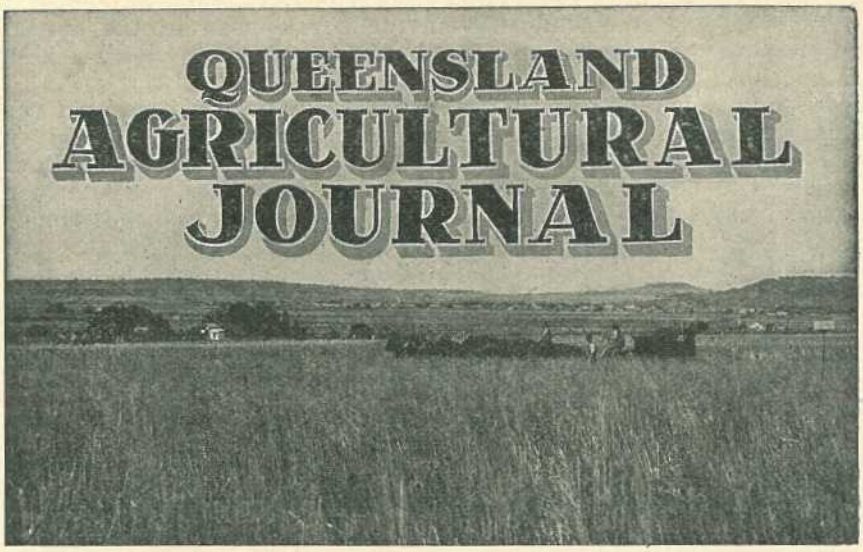
ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten shillings,** including postage.



VOL. XLVI. 1 DECEMBER, 1936. PART 6

Event and Comment

Inauguration of the Faculty of Veterinary Science.

THE official inauguration of the Faculty of Veterinary Science within the University of Queensland, on 29th October, was an occasion of more than ordinary importance. Although the work of the Faculty was initiated at the beginning of March of this year, the inauguration ceremonies were delayed until October on account of the absence abroad of the Premier, Hon. W. Forgan Smith, LL.D. It is the practice of the University to mark the establishment of new faculties with an inaugural oration by the newly appointed professors, and on this occasion a notable address, which is printed in this issue, was delivered by Professor H. R. Seddon, Dean of the Faculty of Veterinary Science.

The Vice-Chancellor of the University, Dr. W. N. Robertson, presided over a large public gathering and in introducing Professor Seddon outlined his career in New Zealand, Victoria, and New South Wales, his association with University and Governmental activities in the field of veterinary science and his record of achievement in veterinary research.

The Minister for Agriculture and Stock, Hon. Frank W. Bulcock, in a brief introductory address stressed the great importance of the animal industries to Queensland, and referring to the wide variety of problems confronting us in those industries, indicated the urgent necessity for more extensive research activities in this State. The ability to meet these responsibilities, he stated, was dependent largely on the availability of highly trained graduates in veterinary science and it was the desire

of the Government that facilities for the training of Queensland students in this field should be made available. He believed that the Faculty of Veterinary Science within the University of Queensland was destined to have an important influence on the development of the animal industries of Queensland, and that it would establish for itself a high status and reputation. The Minister spoke in eulogistic terms of Professor Seddon, stating that his appointment by the Senate of the University gave him (Mr. Bulcock) deep personal pleasure, since many years ago he had come into contact with Dr. Seddon, then in charge of the Glenfield Animal Health Station, New South Wales, and had then dreamed the hope or thought that when a Faculty of Veterinary Science was founded in Queensland Dr. Seddon would be the first Professor of that Faculty. The Minister concluded by stating that through the offices of the Senate of the University he had been able to associate Professor Seddon with the work of the Department of Agriculture and Stock. Professor Seddon had been appointed as Veterinary Adviser within the Department of Agriculture and Stock, and was now engaged in organising the Division of Animal Industry.

At the conclusion of Professor Seddon's address, a vote of thanks was moved by Professor E. G. Goddard, Dean of the Faculty of Agriculture. He congratulated the Minister on the achievement of his desire to see a Faculty of Veterinary Science at the University of Queensland, and paid a tribute to the foresight and purposiveness of the Premier and the Minister in having secured for Queensland and Queenslanders an institution that should be of immense advantage to the State.

Mr. E. F. Sunners, Chairman of the Queensland Meat Industry Board, in supporting Professor Goddard's remarks, spoke of the grand opportunity that now exists for co-operative effort on the part of the Department of Agriculture and Stock, the University, the Queensland Meat Industry Board and the Council for Scientific and Industrial Research.

The Importance of the Veterinary Profession.

IN the course of his second reading speech on the Veterinary Surgeons Bill, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, made some notable references to the importance of veterinary medicine and surgery in the agricultural and pastoral economy of the State. He said:—

"We have established a veterinary school in Queensland, and shall turn out our own veterinarians, and I venture the opinion that the hardships imposed on stockowners who desire to bring stock from New South Wales will be very largely removed, particularly in view of the fact that what appears to be an indication of the standardisation of treatment in respect of pleuro-pneumonia will soon become an accomplished fact.

"There is probably no profession in Australia nor in the world that has made such progress during the last decade as that of the veterinarian. Listening to the inaugural address of Professor Seddon at the ceremony of the establishment of the Faculty of Veterinary Science within our own University, entitled 'Animal Health in Queensland,' I was surprised to learn that in the United States of America there are 10,000

qualified practising veterinarians. That fact is rather significant, as America is apparently the home of the motor-car. It is also remarkable to note that of this number 3,000 are employed by one research organisation. If one research organisation alone in America regards the value of veterinary science as justifying the employment of that number of men, surely we in Queensland can afford to accept our responsibilities in regard to the control of the profession here! . . . .

". . . . There is now a general recognition of the value of stud stock breeding. To-day, people will not take the risks that they were prepared to take a few years ago.. . . I say frankly that if I could provide double the veterinary service that I am able to provide at the present time, that duplicated veterinary service would be fully employed, because there is a recognition on the part of the stockowner that the veterinarian has a definite place in his practice of flock or herd management."

Proposed Commodity Pool Merger.

A SUGGESTION for the consideration of the possibility of marketing farm products more economically was made by Mr. E. Graham (Under Secretary, Department of Agriculture and Stock and Director of Marketing) in the course of his annual report to the Minister (Hon. Frank W. Bulcock), and which was recently presented to Parliament. Mr. Graham said:—

"From the operations of pools over a number of years there emerges the desirability of arranging for the amalgamation of several of the existing pools under one board, and in this connection I commend to the consideration of growers the desirability of the formation of a cereal pool to be constituted under the Primary Producers' Organisation and Marketing Acts and which would function in respect of the marketing of cereals and seeds comprising wheat, canary seed, barley—for which commodities pools are already in existence—and later, possibly maize and setaria (known locally as panicum seed) grown in Southern Queensland.

"These commodities have many features in common, and for the greater part they are produced in the same tract of country, and it is reasonable to surmise that the products would be controlled and marketed more economically by one board and a central organisation than is possible at present, when there are several pool boards operating. No doubt a strong case could be set up in favour of the amalgamation of these and possibly some other pools now functioning as independent entities. An amalgamation would not deprive any particular industry of its prestige, but would pave the way towards improvement in the efficient and economical functioning of the pools. The matter of the coalition of several of the pool boards is thought to be worthy of very careful consideration and, I think, the endorsement of growers. It is to be mentioned that provision exists under the Primary Producers' Organisation and Marketing Acts to enable the boards to effect amalgamation.

"The principal factors in carrying the amalgamation into fruition would be the agreement of the growers as to the advisability of such action, and the preparedness of the boards to appreciate that the amalgamation may be necessary in the best interests of the industries concerned; and that these interests should be regarded as of paramount importance, while the preservation of the identity of any particular board should be made a matter of secondary consideration."

The Cotton Web-spinner.

W. J. S. SLOAN, B.Sc.Agr., Assistant Entomologist.

THE cotton web-spinner, *Loxostege affinitalis* Led., was first observed in the Callide Valley five years ago. Until the close of the last season, however, the damaged plants have normally been weeds, though occasionally cotton stands have been lightly affected. In the 1932-33 season, T. H. Strong, who was then on the entomological staff of this Department, reported light attacks of the pest on cotton from invading larvæ which had bred up on nearby weed host plants in November and February. In the 1935-36 season, however, quite serious losses of seedling cotton were experienced as a result of the abnormal population of the pest which developed in several districts. Two very distinct broods of larvæ occurred—one in the first half of October, 1935, and one at the end of January and in early February, 1936. Due to irregular weather conditions prevailing during the 1935-36 cotton season, the crop was spread over a number of plantings, so that seedling cotton was present at the time of each heavy brood.

Distribution in Cotton Districts and Elsewhere.

The first outbreak of the pest in the 1935-36 season was confined mainly to the Callide and Dawson Valleys, with the exception of a small infestation in a field of cotton at Mundubbera. With the second distinct brood, heavy larval populations also occurred in the Upper Burnett.

A small number of records of this insect, in addition to the one already mentioned, have been accumulated in past years, and these indicate a wide distribution in the State. The records are as follows:—On potato at Gatton, September, 1931, H. Hacker; on cotton at Valentine Plains, near Biloela, November, 1933, T. H. Strong; on tobacco at Mareeba, December, 1934, J. H. Smith.

The infestation during the summer of this year was evidently very widespread. Officers of the Commonwealth Prickly-pear Board bred the species from a number of sources, and A. P. Dodd, the officer in charge of the scientific work of the Board, kindly made the records available. Plants including Bathurst burr (*Xanthium spinosum*), galvanised burr (*Bassia burchii*), roly poly (*Salsola kali*), *Chenopodium cristatum*, and *Solanum* sp. were infested in the Yalleroi district of the Central-West in February; herbage was infested at Clermont and at Blythedale near Roma during the summer months, while the insect was bred from herbage at Goondiwindi in May, 1936.

A report of injury to saltbush in the Roma district during April was investigated by J. A. Weddell, who found that extensive damage was caused by caterpillars that later proved to be this species. The plants affected included the common saltbush of the district, *Atriplex muelleri*, another species of saltbush, *Atriplex* sp., *Chenopodium* sp., pigweed, Bathurst burr, and *Bassia echinopsila*. Grasses were unaffected. The caterpillars were first noticed on the saltbush about the end of January and the infestation continued during February, the following generation occurring during April. The infestation on the saltbush was of some importance as this plant represented a valuable reserve for winter feed.

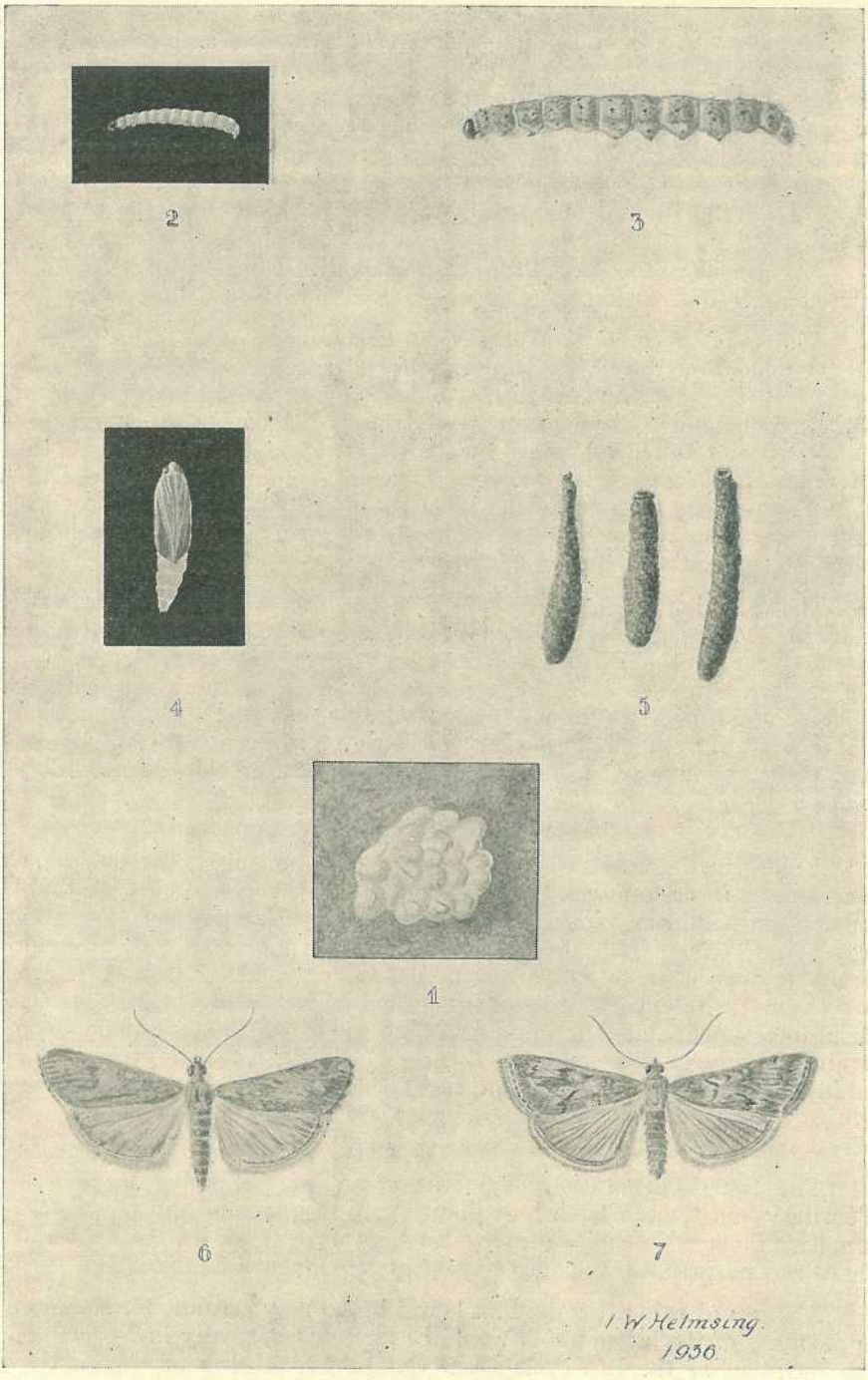


Plate 311.

COTTON WEB-SPINNER (*Loxostege affinitalis* Led.).—Fig. 1.—Egg mass x 10. Fig. 2.—Young larva x 2. Fig. 3.—Fully-grown larva x 2. Fig. 4.—Pupa x 2. Fig. 5.—Earthen tunnels, natural size. Fig 6.—Adult male x 2. Fig. 7—Adult female x 2.

Host Plants.

Numerous weeds and crops such as cotton, maize, and lucerne were readily attacked by the pest in the outbreak in the cotton districts. Among particularly favoured weed hosts were the following:—Red pigweed (*Portulaca oleracea*), black pigweed (*Trianthema portulacastrum*), hogweed (*Trianthema decandra*), roly poly, Bathurst burr, and various species of *Amarantaceæ* and *Chenopodiaceæ*. Even hardened unattractive galvanised burr was attacked by the larvæ of the October brood.

Lucerne was the only crop on which direct laying of eggs took place, maize and cotton suffering loss from larval invasions only.

The weed host relationships were particularly interesting. With the October brood of larvæ Bathurst burr, creeping saltbush, and roly poly were specially favoured host plants, and in a number of cases in the Dawson and Callide Valleys patches of burr were completely defoliated and destroyed. With the January-February brood, despite the presence of fresh, growing Bathurst burr, not one larval specimen of the cotton web-spinner was collected from it. Roly poly was still favoured, and along with it the main weed hosts were red and black pigweeds, hogweed, and several species of *Amarantaceæ*.

The variation in host preference as between these two broods was very marked. The reason for the distinct difference in selection of weed hosts is not clear, but climatic conditions may have had some bearing on the matter. In each case the brood appeared when there was a fresh flush of weed growth following on good rains, but in the second period the amount of rain was larger, the period over which it fell was longer, and the maximum and minimum daily temperatures were considerably higher.

Probable Cause of the Outbreaks.

Following on good winter and early spring rains, there was an emergence of cotton web-spinning moths in the grasslands and old cultivation paddocks, numerous enough to annoy horses when ploughing was being done. With the plentiful fresh weed growth then present, heavy layings of eggs took place in September, and by October larvæ were very prevalent. The long dry period of November and December then intervened and few adults and no larvæ of the pest were seen again, until large numbers of moths emerged just a few days after the middle of January following on the good rains which fell from the 7th to the 14th of that month. Egg-laying again took place and large larval populations appeared.

The fourth generation of moths appeared about the middle of February and though fresh host plants were in quantity and moths laid some fertile eggs in the laboratory, no eggs were found in the field and there was no reappearance of the pest in subsequent months.

Absence of rain after the first larval brood may account for the non-appearance of the larvæ which would be expected normally in November, the duration of the life cycle from egg to pupa being approximately four weeks in summer. With the January-February brood the moths did reappear in the field in large numbers, but no further egg-laying was observed.

The outstanding climatic factors which may have had some bearing on the absence of a further observed laying of eggs in February, 1936, were—

(1) An unusually heavy fall of rain which occurred about the time of the peak emergence of the moths in mid-February; and

(2) A hot dry spell which set in immediately afterwards and was unbroken until the first week of March.

Nature and Extent of Injury.

With the weeds (Plate 314) the main injury consisted of defoliation of the plant, and where the larvæ were plentiful stems were eaten also. As mentioned previously, the October generation of larvæ was responsible for the destruction of quite an amount of Bathurst burr, but generally the attack on the weeds did not kill them. The pigweeds, hogweed, and other plants, though frequently carrying heavy populations of the larvæ, were able to seed and with the first good rains came away in a fresh mass of growth. In many cases the amount of seed actually produced was decreased, but this is not a significant factor in view of the large quantity which matures. Hence for the cotton web-spinner to be of any value in controlling these weeds, the feeding period would have to be longer or the number of broods larger and more consistently reproduced.

Eggs are laid on the tips of lucerne shoots and the young larva feeds on the tender leaves, at the same time spinning a web. By the time the larva is full grown the leaves of the lucerne shoot have become webbed together to form a tunnel within which the larva lives and eats the plant tissue. Thus the top leaves become skeletonised and bound together with a web which is cluttered with fæces. The yield of a lucerne field affected in this manner is considerably reduced, and the resulting hay is of poor quality.

Cotton and maize fields suffered from invasions of the larvæ from neighbouring breeding sources, and maize seedlings were defoliated and sometimes destroyed.

Invasions were of two types—firstly, external from weed and economic hosts, and secondly, internal from weed hosts.

The external invasions may be caused by a drying out of host plants with a consequent shortage of food such as occurred with the October brood, or abnormally heavy populations resulting in a concentration of predators and parasites causing irritation of the larvæ, or by the mechanical disturbance of the host plants.

The cotton web-spinner was associated on several occasions with the larvæ of the corn ear worm, *Heliothis obsoleta* Fabr., in both weeds and lucerne paddocks, for both favour similar hosts. Where an abnormally heavy population was the cause of migration, the corn ear worm larvæ were usually the first to migrate, but where food shortage was the trouble, both species migrated together. The corn ear worm, being a more active and more voracious feeder, was usually found in the forefront of the migration. Contamination of the host plants with web and fæces where both species were associated in heavy numbers was considered to be one of the significant stimuli in causing the corn ear worm larvæ to migrate first. The third cause of external invasions is the mechanical disturbance

of the host plants such as occurs in cutting a field of lucerne, turning in a herd of cattle to graze, ploughing a field or otherwise disturbing the larvæ, such disturbances resulting in migration.

With regard to internal invasions from weeds within the crop, this usually occurred where a farmer had allowed his cotton fields to become

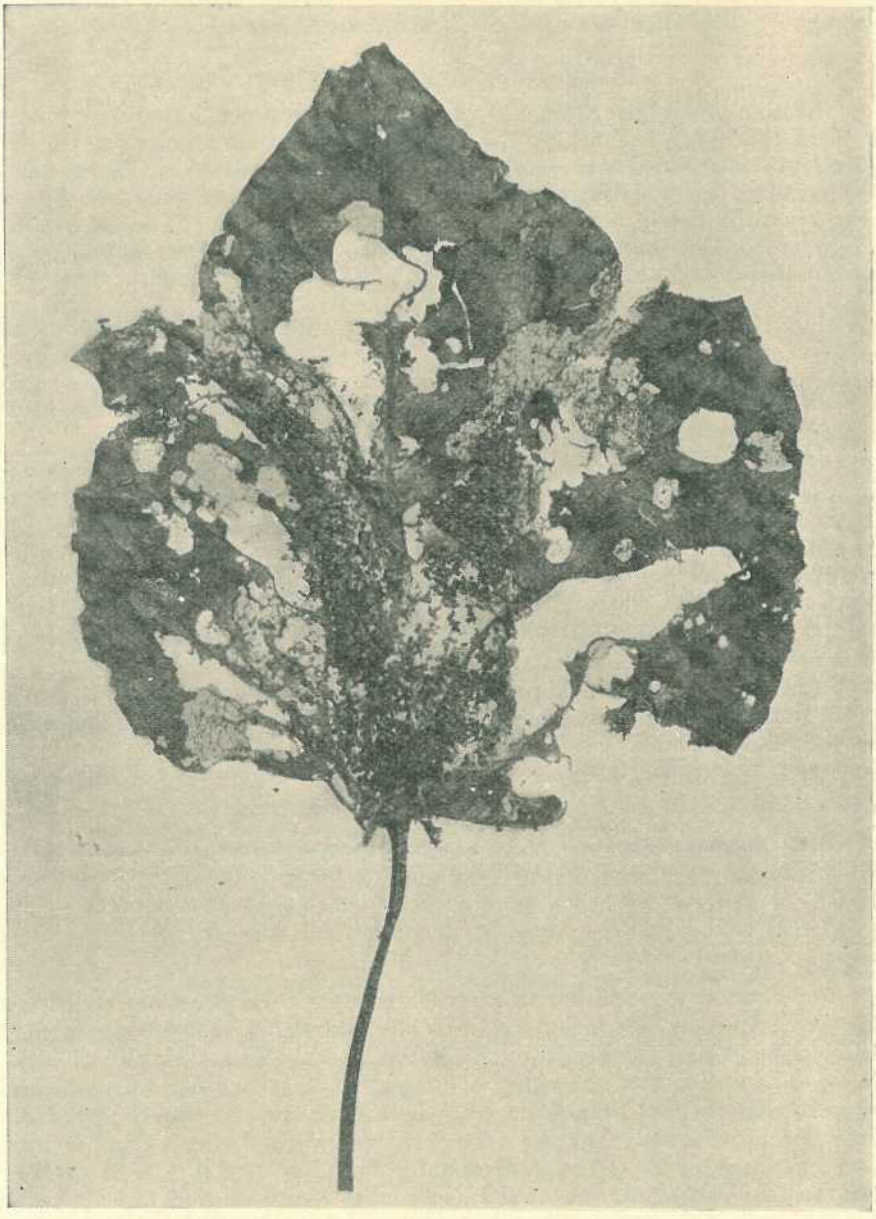


Plate 312.

Cotton leaf showing characteristic damage by larvæ of the cotton web-spinner, *Loxostege affinitalis* Led. Note the webbing and entangled frass.

weedy and then cultivated while the weeds were infested with larvæ. Here again larvæ of both the cotton web-spinner and the corn ear worm were frequently found associated.

Seedling cotton (Plate 313) when invaded was often completely destroyed. In lighter infestations the young plants were defoliated, leaving the central buds more or less untouched. In such cases when fair rain fell within a reasonable period or where the soil moisture content was suitable, the damaged seedlings shot again satisfactorily.

The destruction of seedling cotton was serious because it meant that those farmers who lost cotton stands with the first attack in October were compelled to wait, in a number of instances, until after Christmas before securing sufficient soil moisture to replant. Losses with the January-February brood resulted either in the abandonment of a crop for the season or the planting of a very late crop, which all too frequently was subsequently subjected to severe attacks by other insect pests.

Older cotton, bearing squares, flowers, and bolls, when severely attacked was usually defoliated or the leaves badly skeletonised (Plate 312). Normally the bolls were unaffected, but a few squares and flowers were occasionally slightly chewed. In one instance a plot of eight-weeks-old cotton was attacked after cultivating implements had disturbed the infested weeds, and though plants were old enough to carry squares, quite a few of the attacked plants were killed.

The easily distinguishable characteristic of the attacked parts of a plant was the presence of webbing covered with excreta.

Life History.

Data gathered from the January-February outbreak of the pest indicated that a summer brood was about a month in duration from the appearance of one batch of moths to the next.

Eggs are laid in bundles of up to nine, usually on the tender tips of the host plants, and several bundles may occur on one tip. They hatch in two to four days in summer. The larval life for the same season is about three weeks.

When about to pupate the mature larva, which is active in its movements both backwards and forwards, burrows into the ground to a depth of half to one and a-half inches. In pupating it spins a web on the ground gathering pieces of debris to form a cover over the place where it enters the ground. The sides of the tunnel are lined with a tough web of silk and the tunnels may be removed intact from the soil (Plate 311; fig. 5). The larva forms a typically lepidopterous pupa at the bottom of the tunnel a few days after entering the soil. In summer the moth emerges in approximately seven days after pupation.

Description of Life Cycle Stages.

The irregularly rounded egg (Plate 311; fig 1) is small, light yellow and flat, its height being considerably less than its width. The eggs overlap each other to form a small compact bundle.

The young larva is approximately one twenty-fourth of an inch long, and is hairy with black dots situated at the hair bases. The head and the dorsum of the first thoracic segment are shiny black in colour.

The general body colour of the older larva (Plate 311; fig. 3) is light yellowish green to dark green, being of a darker shade before ecdysis, and lighter immediately after.

The head of the mature larva, which is about three-quarters of an inch long, is black. The first thoracic segment is irregularly marked with black patches, which in the young larva show up as a black plate, unbroken except for a pale-coloured median line. The segment is divided along the middle of the back by this line which is continued along the length of the larva. This is somewhat darker than the main body colour, and is bordered along either side by an irregular pale-coloured margin. A distinct creamy white irregularly shaped line runs along the entire length of the sides from the first thoracic segment.

