will only attack bruised or wounded fruit. Hence it is necessary to be careful that no injuries are given by the clippers or finger nails during picking. Fruit should be cut and not pulled. Long stalks which may injure other fruit must be avoided.

The fruit must be carefully handled and accurately packed so as to avoid bruising. Any injured fruit should be discarded. In order to reduce the number of fungus spores present in the plantation all waste fruit in the orchard or packing shed should be collected at frequent intervals and destroyed by fire or burying.

Fruit must be carefully graded for size and colour, and only one size of fruit of one quality should be packed in one case. The flat bushel-case (long packer) commonly used for citrus fruits does not lend itself to up-to-date methods of grading and packing, and we have yet to find a better case than the American orange case. Failing this case, a bushel-case suggested by the New South Wales Department of Agriculture is the most suitable for citrus fruits, and were it adopted it would be a simple matter to standardise the grades of our citrus fruit, as has been done in respect to apples packed in the standard bushel-case used generally for apples throughout the Commonwealth. The inside measurements of the case suggested are 18 in. long, 11¾ in. wide, and 10½ in. deep. This case has a capacity of 2,200 cubic inches, but is not included in the schedule of the regulations under "*The Fruit Cases Acts*, 1912-1922." The half-bushel case, No. 6 of the Schedule above referred to, is

10 in. by 11¾ in. by 5¼ in. inside measurements with a capacity of 1,100 cubic inches. The case should be suitable for oranges and the half-case for mandarins. No matter which case is used, the fruit must be sweated for seven days before it is sent to the Southern markets, in order to determine what fruit has been attacked by fruit fly, and also to enable bruised or injured fruit liable to blue mould to be removed prior to despatch.

Growers are reminded that the control of the bronze orange bug is best achieved by spraying with the resin-caustic soda-fish oil mixture normally either late in March or early in April. Applied at this time of the year the spray can give a mortality of 98 per cent. of the bronze bugs, which are then present solely in the very young stages. This spray is also very effective against several of the important scale insects infesting citrus.

Red scale is a pest to which citrus growers will shortly have to give attention, it being considered that control is best established from the middle of March to early in April. Fumigation with hydrocyanic acid gas is most effective against red scale, but success may also be achieved with white oils or with the resin-caustic soda-fish oil mixture evolved for the control of the bronze orange bug. Red scale, of course, is pre-eminently a pest of the hotter drier citrus districts.

Strawberry planting may be continued during the month, and the advice given in last month's notes still holds good. Remember that no crop gives a better return for extra care and attention in the preparation of the land and for generous manuring than the strawberry.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE advice given in these notes for the last few months regarding the handling, grading, and packing of fruit should still be followed carefully. The later varieties of apples and other fruits are much better keepers than earlier-ripening sorts, and as they can be sent to comparatively distant markets, the necessity for very careful grading and packing is, if anything, greater than it is in the case of fruit sent to nearby markets for immediate consumption. Instruction in the most up-to-date methods of grading and packing fruit has been published by the Department, which advice and instruction should enable the growers in that district to market their produce in a much more attractive form.

The same care is necessary in the packing of grapes. Those who are not expert cannot do better than follow the methods of the most successful packers.

As soon as the crop of fruit has been disposed of, the orchard should be cleaned up, and the land worked. If this is done, many of the fruit-fly pupæ that are in the soil will be exposed to destruction in large numbers by birds, or by ants and other insects. If the ground is not worked and is covered with weed growth, there is little chance of the pupæ being destroyed.

Where citrus trees show signs of the want of water, they should be given an irrigation during the month, but if the fruit is well developed and approaching the ripening stage, it is not advisable to do more than keep the ground in a thorough state of tilth, unless the trees are suffering badly, as too much moisture is apt to produce a large, puffy fruit of poor quality and a bad shipper. A light watering is therefore all that is necessary in this case, especially if the orchard has been given the attention recommended in these notes from month to month.

Farm Notes

MARCH.

LAND on which it is intended to plant winter cereals should be in a forward stage of preparation. Sowings of lucerne may be made at the latter end of the month on land which is free from weed growth and has been previously well prepared.

The March-April planting season has much in its favour, not the least of which is that weeds will not make such vigorous growth during the succeeding few months, and, as a consequence, the young lucerne plants will have an excellent opportunity of becoming well established.

Seed wheat should be treated with copper carbonate for the control of bunt. For oats and barley seed the use of formalin or a reliable mercury dust is advisable.

Potato crops should be showing above ground, and should be well cultivated to keep the surface soil in good condition; also to destroy any weed growth.

In districts where the potato crop is subject to Irish blight it is advisable to spray the plants for the control of this disease. Bordeaux mixture of 4.4.40 strength should be applied at least three times at intervals of ten days to a fortnight, commencing when the plants are about six weeks old.

Maize crops which have fully ripened should be picked as soon as possible and the ears stored in well-ventilated corn cribs, or barns. Selected grain which is intended for future seed supplies should be well fumigated for thirty-six hours and subsequently aerated and stored in airtight containers. The germination of the maize is not normally affected by this treatment if dry and mature when treated.

The following crops for pig feed may be sown:—Mangel, sugar beet, turnips and swedes, rape, field cabbage, and carrots. Owing to the small nature of the seeds, the land should be worked up to a fine tilth before planting, and should contain ample moisture in the surface soil to ensure a good germination. Particular attention should be paid to all weed growth during the early stages of growth of the young plants.

As regular supplies of succulent fodder are essentials of success in dairying operations, consideration should be given to a definite cropping system throughout the autumn and winter, and to the preparation and manuring of the land well in advance of the periods allotted for the successive sowings of seed.

The early-planted cotton crops should be now ready for picking. This should not be done while there is any moisture on the bolls, either from showers or dew. Packed cotton showing any trace of dampness should be exposed to the sun for a few hours on tarpaulins, bags, or hessian sheets, before storage in bulk or bagging or baling for ginning. Sowings of prairie grass and *Phalaris bulbosa* (Toowoomba canary grass) may be made this month. Both are excellent winter grasses. Prairie grass does particularly well on scrub soil.

Dairymen who have maize crops which show no promise of returning satisfactory yields of grain would be well advised to convert these into ensilage to be used for winter feed. This, especially when fed in conjunction with lucerne or cowpea, is a valuable fodder. Where crops of Soudan grass, sorghum, white panicum, Japanese millet, and liberty millet have reached a suitable stage for converting into ensilage, it will be found that this method of conserving them has much to recommend it. Stacking with a framework of poles, and well weighting the fodder, is necessary for best results. All stacks should be protected from rain by topping off with a good covering of bush hay built to a full cave and held in position by means of weighted wires.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

MEAN WHAT YOU SAY.

IT is most important that parents should mean what they say in dealing with their children, and that the children should know this. It is worse than useless to allow a child to do something one day and punish him for doing the very same thing next day. How is he to know what to expect? Last week mother did not allow him to play out on the street, but one day the week before she did. Naturally, being a clever, reasonable child, he thinks he will risk it again. Mother may not punish him.

Bribes and threats are wrong means of teaching a child to obey. If you tell a child that you will give him something nice if he does what you ask you are bribing him, and before long you will find he will do nothing unless he gets something out of it.

Very few of the parents who threaten their children mean what they say. A mother may say to her naughty child: "I will ask the policeman to come and take you to gaol." She knows it is not true. At first her threat frightens the child; then he learns that it is not true, and before long he takes no notice. Threats may turn him into a coward; every mother who wants her child to be brave should avoid them. On the other hand, if the threats are never carried out the child may grow indifferent. It is best never to threaten.

Children do not obey people whom they cannot trust, and parents who break promises to their children cannot expect to be trusted or obeyed by their children.

Speak Quietly.

Here is another point. When your child is not obedient do you become angry and raise your voice? That excites the child, and some children like such excitement very much. They will even do things they know are naughty just for the sake of seeing mother lose her temper. If parents can manage not to get angry they will find it much easier to teach their children to be obedient. Loud talking is a strain to listen to, and is bad both for children and for grown-ups. It makes the home noisy; noise makes everyone in the home nervous and irritable. Parents who always speak quietly find that their children will listen to them more willingly.

Be Reasonable.

A toddler's doings, which seem so trivial to many grown-ups, are really very important indeed to him; and the things that grown-ups think so very important mean nothing at all to him. He does not think, for example, it is important to give up his play and come to dinner as soon as he is called.