On the thorax betwen the median and side lines are four black spots on the second and third segments. There are two black spots on the intersegmental membrane, only one being obvious in younger specimens.

On the abdomen between the median and side lines are three black spots triangularly spaced on each segment, but unless viewed by the aid of a lens these appear as one large black patch situated just above the white side line.

A black spot is found between the white line and the legs on the second and third thoracic segments, and each abdominal segment has three, except the segments bearing prolegs, in which case only two spots are present.

On the larva each of the spots forms the base of one or more hairs. Usually only one hair to each spot is found on the abdomen.

The larva is slenderly built and is typically lepidopterous, possessing a pair of legs on each thoracic segment, four pairs of abdominal legs, and a pair of claspers on the hind abdominal segment. The abdomen is composed of ten segments.

When about to pupate or after being kept in the dark, the mature larva loses colour.

The pupa (Plate 311; fig. 4) is not quite half an inch in length and is brown in colour. As a rule the wing buds appear a darker shade of brown than the rest of the pupa. The abdomen is a creamy brown, but its last segment is sometimes more intensely brown.

The moth (Plate 311; figs. 6 and 7) is not a conspicuous insect, and when at rest on the ground or in rubbish is not easily detected. The body length is approximately three-eights of an inch and the wing spread about seven-eights. The forewings of the female are brown in colour, with light and dark markings, and like the fawn-coloured hind wings carry a margin of fine hairs. The forewings of the male are fawn coloured with similarly coloured hind wings. The forewings may have dark markings. Both pair of wings carry a margin of fine hairs. The male is slightly smaller and is less stoutly built than the female.

Natural Enemies of the Cotton Web-spinner.

The larvæ were attacked by numerous predators and parasites, many of which were also active on the larvæ of the corn ear worm. Green ants were very active among the moving swarms, and Ichneumonid, Braconid, and Tachinid parasites were plentiful. In several cases observed the predatory bug, *Oechalia consocialis* Boisd., was responsible for heavy losses among the larvæ.

One or two pupæ were unearthed which were enveloped in a mass of fungus, but this type of mortality was not very common. The feeding of birds on the pests was not noticed to be very plentiful in the cotton districts despite the prevalence of the insects.

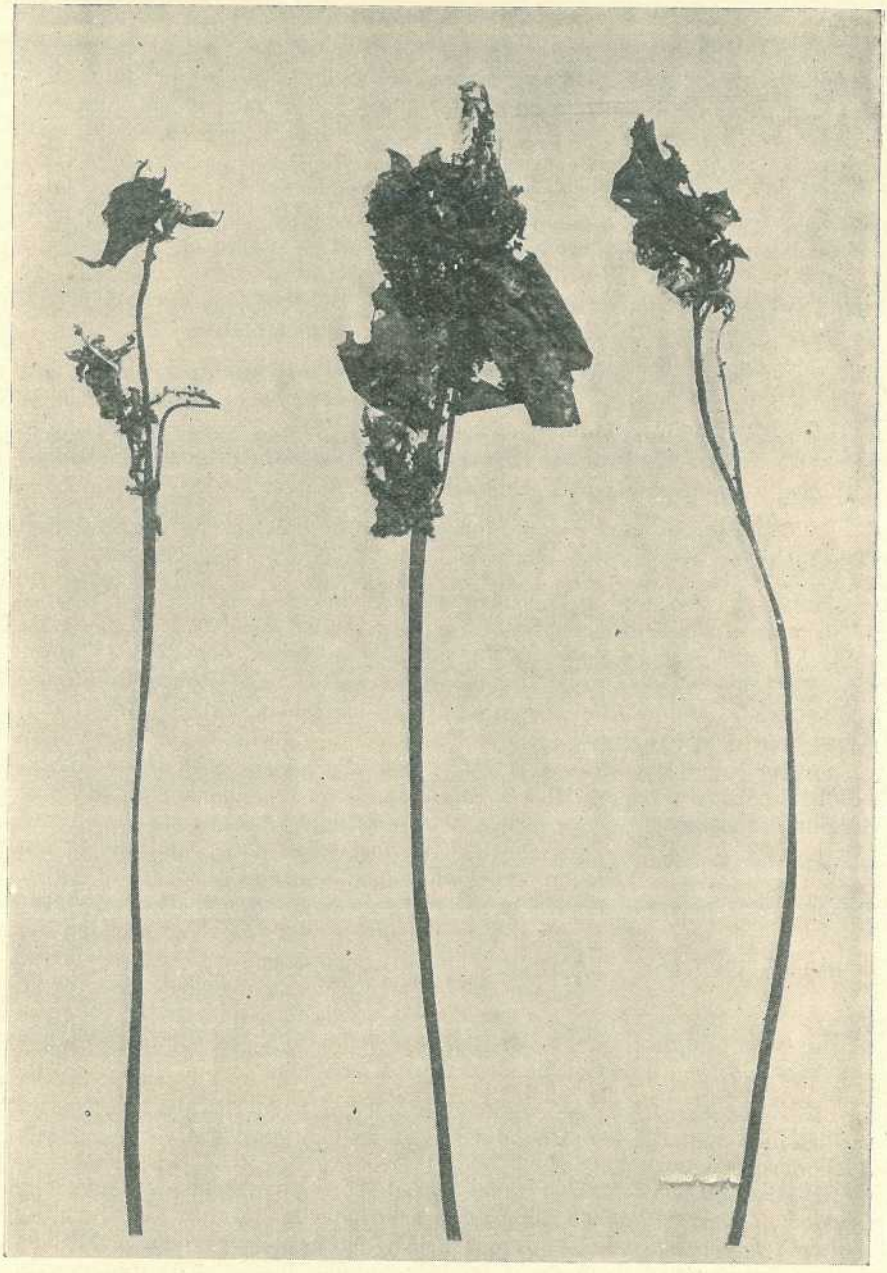


Plate 313.

Cotton seedlings with cotyledonous leaves and growing points injured by larvæ of the cotton web-spinner, *Loxostege affinitalis* Led.

Some very potent environmental control must have been at work on the adults after the last emergence in February, for although trapped moths laid fertile eggs in the laboratory, no eggs were found in the field, and not one larva was seen afterwards, despite the presence of quantities of fresh weed growth.

Control Measures.

A most important factor in the control of the pest is the maintenance of clean fields. If the various weed hosts are allowed to grow and breed larvæ, then any disturbance of the weeds may cause the larvæ to migrate to the crop. Headlands should be kept free of weeds, and crops should not be grown in close proximity to old weedy paddocks as the latter only serve as breeding sources from which the larvæ may later migrate. These two points are similarly very significant in dealing with corn ear worm, and too much emphasis cannot be placed on the need for rigid observance of these precautions. The cotton web-spinner has not been observed laying on cotton, and in all cases of damage due to its activities weed growth was primarily the important factor.

Lucerne, as previously mentioned, was the only cultivated host plant on which direct laying took place, and due to the poisoning risk to cattle it is better to refrain from using any of the poisonous insecticides on such a crop. The best way to treat an affected lucerne field is to cut it immediately the pest is detected in large numbers.

In controlling an invasion in a cotton field both the internal and external types require consideration.

With the internal type, swabbing the affected plants and nearby weeds with a solution prepared according to the formula 1 lb. arsenate of lead, 1 gallon molasses or a 7 lb. tin of treacle, and 6 gallons of water proved highly successful. The solution enables the poison to adhere to the plants, and at the same time attracts the caterpillars, although it is not considered that the power of attraction extends much more than an inch or so. It is unnecessary to cover the plants with the solution, a light sprinkle being all that is required. The solution is flipped on to the plants with a whitewash brush or a bundle of twigs or straw. About 1,000 yards of cotton two months old was done with 3 gallons of the swabbing solution. Dusting with calcium arsenate at the rate of 10 lb. per acre was only about half as effective as swabbing, the latter giving 85 per cent. control 48 hours after application. If the seedlings are less than a fortnight old replanting is usually necessary, as by the time the larvæ have eaten a lethal dose of poison, all the foliage has been destroyed. However, if only a portion of the field is affected, as is usually the case, measures as adopted for treating the external invasion should be taken to prevent larvæ migrating to clean cotton nearby.

With the external type, the well-known method of drawing a furrow and baiting with the usual cutworm bait may be used quite successfully if the migration is located before it enters the cotton, or it may be employed to prevent further spread of the pest in a field only partially invaded. The formula of the bait is as follows:—Twenty-five lb. bran, 2 quarts molasses, and 1 lb Paris green, enough water, about 2 to 2½ gallons, being added to make a friable crumbly mash. The molasses in this case is double the quantity usually recommended because of the hot dry conditions frequently prevailing when the bait is likely to be

used for the purposes under discussion. Generally this bait may be broadcast among and in front of the larvæ or spread in one or more furrows drawn directly across the advance of the invasion.

The use of freshly cut fleshy weeds which are favourite hosts of the insects, dipped in the swabbing solution previously mentioned, and strewn in a long barrier about 6 inches high in front of the advancing

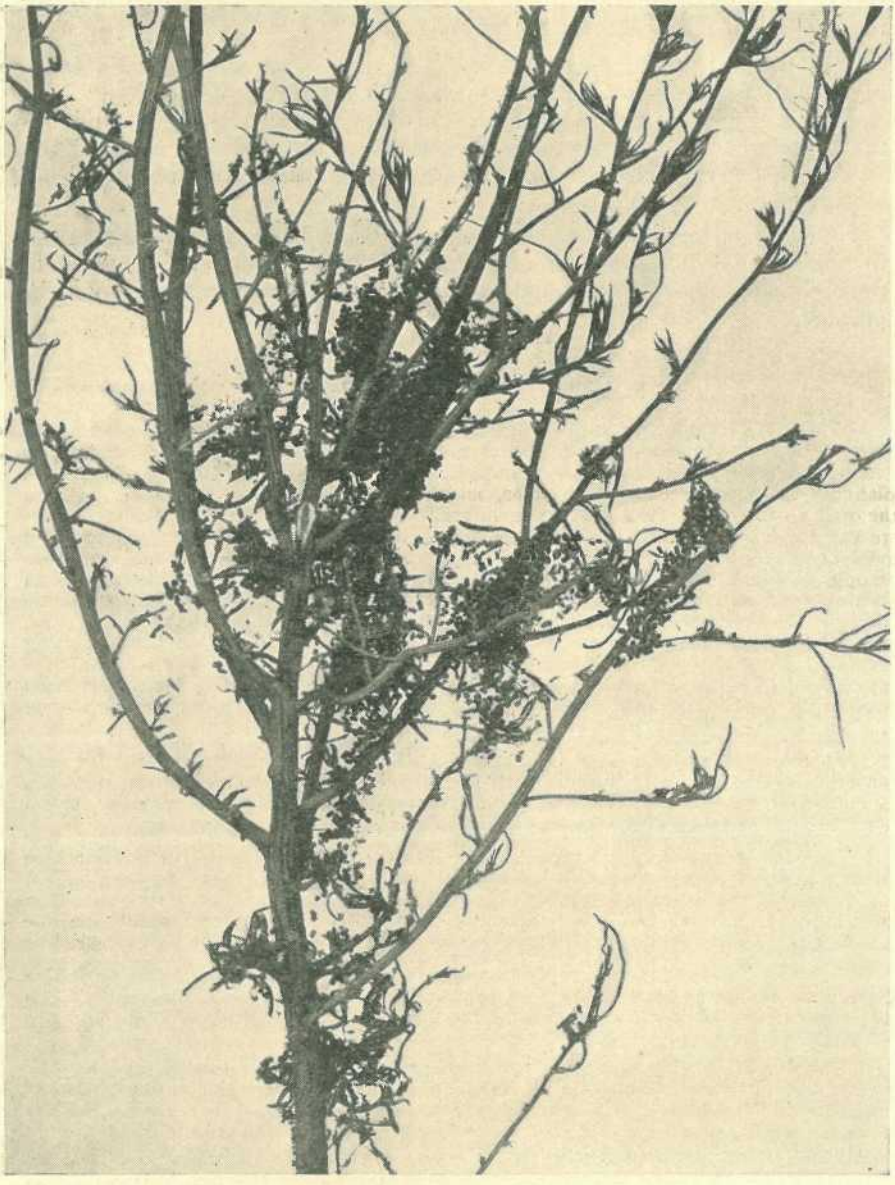


Plate 314.

Typical appearance of roly poly attacked by larvæ of the cotton web-spinner, *Loxostege affinitalis* Led., showing webbing and entangled frass.

larvæ is also recommended. The fleshy weeds keep the bait fresh for a few days, and when the larvæ meet the barrier, not many of them go past it.

As a rule, however, the invasion is not noticed until it is well advanced into the cotton and is causing damage. If the seedlings are young, then replanting may be necessary, but if the bushes are four weeks or older, swabbing of the bushes gives excellent results. Twelve feet in front of the margin of the invasion should also be treated in order to catch any further migrating larvæ.

In preventing the spread of the pest in cotton carrying bolls swabbing with the poisoned molasses solution is highly recommended. It is easy to carry out, produces a high mortality among the larvæ, and has the advantage of cleaning plants when they are infested with caterpillars. In this latter respect, it is much more efficient than the ordinary bran baiting method.

The baits and the swabbing mixture must be used with discretion to ensure that domestic animals and children do not have access to them, because both the arsenate of lead and Paris green are deadly poisons.

POINTS IN HARROWING.

The entire absence of rain during the last few weeks has not been confined to one section of the State, consequently not only are the resultant dry conditions acting adversely upon the winter cereal and other crops already above ground, but are delaying the planting of sugar cane, potatoes, maize, and other staples, as well as preventing the preparation of further areas intended for summer cropping. On holdings where the latter has not already been accomplished, all energies will be concentrated on the carrying out of such work when rain comes, and care should be exercised at the same time in seeing that the loss of soil moisture, which is more or less inevitable to some extent, is reduced to a minimum. This can be accomplished economically and effectively through the use of the tine harrows, running them to and fro over the field in the same direction after the ploughing or other cultural operation has been done at the close of each day's work. On areas which have already received their final preparation, but which for some reason cannot be sown after rain, it is advisable to adopt the same procedure to restore the surface mulch and prevent the loss of moisture.

It must be realised that tine harrows will produce satisfactory results only on friable soils, so should the soil be of a clayey nature and inclined to run together, a cultivator, tined for preference, should be used for stirring the surface, for on such soils it is inimical to the best result if the mulch is made too fine.

Growing crops—such as wheat, oats, barley, and maize—derive considerable benefit through being harrowed during the early stages of their growth, but in all instances the operation should be carried out at right angles to the direction which the crop was sown—that is, across the drills. The harrow should not be allowed to collect rubbish, otherwise many of the young plants will be destroyed.

Growers should not fail to realise that maize is one of the crops on which harrowing can be practised with very beneficial results, although of necessity it can be only carried out during the heat of the day, when the plants are tough and not so likely to suffer injury.

The first harrowing may be given three or four days after sowing, and may be continued until the plants are 6 inches high, resulting in the conservation of moisture and the control of new weed growth, both between and in the rows, thereby reducing scuffling and chipping to a minimum, with a commensurate reduction in production costs.

When the all round benefits accruing from the use of the tine harrows comes to be realised, they will not continue to be the least used implements of a farmer's outfit. They are seen all too frequently propped up carelessly somewhere or lost temporarily in some corner of the cultivation. They should be the most used and highly valued implements in the farm equipment.

Studies on the Biology and Control of the Large Roundworm of Fowls, Ascaridia galli (Schrank 1788) Freeborn 1923.

F. S. H. ROBERTS, D.Sc., Animal Health Station, Yeerongpilly.

[*Continued from p. 601, Part V., Vol. XLVI.—November*, 1936.]

PART VI.

6. THE CONTROL OF ASCARIDIA GALLI.

1. INDIVIDUAL TREATMENT.

(iii.) Field Experiments with Carbontetrachloride.

Experiment 1.

FOR this experiment White Leghorn hens about three years old were employed. Pen 1 of 68 birds was retained as a control, and was at no time interfered with during the course of the trial; pen 3 of 66 birds was given 2 ml. carbontetrachloride following overnight starvation, on the first morning of each of the fourth, seventh, and tenth weeks; pen 2 of 68 birds was on the occasion of each treatment of pen 3 starved overnight, and next morning given 2 ml. water. In this way, it was considered, it might be possible to secure any effects of treatment associated solely with starvation and handling, and thus obtain a more accurate interpretation of any effects following the drug itself.

The egg production (E.P.) and food consumption (F.C.) per bird per week during the period of the trial are given in Table XXVII.

TABLE XXVII.

No. Pen.	No. Birds.	Treatment.	1st Week.		2nd Week.		3rd Week.		*4th Week.		5th Week.		6th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
1	68	Controls	27·0	2·1	25·5	2·3	27·8	2·5	27·0	3·2	26·6	3·5	30·3	3·7
2	68	2 ml. water	26·4	1·5	23·2	1·5	23·7	1·7	26·3	2·3	25·1	2·8	25·8	2·8
3	66	2 ml. CCl_4	28·9	1·8	25·8	1·8	25·7	1·9	26·7	2·3	26·2	2·6	26·4	2·9

No. Pen.	No. Birds.	Treatment.	*7th Week.		8th Week.		9th Week.		*10th Week.		11th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
1 ..	68	Controls	27·3	3·8	27·1	4·3	30·1	4·1	30·3	4·3	30·5	4·5
2 ..	68	2 ml. water	28·0	3·3	25·8	3·7	25·4	4·1	30·8	4·3	31·8	4·5
3 ..	66	2 ml. CCl_4	26·8	3·1	25·2	3·7	25·6	3·8	30·6	3·9	31·2	4·2

* Treated.

Effect of Treatment upon the Infestation.—During the twelfth week, that is, a little over two weeks since the last treatment, 10 birds from each pen were autopsied. A total of 33 worms was collected from pen 1, 30 from pen 2, and 3 from pen 3. These figures indicate that only a light infestation was present during the trial, and that treatment with carbontetrachloride had produced a very marked decrease in the numbers of worms.

Effect of Treatment upon Egg Production.—A consideration of the actual figures of production per bird per week as presented in Graph No. 8 shows firstly that the production of the control birds was highest throughout the whole period of the trial. The production of the birds, which were starved, handled, and given water (pen 2) was at the beginning of the trial lower than that of either the controls or of the

birds given carbontetrachloride, but gradually increased, however, and at the end of the eighth week overtook that of the controls. The production of the birds to which 2 ml. carbontetrachloride (pen 3) had been given, however, never at any time equalled the controls, and at the end of the fourth week was overtaken by that of the birds given water only, whose production, thereafter, in general remained the greater. There is no consistent evidence, however, that the production of Pen 3 during the week in which treatment was applied decreased very markedly. Any immediate effects of treatment on egg production would seem to have been slight, but as a result, the treated birds over the period of the trial did not at any time reach full production.

GRAPH No. 8.

INDIVIDUAL TREATMENT WITH CARBONTETRACHLORIDE. EXPERIMENT 1.

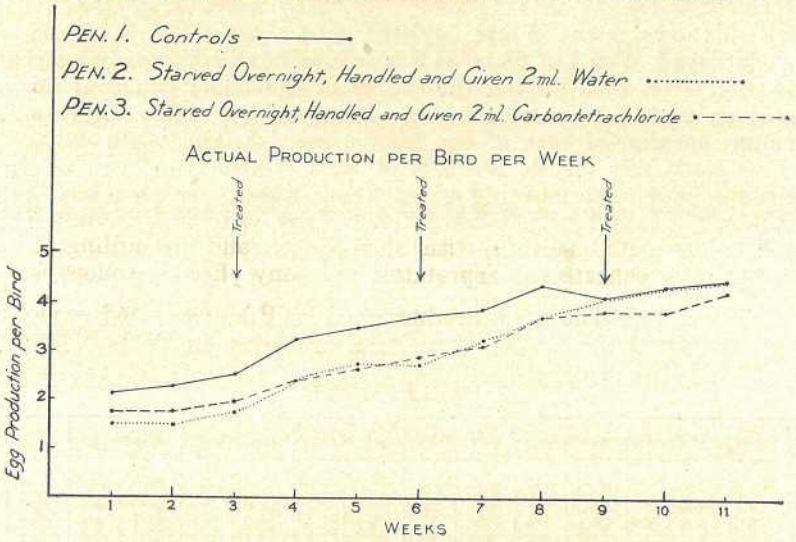


Plate 315.

When the figures of production for the three pens were corrected it was found that, over the eight weeks' period in which treatment was applied, the control pen had produced 56·0 eggs per bird, the pen given water 60.9 eggs per bird, and the pen given carbontetrachloride 52.9 eggs per bird (standard error 1.2). While there is a significant difference between the production of the control pen and of the pen given water, this cannot be regarded as indicating that starvation, handling, and the administration of 2 ml. water are beneficial to production, but it at least denotes that in this case starvation and handling did not decrease production. The difference between the production of the controls and of the birds given carbontetrachloride, whilst not significant, is very nearly so, while the difference between the production of the treated birds and of the birds given water only is highly significant, indicating that under the conditions of the experiment, treatment with 2 ml. carbontetrachloride did have an adverse effect upon production.

Effect of Treatment upon Food Consumption.—Corrected food consumption figures over the eight weeks treatment was applied showed that pen 1 consumed 445·1 oz. per bird, pen 2 463·6 oz. per bird, and pen 3 426·0 oz. per bird (standard error 5·49). The consumptions of

pens 1 and 2 were therefore significantly higher than that of pen 3, which had been treated with carbontetrachloride. There were, however, no significant differences between the consumption of any of the pens in so far as the ratio, food consumed per bird—per dozen eggs produced was concerned, as for every dozen eggs produced, pen 1 consumed 194.13 oz., pen 2, 194·58 oz., and pen 3, 204·36 oz. (standard error 5·34).

Toxicity.—No marked and lasting ill-effects of treatment with 2 ml. carbontetrachloride given per syringe were observed at any time in any of the 66 birds to which this dose was administered. On the occasion of each treatment a few birds appeared temporarily depressed, but recovered very rapidly. The day immediately after treatment was occasionally characterised by a conspicuous decrease in production, but this effect was not consistent.

Experiment 2.

The birds used for this trial were Australorp hens about three years old. Pen 4 of 30 birds was retained as untreated controls. Pen 5 of 31 birds was given 2 ml. carbontetrachloride following starvation overnight, on the first day of the sixth, ninth, and twelfth weeks.

Food consumption (F.C.) and egg production (E.P.) per bird per week during the period of the trial are given in Table XXVIII.

TABLE XXVIII.

No. Pen.	No. Birds.	Treatment.	1st Week.		2nd Week.		3rd Week.		4th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
4 ..	30	Control	..	2·8	..	2·8	32·0	3·2	28·2	2·9
5 ..	31	2 ml. carbontetrachloride ..	..	1·6	..	1·7	31·0	2·2	28·7	2·6

No. Pen.	No. Birds.	Treatment.	5th Week.		*6th Week.		7th Week.		8th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
4 ..	30	Control	30·6	3·0	32·9	2·9	30·3	3·4	33·0	3·5
5 ..	31	2 ml. carbontetrachloride	29·9	2·8	33·6	2·7	29·9	3·0	27·7	3·3

No. Pen.	No. Birds.	Treatment.	*9th Week.		10th Week.		11th Week.		*12th Week.		13th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
4 ..	30	Control	27·0	3·2	31·0	3·6	33·7	3·6	34·0	3·9	33·5	4·0
5 ..	31	2 ml. carbontetrachloride	34·8	2·7	31·2	3·5	29·4	3·4	30·3	3·9	35·4	4·1

* Treatment.

Effect of Treatment upon the Infestation.—This was not determined, as no birds were available for autopsy.

Effect of Treatment upon Production.—The actual weekly production per bird in the treated and control pens over the period of the trial is presented in Graph No. 9. From this graph it will be observed that over the five weeks prior to treatment the production of pen 5 showed a marked and steady increase, and it would appear that the effect of the first treatment was such as to arrest this increase, and that thereafter the subsequent treatments did not permit the production to equal that of the controls till the twelfth week. There is no consistent evidence, however, that production was decreased during the week of treatment such as one might expect to follow from the administration of the drug. There was certainly a decrease following the first and second treatments, but

in these instances a decrease also occurred in the production of the controls, whereas the third treatment was associated with an immediate increase. The corrected figures of total egg production over the period in which treatment was applied, however, showed that the controls produced 24·9 eggs per bird, and the treated pen 29·8 eggs per bird (standard error 1·25). The difference of 4·9 eggs per bird is significant and indicates that treatment was beneficial to this extent.

GRAPH No. 9.

INDIVIDUAL TREATMENT WITH CARBONTETRACHLORIDE. EXPERIMENT 2.

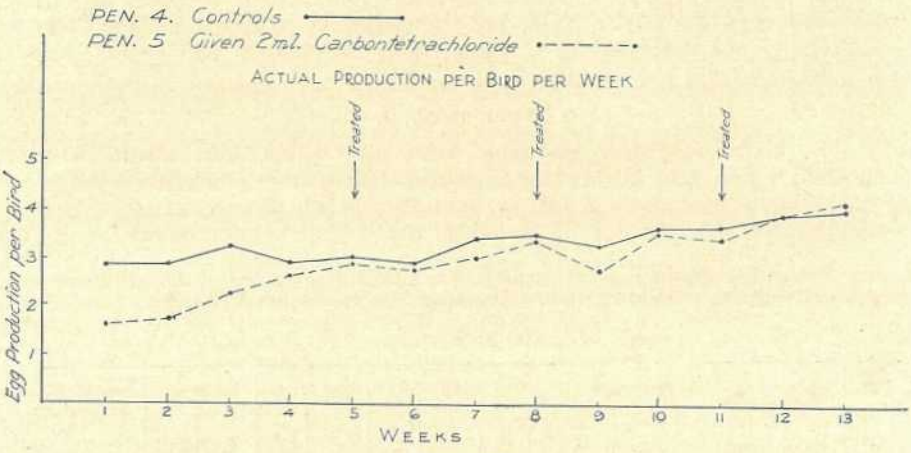


Plate 316.