It is a good plan to allow the child a few minutes to finish what he is doing before you expect him to obey a command. Let him have five minutes' grace before mealtime and before bedtime, for instance. There are some things little children really cannot do, and yet they are often asked to do them—for instance, to sit still for a long time, to keep from making a noise for a long time. It is not fair to expect little children to do these things, which adults can, of course, do quite easily. The child's muscles are too busy growing to allow him to sit still for a long time. They need constant exercise—by wriggling and other means which sometimes annoy tired mothers—in order to grow. Only an adult, whose muscles have reached their final stage of growth, can discipline his muscles so that he can sit still for a long time. And making a noise is a part of the business of growing. The toddler's chattering and shouting are just as important to healthy growth as is the lusty crying of the healthy infant.

It is not really hard to teach a child to obey the first time you speak if you always speak quietly, never angrily; if you let the child find by experience that everything is pleasant when he takes notice quickly but not so pleasant if he does not obey. When the little child is good and obedient it is right for mother to show that she is pleased to allow some little treat.

Teach Children to Think for Themselves.

If people are to be happy when they grow up they must have learned to obey certain rules when they were children; but they must have learned to think for themselves. Children must be taught to think for themselves what is right for them to do. There are children who never do anything by themselves. They never think for themselves. They have to wait until someone tells them what to do. When they grow up they are very unhappy because they cannot be independent.

Let us teach our children to think for themselves, encourage them when they plan to do things without help, when they attempt to fasten their own shoes, to put on their own socks, to do up their buttons, to wash their faces. They may seem to be getting on very slowly. It takes time to let them make the effort to help themselves, but try to be patient while they accomplish what they are trying to do. Praise them for trying to help themselves. It will be all the better for them if they learn to be independent, and in the long run all the better for mother.

IN THE FARM KITCHEN.

PINEAPPLES FOR SUMMER DISHES.

Following are some recipes which reveal pineapple in a new light:—

Pineapple Meringue.

Take 1 pineapple, ¼ lb. sugar, ½ pint water, 4 oz. crystallised fruits, 4 egg-whites, ½ lb. castor sugar, 6 meringues, 1 tablespoonful sherry, ¼ pint whipped cream, cochineal.

Boil the founr ounces of sugar and the water together till thick syrup, mince crystallised fruit very finely, pour syrup on to fruit, let it get cold, peel pineapple, core the centre, add sherry to syrup, fill pineapple with mixture, putting fruit in centre and syrup last of all. Whip egg-whites very stiffly, add castor sugar, put in a forcing bag with rose pipe, and cover the pineapple with it, stand on a baking sheet in oven until meringue is quite set, then take out and stand on a glass dish, pour remainder of syrup on the fruit in the centre, place in the hole the pineapple-top, neatly trimmed, fill meringues with whipped cream, coloured a delicate pink with a little cochineal, and pour the remainder of the cream round the base of the pineapple and arrange meringues on top.

Pineapple Sponge.

Take half grated pineapple, ½ oz. gelatine, 2 egg-whites, 1 lemon, 2 oz. sugar, ½ pint custard, 1 tablespoonful sherry, crystallised fruits.

Soak the gelatine in about two tablespoonfuls water for one hour, dissolve over hot water with the juice of a lemon and sugar, add the pineapple, and stir all over the gas until thoroughly mixed. Add the sherry, and pour into a basin to slightly set, beat the egg-whites stiffly, and add to the fruit mixture, and whisk till firm. Stand on ice for a little while, then heap on a glass dish; pour custard round and garnish with crystallised fruits.

Pineapple Meringue Pie.

Take 1 ripe pineapple, ½ cupful sugar, 1 cupful thin cream, 3 eggs, pinch salt, 3 tablespoonfuls castor sugar, pastry.

Pare and remove the "eyes" from the pineapple, grate finely. Add the sugar, cream, egg-yolks beaten slightly, and a pinch of salt. Mix all well together and bake in a pie pan, lined with a good pastry, until firm in the centre. Whip the egg-whites very stiffly, and add the castor sugar and mix well. Spread the meringue on pie and return to oven to brown.

Pineapple Tartlets.

Take 1 small pineapple, 2 oz. castor sugar, ½ pint cold water, 3 oz. blanched almonds, 6 oz. shortcrust.

Pare and remove the eyes of the pineapple, then slice and core. Place in a saucepan. Add the sugar and water. Stir till boiling, then simmer for fifteen minutes. Drain, then boil syrup till thick. Cool. Line tartlet tins with shortcrust. Prick with a fork and bake in a hot oven for a quarter of an hour. Place a pine-apple ring in each case. Cover with syrup. Decorate with almonds.

Pineapple Tarts.

Take 1 small pineapple, two-thirds of a cupful of sugar, juice ½ orange, ½ lemon, rind ½ orange, 1 egg-white, 1 tablespoonful castor sugar, pastry.

Pare and grate the pineapple, add the sugar, orange, lemon juice, and the grated orange rind. Cook slowly until mixture thickens. Prepare some small pastry shells, made in small patty-pans. Turn mixture into the pastry shells. Make a meringue with the egg-white and castor sugar, and pile in a pyramid on top of each. Return to the oven to brown delicately.

Pineapple Dainty.

Take 1 tin sliced pineapple, good ½ oz. gelatine, ½ cupful hot water, sugar to taste, some glace cherries, carmine.

Dissolve the gelatine in the hot water. Drain syrup from pineapple; add dissolved gelatine to syrup and water to make one pint of liquid. Add sugar to taste if required. Run a little of the jelly into the bottom of a plain mould, and

when set place a slice of pineapple with a cherry in the centre. Pour over a little more jelly. When this is set, mask the sides of the mould with jelly and decorate with slices of pineapple and cherries. Chop the remainder of the pineapple and add to the jelly; add a few drops of carmine. Whisk well until thick and on the point of setting, then fill the prepared mould till set. Turn out on to a glass dish and serve with whipped cream if liked.

Pineapple Medley.

Take 1 large tin pineapple (sliced), 2 bananas, 1½ oz. almonds, 2 oz. glace cherries, 3 dessertspoonfuls orange juice, ½ oz. gelatine.

Drain the pineapple and put it through the mincer, keeping back three slices for decoration. Blanch and chop the almonds, cut up the cherries, and peel the bananas. Cut them into small dice. Dissolve the gelatine in a saucepan with half a gill of the pineapple juice, warmed, then strain it into the remainder of the juice and add the orange juice. Stir in the minced pineapple and other prepared fruits and almonds, then turn them into a mould which has been rinsed out with cold water. When quite set, unmould the medley and decorate it with whipped cream and the remainder of the pineapple.

Pineapple Lemonade.

Take 1 pineapple, 1 lb. castor sugar, 5 lemons, 3 pints water.

Carefully peel and grate the pineapple. Pour over it the strained juice of the lemons. Boil sugar and one pint of the water for ten minutes, stir syrup into the fruit juices, add one quart of cold water, then strain through fine muslin. Serve in glasses quarter-filled with cracked ice, adding a cherry to each glass.

Pineapple and Melon Jam.

Take 2 lb. pineapple, 4 lb. of the firm part of a sugarmelon, 3 lb. sugar.

Peel and cut into cubes the firm part of the melon. Peel and grate the pineapple with a fork. Put the fruit into a preserving pan and boil for three hours with half of the sugar, add the remainder of the sugar, and boil for one hour longer or until it jells.

Pineapple and Tomato Jam.

Take 3 large pineapples, 7½ lb. tomatoes, sugar.

Peel the pineapples, remove the "eyes" and chop up finely. Put the tomatoes into boiling water, so that the skins come off easily. Put the pineapple and tomatoes into a preserving pan and stew gently till the pineapple is soft. Then add three-quarters of a pound of sugar to each pound of mixture and boil till it is done. Let it cool a little before putting into the jars, which must be warm and perfectly dry.

A LIBRARY FOR COUNTRY PEOPLE.