Effect of Treatment upon Food Consumption.—There was no difference between the food consumption of both pens over the period treatment was undertaken, as each pen consumed 253·8 oz. per bird (corrected figures), but when the amounts of food consumed per bird by each pen to produce a dozen eggs were compared it was found that pen 4 required 123·39 oz., and pen 5 104·13 oz. (standard error 5.97), thus indicating that as a result of treatment the birds consumed significantly less food per egg produced than the untreated birds.

Discussion.

As only a light infestation existed in Experiment 1, and as no evidence was secured of the presence of worms in Experiment 2, the results regarding the effect of treatment upon egg production, etc., as indicated from these two trials, may quite conceivably have a different interpretation when heavily-infested birds are treated. Furthermore, treatment was given at three-weekly intervals and such effects as were instanced here may not be repeated with treatments more widely spaced. The three-weekly interval was selected in view of the recordings in the literature of the harmful effects of treatment upon production, as it was considered that with such frequent treatments any such ill-effects would be exaggerated and thus readily observed.

Where preventive measures are not enforced, the ideal interval between treatments to secure efficient control would be such that the worms would not become sufficiently large or numerous to affect the health of the fowl in any way. Such an interval would also take into

account the maturity period of the worms in grown birds, which is at present unknown. Further experiments in the use of carbontetrachloride in the field are, therefore, desirable, in which heavily-infested birds are employed, and in which the interval between treatments is longer than three weeks.

The interpretations of the results secured from the two experiments described above may be summarised as follows:—

1. Treatment with 2 ml. carbontetrachloride proved very effective against *A. galli.*

2. The starvation and handling accompanying treatment did not in this instance affect the production of White Leghorn hens. This effect was not expected as this breed is generally regarded as being notoriously "temperamental," as a consequence of which production may be affected by unusual circumstances. That no such effects were observed in this case may have been due to the fact that the birds had just recovered from a moult. It is also frequently asserted that during the spring months White Leghorns may be handled with impunity. Further investigation into this point is required with treatments given at various times throughout the year.

3. Over the period of the trial in which treatment was applied, a pen of treated Australorps yielded significantly more eggs than an untreated pen though full production was not reached till the twelfth week of the trial. On the other hand, the production of a pen of treated White Leghorns was less than that of a control, untreated pen, and much less than that of a pen given identical treatment, but with the carbontetrachloride replaced by water. In either experiment there was no marked and consistent decrease in production accompanying treatment as is recorded in the relevant literature, but in the case of the White Leghorns the weekly increase in production was in general smaller than that of the controls, so that at no time did the birds reach full production.

Thus treatment was not very harmful to the production of the Australorps, but was apparently detrimental to that of the White Leghorns. This may have been associated simply yith the physiology of the breeds or it may indicate that the 2 ml. dose of carbontetrachloride as given at three weekly intervals was more readily tolerated by the heavier Australorps.

4. The fact that over the period of the trial the treated White Leghorn pen consumed significantly less food than either the control pen or the pen given water, but that the food consumed per egg produced ratio remained without any significant differences between the three pens, also indicates an intolerance by the treated pen to the treatment employed. The treated and control Australorps, however, consumed practically the same amount of food, but in this case the treated pen consumed a significantly smaller quantity of food for every egg produced than the untreated pen.

2. FLOCK TREATMENT.

(i.) RESUME OF PREVIOUS INVESTIGATIONS.

In 1916 Herms and Beach[65] evolved a flock treatment for the removal of roundworms from poultry which they claimed to be highly efficacious. They recommended that the birds to be treated should be fed one-half the usual evening ration on the day previous to treatment.

They were then to be starved till 2 p.m. the next day, and then given one-half the usual ration to which was added 1 lb. of finely-chopped tobacco stems previously steeped for two hours in sufficient water to cover them, both the chopped-up stems and the liquid being used. This quantity was sufficient for 100 birds. Two hours later the birds were to be given one-fourth the usual ration in which Epsom salts at the rate of 11 oz. for every 100 birds was mixed. The treatment was to be repeated after seven days, and during the feeding of the treated mash care was to be taken that every bird secured its share.

This infusion was tested by Hall and Foster[60] on six chickens. The birds refused to eat all the prepared mash on the first day, and were fed the remainder on the second day. The infusion was mixed with bran, but the birds were at no time eager for it. Unfortunately, no Ascaridia were present in any of the birds treated, but as 30 out of 162 *Heterakis gallinæ* were passed, Hall and Foster were of the opinion that the infusion would also show a degree of efficiency against the large roundworm.

The writer[87] gave this tobacco infusion to 12 birds not exposed to reinfestation, repeating the treatment after ten days, but the number of Ascaridia passed was computed to be only 47 per cent of the total number present.

According to Freeborn[53] the use of commercial tobacco dust as a flock treatment was first introduced by a Californian poultry farmer. It was tested by Dougherty and Beach[48], and satisfactory results were secured from the feeding of a dry mash containing 2 per cent tobacco dust for a period of three weeks. Freeborn[51, 52, 53] reporting on trials carried out by him found that if a dry mash containing 2 per cent. tobacco dust with a 1·5 per cent. to 2 per cent. nicotine content was fed for a period of one month it was 90 per cent. to 100 per cent. effective against *A. galli*, and 80 per cent. to 85 per cent. effective against *H. gallinæ*. He also noted that although treated birds consumed less food than untreated birds, they transformed 9.52 per cent of the food into body weight, whereas untreated birds transformed only 9·33 per cent.

A report by the Missouri Poultry Station[85] indicated that satisfactory results may be obtained from the use of tobacco dust with a nicotine content of only 1 per cent. Hebrant and Liegeois[66] and Kaupp and Dearstyne[71] have also reported favourably on this method of flock treatment. The writer[87] tried a dry mash containing 2 per cent. tobacco dust on 12 birds over a period of three weeks, but only 34 per cent. of the Ascaridia present were estimated to have been removed. The nicotine content of the tobacco dust employed, however, was only ·86 per cent.

Despite very satisfactory laboratory trials, Freeborn[52, 53] found that this method of flock treatment was not always successful when applied in the field. These unfavourable results he considered were due chiefly to the fact that commercial tobacco dust may contain too small a percentage of nicotine or that the prepared mash may be distasteful to some of the birds. He, therefore, endeavoured to use nicotine sulphate as a flock treatment, but his experiments with this drug either in the drinking water or mash showed that when nicotine sulphate was given in sufficient quantities to remove the worms it was both distasteful and toxic. Nicotine sulphate as a flock treatment was also tested by Old and Knox[78]. They found that the highest limits of dilution that could be given in drinking water without toxic effects was 9 ml. in 991 ml. of water.

When mixed with the mash it was possible to increase the amount of the drug to 10 ml. in 990 ml. of water.

Another drug recommended for mixing with the mash as a flock treatment is oil of chenopodium. According to the Californian Experiment Station good results may be secured by mixing this drug with a small quantity of mash at the rate of 1 teaspoonful for every 12 birds. The writer used the mixture on twelve birds[87] and obtained an estimated efficiency of 42 per cent.

(ii.) Laboratory Experiments.

THE ADMINISTRATION OF DRUGS IN DRINKING WATER.

It was felt that as the intake of drinking water varies to a great extent throughout the year and does not, moreover, appear to be associated with age or weight to the same degree as the intake of food, consistent results from any drug administered in this way could not be expected.

The use of a 1-3,000 carbontetrachloride emulsion (Finnemore[49]) for fourteen days, and of 1-5,000 dilutions of copper sulphate and nicotine sulphate respectively for eight days did not give any promising degree of efficiency. A 1-1,500 dilution of nicotine sulphate, however, gave better results. Over a three days period, 10 birds, 24 oz.-37 oz. in weight, given this dilution, passed 19 worms with 75 remaining on autopsy. The trial was not continued longer than three days as a comparison of the water consumption of the treated birds, namely 150 ml. per bird per day, with that of the controls, namely 230 ml. per bird per day*, indicated that the dilution was distasteful.

THE ADMINISTRATION OF DRUGS IN THE MASH.

Carbontetrachloride.

This drug, administered in a small quantity of mash with equal parts of liquid paraffin or in the form of an emulsion (Finnemore[49]), did not give any efficiency for the quantities employed, which were such that each bird would consume 1 ml. of the drug.

Tobacco Dust.

A preliminary test by the writer[87] with a dry mash containing 2 per cent. tobacco dust (·86 per cent. nicotine) fed over a period of three weeks did not give very promising results, due probably to the low nicotine content of the tobacco dust employed. Enquiries have since shown that a commercial tobacco dust containing more than about 1 per cent nicotine is not obtainable in Queensland. An experiment was, therefore, carried out, using 11 birds which were fed 4 per cent. tobacco dust (·81 per cent nicotine) in the mash, thus approaching the amount of nicotine in the treated mash recommended by Freeborn. This mixture proved decidedly distasteful, as at the end of seven days, when the experiment was discontinued, the treated birds had consumed only 1·6 oz. per day per bird as compared with 2·6 oz. per day per bird by the controls.

*Note.—Evaporation, which was the same for both groups, is included in these figures of water consumption.

Nicotine Sulphate (40 per cent. nicotine) and Copper Sulphate.

In the first trial with these two drugs, 10 birds, 22 oz. to 33 oz. in weight, were fed a mash containing ·5 ml. nicotine sulphate* and ·5 gm. copper sulphate in 100 ml. of water per pound. This treated mash was kept constantly before the birds, but was always freshly mixed each day. After a four-day period 64 worms had been passed, the majority of which, namely 42, were voided on the third day. During this period the food consumption of 10 control birds, of similar weights, on untreated mash was 2·7 oz. per day per bird, and that of the treated birds 2·8 oz. per day per bird. On autopsy 40 worms were present, the efficiency of this treatment over the four-day period being, therefore, 61·5 per cent.

In a second experiment a mash containing ·5 ml. nicotine sulphate and 1 gm. copper sulphate in 100 ml. water per pound was employed with 11 birds averaging 27 oz. in weight. At the end of two days feeding 74 worms had been passed. As the food consumption of the treated birds during this period was only 1·9 oz. per day per bird, as compared with 2·8 oz. per day per bird by the controls, and as the droppings of the treated birds had become noticeably hard and scanty in character, the trial was discontinued. On autopsy 71 worms remained, giving an efficiency of 51 per cent. for this mixture with two days' feeding.

Nicotine Sulphate (40 per cent. nicotine).

In these trials a mash containing nicotine sulphate at the rate of ·5 ml. in 150 ml. of water per pound of dry mash was employed. As in the above experiments the treated mash was kept constantly before the birds, and was freshly mixed every day.

(*a*) In the first trial 11 young White Leghorn cockerels, 17 oz. to 26 oz. in weight were used, and the treated mash was fed over a period of eight days. During this period a total of 120 worms were eliminated. As no worms were voided on the ninth day the birds were autopsied, and it was found that 57 worms had survived—an efficiency of 67.8 per cent.

The food consumption of the treated birds over this period was 2.7 oz. per day per bird, and the average gain in weight 5·5 oz. Eleven control birds, 16 oz. to 26 oz. in weight, consumed 2·7 oz. of mash per day per bird and gained in weight 4·5 oz. per bird.

(*b*) In a second experiment, 119 worms were removed from 12 young birds, 19 oz. to 26 oz. in weight over a seven-day period. On autopsy, 43 worms were present, an efficiency of 71·2 per cent.

The food consumption of the treated birds was the same as that of the controls, namely 2·7 oz. per day per bird, and the gain in weight an average of 4·2 oz., as compared with 4·3 oz. by the controls.

(*c*) In this trial seven White Leghorn cocks, 3 lb 5 oz. to 4 lb. 3 oz. in weight, and one pullet, 2 lb. 2 oz. in weight, were given this prepared mash. After seven days 151 worms had been passed, and as no worms had been voided since the fifth day, the experiment was discontinued. The food intake was equivalent to 3·4 oz. per day per bird, and on autopsy six worms, none larger than 20 mm. in length, were found to be present. This gives an efficiency for the five-day period of treatment of 96·2 per cent.

*Note.—This amount of nicotine sulphate was computed from an estimation of the amount of nicotine consumed per day by birds if given a mash containing 2 per cent. tobacco dust with a 2 per cent. nicotine content.

(*d*) In a further experiment with grown birds five Australorp cocks, 4 lb. 1 oz. to 5 lb. 15 oz., were employed. After five days 42 Ascaridia had been voided. The food consumption was 3·9 oz. per day per bird over the seven days of treatment, and on autopsy 10 very small worms 4 mm. to 15 mm. in length were found to have survived—an efficiency of 80.8 per cent.

(*e*) In a final test with 10 adult hens, 3 lb. 10 oz. to 4lb. 11 oz. in weight, the prepared mash fed for a period of seven days removed 109 worms, and gave an efficiency of 100 per cent. The food consumption varied from 3.3 oz. to 3.5 oz. per day per bird.

Discussion.

The results secured show that a mash containing ·5 ml. of nicotine sulphate per pound weight of dry mash is capable of giving a high efficiency against *A. galli* if fed continuously over a period of 7-8 days. From a total of 45 birds, 23 young birds and 22 adult birds, to which this prepared mash was offered for this period, 541 worms were removed, leaving 116 on autopsy, an efficiency of 82·5 per cent.

The trial with a mash to which ·5 gm. of copper sulphate per pound was added in addition to the nicotine sulphate indicates that good results may be also secured from this combination. A comparison of the efficiencies computed from a four days' feeding of a mash containing nicotine sulphate alone does not, however, indicate that the addition of the copper sulphate is warranted. The trial in which 1 gm. of copper sulphate per pound of mash was employed with the nicotine sulphate also denotes that copper sulphate fed continuously over a few days may have harmful effects upon the birds so treated.

In the case of the young birds given this nicotine sulphate mash, the food consumption and gains in weight of the treated birds compared very favourably with the food consumption and gains in weight by the control birds. No suitable controls could be maintained for the adult birds, but a comparison of their food consumption, 3·3 oz. to 3.9 oz. per day per bird, with that of similar birds reared on the intensive system on this station, namely 3·4 oz. to 4 oz. per day per bird, indicates that the prepared mash was not distasteful in any way.

It is interesting to observe the rate at which the worms were voided by the birds of different ages employed in these trials, as given in Table XXIX.

TABLE XXIX.

No. of Group.	No. of Birds.	Age.	Worms Voided.									
			1st Day.	2nd Day.	3rd. Day.	4th Day.	5th Day.	6th Day.	7th Day.	8th Day.	Total.	Per cent. Efficiency.
51 ..	11	3 months ..	26	36	28	14	7	9		1	120	68·7
52 ..	12	3 months ..	16	42	27	29		4	1	..	119	71·2
53 ..	12	9 months ..	95	76	21		..	..	1	..	193	92·3
54 ..	10	Aged ..	19	79	9		1	1	..	..	109	100·0

It would appear from this table that the worms were more readily and more rapidly removed from the older birds by this nicotine sulphate mash. In the older groups, the efficiencies were considerably higher and

were for the most part obtained, moreover, after only four days' feeding, whereas in the young birds, a good number of worms were still present after seven days' treatment.

Another observation of significance is that, in the old birds given this prepared mash, the infestation that survived treatment consisted entirely of young, immature worms (Group 53).

In conclusion, it may be said that the above experiments indicate that the feeding of a dry mash to which is added ·5 ml. of nicotine sulphate per pound for a continuous period of seven days is efficient against *Ascaridia galli* and harmless to the birds. The mash was prepared freshly every day, and it was found the nicotine sulphate was best mixed when each ·5 ml. was added to 150 ml. of water. The mixing was thorough, so that the mash remained flaky and devoid of lumps.

Efficiency against Heterakis gallinae.

As groups 53 and 54 also contained a natural infestation of the cæcum worm, *Heterakis gallinæ*, the opportunity was taken to ascertain the efficiency of this prepared mash against this species after a period of feeding for seven days. A total of 856 worms were passed by the 22 birds treated, and on autopsy 713 remained. These figures indicate an efficiency of 54·5 per cent.

(iii.) Field Experiments, With Nicotine Sulphate.

Experiment 3.

The birds employed in this experiment (White Leghorns) had been received as day old chicks. At one month old they were divided at random into two groups, each of which was confined to a separate pen. One group (A) was infested with *A. galli*, and the second group (B) was maintained under conditions most likely to keep them worm free. At this time, the writer had in mind an experiment in which the production of wormy and clean birds could be compared so that any effects of *A. galli* upon production could be noted. After some time, however, Group (B) became infested, and this experiment had to be abandoned. Four months before these treatment trials commenced Group (A) was divided between two pens, Nos. 8 and 9, and Group (B) between two pens, Nos. 6 and 7. The infestations existing at any subsequent time in pens 6 and 7 and in pens 8 and 9 respectively should therefore have been approximately equal. When the trial was commenced pen 6 was retained as a control to pen 7, and pen 8 as a control to pen 9. Pens 7 and 9 were given a nicotine sulphate prepared mash (·5 ml. nicotine sulphate in 150 ml. water per pound of mash), for a period of seven days during the sixth, tenth, fourteenth, and eighteenth weeks of the trial. During the periods when these two pens were treated, the control pens were given a mash containing 150 ml. water per pound of dry mash. These birds were about eight months old when the trial was commenced.

The food consumption (F.C.) and egg production (E.P.) per bird per week of the four pens over the period of the trial are given in Table XXX.

TABLE XXX.

No. Pen.	No. Birds.	Treatment.	1st Week.		2nd Week.		3rd Week.		4th Week.		5th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
6 ..	25	Control	24·5	3·0	24·5	3·2	24·5	3·9	24·5	3·6	24·5	4·2
7 ..	24	Ni. Sulph.	24·5	2·9	24·5	3·0	24·5	4·0	24·5	3·1	24·5	4·0
8 ..	23	Control	23·6	3·9	23·6	4·0	23·6	4·1	23·6	4·6	23·6	5·0
9 ..	26	Ni. Sulph.	22·2	3·0	22·2	3·1	22·2	3·6	22·2	3·7	22·2	4·4

No. Pen	No. Birds.	Treatment.	*6th Week.		7th Week.		8th Week.		9th Week.		*10th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
6 ..	25	Control	27·4	4·4	28·0	5·0	30·7	5·1	30·2	4·7	32·8	4·5
7 ..	24	Ni. Sulph.	27·0	4·0	25·3	3·5	30·3	3·7	30·2	4·6	24·1	4·5
8 ..	23	Control	29·4	4·5	24·0	4·8	30·2	4·7	31·1	4·9	26·6	4·1
9 ..	26	Ni. Sulph.	30·8	4·6	23·1	4·5	31·2	4·5	29·7	4·9	29·6	4·7

No. Pen.	No. Birds.	Treatment.	11th Week.		12th Week.		13th Week.		*14th Week.		15th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
6 ..	25	Control	29·0	4·4	32·6	4·8	30·3	5·2	32·1	5·1	31·0	5·0
7 ..	24	Ni. Sulph.	27·5	2·7	29·9	3·3	27·6	4·4	26·1	5·2	31·0	4·7
8 ..	23	Control	24·8	3·1	28·8	3·3	22·5	3·9	31·0	3·9	31·5	4·2
9 ..	26	Ni. Sulph.	28·0	4·5	28·9	4·4	27·3	4·5	26·5	4·0	30·8	4·0

No. Pen.	No. Birds.	Treatment.	16th Week.		17th Week.		*18th Week.		19th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
6 ..	25	Control	30·4	4·3	30·8	4·5	36·0	4·3	31·5	4·3
7 ..	24	Ni. Sulph.	28·3	4·7	32·2	5·0	30·4	5·3	36·5	5·2
8 ..	23	Control	34·0	4·3	31·0	4·5	35·3	4·6	32·5	5·1
9 ..	26	Ni. Sulph.	26·7	4·1	29·5	4·3	29·7	4·3	28·8	4·2

* Week of treatment.

Effect of Treatment upon the Infestation.—During the week of the first treatment (sixth week) large numbers of worms were passed by pens 7 and 9. To check this observation, five birds from each pen were autopsied at the beginning of the seventh week. From pen 6 an average of 34·2 worms were secured, the majority of which (126) came from one bird. Pen 7 yielded only 2·0 worms per bird; pen 8, 32·2 worms per bird, the infestation in this case being fairly evenly distributed among the five birds examined, and pen 9, 1·4 worms per bird. The worms remaining in the treated birds were all small in size, moreover, whilst those from the controls contained a good number of large and mature forms.

At the conclusion of the trial and during the twentieth week 17 birds from each of the pens 6, 8, and 9, and 16 birds from pen 7 were examined. The number of worms collected from each of the respective pens is given in Table XXXI.

TABLE XXXI.

Number of Pen.	Number of birds examined.	Total number of worms present.	Range of Infestation.	Average number worms per bird.
6 (control)	17	337	0–126	19·8
7 (treated)	16	109	0–37	6·8
8 (control)	17	869	2–135	51·1
9 (treated)	17	73	0–11	4·3

Here again the worms remaining in the treated birds were all small in size (mainly about 1 inch in length), whilst of those from the controls a good percentage were large and mature.

Taking into consideration the fact that the worms that survived treatment were all small and immature forms, these results indicate that the nicotine sulphate treatment had been successful in controlling the infestations under conditions involving a continuous exposure of the birds to infection. Such control is especially prominent in the the case of pens 8 and 9, where a very heavy infestation was undoubtedly present.

As all pens had picked up a natural infestation of *Heterakis gallinæ* before the subdivision of the two groups, the opportunity was taken to ascertain whether the efficiency of this treatment as secured under laboratory conditions would be confirmed. The results obtained are given in Table XXXII.

TABLE XXXII.

Number of Pen.	After First Treatment.		At End of Trial.	
	Number of birds examined.	Number *H. gallinæ* per bird.	Number of birds examined.	Number *H. gallinæ* per bird
6 (control)	5	4·8	17	16·7
7 (treated)	5	2·0	16	7·5
8 (control)	5	5·6	17	40·1
9 (treated)	5	1·4	17	22·8

These figures indicate, it is considered, that this nicotine sulphate treatment continued over a period of seven days may under field conditions assist in controlling *Heterakis gallinæ*.

Effect of Treatment upon Egg Production.—The actual weekly production per bird of the four pens employed in this experiment is presented in Graph No. 10. A consideration of the production of pens 6 and 7 (Graph No. 10 (A)) shows that a decrease in production occurred during the period following each treatment, the production thereafter increasing gradually till the next treatment was given. The fall in production after the second treatment is very marked, and out of all proportion to the decreases that occurred after the other treatments, and was probably assisted by other influences. On the whole, however, the production of pen 7 shows a gradual rise, and after the third treatment overtook that of the control pen, and thereafter remained the greater. A comparison of the figures of corrected egg production for the fourteen weeks in which treatment was applied, namely, 67·0 eggs per bird from pen 6, and 65·0 eggs per bird from pen 7 (standard error 2·555), did not disclose any significant difference between the production of the two pens. It would appear that if the decrease in the production of pen 7 following the second treatment had been of somewhat similar value to the decreases that occurred after the other treatments, the treated pen would have produced significantly more eggs than the control pen.

Pen 6, it will be remembered, at the conclusion of the trial showed, on the average, only a light infestation, namely 19·8 worms per bird, but from a consideration of Graph No. 10 (A), however, it would appear as though this infestation had been responsible for the decrease in production which occurred during the last four weeks of the trial. Although the average number of worms per bird was comparatively small, the individual infestations showed a very marked variation in numbers, and it is considered that this drop in production was chiefly due to the very heavy infestations that were present in some of the birds.

When the production of pens 8 and 9 is considered (Graph No. 10 (B)) it will be seen firstly that the production of the control pen (pen

GRAPH No. 10.

FLOCK TREATMENT WITH NICOTINE SULPHATE. EXPERIMENT 3.

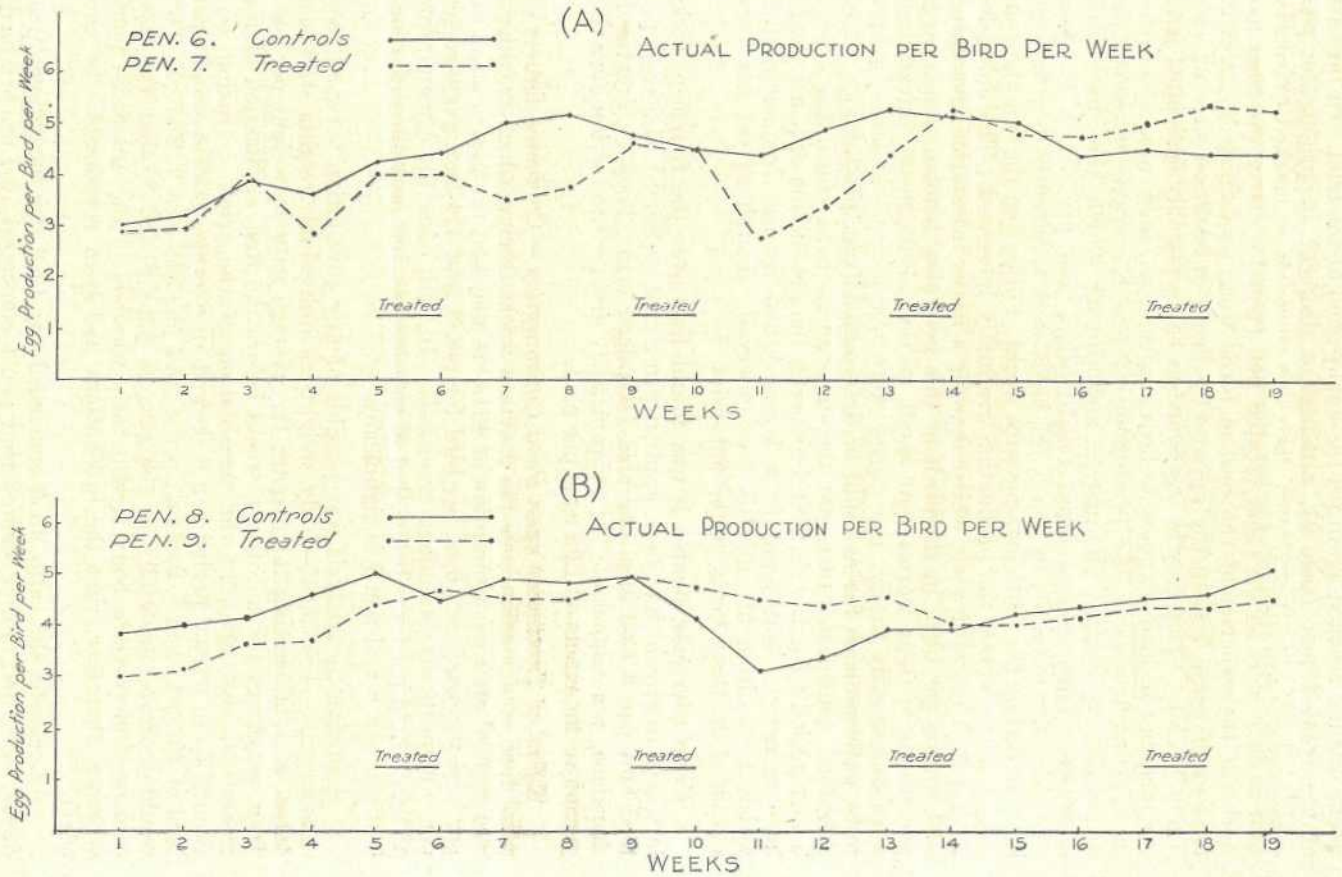


Plate 317.

8) showed considerable fluctuation. After the ninth week a very marked drop in production occurred, and the production of the previous few weeks was not reached again till the final period of the trial. In the case of the treated pen (pen 9), although a decrease in production was associated with treatment, such decreases were not so marked or consistent as they were in the other treated pen (pen 7). Over the final five weeks of the experiment the control birds were producing the greater number of eggs, despite the apparently heavy infestation present (see Table XXXI.). This may be explained as being possibly associated with the fact that in birds exposed to heavy infestation, there are, as denoted by the fluctuations in the production of pen 8, periods in which the infestation is largely eliminated, and during which the production increases. Then follows rapid reinfestation, and production is again effected. For example, in pen 8, the birds were apparently very heavily infested during the tenth and eleventh weeks. Following the spontaneous loss of many worms the production gradually increased. The autopsies during the twentieth week, whilst showing a heavy infestation, averaging 51·1 worms per bird, in the birds of this pen, also denoted that a large percentage of these worms were small, so that although the infestations were numerically heavy, the worms were not in general large enough to be pathogenic so far as could be determined from production. It is, therefore, considered that had the experiment been continued over a longer period a further marked decrease in the production of pen 8 would have occurred. This opinion is strengthened by the frequency with which a condition of enteritis was observed, though as yet not very advanced, in these birds at the autopsies.

From corrected figures it was found that over the fourteen weeks in which treatment had been applied pen 8 had produced 51·5 eggs per bird and pen 9 64·3 eggs per bird (standard error 2·555). Treatment therefore, was responsible for a significantly greater production over this period to the extent of 12·8 eggs per bird.

Effect of Treatment upon Food Consumption.—Corrected figures of total food consumption over the fourteen weeks during which treatment was applied gave a consumption of 421.6 oz. per bird for pen 6, 395·2 oz. per bird for pen 7, 421·6 oz. per bird for pen 8, and 414·1 oz. per bird for pen 9 respectively (standard error 8·35). In both cases the consumption of the treated pens was below that of the controls, but only the difference between pen 6 and pen 7 is significant.

Although no analysis was possible of any correlation between food consumption—treatment—body weight, as individual weights were not taken, it is interesting to compare the average gain in weight per bird from weighings taken thirteen weeks before the first application of the treatment, and again at the termination of the trial. During this twenty-seven weeks' period pen 6 showed an average gain in weight per bird of 25·9 oz.; pen 7, 26·2 oz.; pen 8, 20·2 oz.; and pen 9, 27·7 oz. This would indicate, especially in the case of pens 8 and 9, that the food consumed-increase in body weight ratio was less in the untreated pens, showing, therefore, that the infestations had been responsible for this effect.

As regards the ratio, food consumed per bird per dozen eggs produced, corrected figures showed that pen 6 consumed 75·9 oz. per bird; pen 7, 74·82 oz. per bird; pen 8, 103·32 oz. per bird; and pen 9, 77·16 oz. per bird respectively (standard error 2·12). Thus, the effect of treatment on pen 9 had been to give a significantly smaller consumption for

every dozen eggs produced to the extent of 25·16 oz. The consumptions of pens 6 and 7, however, were practically equivalent.

Experiment 4.

For this experiment Australorp hens three years of age were available. The procedure of treatment was similar to that used in Experiment 3, but in this case the nicotine sulphate prepared mash was fed on three occasions at three-weekly intervals, during the sixth, ninth, and twelfth weeks.

Egg production (E.P.) and food consumption (F.C.) per bird per week throughout the period of the trial are given in Table XXXIII.

TABLE XXXIII.

No. Pen.	No. Birds.	Treatment.	1st Week.		2nd Week.		3rd Week.		4th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
10 ..	31	Ni. Sulph.	..	1·5	..	1·9	31·0	2·0	27·0	2·5
4 ..	30	Control	..	2·8	..	2·8	32·0	3·2	28·2	2·9

No. Pen.	No. Birds.	Treatment.	5th Week.		*6th Week.		7th Week.		8th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
10 ..	31	Ni. Sulph.	28·5	2·4	27·3	3·1	27·3	3·3	24·0	3·2
4 ..	30	Control	30·6	3·0	32·9	2·9	30·3	3·4	33·0	3·5

No. Pen.	No. Birds.	Treatment.	*9th Week.		10th Week.		11th Week.		*12th Week.		13th Week.	
			F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.	F.C.	E.P.
10 ..	31	Ni. Sulph.	27·6	3·1	29·6	3·5	29·6	3·7	30·8	3·9	32·8	4·0
4 ..	30	Control	27·0	3·2	31·0	3·6	33·7	3·6	34·0	3·9	33·5	4·0

* Week of treatment.

Effect of Treatment upon the Infestation.—This could not be determined as no birds were available for examination.

Effect of Treatment upon Egg Production.—The actual egg production per bird per week of the treated pen (10) and of the control pen (4) are compared in Graph No. 11. It would appear from this graph that treatment did not at any time affect production, but that it had been responsible for immediately increasing the production, and thereafter maintaining it at the same level as the controls.

A consideration of the corrected figures of production showed that over the eight weeks in which treatment was applied, pen 4 produced 24·9 eggs per bird, and pen 10 31·0 eggs per bird respectively. As the standard error was only 1·01, the difference of 6·1 eggs is highly significant, and indicates that the treatment had been beneficial to this extent.

Effect of Treatment upon Food Consumption.—There was no significant difference between the two pens in the total amount of food consumed over the eight weeks period. Pen 4 consumed 249.8 oz. and pen 10, 234·6 oz. (standard error 7·76). When the ratio food consumed per bird per dozen eggs produced was compared, however, it was found that pen 10 required 90·93 oz. per bird, and pen 4, 121·44 oz. per bird (standard error 3·81). The control pen, therefore, required 30·51 oz. of food more than the treated pen to produce a dozen eggs, which difference is significant.

Discussion.

The results secured from these two experiments indicate firstly that further fields trials with nicotine sulphate as a flock treatment are desirable in which the application of treatment is carried over much longer periods.

GRAPH No. 11.

FLOCK TREATMENT WITH NICOTINE SULPHATE. EXPERIMENT 4.

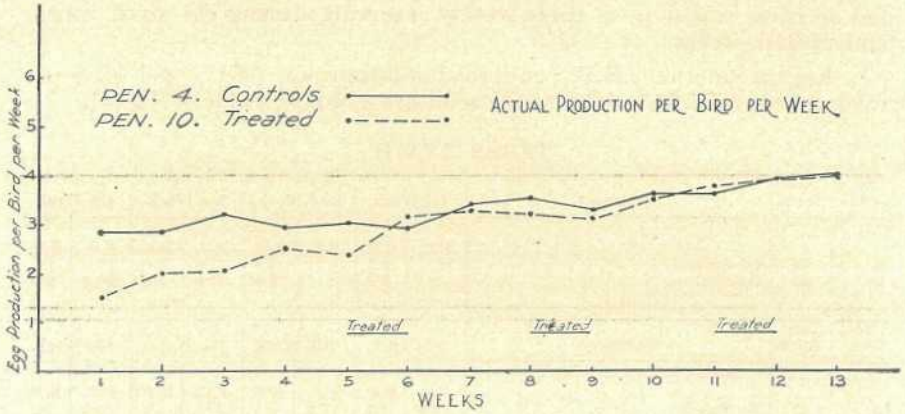


Plate 318.

Under the conditions governing the experiments, however, the following conclusions may be drawn:—

1. *Ascaridia galli* affects production, but in the case of birds on an adequate diet, and otherwise well cared for, the infestation must be heavy before any ill-effects are manifested. When such birds are exposed to a heavy infestation there appears to be a regular turn-over in the worm burden. That is, the infestation reaches proportions at which it may cause a marked decrease in production. Many of the worms are then lost, the effect of which is shown by a temporary increase in producton. Reinfestation rapidly occurs and production is again affected.

As the birds used in these experiments were also infested with *Davainea tetragona* and *Heterakis gallinæ* it might be said that any beneficial effects of treatment on production may not have been associated solely with the removal of *A. galli*, especially as treatment had some degree of efficiency against *H. gallinæ* as well. The cestodes were fairly evenly distributed among the treated and control birds, and the infestation with *H. gallinæ* was apparently never very heavy. The writer feels safe, therefore, in permitting himself to consider any favourable effects arising from treatment as being chiefly, if not entirely, due to the removal of the *A. galli*.

2. Birds heavily infested with *A. galli* consume more food per dozen eggs produced and convert less food into body weight.

That *A. galli* may have a very marked effect upon body weight is shown by the respective increases in weight per bird of the four pens of White Leghorn pullets over a twenty-seven weeks' period, during the last fourteen weeks of which two of the pens received treatment. These

increases in weight, together with the average number of worms per bird found in each pen at the conclusion of the trial, are, for the sake of emphasis, repeated in Table XXXIV.

TABLE XXXIV.

Number of Pen.	Increase in body weight over 27 weeks period.	Average number worms per bird at conclusion of trial.
	Oz. per bird.	
6 (control)	25·9	19·8
7 (treated)	26·2	6·8
8 (control)	20·2	51·1
9 (treated)	27·7	4·3

A consideration of these figures indicates little differences between the gains of pens 6, 7, and 9, but in the case of pen 8 the gain of only 20.2 oz. is conspicuously lower than that of any of the other three pens. It would, therefore, appear that the infestation of the control pen (pen 6) had never been sufficiently severe to affect growth, whereas in pen 8, which was also untreated, the infestation had been heavy enough to prevent the birds in this pen from gaining in weight to a normal extent. This would indicate that the figure at which an infestation commences to affect the body weight of young laying birds is somewhere between 20 and 50 worms, and that a worm burden of 50 or more worms is definitely pathogenic.

3. In the case of pen 7, treatment was followed by a period of decreased egg production on each occasion. With pen 9, however, while there are indications that a slight decrease following treatment did occur at times, such a decrease is not so constantly or so conspicuously associated with treatment. The treatment periods of the Australorps, on the other hand, showed no such effect at any time.

Pen 10, it will be remembered, contained aged birds (three years) of a heavy breed, whilst the birds in pens 7 and 9 were much younger birds (about eight months of age at the beginning of the trial) of a light breed. The birds in pen 7 were, moreover, in general apparently only lightly infested, so that there was little evidence that the infestation had affected the production of this pen to any marked degree, except towards the final periods of the trial. In pen 9, on the other hand, the infestation was heavy, and apparently was sufficiently severe to affect the health of the birds so far as production was concerned. A possible interpretation of the inconsistent behaviour of the three treated pens to treatment is, therefore, that the use of nicotine sulphate at the rate of ·5 ml. per pound of mash for a period of seven days may have been toxic to the younger birds. Where an infestation sufficiently heavy to affect production exists among such young birds, however, the continued employment of treatment by removing the worms and keeping them below the level at which they become pathogenic, increases production, the elimination of the infestations more than compensating for any toxicity associated with the treatment.

This interpretation emphasises the necessity for further trials in which the period of treatment is reduced to four days, for, as indicated from the laboratory trials, little increase in efficiency occurs when the treatment of birds over six months of age is continued beyond this period.

4. Treatment over seven days under field conditions and at monthly intervals is highly effective against *A. galli*, and moderately so against *H. gallinæ*. In these trials, as in the laboratory experiments, it is interesting to note that only small worms survived. Why this should be so is not understood, and, from the size of the worms surviving, cannot be explained as being due to the fact that during the time of treatment such worms were buried in the intestine tissues.

[TO BE CONTINUED.]

GROW MORE PASSION FRUIT.

There is a very much greater demand for passion fruit, both locally and for export, than Queensland produces, and as this State grows a passion fruit of the very highest quality, it should be produced to a greater extent than it is. As an occupation on the orchard, it is one of the most pleasant. Previously, production of this fruit has been chiefly undertaken as a sideline only—a kind of secondary affair, which, if it yielded a return, so much to the good; it it didn't, well, it did not matter a great deal. With the ever-expanding demand, it warrants being made a principal crop, and being subjected to kind treatment.

Vines are prone to several diseases, which, with proper attention, can be controlled, but which, when the vines are allowed to grow uncared for, quickly destroy them. Due to these diseases and the haphazard method of cultivation frequently employed in the past, the idea has become current among orchardists that vines can only be grown for about two or at most three years. That this is erroneous is being demonstrated at the present time by vignerons who have made passion fruit growing their main occupation, and who have vines bearing well at seven years of age. These growers, however, prune correctly, and spray at the correct times, as advised by the Department. They also grade and pack their product for market, and the result is they are reaping the benefit of an excellent monetary return.

It is stated by some that passion fruit growing entails too much work pruning and spraying, and the results are not worth it. A careful analysis of the position will refute such statements. Pruning the vine undoubtedly is a tedious and lengthy operation. Spraying also is objectionable, but remember that citrus growers, grape growers, and practically growers of all other kinds of fruit must also prune and spray their trees. So far as returns are concerned, good vines produce up to half a bushel of fruit per year. They are usually planted 15 feet by 8 feet apart, or 363 vines per acre. Prices vary from 22s. 6d. per half-bushel during the periods of scant supplies to 4s. 6d. per half-bushel paid by the local factories. From these figures, orchardists can estimate for themselves the likely returns. On a conservative average of 3s. 6d. per half-bushel clear of marketing expenses, the return would be £63 per acre per annum. Are there many other fruit crops netting orchardists this sum per acre?

A pamphlet giving full cultural details is available free on application to the Department of Agriculture.

Briefly, for the guidance of those who may be considering planting, it should be remembered that the passion vine is a climber, and thrives in warm, moist situations, preferably in the coastal districts. It grows well on the coastal highlands, like the Blackall Range and Tamborine Mountain, and also on the lowlands between the ranges and the sea. The vine will resist light frosts, but heavy frosts will cause damage.

Reasonably fertile scrub and forest loams, provided they are well drained, are suitable soils, and if a hillside site is chosen, it should be well sheltered from heavy winds and preferably have an easterly or north-easterly aspect. It is important that the trellises be strongly made, and that they be at least 6 feet in height.

Two crops are borne each year, a summer and a winter crop, whilst occasionally intermediate crops are borne.

Spring is the best time to plant, though autumn planting is sometimes practised. Spring-planted vines sometimes return a small crop the following winter, but the first main crop can be looked for twelve to fifteen months after planting. With autumn-planted vines, the first main crop is often not obtained until eighteen to twenty-one months after planting.

Principles of Botany for Queensland Farmers.

C. T. WHITE, Government Botanist.

[*Continued from p. 632, Nov.*, 1936.]

Part IV.—CLASSIFICATION.

THE SYSTEMATIC ARRANGEMENT OF PLANTS IN GROUPS. ACCORDING TO THEIR AFFINITIES.

CHAPTER XIX.

General Notes on Classification.

THAT branch of botany which deals with the naming, describing, and arranging of plants into groups according to their natural affinities is termed systematic botany, and in the early days of the science practically every botanist's activities were devoted to it. This was only natural, as it is obvious that, owing to the very large number of plants known to inhabit the globe—somewhere about 150,000 flowering plants having been described, and possibly a greater number of cryptogramic ones—it is necessary to have as far as possible some uniform system of naming and classifying these multitudinous forms. One of the principal objects of systematic botany is to describe and arrange plants in such a way that, if one wishes to ascertain the correct name of any particular plant, one may do so by referring to some work in which the descriptions of the different plants are set forth on this plan.

Various systems of classification have been proposed from time to time. In any natural system all the characters exhibited by the plant, not only its external features, but its anatomy, life history, and—as far as possible—its genealogical history, are taken into consideration in placing it in its position in the system.

The Unit of Classification; the Species.—"A species is the smallest group of plants existing wild in nature, which can readily be distinguished from all other groups, owing to the fact that the individuals composing it all possess in common certain well-marked characters (specific characters) by which they can be distinguished from all other plants. The individuals also which compose the species are, when developed normally in a state of nature, always able to transmit their specific characters unchanged to the majority of their immediate offspring." (Hole—"Manual of Botany for Indian Forest Students.")

The species forms a natural unit upon which all other groups may be built.

In some works distinctions of groups of lesser importance than a species are attempted, but in the majority of systematic works on Australian plants—e.g., "Floras"—all are placed under the term "variety."

A variety is a group of plants subordinate to a species and generally with only a minor difference, such as size of leaf, colouring of flowers, &c., from the parent type. The differences may or may not be constant —i.e., they are not always transmitted unchanged from the parent to the majority of its immediate offspring,

The Genus.—Everyone is acquainted with the fact that certain groups of species resemble each other closely, but are yet quite distinct the one from the other; such species are grouped together by the

systematist and form what is spoken of as a genus. The Blue Gums, Stringybarks, Boxes, and Ironbarks, for instance, are trees that resemble one another more or less in their general features; they all have oil-bearing leaves; their calyx lobes are welded together to form a little cap (operculum) which fits over the young sexual parts of the flower, falling off at their maturity; they all have dry seed capsules with small angular seeds—in other words, they are all Eucalypts, or "gum-trees," or, in the terms of systematic botany, different species of the one genus.

Botanical Names.—The present system of naming plants is known as the binomial system, and was introduced into botanical and zoological work by Carl von Linné (generally Latinised as Linnæus). Every plant has two names—firstly, the generic name or name of the genus (corresponding to the surname of a person), and, secondly, the specific name or name of the species (corresponding to the christian name or baptismal name of a person). Every plant of the same genus has the same generic name; so that all plants belonging to the Eucalypt or gum-tree genus bear the common generic name of *Eucalyptus*, while the various species are distinguished by their specific names—*e.g.*, *Eucalyptus maculata* Spotted Gum), *E. crebra* (Narrow-leaved Ironbark), *E. microcorys* (Tallowwood). The same specific name can be used for only one plant in the same genus; thus we cannot have two species called *Eucalyptus maculata*.

The Natural Order or Family.—As groups of species are placed together in genera, so the genera in their turn are collected together to form still larger groups—viz., natural orders or families; thus the species comprising the genera *Eucalyptus* (Gum-trees), *Melaleuca* (Tea-trees), *Tristania* (Swamp Mahogany), *Leptospermum* (Wild May), and a number of others resembling one another in all possessing certain characters in common—as simple, undivided, oil-bearing leaves—go to form the large family Myrtaceæ.

The Larger Groups.—The type of grouping which has just been described is continued through the whole of the vegetable kingdom. The families are collected together in groups called series, the series into sub-classes and classes, the classes into subdivisions and divisions, and the lastmentioned into sub-kingdoms (of which there are only two), which naturally lead to the kingdom.

To take as an example the Spotted Gum, we can trace it down through the various groups just mentioned, starting with the largest or highest and working down the scale to the lowest or smallest. Thus:—

The Vegetable Kingdom.

Sub-kingdom: Phanerogamia.

Division: Embryophyta Siphonogama.

Subdivision: Angiospermæ.

Class: Dicotyledoneæ.

Sub-class: Archichlamydeæ.

Series: Myrtifloræ.

Family: Myrtaceæ.

Genus: Eucalyptus.

Species: Maculata.

The Sub-Kingdoms.—Of recent years there has been a tendency by many botanists to drop the use of the term *Phanerogams*[1] for the flowering plants and substitute the terms *Spermatophytes*[2], and Engler and Prantl, in their system, now largely used by botanists, proposed the name *Siphonogams*[3] for them. In all cases the terms *Cryptogams*[4] is retained for the flowerless plants. The name *Phanerogam* is still in general use among the majority of people, and in the following pages we will continue to speak of the two great divisions of the vegetable kingdom as Phanerogams or Flowering Plants and Cryptogams or Flowerless Plants. The great distinction between the two groups lies in the fact that reproduction in the former is carried on mainly by seeds, many-celled structures, each of which contains an embryo or young plant. On the other hand, seeds are never formed in the Cryptogams, reproduction being mainly effected by means of minute one-celled bodies termed spores.

CHAPTER XX.

Main Divisions of the Vegetable Kingdom.

Plants may be divided into six more or less natural and well-defined groups. These, in the accepted order of their development, starting with the lowest are: (1) The Myxomycetes or Mycetozoa; (2) Thallophytes; (3) Bryophytes; (4) Pteridophytes; (5) Gymnosperms; (6) Angiosperms. The plants included in the four groups together form the Cryptogams or flowerless plants, and the two last the Phanerogams or flowering plants, or Spermatophytes or seed-bearing plants.

THE MYXOMYCETES.—The Myxomycetes or Mycetozoa are commonly spoken of as the "Slime Fungi," and are regarded as a very lowly group on the borderland between plants and animals. The species are almost entirely saprophytic, living on decaying organic substances, such rotting leaves or wood, animal excreta, &c., and are devoid of chlorophyll.

A very few are parasitic, the best-known of these being *Plasmodiophora brassicæ,* which is the organism responsible for the "Club Root" or "Finger and Toe" disease of Cruciferous plants (turnips, cabbage, cauliflower, and garden flowers, such as wall-flower, candytuft, &c.). Like other lowly forms, many of the species have a wide—practically world-wide—geographical distribution, some of the species recorded for Australia being also found in Europe, Asia, Africa, and North and South America.

In their vegetative condition they consist of a naked mass of protoplasm—a plasmodium—capable of movement and resembling a gigantic amœba. The plasmodium, after a time, gives rise to either a single spore-producing or fruiting body—a sporangium—or it may divide into a number of parts, each of which develops into a sporangium. The external part of the plasmodium hardens to form the wall of the sporangium, while the internal part divides up into a number of cells, each of which provides itself with a cell-wall and becomes a spore. The cell dies, becomes ruptured, and the spores escape. After germination

1. From the Greek *phaneros,* manifest or plain, and *gamos,* marriage.
2. Greek *sperma,* a seed; *phyton,* a plant.
3. Greek *siphon,* a tube; *gamos,* marriage—referring to fertilization by means of a pollen tube.
4. Greek *cryptos,* hidden; *gamos,* marriage.

the outer membrane or wall of the spore bursts and a slimy mass of protoplasm escapes; this is provided with a minute flagellum by means of which it may creep about or may actively swim about in water, when it is said to be in the mastigopod stage. Later the flagellum is withdrawn and it creeps about by means of simple projections or protusions known as pseudopods, this being called the amœboid stage. The *myxamœbæ*, as they are called, collect together, forming the plasmodium. The plasmodium now gives rise to the sporangia, and the life-cycle is again repeated. In most of the Myxomycetes part of the internal protoplasm of the sporangium—before spore formation—is modified to form a number of threads, making what is known as a capillitium.

THALLOPHYTES.—The Thallophytes (or Thallophyta) constitute a very large group of plants characterised by their simple structure. The bodies of plants comprising it show no distinct differentiation into roots, stems, leaves, &c., and have no woody or vascular system. Such a simple vegetable body is spoken of as a thallus. Many of the lower forms are unicellular, but in the higher ones the thallus may be multicellular and attain a great size (*e.g., Macrocystis pirifera,* a seaweed of the southern seas, is said to attain a length of 700 feet). The Thallophyta may be subdivided into four well-differentiated and natural groups—viz., (1) algæ; (2) fungi; (3) bacteria; (4) lichens.

Algæ.—The algæ are mainly aquatic, and may be unicellular or multicellular and attain a large size. They may inhabit either fresh-water streams and pools or salt water, the larger forms of those inhabiting the latter being familiarly known as "seaweeds." The algæ contain chlorophyll, but the chlorophyll is often masked by other pigments, and on this account they have been roughly divided into divisions known respectively as the green, brown, red, and blue-green algæ. The red and the brown algæ are mainly marine (seaweeds). Reproduction in the simple forms may be by simple cell division, and in the higher forms may be asexual or sexual by means of spores.

The Fungi.—One of the chief characteristics of the fungi is the complete absence of chlorophyll in all the species; other pigments may be present, but in the absence of chlorophyll fungi are dependent on living or decaying vegetable or animal matter for their carbonaceous food—i.e., they are either parasitic or saprophytic.

A few are symbiotic, living in intimate relation with chlorophyll-containing plants without injuring them, as where they occur in association with roots forming mycorhiza. Probably the best-known form of symbiosis is where they live with algæ, forming lichens.

The thallus or body of a fungus is composed of filamentous threads termed hyphæ; it may be divided into two distinct parts—viz., (1) a vegetative portion termed the mycelium or spawn, and (2) a more or less specialised portion bearing the reproductive organs or spores.

The mycelium consists usually of a number of loosely interwoven hyphæ whose function is to absorb nutritive material from the host plant or medium in which the fungus grows. In parasitic sorts the hyphæ may either penetrate the cells of the host plant or simply ramify between them. In the saprophytes the mycelium may attain a large size, presenting masses of hyphæ of a cobwebby or cottony appearance, as may be often seen in manure heaps, decaying leaf-mould, &c. In some

species, (*e.g.*, those of the genera Cordyceps and Isaria) it penetrates the larvæ of insects, eventually killing them and filling the body of the larvæ with hyphal threads.