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RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF DECEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1936 AND 1935, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of Years' Records.	Dec., 1936.	Dec., 1935.		Dec.	No. of Years' Records.	Dec., 1936.	Dec., 1935.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	7·22	35	11·34	1·21	Clermont	3·84	65	3·08	1·73
Cairns	8·74	54	8·95	·62	Gindie	2·82	37	..	2·97
Cardwell	8·21	64	12·22	·53	Springsure	3·26	67	2·20	3·23
Cooktown	6·62	60	7·53	·12					
Herberton	5·72	50	7·57	2·58					
Ingham	6·92	44	12·98	1·04					
Innisfail	11·79	55	16·77	1·36					
Mossman Mill ..	10·31	23	15·04	·70	*Darling Downs.*				
Townsville	5·49	65	7·03	·50					
					Dalby	3·34	66	5·10	5·01
Central Coast.					Emu Vale	3·51	40	3·35	2·40
					Hermitage	2·95	30	..	3·18
Ayr	3·95	49	8·16	·28	Jimbour	3·28	48	5·56	2·92
Bowen	4·38	65	10·29	·37	Miles	3·16	51	3·38	2·56
Charters Towers ..	2·28	54	3·56	·134	Stanthorpe	3·58	63	5·59	3·34
Mackay	7·09	65	10·25	·148	Toowoomba ..	4·43	64	5·91	2·66
Proserpine	7·78	33	8·87	·312	Warwick	3·42	71	5·72	3·55
St. Lawrence ..	4·77	65	3·93	·169					
South Coast.									
Biggenden	4·71	37	5·19	4·58	*Maranoa.*				
Bundaberg	5·15	53	3·01	9·32					
Brisbane	4·94	84	1·80	3·63	Roma	2·54	62	4·96	2·08
Caboolture	5·31	49	1·87	4·47					
Childers	5·70	41	5·12	6·93					
Crohamhurst	7·32	43	2·27	8·30					
Esk	4·75	49	3·43	4·60					
Gayndah	4·22	65	2·96	6·19					
Gympie	6·08	66	3·76	6·57	*State Farms, &c.*				
Kilkivan	4·61	57	2·25	6·45					
Maryborough ..	5·12	65	3·93	5·51	Bungeworgorai ..	3·01	22	6·10	·95
Nambour	6·93	40	1·38	4·97	Gatton College ..	3·75	37	8·69	5·29
Nanango	3·84	54	2·93	2·91	Kairi	6·30	22	..	..
Rockhampton ..	4·85	65	2·64	5·85	Mackay Sugar Experiment Station	8·07	39	10·55	1·66
Woodford	5·64	49	2·18	4·88					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—DECEMBER, 1936.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Means Atmospheric Pressure at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·81	85	77	89	5, 21, 23, 24, 25, 26, 27, 29, 30, 31	73	3, 4	753	16
Herberton	..	81	64	90	2	59	15	705	17
Rockhampton	29·90	88	71	95	3	66	2	264	10
Brisbane	29·95	85	68	95	23	64	5	180	8
Darling Downs.									
Dalby	29·91	88	64	100	2	54	5	510	13
Stanthorpe	..	81	58	95	1	43	5	559	14
Toowoomba	..	83	61	96	2	49	5	591	12
Mid-Interior.									
Georgetown	29·83	93	72	100	22, 23,	67	15	1116	18
Longreach	29·82	98	71	106	23	61	5	128	9
Mitchell	29·86	90	68	101	1, 2, 3, 21	54	5	343	15
Western									
Burketown	29·80	94	76	100	24	65	5	703	11
Boulia	29·78	102	75	109	12, 23	60	5	64	3
Thargomindah	29·80	95	70	106	12	56	5	484	5