Very often the hyphæ are interwoven to form a thick, felty or woody mass of false tissue (i.e., it is formed by the interweaving and growth of the hyphæ—not by cell division). This is the case with the spore-bearing portion of the larger fungi, such as the mushrooms and toadstools.

Reproduction is by means of spores which may be either sexually or asexually produced. In one group—the yeast fungi—no distinct mycelium and reproductive portions are present, the plants being unicellular. As many of the fungi are parasitic upon and very harmful to other plants, they form a group of great importance to the agriculturist.

Bacteria.—Like the fungi, bacteria are quite devoid of chlorophyll. One of the chief characteristics of the group is the extremely minute size of the individuals, most of the species in at least one direction measuring somewhere about 1/20,000 or 1/25,000 of an inch. They are sometimes spoken of as the Schizomycetes or splitting fungi. They have been placed as a subdivision of the fungi, but are probably best regarded as a distinct group of the Thallophyta.

The bacteria which live in the nodules that occur on the roots of leguminous plants have already been referred to. They are able to fix the free nitrogen of the atmosphere and pass it on in the form of nitrogenous compounds which can be used by the associated plants as food, this source of nitrogen not being otherwise available to them. On the other hand, the bacteria receive from the green plant the carbon, minerals, and water required for their own development, this being a case of true symbiosis. These nodule-producing bacteria occur in most soils, and make their way through the epidermis into the centre of the root, where they induce an exuberant growth of parenchymatous tissue, resulting in the formation of the well-known root nodules. After a time the bacteria—which on first entering the root tissue are minute rods (bacilli)—change their shape and increase considerably in size and are then termed bacteroids. In this form they are gradually absorbed by the green plant, and transformed into nitrogenous compounds which are either utilised by the plant as food or stored away as reserve material. Numbers of them, however, are returned to the soil, thus providing for the infection of other leguminous plants. It will easily be seen, therefore, how it comes about that leguminous plants are so valuable as green manures, the nitrogen stored by them—mainly by bacterial action—being returned to the soil on their decay, when it becomes available to other crops that may afterwards be grown on the same land.

Lichens.—The lichen plant consists of a thallus built up by a fungus and alga living together and usually supposed to be in symbiotic relationship. The lichen or thallus is said to be foliose or foliaceous when the thallus is a flat structure adhering more or less loosely to the substratum on which it grows; on the under surface of the thallus are usually developed a number of rootlike bodies termed rhizoids, which serve as organs of attachment. When the thallus adheres so closely to the substratum that it forms an almost inseparable crust from it, it is spoken of as a crustose lichen. When the thallus is erect or pendulous and branching freely in all directions, it is said to be fruticose; the

various species of *Usnea,* colloquially known as "Old Man's Beard," are familiar examples of this type of lichen, and may be seen hanging down in greyish-green beardlike masses from dead limbs of trees, old wooden fences, &c. As may be supposed, intermediate conditions between these forms are met with.

Lichens are very familiar plants, and are found growing on soil, rocks, bark of trees, and dead wood. As a whole, they are of little economic importance, though in colder countries some of the species are used medicinally, and some in the preparation of dye-stuffs. Like other plants, they act as purifiers of the air, and aid in the reduction of rocks to soil. Their principal interest to the farmer, however, lies in their relationship to the health of trees, and in this respect we cannot do better that quote a well-known authority on the group—Mr. Bruce Fink. In his work "Lichens of Minnesota" (Contributions from the United States National Herbarium, Vol. 14, p. 36) he says:—"In France and other countries of Europe foresters have supposed that lichens are injurious to trees, and have to a limited extent practised scraping the larger ones from the bark, along with certain other fungi. However, it would be difficult to accomplish much in this way in large forests, even were it known that the lichens are very injurious to the trees. In the United States M. B. Waite, while experimenting with fungicides on fruit trees, noted that Bordeaux mixture killed the lichens very effectually. He is not at all certain that the lichens are injurious to the trees, but thinks that they at least may interfere with the functions of the bark. It is true that the more conspicuous foliose lichens are more common on unhealthy trees than on thrifty ones; but the question remains whether the lichens have worked the injury to the trees, or whether unhealthy trees are more easily penetrated by the rhizoids of the lichens, and also whether they furnish some food materials for the lichens not present in healthy trees or not easily obtained from them. It is probably not worth while to take time to remove lichens from any trees of temperate regions for the sake of saving the trees from injury."

Bryophytes.—The Bryophytes (or Bryophyta) include two sub-groups—the Liverworts and Mosses. Neither group is of any particular importance to the farmer, and space allows little more than a mere mention of their existence. The latter group is familiar to almost everyone, but the former is less generally known.

The Liverworts (or *Hepaticæ*) are of a lower type than the mosses, and the body is either a thallus or may be differentiated into stem and leaves, the latter being only one cell in thickness and devoid of a midrb. There is no trace of even a rudimentary vascular tissue. In the Mosses (or *Musci*) the body is differentiated into stem and leaves, and the latter, in most cases, possesses a distinct midrib several cells in thickness. Commonly the central portion of the stem and the midrib of the leaf is composed of specially differentiated tissue that serves for the conduction of water and assimilated food, and represents a rudimentary vascular system; there is no true wood or vessels, however, as in the higher plants.

Information in regard to further characteristics of the Bryophytes, their life history, &c., will have to be sought for in more general botanical text-books.

PTERIDOPHYTES.—In the Pteridophytes (or Pteridophyta) a distinct woody or vascular system is first met with, and they are often therefore referred to as the Vascular Cryptogams. They fall naturally

into several well-differentiated subdivisions, by far the two largest being the Ferns and the Lycopods or Club Mosses. Of the second of these groups—the Club Mosses—a great many of the species possess considerable beauty, and on this account are largely cultivated in plant houses for ornamental purposes, species of *Lycopodium* (Tassel Ferns) and *Selaginella* being plants well known to gardeners; they are, however, of no particular interest or importance to the farmer, and, as with some other cryptogamic plants, information regarding them will have to be sought for in the more general text-books of botany.

The first-mentioned plants—the Ferns—though, with the exception of the common Bracken, of no particular importance to the farmer, constitute a group a number of the members of which are so plentiful and such a characteristic feature of the landscape that some reference to the general characters of the group may not be deemed out of place. The leaf of the fern plant is termed a frond; the veining is usually forked, and the very young frond is coiled in the bud stage. Most fern stems are herbaceous and take the form of a rhizome, which is often creeping, as in the common Bracken (*Pteridium aquilinum*); in other cases it is short and tufted, as in the Mountain Bracken (*Balantium dubium*); in some it is climbing, attaching itself to rocks or tree trunks by means of numerous adventitious roots, as in *Arthropteris tenella, Polypodium scandens,* &c., or may climb by twisting round some support or scrambling over shrubs and trees, as in the Climbing Maiden Hair (*Lygodium scandens*).

In some cases the stem is upright and may form a trunk of several feet; these are the well-known Tree Ferns. The vascular bundles in the ferns are closed; hence there is no secondary growth in thickness.

Reproduction is by means of spores. The spores are borne in little cases termed sporangia (singular, sporangium), and the sporiangia are collected in groups called sori (singular, sorus), usualy borne on the back of the frond, and in the majority of ferns occurring in the form of little, round, yellowish or brown masses; they are often protected by a little shieldlike outgrowth of the leaf-tissue known as an indusium.

The spores are released by the rupture of the sporangium, and, on reaching a suitable medium, germinate and grow out into a tube, or, rather, a string of cells, which later develops into a small, green, flat, heart-shaped plate of tissue—the prothallus—bearing on its under surface a number of root-hairs and rhizoids. The prothallus is important, as it represents a distinct phase in the life history of the fern plant; it is homologous with the thallus or plant body of the liverworts and mosses, and on its under surface are borne the sexual reproductive organs—the antheridia or male sexual organs, and the *archegonia* or female reproductive organs.

When mature, provided sufficient moisture is present, these burst and a number of spermatozoids or actively moving male cells are discharged from the antheridia. The archegonium is provided with a short neck, which on maturity bursts or opens at its apex; below the neck and deeply embedded in the tissue is the ovum or egg-cell. The spermatozoids, attracted by an exudate of the archegonium, make their way to it, and one or more pass down the neck and fuse with the egg-cell, resulting in the formation of a zygote. This surrounds itself with a cell-wall, and is the starting point of a new fern plant similar to the parent. For a time the embryo remains attached to the thallus by means of a special

organ termed the foot, from which it obtains its nourishment through its own leaves and roots; the prothallus then usually withdraws and dies away, and the embryo continues to grow until it develops into a plant similar to the parent from which it originated.

GYMNOSPERMS and *ANGIOSPERMS.*—These two groups together constitute the sub-kingdom *Phanerogamia* (Phanerogams), and, as they possess many characteristics in common, it is convenient to treat them together. The chief difference that separates them from the Cryptogams is that, in place of reproduction being mainly carried on by means of spores, the sexual process results in the formation of the seed, by means of which reproduction is carried on; on this account they are often termed the *Spermatophyta,* or seed-bearing plants. Another difference separating them from the Cryptogams is that the male reproductive cell is carried to the female cell by a tube thrown out from the pollen grain, and on this account they have been termed *Siphongamia.* Another and less important distinction lies in the fact that the male and female organs—which are very distinct—are borne on specially modified shoots which we term flowers. There is scarcely any need here to go into the morphology, anatomy, and life history of the flowering plants, as these have already been dealt with in previous chapters. It may be as well, however, to outline briefly the distinctions between the two groups.

The distinguishing characters of the Gymnosperms are:—The "flowers" are without perianth leaves, the ovule is not enclosed in an ovary, and the pollen grains enter the micropyle and come to lie directly on the surface of the nucellus; the male reproductive cell in the lower forms is a spermatozoid. The endosperm of the seed is formed before fertilisation. Vessels (pores)—except in the Gnetaceæ—are absent from the wood.

Angiosperms.—The distinguishing characters of Angiosperms are: The flowers, except in some of the lowest forms, possess a perianth; the ovule is enclosed in an ovary, and the pollen grain, instead of coming into direct contact with the ovule, is received and germinates on a specially modified area—the stigma, an organ which is missing in the Gymnosperms. The male reproductive cell is never a spermatozoid, and the endosperm and perisperm are formed mostly after fertilisation and probably as a result of it. The wood, in almost all cases, contains true vessels.

Further Subdivisions: *Gymnosperms.*—The Gymnosperms have been divided into four classes—the Cycadales, containing the family Cycadaceæ; the Gingkoales, containing only one living member—*Gingko biloba,* the Maidenhair Tree of China and Japan (family Gingkoaceæ); the Coniferæ, containing seven more or less well-differentiated families; and the Gnetales, containing three small families.

Of these, the Cycadaceæ are plants of fernlike growth, of some importance to the farmer and grazier as plants poisonous to livestock; the Australian members of the family are dealt with in a special chapter.

The Coniferæ constitute a group of the most importance, as coniferous woods form the world's main supply of commercial timber. The most recent classification divides the Conifers into seven families.

The Gnetales form a group now divided into three small families of diverse form—viz., the Ephedraceæ, with about 35 species, growing in the arid areas of the Mediterranean regions, Asia, North America, and

South Africa; the Welwitschiaceæ, containing a single species—a remarkable plant (*Welwitschia mirabilis*)—a native of Western South Africa; and Gnetaceæ, with about 30 species, trees or woody climbers of the rain-forests of tropical America, Asia, and New Guinea. The Gnetales differ from all other Gymnosperms in that the wood contains true vessels. No species, however, occurs in Australia, and the group is one of little or no importance to the Australian agriculturist or forester.

Angiosperms.—The angiosperms have been divided into two classes —(*a*) the Monocotyledons, and (*b*) the Dicotyledons.

The Monocotyledons are characterised mainly by the embryo containing a single cotyledon; the floral members mostly occur in whorls of three, and in many cases the perianth leaves are alike and petaloid. The leaves are mostly parallel-veined, reticulate veining being rare—though it occurs in the family Araceæ—*e.g.*, Cunjevoi (*Alocasia macrorrhiza*) and the numerous garden varieties of Caladium. The stem or trunk is not distinctly divided off into pith, wood, and bark; the vascular bundles are closed; hence secondary thickening, except in a few exceptional cases, does not take place.

The Dicotyledons are characterised mainly by the embryo containing two cotyledons. The floral members mostly occur in whorls of five or four, though in this respect the flowers vary very considerably, and the perianth is usually distinctly differentiated into calyx and corolla. The leaves are reticulate-veined, and in the majority of cases are distinctly divided into petiole and blade. The vascular bundles of the stem are arranged in a ring and are open, so that secondary growth in thickness in all the larger plants takes place. Distinct pith, wood, and bark are usually present in the woody species.

The Dicotyledons constitute probably about three-fourths of the flowering plants of the world.

They are again divided into two sub-classes—(*a*) the Archichlamydeæ, and (*b*) the Metachlamydeæ or Sympetaleæ.

In the Archichlamydeæ the perianth is either absent or rudimentary (*e.g.*, She-oaks or *Casuarinaceæ*), in one whorl (*e.g.*, Silky Oaks or *Proteaceæ*), or in two whorls, in which case the parts of the inner whorl (corolla) are free.

In the Metachlamydeæ the perianth is in two whorls, the corolla is gamopetalous, and the stamens are often epipetalous.

CHAPTER XXI.

Gymnosperms.

The Gymnosperms, according to the latest classification, are divided into seven classes. They are an ancient group, and of these seven classes three are fossil only. The four living classes are the Cycadales, Gingkoales, Coniferæ, and the Gnetales.

The Cycadales or Cycads.

The Cycadales contain a single family—the Cycadaceæ. They are plants of palmlike or fernlike growth and of little economic importance. The leaves are once or twice divided. The plants are dicœcious—*i.e.*, either male or female. The male flowers are borne in comparatively large cones consisting of numerous spirally arranged scales, each scale bearing

on the under surface numerous anthers. The females are borne in a loose cone breaking up into several-seeded, leaflike, simple, distinct seed-leaves, as in Cycas, or form distinct cones consisting of numerous scales, each with two pendulous ovules. The cones often become very large when fully developed.

The family is represented at the present day by about seventy species divided into nine genera, and widely spread through the tropical and subtropical regions of the world. Three genera occur in Australia —namely, Cycas, containing six species, Macrozamia, containing twelve species, and Bowenia, containing two.

Cycas is confined to the tropical zone, and contains four species in Queensland, and two in the north-west of Western Australia. The members always form a distinct trunk, and in leaf only can be distinguished from arborescent species of Macrozamia by the leaf segments, which always possess a distinct midrib. The most widely distributed species in Queensland is *Cycas media,* abundant in Eucalyptus forests from Rockhampton to the extreme north of the State and stretching over to the southern part of the island of New Guinea. The other species in Queensland, so far as records go, are confined to one or two localities, but are very imperfectly known.

Macrozamia is represented in Australia by about twelve species, but the differences between some of them are not at all clear. One or two have a comparatively large range; others are confined to restricted areas.

Bowenia is distinguished from other Cycads by the leaves being bipinnate. The genus is endemic in Queensland, being represented by two species—namely, *B. spectabilis,* widely spread in the north-eastern portion of the State, and *B. serrulata,* confined to Byfield, near Keppel Bay.

Zamia, Zamia Palm, or Zamia Fern are various popular names given in Queensland to different species of Cycads. In addition, Burrawang or Wild Pineapple is a name frequently given to species of Macrozamia, particularly to *M. spiralis.* All the Australian members have a bad reputation as plants poisonous to stock. Following serious losses with travelling sheep in New South Wales, which had eaten freely of the seeds of the common Burrawang (*M. spiralis*), feeding tests were carried out at the Veterinary Research Station, Glenfield, New South Wales, by Dr. H. R. Seddon. No poisonous principle has been isolated from these plants, but Dr. Seddon states that from the lesions produced it would appear that the toxin is a specific protoplasmic poison having the selective action of endothelial cells. The pith of the stem is rich in starch, and has been used as a stock food. The poisonous properties, which are contained in the pith as well as the roots, leaves, and seeds, are readily removed by heat.

The Gingkoales.

The class Gingkoales, consisting of a single family (*Gingkoaceæ*), is of little importance to Australian foresters or agriculturists. The only living member (*Gingko biloba,* the Maidenhair Tree, a native of China and Japan) is a relic of a one-time widely spread and species-rich group. The tree is sometimes seen in Queensland gardens.

The Coniferæ or Conifers.

The Conifers constitute a group of great economic importance, as from coniferous forests is drawn the world's main supply of commercial timber.

Many botanists have proposed different classifications for the group. The most recent—that of Pilger in the second edition of Engler's "Pflanzenfamilien"—divides them into seven families. These seem naturally fairly well defined. The system proposed has much to recommend it, and will probably be adopted by most botanists. The seven families proposed are: (1) *Taxaceæ;* (2) *Podocarpaceæ;* (3) *Araucariaceæ*; (4) *Cephalotaxaceæ*; (5) *Pinaceæ*; (6) *Taxodiaceæ*; (7) *Cupressaceæ.*

Family Taxaceæ (The Yews).

Taxaceæ as now defined contains only only three genera—namely, *Torreya,* from temperate Asia and North America; *Taxus,* a Yew from Europe and North America; and the remarkable *Austrotaxus,* confined to a very limited area in New Caledonia. They are trees or shrubs with linear, needle-shaped or narrow leaves. The male flowers are axillary and single, or (in *Austrotaxus*) borne in very small spikes (amenta). Each stamen bears 2-8 anthers; the female flowers are borne on short axillary shoots with a single terminal ovule, and are surrounded at the base with numerous bracts. The seeds possess an arillus.

Family Podocarpaceæ (The Podocarps).

Podocarpaceæ as now defined contains seven genera, five of which occur in Australia. They are trees or shrubs with scalelike, needle-shaped, linear-lanceolate or even broadly ovate leaves. In one genus—*Phyllocladus*—the leaf functions are carried on by flattened branches or phylloclades. The male flowers are borne on leafy shoots, terminal or axillary, and mostly have an elongated axis with numerous stamens. Each stamen bears two anthers; the female bears one or several carpels always with only a single ovule. Cotyledons two. Of the five Australian genera, only one—namely, *Podocarpus*—occurs in Queensland. It is a genus of somewhat resinous trees or shrubs. The leaves are variable, but in Queensland species are alternate and flat and (except in *P. Ladei*) with a prominent midrib. The male flowers are in cylindrical amenta, the scalelike apices closely packed, each scale bearing two anther cells. The female flowers usually possess 3-4 sporophylls, one or two of which bear in their axils a fertile scale folded over and united to an inverted ovule, but usually only one matures. In many species the sterile scales or sporophylls often fuse with the upper part of the stalk to form a fleshy receptacle below the seed. The outer seed coat may be dry or fleshy.

Podocarpus is a widely distributed genus represented in Australia by seven species, five of which occur in Queensland. The only species of any importance as timber trees all occur in Queensland, one of these—*P. elata,* the common She Pine or Brown Pine—stretching into New South Wales.

Family Araucariaceæ (The Bunya, Hoop, and Kauri Pines).

Araucariaceæ is a family of large trees with broad, narrowly-lanceolate or needle-shaped and spreading or small imbricate leaves. The trees are typically monœcious—*i.e.,* the male and female flowers are distinct but borne on the same tree—though apparently sometimes diœcious, due to the preponderance of one sex on certain trees. The male flowers are borne in cylindrical amenta in the leaf axils or terminating short shoots. The male sporophylls are closely packed, and bear 3-20 anther cells or stamens on the lower surface. The female amenta terminate short branches, and are composed of numerous imbricate scales or sporophylls,

each bearing a single ovule. The mature cones are mostly globose or somewhat globose in form, and vary from the size of an orange to that of the human head.

The family consists of two genera, both of which are represented in Australia—namely, *Araucaria* and *Agathis*. They are fundamentally differentiated as follows:—

Seeds united with the ovuliferous scale or female sporophyll	*Araucaria*
Seeds quite free from the scale	*Agathis*

At present the family is almost confined to the Southern Hemisphere.

The genus *Araucaria* at present is only found in the Southern Hemisphere, the species being distributed through South America, New Caledonia, New Guinea, and Eastern Australia. The only two Australian species (*A. Bidwillii* and *A. Cunninghamii*) are both found in Queensland, the latter stretching into northern New South Wales. In past geological times *Araucaria* had a much wider range than at the present day, there being abundant geological evidence in different parts of the world that during the Jurassic period *Araucaria* trees existed closely related to the existing ones. The genus is divided naturally into two very distinct sections—

(*a*) In which the cotyledons remain under the ground, the leaves flat and spreading and the cones very large. The seed scales and seeds are heavy and are not wind-borne;

(*b*) In which the cotyledons come up out of the ground, the leaves on adult trees are small and imbricate, and the cones are comparatively small (about the size of a large orange). Sporophylls and seeds are comparatively light and wind-borne for at least a short distance.

Of the two Australian species, *Araucaria Bidwillii*, the Bunya Pine, belongs to the former group, and *A. Cunninghamii*, the Hoop Pine, to the latter.

Agathis is a genus of trees in many cases very large. The leaves are flat, broad, and alternately arranged. The leaves on young trees or coppice shoots are not markedly different from those on the adults, though, generally speaking, they are somewhat larger and broader. The mature cones are comparatively large—usually somewhat larger than a cricket ball—the scales thin, scarcely woody, broadly wedge-shaped, and closely appressed. The seeds are oblong-cuneate, deeply emarginate or truncate at the apex, with both or one of the lateral edges produced into a membranous wing.

Agathis is a widely spread genus, 12-20 species—according to the view taken of the limits of the different kinds—being known. The genus is almost wholly confined to the Southern Hemisphere, stretching from New Zealand through New Caledonia, the Solomon Islands, and Queensland to Malaya and the Philippine Islands. The resin, which exudes freely from the wounds, is found in some countries, notably in New Zealand, in a fossil or semi-fossil state in huge quantities on the site of ancient Kauri forests. The fossil gum is regarded as superior to the fresh gum and brings a higher price. Both are extensively used in the manufacture of varnishes. So important is the resin regarded that in some countries—for instance, the Philippine Islands, Borneo, and other parts of the Malay Archipelago—it is regarded as the chief

product of the tree rather than the timber, as is the case in Queensland. The common Malayan species is *Agathis alba,* and has a wide range through the Philippine Islands, Cochin China, the Malay Peninsula, and several of the islands in the Malayan Archipelago. The resin is commercially known as Manila or Borneo copal or dammar.

Agathis robusta is the common Kauri Pine of Southern Queensland, and is confined to the Wide Bay district; having been operated heavily upon in the past, large trees are now very rare.

Agathis Palmerstoni is the common Kauri Pine of North Queensland and has a comparatively limited range in the coastal ranges of the Atherton Tableland and the Cairns timber district.

Family Cephalotaxaceæ.

Cephalotaxaceæ is a small family of two genera—*Cephalotaxus* and *Amentotaxus*. It is confined to the Himalayan region, China, and Japan. The members are small or medium sized trees, regarded by most botanists as very closely allied to the true *Taxaceæ* (Yews and their allies).

Family Pinaceæ (The True Pines).

The family *Pinaceæ* as now limited is confined to the Northern Hemisphere and consists of trees with needle-shaped, spirally arranged leaves. The flowers are monœcious, males and females being found on the same tree. The male flowers are usually numerous and spirally arranged in a dry spike (amentum). Each consists of an anther scale bearing two anthers on its lower surface. The female amenta are composed of numerous bracts, each with an ovule-bearing scale in its axil, the whole ripening into a hard, woody cone. The seeds are two at the base of each scale and are usually winged.

From the Pinaceæ is drawn the main bulk of the world's supply of softwoods. For the most part, the species are gregarious, forming the coniferous forests of the Northern Hemisphere.

The largest genus is *Pinus,* which contains the true Pines. It consists of about seventy species and is confined to the Northern Hemisphere, where it has a wide range from the limit of tree growth in the Arctic Circle to the tropics of Asia and America. In the tropics the trees are usually confined to more or less temperate altitudes and are rarely found on the plains. Apart from their value as timber producers, pines have other economic uses. Several species yield, by tapping, an oleo-resin which on distillation yields tar-oils, turpentine, pitch, &c., Pine-leaf oil, procured by distillation of the leaves, is largely used medicinally. The leaves are sometimes reduced to fibre, which is used for weaving into medicated underclothing, for surgical dressings, for stuffing upholstery, and in the manufacture of coarse matting. The seeds of some species are largely used for food in the countries in which they grow.

A number of Pines are cultivated in Queensland, particularly on the Darling Downs and in the Granite Belt. The commonest of these is the Insignis Pine (*Pinus radiata*). This Pine was introduced into England in 1831-32 by David Douglas, an English botanist, who gave it the manuscript name of *Pinus insignis.* Soon afterwards more material was received, and D. Don described and published it under the name of *Pinus radiata.* As this was the first published description, *radiata* is the name that should stand.

The late Professor E. H. Wilson, one of the greatest authorities in the world on the trees of the Southern Hemisphere, stated in one of his articles that it rather looked as if this tree would prove the Northern Hemisphere's greatest gift to the forests of the South, including Australia, New Zealand, and South Africa. He goes on to state that it surprised him to find a species so rare as a wild tree and of so little value in its native land to be of such immense importance in the Antipodes. In the Southern Hemisphere the wood of the Insignis Pine is superior to that of the same tree growing in California, its native state.

Other Pines commonly seen in Queensland gardens and parks are the Aleppo Pine (*P. halepensis*) and the Chir Pine (*P. longifolia*).

FAMILY TAXODIACEÆ.

Taxodiaceæ is a family of trees with scalelike, large, needle-shaped or falcate leaves. The male flowers are borne in small terminal or axillary amenta. The female flowers are borne in terminal amenta which are solitary and composed of numerous spirally arranged, ovule-bearing scales. The mature cones are woody or hard-leathery. The seeds are 2-9 to each scale and usually have a narrow, winged edge. The family contains some extremely important genera—for instance, *Sequoia*, containing the Californian Redwood and the Big Tree, *Taxodium*, the Swamp Cypress, *Cyrptomeria*, the Japanese Redwood, and *Athrotaxus*, the King William Pine or King Billy Pine of Tasmania.

FAMILY CUPRESSACEÆ (THE CYPRESS PINES AND JUNIPERS).

The family *Cupressaceæ* is a family of much-branched shrubs or trees. The leaves are decussate—*i.e.*, opposite, with the one pair at right angles to the adjoining pair, or in whorls or three. Those on young trees or barren branchlets are needle-shaped and spreading; those on the adult tree mostly scalelike or appressed closely to the branchlet; more rarely, as in some Junipers, they are needle-shaped and spreading. Both male and female amenta are terminal or axillary and with the scales opposite or whorled. The anther-bearing scales are broad and bear 3-5 free anthers. The cones are woody, as in the Cypress Pines, or fleshy, as in the Junipers. The seeds are 1-3 in each cell and may be winged or wingless.

In Australia the most important genus of the family is *Callitris*, a genus of small or medium sized trees, containing nineteen described species—with the exception of one in New Caledonia—confined to Australia. Unlike the other Australian genera of Conifers, it is represented in every State of the Commonwealth.

The systematic economic products, chemistry, and anatomy have been exhaustively studied by Messrs. R. T. Baker and H. G. Smith, and the results published in their large work "A Research on the Pines of Australia." One of the principal features in regard to timbers of the Australian Cypresses is their comparative power of resistance to the attacks of termites (white ants), probably due to the presence in the wood of a phenol and other chemical bodies. In addition to their value as timber trees, at least two of the species—*C. columellaris* (the Sand Cypress) and *C. calcarata* (the Black Cypress)—possess barks with a high, but very variable, tannin content. The inner bark also contains an oleo-resin, which when the bark is injured exudes in tears,

the resin being variously known as "Pine Resin," "Cypress Pine Resin," or "Australian Sandarac." It is particularly well suited for the manufacture of pale spirit varnishes.

CHAPTER XXII.

Angiosperms (Monocotyledons).

SOME OF THE PRINCIPAL FAMILIES.

There has been considerable difference of opinion as to the limits of the main plant families of recent years. The present tendency is to divide the larger families of the older classifications into several smaller ones. In the system of Bentham and Hooker adopted in most of the older works in Australia on plants only twenty-three families of Monocotyledons were recognised. Engler and Prantl, by subdividing some of the larger ones, increased the number to thirty, and Hutchinson, in his recently published "Families of Flowering Plants," recognises sixty-seven.

Eleven of the more important families or natural orders have been selected and their characters briefly outlined for the present work. The limits of the families are those of the Engler and Prantl system.

Family Gramineæ (The Grasses).

Grasses are annual or perennial plants, in one group—the bamboos—attaining the size of shrubs or trees. The stems are erect or creeping, mostly cylindrical, rarely flattened, and usually hollow, being only solid at the nodes. The leaves consist of a sheath, ligule, and blade. The sheaths encircle the stem with the margins free—*i.e.*, the sheaths are open. At the junction of the sheath and the leaf-blade is usually the ligule—a small outgrowth, the presence or absence of which is an important point in the determination of grasses from vegetative characters alone. It may be membranous or reduced to a fringe of hairs. The blades are usually long and narrow. The flowers are mostly hermaphrodite, although sometimes, as in the maize, are unisexual. They are mostly small and inconspicuous and consist of stamens and pistil, and of two or three minute transparent or sometimes fleshy scales called the lodicules, which are supposed to represent a reduced perianth, placed between two or three bracts, the outer ones now called the lemmas, although in older descriptions they were usually referred to as the flowering glumes, and the inner one called the palea, the whole forming a floret or false flower. The florets may be single, or several may be borne together on a slender axis, bearing at the base two empty bracts, called the upper and lower glume respectively. The florets and glumes together form a spikelet. The fruit (technically termed a caryopsis) is usually referred to as grain or "seed" and has a thin pericarp adnate to the seed.

Gramineæ is the family of the greatest economic importance, as it contains the principal grain crops of the world—wheat, rice, barley, rye, &c. The native grasses of Queensland number over 500 different sorts or species and represent very largely the basis of the wealth of the State.

Family Cyperaceæ (The Sedges).

The sedges are very closely related to the grasses, but differ in that the stems are mostly triangular and solid, whereas in the grasses

the stems are hollow except at the nodes. The flowers in sedges are borne in the axil of a single bract, whereas in the grasses they are borne in the axil of two bracts—the lemma and palea respectively. In sedges the leaf-sheaths are closed, whereas in the grasses they are open, or at least the margins are free and not united.

The sedges, on the whole, are not of much economic consequence. They favour rather damp, badly drained situations, and in such places often represent quite a considerable bulk of the fodder available. One or two, such as Nut Grass (*Cyperus rotundus*), are very bad weeds of cultivation.

FAMILY PALMÆ (THE PALMS).

Palmæ is a family of trees, shrubs, or, more rarely, forest climbers. The trunk is simple, very rarely branched. The leaves are alternate, and in the climbing species—*e.g.*, Lawyer Canes or Rattans (*Calamus* spp.) are more or less distantly placed along the upper parts of the stem. In the arborescent ones they are mostly arranged in a large terminal crown, and as they drop off they leave the stem covered with leaf scars. The leaf-blade is either palmately or pinnately divided, and by this distinction palms can readily be divided into two distinct classes—(*a*) the Fan Palms, and (*b*) the Pinnately or Feather-leaved Palms. The inflorescence variously forms a spike raceme or panicle often very large and intricately branched. In the young stage the whole inflorescence is enclosed in a large spathe or the individual branches are enclosed in smaller spathes. The flowers are mostly unisexual, male and female growing on the same tree and mostly in the same inflorescence, though occasionally they may be on different trees, as in the common Date Palm. In a few cases they are hermaphrodite. The flowers are typically 3-merous, as in most of the Monocotyledons, though one or more of the parts may be abortive or missing. The perianth segments are usually cream-coloured and of a rather thick, leathery nature. The carpels are three and may be free or united. In most cases only one carpel develops, the other two becoming aborted. The fruit is mainly a 1-seeded berry or drupe.

The Palms number over 1,000 species. They are essentially tropical plants, a few extending to the sub-tropics and a very few to more temperate regions—*e.g.*, one in Southern Europe, a few in Korea and Southern Japan, a few in New Zealand, and one in Chile. In Australia by far the greater number of species occurs in North Queensland. Queensland possesses about thirty species, distributed over fifteen genera.

FAMILY ARACEÆ (THE AROIDS).

The family *Araceæ* is a family of herbs with a tuberous or elongated, fleshy rhizome, terrestrial, but often rain-forest (scrub or jungle) climbers, clinging to the host tree or to rocks by means of numerous aerial roots. The main character of the family is that the flowers are small and crowded on a spadix enclosed in a spathe. The individual flowers are hermaphrodite or unisexual, the males in the upper part of the spadix, the females in the lower; rarely the males and females are on different plants. A perianth is present in the hermaphrodite, but is absent from the unisexual flower. The fruit is a many-seeded berry.

The family contains some important tropical crops, as the Dasheen and Taro. Some of the species, such as the Arum Lilies, Caladiums, &c., are common in garden culture. The plants contain numerous needles

of calcium oxalate which make them inedible in the raw state (see p. 612 and Plate 260) and only eatable after considerable cooking. A common climber in Queensland gardens and bearing an edible fruit is *Monstera deliciosa*. Several members of the family are found growing wild in Queensland either as terrestrial herbs (*e.g.*, Cunjevoi) or as forest climbers (*e.g.*, species of Pothos and Raphidophora).

Family Bromeliaceæ (The Bromeliads or Pineapple Family).

Bromeliaceæ is a family of tropical American plants, herbs, or epiphytes growing on trees and rocks. The leaves are usually long and crowded at the base of the plant. The flowers are borne in a terminal inflorescence and are often very showy and accompanied by numerous coloured bracts. The perianth is usually distinctly marked off into a calyx and corolla. The stamens are mostly six in number, and the ovary is inferior. The fruit is a fleshy berry or dry capsule and is crowned by the persistent calyx. In one genus (*Ananas*, the Pineapple) the rhachis of the inflorescence, the bracts, and fruits are all welded together, as the fruit ripens, into a fleshy mass producing a large succulent syncarp. The rhachis further develops beyond the inflorescence or "fruit" to develop an apical crown of leaves.

The species are all natives of tropical America, and several are cultivated in Queensland gardens as ornamental plants. The most important economically is *Ananas sativa*, the Pineapple. The leaves of the Pineapple and some other members yield an excellent fibre. On the inner face at the base of the leaves peculiar absorptive hairs are developed which enable Bromeliads to utilise water and plant foods in solution, which are held in the dipper-like base formed by the enclosing leaf-sheaths. This is the reason for applying fertilizer to the base of the leaves of pineapple plants as well as, or instead of, to the soil.

Family Liliaceæ (The Lilies).

The *Liliaceæ* or Lily family is a family of mostly herbaceous plants commonly with a bulbous or rhizomatous base, sometimes climbers, rarely arborescent. The leaves are variously shaped; in the arborescent species they are mostly crowded at the ends of the trunk or branches. The flowers are hermaphrodite and typically 3-merous. The ovary is superior. The fruit is either an indehiscent berry or a capsule opening in three valves.

Liliaceæ is a very large family distributed over both the temperate and tropical regions of the world. Some of the species are used as culinary vegetables, as the Onion (*Allium Cepa*); some in medicine, as the Sarsparilla (*Smilax officinalis*), the Squill (*Urginea scilla*), and the common aloe (*Aloe vulgaris*); some for fibre, as the Sisal Hemp (*Agave sisalana*) and the New Zealand Flax (*Phormium tenax*). Large numbers, as Lilies, Tulips, Hyacinth, &c., are cultivated as ornamental plants. The family is well represented in Australia.

Family Amaryllidaceæ (The Amaryllids).

As understood by most authors, this family is only separated from the true Lilies on the very slender distinction of the ovary and fruit being superior in *Liliaceæ* and inferior in *Amaryllidaceæ*. Hutchinson, in his recent work (already quoted), has removed a number of the *Liliaceæ* into the *Amaryllidaceæ*, and has taken as the main character of the family an umbellate inflorescence subtended by an involucre of two or more bracts.

The family is frequent in garden culture, containing the very showy species and hybrids of *Hippeastrum* (generally known in cultivation as Amaryllis) and other plants. The family is not numerically strong in Australia, the largest genus being *Crinum*, of which several species are recognised as native.

FAMILY MUSACEÆ (THE BANANAS).

In the earlier systems the family *Musaceæ* contained several other genera than Musa (the Bananas proper). Hutchinson, in his most recent treatment, confines the family to the Bananas, excluding the Strelitzias, Travellers' Tree (*Ravenala*) and others. The members of the genus Musa are treelike herbs, the stem or trunk formed by the spirally arranged persistent leaf-bases. The leaf-blade is large, with a strong midrib and numerous parallel veins arranged at right angles to it. The flowers are mostly unisexual and borne in a long, upright or pendulous terminal inflorescence. The female or fruit-bearing flowers are borne in the lower, the male or sterile flowers in the upper or apical, part of the inflorescence. The flowers are in groups of five or more subtended by large, usually reddish-purple bracts. The perianth is divided into a distinct calyx and corolla. The calyx is spathaceous, open on the inner side and toothed at the apex. The corolla is mostly smaller than the calyx and two-lipped. The stamens are five, with or without an additional smaller rudimentary one. The ovary is inferior and 3-celled. The fruit is fleshy and indehiscent. The seeds (not present in the edible cultivated ones) possess a hard testa or seed coat.

The Bananas number approximately forty-five species widely spread over the tropical and subtropical regions of the world. Three species are indigenous in North Queensland.

FAMILY ZINGIBERACEÆ (GINGER FAMILY).

The members of the family *Zingiberaceæ* are perennial herbs generally with an underground rhizome. The leaves consist of a lower portion (the sheath) and an expanded portion (the blade). At the top of the sheath and base of the blade there is usually a small outgrowth—the ligule. The inflorescence may be terminal on the leaf-shoots or borne on a separate stem. The perianth is distinctly marked off into calyx and corolla. The calyx is usually tubular or spathaceous (*i.e.*, splitting open on one side), and is variously toothed at the apex. The corolla is united in the lower part, but split into three parts (lobes) in the upper. Only one perfect stamen is developed, the other two being united to form the labellum, which is usually petal-like, and the showiest part of the flower. The ovary is inferior, and the fruit is either capsular or more berry-like and indehiscent; the seeds are numerous.

The family is a tropical one, finding its greatest development in the Indo-Malayan region. Several species (Wild Gingers) are found in the forests of coastal Queensland. The most important economic species is the Ginger (*Zingiber officinale*).

FAMILY CANNACEÆ (THE CANNAS).

The Cannas are plants of similar habit to the Gingers, but the leaves do not possess a ligule at the junction of sheath and blade. The flowers are showy and are borne in a terminal inflorescence. The perianth is divided into a distinct calyx and corolla; the calyx consists of three sepals, and the corolla of three usually long, narrow petals.

The stamens are six in number, usually only one perfect, the others modified into showy petal-like structures, representing the showy part of the flower of the numerous cultivated forms. The ovary is superior, the fruit a dry capsule, the seeds numerous and round.

The family consists of a single genus containing several species, natives of tropical America. The limits of the natural species are not well defined. The numerous cultivated varieties are the result of hybridisation. *Canna edulis* is cultivated in tropical and subtropical countries on account of the starch content of its large tubers. It is known within Australia and abroad as Queensland Arrowroot.

Family Orchidaceæ (The Orchids).

The Orchids constitute a very large family of plants, terrestrial (growing in soil) and epiphytic (growing on trees or rocks), or growing among decaying vegetable matter. Most of the terrestrial ones are tuberous, the tubers being mostly borne in pairs. In the epiphytic orchids the stems are mainly creeping, the creeping part being known as the rhizome. The ascending stems may be swollen, and are then referred to as pseudo-bulbs, from the Greek *pseudos* (false) and *bulbos* (a bulb). The roots of epiphytic orchids serve not only as a means of obtaining nourishment, but a means of attachment. In some cases they contain chlorophyll—the green colouring matter of plants—and probably perform in part the functions of leaves. The roots of most epiphytic orchids are enclosed in a spongy sheath termed the velamen (Latin, meaning a covering). It is the velamen which gives the white, corky appearance to orchid roots, especially when dried. It is a many-layered, spongy tissue whose function is to suck up rapidly and afterwards hold moisture, to be drawn upon by the plant as required. In some extreme cases, such as two peculiar subterranean orchids—one of which was recently found in Western Australia, and the other in New South Wales—roots may be entirely absent. The leaves are extremely variable, sometimes being totally absent, and only represented by a few scales on the flowering stem, as in the common *Dipodium punctatum*, the Spotted or Hyacinth Orchid. In one case—*Taeniophyllum*—there are no leaves of any sort—not even scale leaves; and in this case the roots are green-coloured and probably perform in part the functions of the leaves. The flowers are variously arranged; they may be solitary or in pairs in the leaf axils, in racemes or spikes, in heads or in branched panicles. The perianth consists of six segments in two series. The three outer members of the perianth are generally referred to as the sepals. The back sepal is referred to as the dorsal sepal, and the side ones are known as the lateral sepals. They may be all very much alike, or the dorsal sepal may be markedly different from the lateral ones. The three inner members of the perianth are the petals, and a feature of practically all orchids is that the lowermost one is very much modified in some way. It is generally lobed and differently coloured from other parts of the flower, and is called the labellum. The one exception to this rule among Queensland orchids is the genus *Thelymitra*, which contains the Sun Orchids. It is to the labellum that the distinctive beauty of some orchids is due, and this member is an extremely important one in orchid classification, particularly in the differentiation of species. The principal distinguishing feature of orchid flowers is that the stamens, the style, and the stigma are united into one body, usually referred to as the column. The stamen is generally regarded as being represented in all

cases of Australian orchids by a single fertile anther, borne at the top of the column. The pollen is mostly somewhat waxy, and is usually arranged in two to eight small globose, egg-shaped or club-shaped pollinia or pollen masses, which may be extended at one end into a straplike body called the caudicle. The stigmas are situated just below the anther. They are three distinct (in *Cypripedium* or Slipper Orchids) or usually only one (supposed to be two consolidated). In this latter case the upper border is usually, though not always, developed into a small body called the rostellum—a hinged or easily detachable organ supposed to represent a sterile or abortive stigma. The column is variously shaped, lobed or winged; it may or may not be developed into a foot at the base, and has an important place in orchid classification. The ovary is inferior—that is, below the perianth segments and stamens, which are situated above it. The ovary eventually develops into a seed capsule, the seeds themselves being minute and borne in great abundance.

Though commonly associated with hot, humid tropical regions, it may be mentioned that the members of this family are not confined to the tropics and sub-tropics of the world, but are moderately common in England, continental Europe, and the temperate parts of the Southern Hemisphere. The orchids of the British Isles number approximately forty distinct species or kinds, and when we come to countries such as France, larger and with a more diversified climate, the number of orchid species goes up to seventy-five or eighty. The family is, of course, a huge one, and contains more species or different kinds than any other family of flowering plants, the number of described species being somewhere about 20,000. The greatest number are found in countries such as New Guinea, Burma, Sumatra, the Malay States, and allied countries. Some of the more showy sorts come from the Upper Amazonian and Central American region, but more numerous kinds are known from the tropics of the old world.

[TO BE CONTINUED.]

COPPER STAND AND CLOTHES DRAINER.

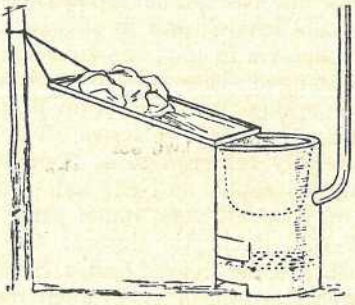


Plate 319.

Take a 40-gallon petrol drum and cut a hole in the top to fit your copper tightly under the ledge, about 3 inches in from the edge of the drum for a 10-gallon copper. About 12 inches up from the bottom of the drum cut a doorway 12 inches wide by 9 inches high. Underneath this, right at the bottom of the drum, cut out a piece 12 inches by 4 inches, for removing the ashes. Next procure an old lid of another drum and punch a number of holes in it like a grate. Then take two very long bolts and put these through the copper stand about 1½ feet apart, about 1 inch under the bottom of the doorway. Place your grate on these bolts and cut a small circle at the back of the drum just above the grate. Rivet on a piece of piping for the chimney and your stand is complete. The drainer is just a long piece of tin with the sides turned up and blunted and which is tied with wire to a post.

Animal Health—The Aim of Veterinary Science.

Professor H. R. SEDDON, D.V.Sc., Dean of the Faculty of Veterinary Science, University of Queensland, and Veterinary Adviser, Department of Agriculture and Stock.*

WITH the establishment of the Veterinary School in the University of Queensland, and the provision of veterinary education in this State, it would seem appropriate to set forth the aims of veterinary science and indicate the scope of the work to be undertaken by our graduates.

IMPORTANCE OF THE ANIMAL INDUSTRIES.

This audience perhaps needs no reminder of the importance of animal production in Queensland, and the effect that successful animal production has on the well-being of the State.

All our foodstuffs of animal origin, with the exception of fish, infant foods, and a few prepared delicacies, come from animals fed and husbanded within the State; and, with the exception of those cattle brought from the Northern Territory, bred and raised entirely within the State. Not only all the beef, mutton, pork, and poultry we eat, but all our supplies of edible animal products such as milk, butter, cheese, and eggs come from our own stock.

There is, therefore, a very considerable animal population, necessary not only to supply our own food requirements, but to some extent those of other States of the Commonwealth. Moreover, it furnishes a surplus for exportation overseas.

Of all the Australian States, Queensland is more dependent upon the livestock industries than any other, our animal production during 1934-35 representing 37·4 per cent. of our total production, whilst in New South Wales it was 28 per cent., Victoria 27 per cent., South Australia 20 per cent., Western Australia 21 per cent., and Tasmania 22 per cent.

The total gross value from animal production in Queensland in 1934-35 amounted to some 20½ million pounds, and of this the value of exports of beef, wool, butter, and so on, was 17 millions. Hence we exported about 83 per cent. of the fruits of our pastoral and dairying industries.

To express our animal wealth in another way, we may recall that the State of Queensland contains nearly half the cattle, a fifth of the sheep, a fourth of the pigs, and a fourth of the horses in Australia, whilst our poultry industry, though still smaller than that in four of the other States, is expanding.

In a very informative article on the subject of the "Empty Spaces" in Australia, and the possibilities of extending occupation and increasing agricultural and pastoral production, the Bank of New South Wales, in its circular for August of this year, points out that opinions may vary as to what area of Australia may be considered as "desert." The writer of this article suggests that in considering the availability of land for settlement we may regard as desert that part of our continent lying

* Address delivered at the official inauguration of the Faculty of Veterinary Science within the University of Queensland, at Brisbane, on 29th October, 1936.

within the 10 inch line of rainfall in the southern part and the 15 inch line in the North (the latter owing to the greater evaporation). That this "desert" area of one and a quarter million square miles is not at present utilised to any great extent is evidenced by the fact that it carries less than 6 per cent. of the sheep population (mainly in Western Australia), and 6 per cent. of the cattle (mainly in Queensland). This "desert" area comprises over one-third of Australia, and, though at present it may not be stocked to capacity, inasmuch as improved water supplies would enable it to carry more, the facts indicate that it is not likely to carry any large proportion of the stock in Australia. If one accepts this area as "desert," the available area of Australia for effective occupation is only some 1,724,600 square miles instead of the actual total area of 2,924,600 square miles.

Particularly important to us in Queensland is that one and three-quarter million square miles of country has been deemed potentially suitable for settlement, for an examination of its distribution shows that nearly one-third (540,000 square miles to be exact) lies within this State.

Whilst opinion may differ as to the real value of much of this country, and even if we allow for factors such as soil fertility and market accessibility—both of which have an important bearing on potential animal production, and which, with other features are in favour of States wholly within temperate climes—it still remains that Queensland seems destined to contribute to the live-stock wealth of Australia an even greater share than it does to-day.

IMPORTANCE OF ANIMAL HEALTH.

Whilst our wealth in numbers of animals is very considerable indeed, the real value of these to the community depends upon the use we can make of them, and the gain to us from their exploitation. It is of prime importance, therefore, that we should get:—

(*a*) The maximum production from the living animal, whether it be in the form of work, or such products as wool, milk, or eggs; and

(*b*) the maximum return from the dead animal, whether it be in the form of beef, mutton, pork, hides, skins, etc.

Anything, therefore, which prevents or lessens our obtaining the full return is a form of wastage and to be obviated if possible.

Important in this regard is animal health, for, using the late Sir Arnold Theiler's definition, health "is that condition of an animal which is most suitable for maximum economic exploitation." To him "the non-productive animal is apparently unhealthy, or better, a diseased animal." Though written only seven years ago, so rapid has been the increase in knowledge that the truth of this is now even more readily apparent, quite recent studies, particularly in nutrition and genetics, showing us that many not obviously diseased animals are in reality so.

RELATION OF HUMAN AND ANIMAL HEALTH.

Animal health is of importance, however, in another direction, and this because there are certain diseases of animals communicable to man. (Parenthetically it may be mentioned that there are also certain diseases of man transmissible to the lower animals.) As examples of animal

diseases which also affect man, we may mention Tuberculosis, Anthrax, and Hydatids. The seriousness of these varies. Though the degree to which man in Australia suffers from them may not be as great as in certain other countries, these diseases, nevertheless, exact a toll on human life and human efficiency, in spite of such measures of control as are in operation at the present time to safeguard human health from attack by them. Anything that we can do—and there are certainly additional measures which could be adopted—will therefore not only lessen animal, but human, wastage.

ANIMALS COMPANIONS TO MAN.

There is still another way in which animals concern us, a phase of animal life which, however, does not bear on our economic needs. I refer to animals as companions of man. Dogs, cats, and birds are commonly kept as companions and pets, affording us comfort and mental happiness which cannot be expressed in monetary terms, but which none the less are of very real value indeed.

Certainly, a proportion of our dog population is maintained solely that these animals may be of service to us for guarding our possessions, or to assist us in droving animals fleeter of foot than ourselves. A further proportion is kept for racing purposes, affording devotees of the sport enjoyment and opportunity for speculation. But a very large proportion of our dogs are not kept for utilitarian or amusement purposes, and, though we have been warned by Kipling against "giving our heart to a dog to tear," it still remains that dogs are valued for their companionship alone. I, being a man, cannot pretend to understand the sentimental value of cats. As there are 24,000 registered dogs in the city of Brisbane, there are probably, in Brisbane alone, 100,000 owners who derive pleasure and comfort from having one, of not more, cats about the place.

Even in this age of motoring, one finds evidence in all States of the pleasure men and women derive from riding, and not only those who rode in pre-motoring days, but those of later generations as well. Few can afford to keep a horse and derive that infinite pleasure which is to be gained by the true horse-lover, but, so popular has riding become in recent years, that it would really seem that, contrary to what has been said of Australians, they do love a horse and derive pleasure from being on horseback.

HOW TO SAFEGUARD ANIMAL HEALTH.

For many reasons, therefore, animal health should be safeguarded. The question is how to do it.

The dog was probably the first animal domesticated by man, and was used by our early ancestors for assistance in hunting, or for guarding food from the depredations of wild animals. Apart from any sentimental reason, therefore—though this doubtless operated at times—he had a material interest in endeavouring, should his dog be wounded or become ill, to restore it to health. Later, as he domesticated other animals, he doubtless cared for them in sickness for much the same reason as we do to-day, for he, like us, was dependent on them for transport, for food, and for raiment.

Through all the ages man has endeavoured to increase his knowledge of animal complaints, but one need not attempt here to trace the developments in veterinary learning. Suffice it to say that the healing art as

applied to animals was referred to in Babylonian writings of some 4,000 years ago; that, as with other sciences, knowledge has waxed and waned, to wax again; but that since the founding of the first veterinary school, in France in 1760, and the setting up of the first in England in 1791, others have been established, in country after country, and there has been a steady acquiring of knowledge, with increase in practitioners of veterinary science, and a recognition by the community that there is a real need for the veterinarian. The veterinarian, too, has come to realise that much more is required from him than the treatment of the sick or injured; that his real province is to safeguard stock from disease, to endeavour to maintain health and to assist stockowners in securing the best from their flocks and herds, whether they be cattle, sheep, pigs, or fowls.