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	February, 1937.		March, 1937.		Feb., 1937.	Mar., 1937.
	Rises.	Sets.	Rises.	Sets.	MOONRISE.	MOONRISE.
					p.m.	p.m.
1	5·26	6·47	5·46	6·24	9·49	8·23
2	5·26	6·46	5·46	6·23	10·24	8·59
3	5·27	6·46	5·47	6·23	11·1	9·38
4	5·27	6·45	5·47	6·22	11·42	10·12
5	5·28	6·44	5·48	6 21	..	11·8
					a.m.	
6	5·29	6·44	5·48	6·21	12·27	11·59
						a.m.
7	5·29	6·43	5·49	6·20	1·15	..
8	5·30	6·42	5·49	6·19	2·11	12·54
9	5·31	6·42	5·50	6·18	3·8	1·53
10	5·31	6·41	5·50	6·16	4·10	2·52
11	5·32	6·40	5·51	6·15	5·10	3·54
12	5·33	6·39	5·51	6·14	6·12	4·55
13	5·33	6·39	5·52	6·12	7·14	5·58
14	5·34	6·38	5·52	6·11	8·14	7·1
15	5·35	6·37	5·53	6·10	9·18	8·8
16	5·35	6·37	5·54	6 8	10·21	9·15
17	5·36	6·36	5·54	6·7	11·32	10·22
					p.m.	
18	5 37	6·35	5·55	6·6	12·36	11·27
						p.m.
19	5·37	6·34	5·55	6·5	1·37	12·28
20	5·38	6·33	5·56	6·4	2·30	1·23
21	5·39	6·32	5 56	6·3	3·21	2·11
22	5·39	6·31	5·57	6·2	4·12	2·54
23	5·40	6·30	5·57	6·1	4·54	3·33
24	5·41	6·29	5·58	6·0	5·33	4·8
25	5·42	6·28	5·59	5·59	6·8	4·41
26	5·43	6·27	5·59	5·57	6·41	5·16
27	5·44	6·26	6·0	5·56	7·14	5·49
28	5·45	6·25	6·0	5·54	7.47	6·22
29			6·1	5·53		6·59
30			6·1	5·51		7·36
31			6·2	5·50		8·17

Phases of the Moon, Occultations, &c.

3 Feb.	☽	Last Quarter	10	4 p.m.
11 „	●	New Moon	5	34 p.m.
18 „	☾	First Quarter	1	49 p.m.
25 „	○	Full Moon	5	43 p.m.

Apogee, 3rd February, at 10 p.m.

Perigee, 16th February, at 6 a.m.

The Moon will pass Jupiter on the 8th, Mercury on the 9th, and Saturn on the 13th, but in daylight and below the horizon.

Mercury rises at 3.39 a.m., 49 minutes before the Sun, on the 1st, and sets at 5.10 p.m., 1 hour 25 minutes before it; on the 14th it rises at 3.39 a.m., 1 hour 55 minutes before the Sun, and sets at 5.13 p.m., 1 hour 25 minutes before it.

Venus rises at 9.0 a.m., 3 hours 34 minutes after the Sun, on the 1st, and sets at 9.7 p.m., 2 hours 20 minutes after it; on the 14th it rises at 9.7 a.m., 3 hours 33 minutes after the Sun, and sets at 8.45 p.m., 2 hours 7 minutes after it.

Mars rises at 11.21 p.m. and sets at 12.30 p.m. on the 1st; on the 14th it rises at 10.49 p.m. and sets at 11.59 a.m.

Jupiter rises at 3.17 a.m. and sets at 5.2 p.m. on the 1st; on the 14th it rises at 2.38 a.m. and sets at 4.20 p.m.

Saturn rises at 8.21 a.m. and sets at 8.52 p.m. on the 1st; on the 14th it rises at 7.34 a.m. and sets at 8.38 p.m.

Although in this the shortest month of the year there are but few of the usual phenomena to record, and those not of great public interest, the wonderful display of the Northern constellations will compensate for the loss. Piloted across the sky by the most attractive little star group seen with the naked eye, the Pleiades, are the Hyades, with the red-glowing Aldebaran of Biblical fame, then Orion, in splendid attire, with two stars of first magnitude and five of the second, his belt inlaid "with patines of bright gold," and the short, gleaming sword. The Great Hunter is followed by Canis Major, with Sirius, flashing and scintillating in various colours, larger than any first magnitude star. Across in the south-east Canopus, in Argo, the second in rank among all stars, is most noticeable. Early in evening, when Venus, like a little Sun, lights up the western sky, the Southern Cross will be rising in the south-east, welcomed as warmly in the Southern Hemisphere as the Pleiades are in Northern lands.

5 Mar.	☽	Last Quarter	7	17 p.m.
13 „	●	New Moon	5	32 a.m.
19 „	☾	First Quarter	9	46 p.m.
27 „	○	Full Moon	9	12 a.m.

Apogee, 3rd March, at 6.0 p.m.

Perigee, 15th March, at 1.0 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.