WHENCE COMES KNOWLEDGE OF ANIMAL HEALTH?

Before we can practise measures designed to promote and maintain animal health, we must gather a knowledge of how ill-health comes about, that is, its causation, and the remedies, both preventive and curative, which may be adopted. This knowledge is not to be sought solely in one place, and there are three classes of persons, by whose united efforts knowledge of animal health is best obtained. I refer to the stockowner, the veterinarian working in the field, and the veterinarian working in the laboratory.

Nature guards her secrets jealously, and what we suspect to be true has to be tested and proved. Field observation and experience must be checked by carefully controlled experiment, and the discoveries of the laboratory must be tested out under field conditions.

Sometimes the clue to the solution of some problem comes from field observation; at other times from some purely laboratory experiment. But, to complete our knowledge we must reconcile the so-called theoretical with the so-called practical, and conversely the so-called practical with the so-called theoretical.

Now, the building up of knowledge is a long, often tedious struggle, but all who contribute to its acquisition are aided by the stimulus so helpful to the true seeker after truth—service for benefit of mankind. These contributors do not work independently, striving for their own sake to ascertain new facts; they place them in the common pool of knowledge, to which flow all the streams of effort, not only those I have mentioned, but those from workers in other spheres as well. Thus are gathered together the efforts of all observers, of all scientists. Truly a community of effort, in which the chemist, the biologist, the physiologist, the physicist, the geologist—in fact, the exponents of all the -ologies (and even those sciences and arts, which, though not called -ologies, contribute in any way to knowledge of life, and the influences which go to maintain it—all, I say, combine to wage war on those factors which cause ill-health in stock.

How appropriate, therefore, that the knowledge we call veterinary science should have its intellectual home in a University.

THE APPLICATION OF KNOWLEDGE OF ANIMAL HEALTH.

But the mere acquisition of knowledge is but a means to an end. If it is to be worth anything, it must be put into practice. As knowledge is acquired so must it be dispersed. A cycle is instituted, for, in the dispersal of knowledge, experience adds to it in snowball fashion.

And as the various sciences contribute to knowledge, so do the exponents of the various sciences contribute to the education of the veterinary graduate, in order that these young men, and women, may go out as disciples, preaching and practising animal health. In this way, the University lecturers in the sciences I have mentioned contribute to the end we have in view, for, whether they actually realise it or not, it frequently happens that the wisdom they propound reaches not only the ears of their students, but later—though possibly not in the same form —the ears of the stockowners.

ORGANISATION OF VETERINARY SCIENCE.

It may not be out of place here to indicate the requirements of a community for the safeguarding of animal health. They may be summarised as follows:—

First, a centre for the training of veterinary graduates.

Second, a state organisation to direct the activities of those engaged on the public behalf in combating ill-health in all its forms.

Third, a number of veterinarians working independently as private practitioners, or engaged by other than State organisations, treating the sick, and advising stockowners in order that such animal health as cannot be said to be of national importance may be adequately cared for.

Moreover, that the best results may be attained it is necessary that these three work in unison, and particularly important is it that there should be the closest liaison between the teaching centre, the research centre, and the extension service.

Let us see what has been done in Queensland to fulfil these requirements.

Owing to the generous provision of the Queensland Government, this University has been able to create a Faculty of Veterinary Science, and is providing that Faculty with the staff, accommodation, and equipment necessary for the instruction of its students; that is, the centre for training which has now been inaugurated.

The State is also alive to the necessity for building up an organisation commensurate with the need for developing veterinary knowledge, and for applying that knowledge. Thus, it is extending and building up those facilities for research, for diagnosis, for administrative control of disease, and for the education of the stockowner, and the furnishing to him of assistance in animal health problems. Moreover the necessary co-operation between the school and the Department of Agriculture and Stock has been provided for.

That those not in State employment should have legal protection for their calling, similar to that afforded the other professions, and that stockowners should be protected againt inexpert and unskilled persons, from quacks and charlatans, the Government to-day introduced in Parliament a Veterinary Surgeons Bill. Whilst the passage of that Bill will safeguard the interests of the qualified veterinarian, that very safeguard will be a protection to the stockowner.

It is far from inappropriate that the State should show such sympathy with, and devote such financial help to, the live stock interests, for it should be realised that the well-being of those interests is not simply a matter which affects stockowners; it is the concern of every member of the community.

Although, perhaps not unnaturally, the bulk of the cost of institutions for research, for teaching, and for the dissemination of information falls on the State, recent events have shown us that very substantial contributions have come from other sources. One refers to such activities as those of the Queensland cattle growers (who have so handsomely contributed, by the stock levy, for researches into Queensland problems); the Australian Dairy Cattle Research Association (which has, with the assistance of the Commonwealth Bank Board and certain other public bodies, made possible extended investigations into Contagious Abortion and Mammitis); the McGarvie Institute (which for several years has expended several hundred pounds annually on research and given scholarships for students, thus providing future officers for the New South Wales Department of Agriculture); the Pasture Protection Boards of New South Wales (which, for several years, have contributed approximately £1,000 annually for research, and another £1,000 annually to the Sydney University Veterinary School); and the Pastoral Research Trust (which arranged the establishment of a fund of some £40,000 for research, and following the efforts of which has come about the Wool Levy for propaganda and research). Private benefactions may not have been many, but are very substantial, and one records the gift of £20,000 by Sir Frederick McMaster, which made possible the establishment by the Council for Scientific and Industrial Research of the McMaster Animal Health Laboratory in Sydney; (and here I may mention that the "John Thomson Lecture" next year is to be given by the officer in charge of that institution, Dr. Clunies Ross); then there is the Garland Estate, which will assist in veterinary and agricultural education in New South Wales; and the more recent Burdekin bequest (reported in Brisbane papers of 22nd September, 1936) of £41,993, which is to be allowed to accumulate to £50,000, when the interest is to be devoted to research into pastoral problems, probably in New South Wales, as the late Mr. Burdekin was a grazier in that State.

In addition, certain organised bodies of stockowners have recently undertaken to supply a veterinary service to their members, and so amplify the extension work carried out gratis by the various State Departments of Agriculture. I refer to the Veterinary Club established by the Graziers' Co-operative Shearing Company, in Sydney, and the more recent appointment by the Graziers' Association of Victoria of their own veterinary adviser.

One may point out here, that whilst all these are designed to benefit the animal health side of the pastoral industry, those other animals, city horses, dogs, and cats, have not been entirely neglected, for two of three veterinary hospitals to be referred to later are supported entirely by public subscription.

Thus we see that within post-war times the consciousness of the necessity for direct contribution by groups of owners for research, education, and extension work, either in connection with some Government or University institution, or independently, has been aroused. Moreover, the feelings of certain owners have been so stirred, either by what they have received from the pastoral industry, or from a realisation of the need for spontaneous individual help, that they have given freely during their lifetime or made provision for a substantial bequest from their estates.

VETERINARY SERVICES AND THEIR ACHIEVEMENTS.

We may, I think, dwell for a few moments on past achievements, and present and future aims, in the field of veterinary science. New knowledge gained in the laboratory is perhaps the most spectacular—it affords an opportunity for headlines—and its very newness, and the knowledge of the overcoming of some obstacle to progress, excite our imagination; less spectacular is the steady progress made in extension work—there is no sudden turning point as with discovery—and it is only after the lapse of a period that one realises the magnitude and worth of the results which have been obtained.

Some little while ago, Dr. J. R. Mohler, the veterinarian in charge of the Bureau of Animal Industry of the United States of America—which Bureau, incidentally, employs more qualified veterinarians than any other organisation in the world, viz., 3,000—in an address entitled "Fifty Fruitful Years of Veterinary Science"—set forth certain achievements which he felt veterinary science could justly claim. Though recorded as achievements, certain of these are nevertheless still to be regarded as aims, for it cannot be said that the full harvest has yet been reaped.

One may well mention each in turn—with some rearrangement and amplification of Dr. Mohler's claims—for they serve to show the work of the present-day veterinarian, and the service he endeavours to render to the community.

1. Conquest Over Fear of Disease.

In times past live stock have, either individually or in large numbers, been suddenly stricken with disease, bringing disappointment, anguish, and mental worry, to say nothing of considerable financial loss, on the unfortunate owner. These diseases were then mysterious in their onset; their very nature was unknown; they could not be combated; and even the most proficient stockowner and the most able veterinarian of those days were helpless. Since that time the work of investigators has revealed to us the nature of most of these diseases; for a large number of measures of control have been evolved, and, in place of that fear of animal maladies, there has developed a sense of security in the presence of many of these diseases, and a confidence in the ability of veterinary science to furnish aid.

2. Succour of the Sick Animal.

Instead of empirical, we now have relatively exact knowledge, and methods of treatment are based upon rational understanding of the causation of disease; so that, whilst we realise that the great healer is nature, our actions aim to assist her, and certainly do not hinder her.

Our knowledge of drugs is more exact, and we have developed drug treatment for diseases which for generations baffled all efforts. We have seen the use of one drug—carbon tetrachloride—confer a benefit equal to an increase in value of £1 per acre over all land on which sheep may contract liver fluke. How valuable this discovery has been to the live-stock industry may be gathered when I state that, in New South Wales alone, there are hundreds of thousands of acres of land so troubled. We have seen X-rays developed for use on animal patients, and veterinary surgery advanced to a high plane indeed, the instruments and technique employed being the same as for the human patient.

3. Combating of Animal Plagues.

Whilst our knowledge is still far from perfect, we can, and do, prevent the entrance of animal plagues into a country. Certainly we cannot always prevent them, and this for much the same reason that the police cannot prevent all crime. We prevent also their spread through a country, thus guarding against the extensive mortalities which have, through the ages, followed the uncontrolled dispersal of animals. Certain diseases have been eradicated from large tracts of land, even from states and countries; and the future will, without doubt, lessen the geographical distribution of many diseases, and bring about complete eradication of not a few—at least in those countries which possess an efficient veterinary service.

Reference to achievements in some other countries, as well as in Australia, may not be inappropriate.

Glanders, at one time a common disease of horses in Great Britain, has been eradicated from that country; so has Rabies or "mad dog" disease. Both are diseases which affect man. Cattle Plague has been banished from most countries in Europe. It accidentally gained entrance to Western Australia in 1923, but, by the adoption of stringent measures for its control, at a total cost of between £50,000 and £60,000, we were spared the spread of a plague which in the eighteenth century in Germany alone caused the loss of 30,000,000 cattle, and less than forty years ago caused the death of 80 per cent. of all cattle in South Africa.

Contagious pleuro-pneumonia has been eradicated from Victoria, and in New South Wales is well under control. It is, in fact, enzootic (that is to say, it occurs) only in dairy herds round Sydney, and doubtless will in the early future be eradicated from these. Unfortunately for New South Wales, this disease exists in Queensland, and, as some 150,000 to 200,000 cattle go from Queensland to New South Wales every year, and it is not possible by mere inspection to detect carriers, the disease gains entrance to New South Wales from time to time.

Thanks to recent researches it is now possible to apply to cattle a test which will detect these carriers, but it is a test requiring special laboratory facilities. This test has been quite successfully employed for picking out carriers of contagious pleuro-pneumonia in a herd, and so freeing that herd of the disease. The application of this test to all cattle entering New South Wales has been seriously considered. It would be a huge undertaking, and the authorities there feel that the cost would be too great. This does not mean, however, that the test will not be availed of at some future date. (The difficulties I may say are not so much with the test, as with holding the animals at the border for the period required to test them.)

Stockowners in Tasmania are no longer harassed by losses from Black disease, for, following the researches of Australian workers, vaccination has afforded a means of preventing it. The extent to which vaccination is relied upon in that State may be gauged, when it is stated that during the year 1933-34, 125,000 sheep were so treated, all vaccination being done voluntarily by stockowners because they realised its economic worth, and not because of any governmental requirement.

Anthrax was once so rife in New South Wales that it occasioned considerable annual loss. To overcome it, vaccination of millions of sheep and hundreds of thousands of cattle was carried out annually; as a result,

losses from that disease have steadily declined, so much so that only about a score of properties suffer annually, and the losses of sheep and cattle in any one year probably do not exceed 200 head.

Due to the energetic measures taken against cattle tick in the United States of America during the past twenty-nine years, the number of counties quarantined has been reduced from 985 to 71, and the cattle tick now exists in only three States, over 800,000 square miles of previously-infested country (an area one and a-half times that of Queensland) having been cleansed.

In the United States tuberculosis in cattle and pigs is being eradicated, and the magnitude of the work entailed may be gathered when we realise that 130,000,000 tuberculin tests have been applied, 3,500,000 herds have been declared free of the disease, and of a total cattle population of 65,000,000, 43,000,000 (seven times as many cattle as there are in the whole of Queensland) are under supervision for the control of the disease. The aim, as expressed officially, is not simply the elimination of the disease from certain dairy herds (as is so often the case with tuberculin testing), but complete eradication of bovine tuberculosis from that country.

In Canada, one-fourth of the total cattle population is under test for the same disease, which is being eradicated not only from individual herds, but from whole areas of country.

This may well be contrasted with the position in Australia, where we find the following:—

New South Wales: Four country towns have a tubercle-free milk supply; and some 62 herds, totalling 4,448 animals, are officially accredited as tubercle-free. (Of these 4,448, 1,890 are Government-owned animals.)

Victoria: Eight herds, with a total of 1,073 cattle, have been accredited as tubercle-free, but in the case of no town is the milk supply wholly from tubercle-free animals.

Tasmania: The whole of the dairy herds supplying Launceston have been under test for some years. The majority are now tubercle-free, and that town may be expected, in the near future, to have a tubercle-free milk supply.

Queensland: A number of dairy farmers have had their herds tested, but again only a very small number of owners are attempting to banish tuberculosis from their herds. Only one dairy in Queensland has so far complied with the requirements set down for a fully-certified dairy —that is a herd free not only from tuberculosis, but from certain other diseases, and producing milk conforming with a certain standard.

Other States: I have no definite knowledge, but the position is, I think, much the same.

Canberra, however, has a tubercle-free milk supply.

Contagious abortion and contagious mastitis, both serious diseases, present in Australia and causing considerable wastage in our dairy industry, are being dealt with in the United States of America by a disease control programme similar to that for tuberculosis.

One could go on and mention many more similar examples, both here and abroad, but sufficient has been said to establish the point that animal plagues are being combated.

4. Contribution to Human Health.

Such control is now exercised over many diseases communicable to man that, at least in civilised countries, many of these diseases no longer menace human health. Veterinary meat inspection, such as we have for the City of Brisbane, removes from us the danger of disease spread by animal foodstuffs, and assures to us the supply of wholesome meat.

In other countries veterinary meat inspection is being utilised to a much greater extent than in Australia. In New Zealand every town of over 5,000 inhabitants has its municipal abattoir, and the inspector, if not a fully-trained veterinarian, works under veterinary supervision.

In several European countries every town of over 2,000 inhabitants has a public abattoir, and veterinary inspection is obligatory; in the other countries the smaller towns are not so well served, but the same system obtains. A similar state of affairs exists in certain American countries, for instance, the United States, Canada, and Brazil.

Having in view the position in most civilised countries, one can readily see how considerable improvement could be effected in Australia.

Considerable effort is made in certain countries to avoid danger to human health from diseases which might be contracted through milk. The most important of these diseases is tuberculosis, but, though control of tuberculosis in cattle is being undertaken in many countries, such is being done primarily because of the loss the disease causes the cattle and pig industries, and not for the influence on human health. That this influence is by no means negligible, however, is evidenced by the fact that already the improvement in the United States of America and Canada is reflected in lessened incidence of tuberculosis in infants.

5. Improvement in Economic Stability.

For economic stability of a country such as ours there must be regular animal production, regular supplies of animal products, and stabilised markets. The control of marketing is not the province of the veterinarian, but as stability of market depends very largely upon regularity of supplies, and these again on the absence of influences calculated to upset regular supply, the veterinarian is not without some responsibility. Extensive disease epizootics (that is, animal plagues), may upset, for one or for several years, the nation's food supplies or its animal exports, and the control of disease, by preventing such occurrences, favours economic stability.

One hesitates to think what would have been the effect on Australia's wool industry had sheep scab not been eradicated. One has only to recall the toll exacted on the cattle industry as tick fever spread through Queensland, causing, it is estimated, the deaths of 2,000,000 cattle between the years 1894 and 1900. To this may well be added the heavy annual toll since that date from mortality, from cost of vaccination, from cost of dipping, from restrictions on stock movements, and from inability to utilise ticky areas for non-immune stock.

Recently, however, it has been shown to be possible to take cattle from a non-ticky area and to depasture them with safety in some of our worst tick-infested country, a thoroughly sound and safe means of immunisation against the three types of tick fever in this State having been evolved.

With eradication of disease much freer movement of stock is possible. There is no need to vaccinate; no need for quarantine, and no need for inspections to check the spread of disease by cattle movement. During recent years the United States of America has suffered considerably from drought, but, thanks to its policy of tick eradication, areas from which cattle tick had been eradicated provided relief country for over 1,000,000 cattle in one year alone.

Ability to control fluke, and stomach and bowel worms, has placed sheep production on a much more stable basis, enabling it to be carried out in localities which a few years ago were regarded as "unsound."

The excellent control now exercised over anthrax in Australia has placed this country in a very fortunate position in connection with the hides industry. As it is possible for hides from Australia to be certified free of anthrax, they are not, like hides from many other countries, subject to trade embargoes, nor is it necessary to sterilise them before using them for trade purposes. Australian hides, therefore, have a free market, and the tanning industry is materially assisted, for to the cost of the raw product it is not necessary to add cost of disinfection.

But ill-health is not always the result of animal plagues. It may be caused by other things than microbes and parasites, and one of the commonest in Australia is faulty nutrition. Sometimes it is a matter of quantity of food, sometimes of quality. Though important investigations have been undertaken on the use of concentrated foods in times of drought or as supplements to natural pasture, much additional investigation is necessary.

We hope to utilise for stock much of our country as yet uncleared or utilised to only a limited extent. Like other countries, we shall have to develop our fattening and dairying areas so that they provide more, better, and more regular supplies of foodstuffs than is possible when we rely on natural pasture alone. We require our pastures to be such that, if possible, we have continuity of adequate foodstuffs. For those parts where this is not possible, we require food supplements at economic prices. This is a matter for team work, and there is considerable scope indeed for the combined efforts of the agriculturalist, the agrostologist, the agronomist, the biochemist, and the veterinarian, in order that this desirable state of affairs may be brought about.

Not only feeding but breeding also is important, and though as yet I have only a limited experience of the cattle industry in this State, I am of opinion that we shall have to exert very considerable effort in this direction also. Our watchword for both feeding and breeding might well be *uniformity,* for in Australia there is, in my opinion, too much *diversity.* We know what standardisation has accomplished for certain industries; can we not feel assured it will do much for the animal industries?

It has been shown that there are considerable areas in Australia where there exists a phosphorus deficiency in the soil, this being reflected in the pasture, so that stock grazed on that pasture do not get the requisite mineral for proper bone formation, and consequently suffer from cripples. It has recently been found, also, that along a large part of the southern border of Australia there exists in sheep a disease which is due to a deficiency of cobalt. As these deficiencies very definitely affect the soundness of the country for stock, their elimination by the provision of preventive and curative licks will be of considerable benefit.

Phosphorus deficiency can be combated, but the use of phosphatic supplements is by no means as general as it should be. Practical measures for the overcoming of the cobalt deficiency are in sight, and doubtless ere long economic livestock production will become possible in areas where this deficiency exists.

There are other diseases with a nutritional basis, some purely nutritional, others actually due to some other agent but confined to animals in which some nutritional disturbance is present. Researches, several quite recent, have shown us how some of these diseases may be prevented or cured. And, although in this nutritional work the chemist, particularly the biochemist, has played a marked part, the veterinarian has contributed his share, for, thanks to the basal knowledge provided by the biochemist, the veterinarian has developed lines of treatment so that the dairy farmer is no longer seriously troubled by such complaints as milk fever, grass staggers, and carrion poisoning, nor the grazier by twin-lamb disease.

Unfortunately, we know only too well that there are many other problems awaiting solution, or awaiting an economic means of prevention, and it is in this direction that the efforts of our future graduates will perhaps be most needed, in order that, by the prevention of wastage from ill-health, the stability of the livestock industries may be assured.

6. Humane Treatment of Animals.

I have referred to present-day ability to treat successfully animals which, like ourselves, unfortunately, suffer ill-health. Most of our interest is in the material exploitation of animals for our own gain, but there is another side to our nature. I refer to the humanity of our treatment.

We should not fail to remember that the lower animals are like ourselves—they have feelings, they suffer pain—and surely we, as fellow living beings, have some responsibility in preventing their suffering.

Recently I had the opportunity of seeing three public veterinary hospitals in the South. At one 16,000, at another 8,000, and at the third some 3,000 individual animals are treated each year. Being situated in the city, it is natural that the majority of these animals were dogs and cats. Two of these institutions, in addition, take from the streets some thousands of unwanted dogs and cats and those which have strayed far from home. Often these animals are suffering from disease, and all too often they are starving or show evidence of having been otherwise ill-cared for. Many of these animals are nursed to health and, if possible, owners are found for them.

As the barbarities of early times have passed away and man has become kindlier, it is good to feel that he is being assisted by what various sciences have given us for the relief of animal suffering. Perhaps the most important is the provision of anæsthetics, both general and local, and I may here mention that not only chloroform, ether, and cocaine, but the newer methods and the most recently discovered drugs for producing anæsthesia are commonly used by the present-day trained veterinary surgeon.

It is really remarkable the way in which these different veterinary hospitals have sprung up in Great Britain and in parts of Australia, and wherever they have been established their resources have been

utilised to the utmost. Whilst veterinary surgeons may carry on extensive practices they cannot undertake all the needs of the community, and, particularly for animals belonging to the poorer classes, there is a real need for clinics to which they may take their dumb friends when they are sick or injured. We look forward in Brisbane, therefore, to the clinic to be established at our veterinary school undertaking humane treatment of animals which otherwise would not be brought to those skilled to treat them.

7. Assistance in Industrial Development.

There are two types of industrial undertakings intimately associated with animals. First, there is that type associated with the exploitation of animal products, that is, the fresh, frozen, and chilled meat industries, the butter and cheese industries, the milk industry, and the poultry industry. Whilst this exploitation of animal products is chiefly a matter for the manufacturer or purveyor, we find that, quite apart from what the veterinarian has to do concerning the health of the living animal, he also contributes some assistance to the purely industrial side itself. To exemplify:—It is a prerequisite that all frozen and chilled meat exported from Australia has to be inspected and passed by a veterinary officer of the Commonwealth Government. Again, extensive investigations have been undertaken by the Council for Scientific and Industrial Research to determine the best method of sending chilled meat overseas and combating troubles which are liable to develop in such a product. It is not without interest to note that in the team of workers employed in these investigations there is, in addition to a bacteriologist, a chemist, and a physicist, a veterinarian. Thus does science become the handmaiden of industry.

There is, however, another type of industry associated with animal production. I refer to those industries concerned in the manufacture of licks, special foods, medicines, vaccines, and so forth, for use on stock. Anyone familiar with the products will appreciate the size and importance of these industries. The technical knowledge responsible for many of these products comes from the veterinarian, and certain of these industries exist solely to provide the stockowner with remedies advocated by the veterinarian.

8. Improvement in International Understanding.

Veterinarians as a profession have for some time had an international conscience. I would remind you that in 1863 John Gamgee (an English veterinary surgeon, then a Professor at the Royal Veterinary College in London) issued a circular inviting teachers in the veterinary colleges and practising veterinary surgeons from all parts of Europe to attend a congress in Hamburg to devise means for the control of animal plagues and in particular the spread of contagious diseases from one country to another. That congress was attended by 101 veterinarians, and it marked the inauguration of regular international veterinary congresses which from then to the beginning of the Great War were held every four years. The congress in 1914 was held in the early days of that fateful August, and broke up precipitately as the war clouds foregathered. From then, unfortunately, there was a period of sixteen years until the succeeding veterinary congress in 1930. I well remember the applause that greeted the president when he remarked that he was sure that it was "the earnest desire of every member that

the congress might be able to gather up and reunite more firmly the threads that had been broken sixteen years previously."

At the succeeding congress, in Boston, in 1934, 2,815 members were enrolled, the majority, naturally, being veterinarians resident in the North American continent, but 655 were from overseas. Fifty-seven countries were personally represented, some by very large delegations.

Those attending this, as other veterinary congresses, were not there to secure information for themselves alone, or solely for the benefit of their nations. They were there, as anyone who has read the proceedings would know, to pool their knowledge that mankind at large might benefit.

And that later-day development, the League of Nations, has furthered this betterment of international understanding and co-operation in veterinary matters. In 1924 it set up the International Office of Epizootics in Paris, entrusting to it the duty of undertaking the scientific struggle against diseases of animals. This international office, unlike the international veterinary congress, which is purely a meeting carried out by the goodwill of veterinarians, rests upon even stronger foundations, for all delegates to its meetings attend solely as accredited representatives of their governments.

Though all this be but like a drop in the ocean, it is such actions which tend toward a better understanding between nations and encourage the desire of the peoples of the world to live at peace with one another.

From what has been said it will be gathered that there is indeed wide scope for the veterinarian, and that, while young as a modern-day profession, and with much to do, veterinary scientists can, with some pride, look back at the work of the earlier practitioners—persons who, in spite of the lack of present-day facilities, have achieved much.

If we of to-day are awed by the magnitude of our task we can derive consolation from the fact that our profession, whilst young, is virile, that it will not have to fight the battle alone (for it will have the ready co-operation of all interests concerned), that it will derive assistance from the men of other sciences, and, moreover, that its members have that "will to win" that is so characteristically displayed by Australians on their cricketing and on their battlefields.

INFLUENCE OF THE FACULTY ON SCIENTIFIC RESEARCH.

Thanks to the munificence of the Government of Queensland and largely through the interest and foresight of the Honourable the Minister for Agriculture and Stock, a Faculty of Veterinary Science has been established in this University, in accordance with the recommendations of the committee appointed by the Honourable the Premier. To all those who have contributed to bring it about Queensland owes a debt indeed.

The Faculty, in the words of that report, is to train men to undertake scientific research in animal problems which are specific to Queensland, and the progressive practical elucidation of the problems themselves. Whilst striving to carry out the trust so imposed upon us, we should, I think, take the broadest view of our responsibilities. There

should be no ambiguity as to our objects, which may be set forth briefly as follows:—

Firstly, to provide for students the means of acquiring a full and proper knowledge of veterinary science.

Secondly, to provide a central fount of wisdom and experience in all matters pertaining to animal health—a fount from which not only our graduates, but other veterinarians in Queensland, may draw assistance and inspiration, and to which they may turn for guidance.

Thirdly, to keep in touch with the needs of our stockowners that we may assist them, in whatever way possible, to derive the maximum profit and pleasure from their animals.

The machinery has been created. It is for us to look after it, see that it runs smoothly, and that it accomplishes the purpose for which it was designed.

CURING OF PINEAPPLE-PLANTING MATERIAL.

The stripping of dried or aged leaves from the bases of crowns, slips, or suckers prior to planting is now a fairly general practice on pineapple plantations, and one which is highly commendable for several reasons. However, the need for adequate "curing" or drying out of planting material after stripping is not yet so generally recognised. Curing of planting material is valuable chiefly as a preventive measure against losses from the disease of young pineapple plants, known commonly as base rot. Experimental work has shown that adequate curing is by far the most effective method of attacking this disease; it is infinitely more effective than preplanting treatment with any known fungicidal dip or spray. The reason for this is simple and easily understood. The fungus which causes base rot in young plants is also the causal agent of the disease of pineapple fruits known as soft rot or water blister. This fungus can gain entry to plant or fruit tissues through a freshly-cut or injured surface only. The wounds resulting from the stripping of basal leaves from planting material will quickly heal over by the formation of protective cork tissue if left exposed to the drying influences of sunlight and air for a few days. Once the wounds are covered by a layer of corky tissue, the causal fungus of base rot can no longer gain entry to the stump through them. If, however, planting material is inserted in the ground immediately after stripping or before healing of the wounds has been completed, heavy losses from base rot may result, especially if the soil is wet or rain occurs shortly after planting.

The length of time necessary for proper curing of pineapple planting material varies with the methods adopted and with the type of planting material. For example, soft succulent slips would require a longer curing period than hard woody suckers. If the freshly-trimmed planting material is cured by standing it upside-down in the sun on a special "trimming-ground" a day or so of exposure will usually be enough to harden the injured tissues sufficiently to present entry of the base rot organism. A better plan, however, is to strip the suckers or slips in the field immediately after their removal from the plants, and then place them back on top of the mother plants for curing, where they may be allowed to remain without injury until required for planting. However, in this method a curing period of at least a week of dry weather, and preferably longer, is desirable. Planting material cured on the mother plants does not suffer appreciable injury if held for periods up to two months between picking and planting, owing to the fact that while air circulates freely around it the foliage of the parent plants affords some protection from strong winds and direct sunlight. On the other hand, the vitality of planting material cured upside-down in the sun is likely to be impaired by extremely long drying periods. This loss of vitality is shown by the slowness with which rooting takes place, and the subsequent retarded growth of the plants.

Three-day Sickness of Cattle.

(Ephemeral Fever.)

C. R. MULHEARN, B.V.Sc., Acting Director, Animal Health Station, Oonoonba, Q.

A RATHER unusual disease, in which the main symptoms are a fleeting fever and lameness, made its appearance amongst cattle in Northern Queensland during the first half of this year. The first cases were reported in the vicinity of Burketown, but a large area of country around the base of the Gulf of Carpentaria soon became infected. The disease then rapidly spread from this area until by the end of September outbreaks had occurred at various centres on the east coast extending from the Daintree Valley to Bowen.

As a result of investigations carried out at the Animal Health Station, Oonoonba, and elsewhere it has been ascertained that this disease is very similar to, if not identical with, a disease of cattle known as "three-day sickness" or "ephemeral fever" in other tropical countries.

There is no evidence to indicate that this disease has ever appeared previously in Australia, and it is probable that the infection was recently introduced.

Animals Susceptible.

Bovines appear to be the only animals that contract the disease naturally in the field, for outbreaks have occurred over a wide area of country, and all other species of domestic animals must have been exposed to infection, yet there has not been a single record of a case of this sickness in Queensland in any animal other than a bovine. An attempt was made to transmit the disease experimentally to sheep and goats, but this was unsuccessful, for these animals remained healthy following the inoculation.

Cattle of all breeds appear to be susceptible, for in addition to the European types cases have been recorded in animals showing distinct evidence of the Brahman cross. As a general rule, mature cattle appear to be more susceptible than calves; nevertheless animals under six months of age can become infected and present typical pictures of the sickness.

Cause and Transmission of the Disease.

The cause of the disease is not definitely known, although it has been established that it is of an infectious nature, and typical cases have been produced experimentally by inoculation of blood from a sick into a healthy animal. This would indicate that the causal organism is present in the blood of the sick animal, and suggests that the disease may be transmitted from one animal to another by means of blood-sucking flies or other insects.

A large amount of evidence collected from natural outbreaks in the field would appear to confirm such a theory, for several outbreaks and individual cases of the disease have been reported in which the animal that developed the sickness had never been in contact with any other animals. It is doubtful if the disease can be transmitted purely by contact, for experiments have been carried out in which sick and healthy animals were confined together in small pens and were feeding and drinking from the same containers, yet the healthy animals failed to

contract the disease, although subsequent experiments proved them to be susceptible. Even if the disease is not contagious—that is, it cannot be transmitted purely by contact—there is no doubt that it is highly infectious, for once it becomes introduced on to a property it soon spreads until in many cases a large percentage of the animals become infected in a few weeks.

Symptoms.

Following blood inoculation the period of incubation (i.e., the time from the inoculation until the first symptoms appear) varies from two to five days. The disease is best described as occurring in three stages. These are—

1. A stage in which fever is the prominent symptom. This lasts for about twenty-four hours.
2. A stage in which muscular stiffness and lameness are evident. This usually lasts from one to two days.
3. Recovery. This is the period during which the animal shows signs of improvement but still exhibits symptoms of stiffness, &c., before returning to normal, usually about one day.

As a general rule the disease appears to come on very suddenly in the field, and the animal is well advanced in the stage of fever before the owner realises that it is sick.

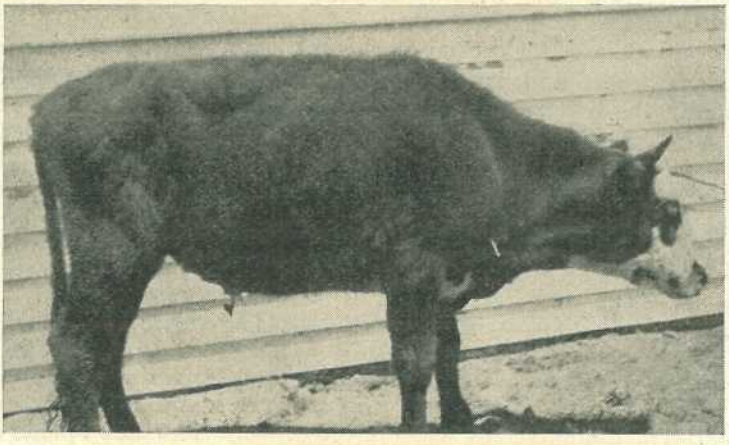


Plate 320.
THREE DAY SICKNESS.—Experimental Case of Disease. Note General Attitude of the Affected Beast.

The first sign of the sickness is a rise in temperature, and if the animal is closely observed at this stage it will be noticed that it is not quite normal. The temperature continues to rise for a period of from twelve to twenty-four hours, until it reaches a maximum of between 106 deg. and 107 deg. Fahr. By this time the animal is more noticeably ill and it has ceased eating and cudding. However, it usually remains in a standing position, and will walk normally or at most a little sluggishly on being driven. In milch cows there is a marked diminution in the milk supply, and there may even be total suppression.

If running at large the sick animal will usually leave the rest of the herd, seek the shade, and stand with its head and ears drooping. In some cases the respiration becomes slightly accelerated and jerky, but in many animals this is not noticeable. At an early stage of the disease, usually at the first rise of temperature, a discharge is noticed from the eyes. This is of a watery nature and at first is not very obvious, but it becomes more copious as the temperature reaches its maximum, and it then sometimes contains a little pus. The amount of this discharge varies in different animals, and in some it is so pronounced that it runs down and stains the side of the face, whilst in others the tears drop only occasionally from the eyes, and they would not be noticed unless careful observations were made. A discharge from the nose usually appears about the same time as that from the eyes. This is at first watery but soon becomes mucoid and stringy, and it is not unusual at this stage of the disease to see the animal with strings of this mucoid material about 3 to 6 inches long hanging from one or both nostrils. This discharge usually remains clear, but in occasional cases it may become slightly "pussy" or turbid. At the same time saliva drops freely from the mouth, and it may at times become frothy.

All the changes mentioned are noticed on the first day, and they represent the first or fevered stage of the sickness. If the animal is running in the paddock and is not under close observation, this stage may not be noticed. Occasionally, and particularly in young animals, recovery follows after this stage, and the animals return to normal after being sick only one day and without showing signs of muscular stiffness or lameness.

In typical cases the second or rheumatic stage of the disease follows the febrile stage, and is seen at the beginning of the second day. Frequently the temperature on the second morning is down to normal, but it may rise again to about 104 deg. by the afternoon. The animal is usually found lying down when this stage has developed, and even though it may be comparatively wild and resent handling when in normal health, it may make no effort to move when approached. When the animal is lying down the head is often resting round on the side of the ribs, as in cases of milk fever. At this stage it is apparent that the animal is sick, and its general appearance causes alarm to the owner if it is his first experience with this disease. The animal has no desire to rise, and difficulty is usually experienced in forcing it to do so, but when forced to stand there may be some quivering of the muscles and the beast may have difficulty at first in maintaining its upright position. The hindquarters, when affected, sway from side to side before they become steady. The animal may move off after standing for a while, but more often it has to be forced to walk, when pronounced lameness is obvious. This may affect either one, two, three, or all four legs. Usually only one or two legs are affected, and to such an extent that at first the animal appears to be unable to bear any weight on them. When all four legs are affected the gait is very proppy and stilted. On walking there is little flexion of any of the limbs, and the toes are dragged along, leaving a mark on the ground. After walking a little distance the gait becomes better, but there is still obvious lameness. When allowed to stand the legs are usually placed well under the body and the back may be arched, according to the number and position of the legs affected. The beast soon returns to the recumbent position on being left alone.

At this stage of the disease the discharge from the eyes has usually cleared up, although the hair over the side of the face may be still matted. However, in some cases a swelling appears around the eyes and the eyeballs become very prominent, due to abnormal pressure at the back of the eye. The nasal discharge usually remains quite copious, and mucoid strings continually form and extend down from the nose before dropping off.

The general appearance of the animal suggests one of fullness, particularly in the left flank, although this is by no means present to the same degree as in cases of hoven or bloat. In some cases gas has been detected under the skin, and this is most commonly seen behind the shoulders. There may even be a slight swelling in this area.

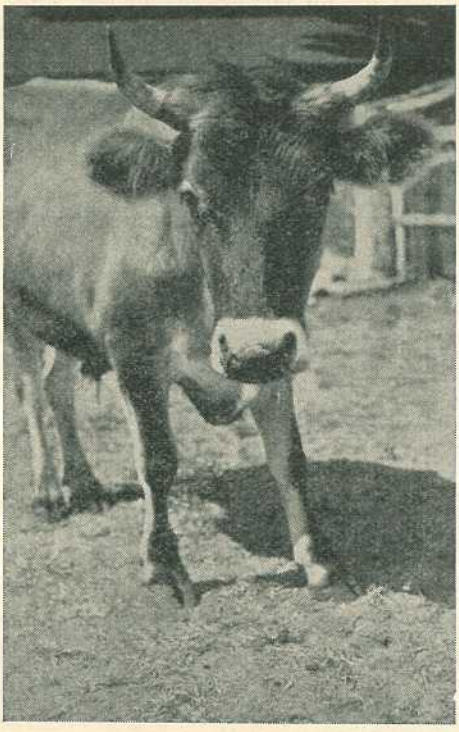


Plate 321.
Three Day Sickness.—Another Experimental Case.
Note Discharge from Eyes and Nose.

The consistency of the fæces varies. In some cases constipation is present, whilst in others there may be a foul smelling diarrhœa. However, in the majority of animals under our observation there has been little change from the normal in this respect. If the disease is at all severe, there is usually a total suppression of the milk supply in dairy cows, and all animals will spend most of this day lying down.

On the third day there are usually signs of improvement, and animals may recommence eating and chewing their cud. The temperature is usually back to normal, but stiffness or lameness is still evident in one or more legs. It is sometimes noticed that a limb which was showing obvious lameness on the second day has recovered, whilst one of the

other limbs which was apparently normal previously has developed lameness. The nasal discharge is still present, though now not so obvious. Towards the end of the third day the general condition of the animal is much improved, and usually by the fourth day the animal has almost completely recovered, except that there may still be some stiffness of the limbs. This, however, is not an obvious lameness, and it usually soon disappears. In dairy cows the milk supply tends to increase again about the third or fourth day in uncomplicated cases, and it is usually back to normal at the end of a week.

The changes described are those observed in a typical case of the disease, and it will be seen that the sickness usually extends over a period of three days, hence the name "three-day sickness."

Atypical cases are by no means uncommon, and these may vary considerably. In some the febrile stage may last over a period of several days, followed by recovery without any marked symptoms of lameness, although the animal will do very little walking and spend most of the time lying down. In other cases the animal will go down on the second day and appear to completely lose the power of either the fore or hind limbs; so that all efforts to force it to stand prove futile. This condition may prevail from a week to a fortnight, and is most commonly seen in dairy cows. More often the hind limbs are thus affected, and the animal can partially raise itself on its forelegs.

The appetite returns after one or two days, and the general appearance becomes bright, but the animal may be down for up to a fortnight before it can again stand and bear any weight on its legs. Most of such cases recover, provided they are carefully nursed whilst on the ground, but the milk supply is greatly diminished, and it may or may not return when the cow eventually is able to stand again.

As a general rule, the mortality rate in uncomplicated cases is very low, being at the rate of about one to five cases per 1,000. In those cases where death has occurred there is usually some other complicating factor, such as general poverty, undue and forced exertion, such as in travelling cattle or cows advanced in pregnancy.

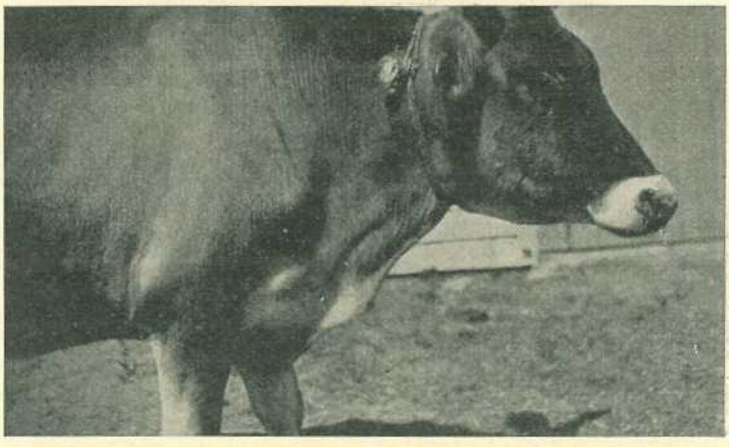


Plate 322.

THREE DAY SICKNESS.—Another Photograph of same Animal. Note Discharge from Eye and Nose. (Experimental Case.)

Post-mortem Changes.

When death occurs in uncomplicated cases of the disease the post-mortem findings are not very outstanding. There may be an abnormal quantity of air in the tissues under the skin, and generally also some air may be noticed under the covering of the lungs, particularly at the borders. The lining of the wind pipe or trachea and its branches into the lungs may be inflamed and swollen and covered with a clear tenacious mucus similar to the nasal discharge prior to death. Sometimes a straw-coloured fluid is found in the chest cavity, and this fluid may also be present in the sac around the heart. The abomasum or fourth stomach may be slightly inflamed, and there is usually some evidence of recent bleeding from the lining of this organ. The spleen may be slightly enlarged, and the gall bladder is often unduly full of fluid bile. However, there is no outstanding post-mortem change which can be taken as definitely diagnostic of this disease.

Treatment.

Medical treatment in the form of drenching is not recommended in uncomplicated cases of this sickness, particularly so when stiffness of the neck muscles is evident. In such cases the animal is not able to swallow normally, and there is a grave danger of portion of the drench entering the lungs and giving rise to pneumonia. Several cases have come before our notice in which animals have recovered from three-day sickness, but subsequently died of pneumonia as a result of being drenched.

Provided the sick animals are well looked after and are placed in a shaded and protected position so that they will not be knocked about by other animals, and are protected from extreme climatic conditions, an uneventful recovery takes place in a few days. It must be borne in mind that many sick animals cannot travel for water, and those that can are not in a fit state to enter a waterhole to drink; consequently, it is essential that an adequate supply of water should be made available to the animals at all stages of the sickness. Potassium nitrate at the rate of 1 oz. to each 4 gallons should be added to this water when the animals are in the fevered stage of the disease.

When an animal becomes cast and remains down for several days, it should be made comfortable by the provision of an adequate quantity of bedding. It should be turned over from one side to the other at least twice a day. The affected limbs should also be fomented by the application of rugs which have been steeped in hot water and then wrung out. Following this the limbs should be well massaged, working from the fetlocks towards the body.

Prevention and Control.

Although there is no evidence to indicate that the disease is contagious, it is advisable to isolate the sick animals, particularly so when only a few cases of disease have occurred.

Sick animals or those that have recently recovered should not be travelled, as this may lead to the spreading of the disease.

However, as the infection is probably also spread by winged insects, it is not possible to confine it to any specified areas by quarantine measures. Nevertheless, owners are advised not to allow cattle from known infected holdings on to their property, for such animals may act as a reservoir, from which the disease will become established.

UNSETTLED weather prevailed during the month of November, storms yielding over an inch of rain being received at many centres. Unfortunately, the falls have not been general, and, following on a long dry period, are totally insufficient to promote plant growth or greatly revive pastures. Where heavier rains have been received it will be possible to proceed with the sowing of summer crops such as maize, sorghum, peanuts, and general fodder crops, but even in such favoured areas further rains will be required in the near future to maintain growth. A large area of land has been prepared for summer sowings, awaiting favourable conditions, as farmers are particularly anxious to replenish their fodder reserves as well as to provide for present urgent requirements.

WHEAT.

Harvesting was practically finalised by the end of November, ripening being accelerated by the dry seasonal conditions. Although the aggregate yield will be below average, the quality of the grain is excellent, a high proportion being suitable for seed purposes. Some excellent yields are reported from individual areas, where early fallowing was practised in order to conserve moisture resulting from summer rains. The large area hurriedly prepared towards sowing time, together with that sown principally for feed, results in considerably lowering the State's average yield per acre. This is particularly noticeable during a period of under-average rainfall.

In the Dawson Valley and Callide districts, where a small area is placed under wheat, the resultant yield has been very satisfactory despite the low rainfall received during the growing period of the crop. On the Downs many crops have been cut with the binder in order to conserve straw. This draws attention to the fact that during the present season many farmers would have received a higher return by marketing their crops as hay or chaff. Owing to the partial failure experienced by many growers, the cultivation of wheat as a summer crop has been suggested. Although accurate experimental work has not been carried out in this direction, it is known that individual farmers have raised satisfactory crops from November and December sowings, and also from self-sown areas where the grain has been broadcast by storms. However, summer sowings cannot be recommended owing to the risk of severe rust infestation reducing yields to an unprofitable

level. Growers attempting summer wheat sowing are therefore advised to give the land an adequate preparation, and to sow rust-resistant varieties such as Three Seas not later than December, as ripening will naturally be retarded with the approach of cooler weather.

COTTON.

The desire for good general planting rains during November has unfortunately not been fulfilled, and several important cotton areas are still awaiting sufficient moisture to allow of planting. Scattered storm rains, however, have fallen over a considerable portion of the cotton belt in sufficient quantities to allow of planting. These areas include the Lockyer and Brisbane Valley, the South Burnett, and portions of the Upper Burnett and the Callide.

Although the general planting will be late, from previous experience there appears to be no reason why profitable yields should not be obtained, for it has been noticed in past years that later plantings, instead of being somewhat restricted in their earlier growth, develop at a quicker rate than do earlier-planted crops.

Seed distribution is still being carried out, and to the 13th November sufficient to plant 57,310 acres has been allotted, and it is anticipated that this season's plantings will be about the same as last year.

SUGAR.

Dry conditions throughout November have seriously retarded the crop in the far North, though timely rains have now relieved the position.

In the central and southern districts light but beneficial storms have improved growing conditions markedly, and the crop prospects in those areas are now reasonably good.

Several mills have completed their harvest, and all report a generally satisfactory season.

AN EFFECTIVE GATE STOP.

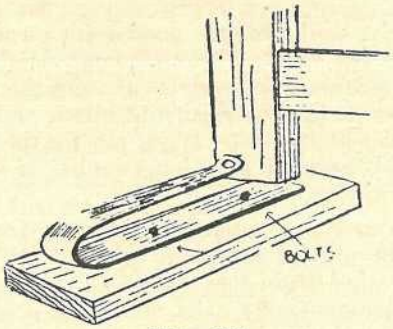


Plate 323.

An effective and easily-operating gate stop can be made from an old rabbit trap. First remove the jaws, plate and cross-piece of the trap, then drill two holes in the bottom-piece. Bolt the trap firmly on to a block of wood fixed in the ground in front of the gate in the open position. Place it high enough to catch the bottom of the gate about half an inch. To release, press the spring down with your foot and pull the gate forward. Instead of the two bolts, iron staples will hold the trap in place on the block.

CITRUS CULTURE IN QUEENSLAND.

R. L. PREST, Instructor in Fruit Culture.

CITRUS-GROWING in Queensland has been mainly confined to the coastal belt, although in recent years it has extended inland to areas of lower rainfall, where suitable water for irrigation purposes is available.

The material success of a commercial citrus orchard depends in a large degree on the location, site, climate, and soil conditions. In the most suitable coastal areas growth is generally more vigorous than in inland districts, but, aided by irrigation, districts with a low rainfall produce a firmer fruit of better appearance and texture. A great deal depends on a regular supply of moisture to develop the full flavour of the fruit, which is not attainable under excess or a fluctuating quantity.

Soils.

Citrus trees thrive and produce good fruit on a rather wide range of soil types, such as red volcanic loams, loams, sandy loams, and sandy soils, providing they are well drained. Although the chemical properties are of great importance, the suitability of citrus soils depends more on the physical properties of the soil. Chief among the physical characteristics are porosity and thorough aeration, coupled, if possible, with depth, to permit perfect drainage.

Shallow soils over-lying retentive clays or rock, are improperly drained and must be classed as unsuitable. Soils of a sandy nature overlying gravelly washes drain too freely as a rule, and are also undesirable. Deep, sandy loams, sandy soils, and deep loams, overlying well-drained subsoils, can be classed as citrus soils.

The most desirable citrus soils are alluvials, deep loams, and sandy loams, overlying a porous subsoil, which in turn overlies a gravelly wash.

Very fertile soils that induce an extremely heavy growth of wood and foliage are apt to be objectionable, because these results are not always conducive to the production of the best crops, nor of fruit of

the best quality and appearance. It is a fact fully supported by experience that the well-drained warm soils preserve the best balance between the vegetative growth of the trees and fruit production. Such soils are usually represented by the lighter types, as heavy types are likely to lack adequate drainage.

In addition to the type as indicated by the surface soil, the subsoil is of very great importance, even greater than the surface soil. The surface may give every indication of being a good citrus soil, and yet the subsoil be of such a character as to make it quite impossible for the commercial production of citrus fruits. For instance, a shallow stratum of soil overlying rock produces a soil condition entirely unsuited for orchard purposes. Under the most favourable soil moisture conditions an orchard planted on such a soil may do well, but it is likely to suffer in times of drought because the reserve of soil moisture is very limited, and in times of excessive rains difficulties resulting from poor drainage are likely to occur.

The nature of the surface soil can be modified by the way in which it is handled, but the subsoil admits of only slight modification by ordinary means, except perhaps by underground drainage, which is generally too costly. If the subsoil is gravelly and over-porous, the trees are likely to feel severely the effects of even a moderate drought, while the other extreme, a heavy clay sub-soil, is very likely to be badly drained. In a badly-drained, heavy clay subsoil the roots in periods of excessive rainfall decay, and the top of the tree commences to die back. Therefore, a soil of this type must be thoroughly drained, yet not over-drained so as to cause the trees to suffer in dry weather. It should be reasonably fertile, and well supplied with humus, otherwise its physical condition will quickly deteriorate, and it will be easily affected by drought and the fertility will be impaired.

Location.

In selecting the orchard site, aspect should be well considered. Citrus trees thrive in a frost-free, well-sheltered, warm situation. In districts where the prevailing winds are such as to interfere with the normal tree growth, belts of standing timber or scrub should always be retained as a protection to the orchard. In inland areas where timber is scarce artificial shelter belts should be planted.

The site should be an area of unbroken, nearly level, or gently sloping land. Steep hillsides should be avoided, as, in addition to the danger of sustaining irreparable losses by soil erosion, the costs of general orchard practices are high. Most centres along the coastal belt are free from damaging frosts. In the Burnett district, however, this is not the case, and on occasions low temperatures have occurred, causing injury to lemons, and, in one or two cases, severe damage to young citrus trees. In such districts care should be exercised to avoid hollows and low areas where frosts are likely to be experienced.

Varieties.

A wide range of varieties of citrus trees has been catalogued, many of which are not worthy of space in the orchard. When making commercial plantings it is advisable to confine the selection of varieties to the narrowest limits. Productivity and market demands are the essential requirements to be kept in view, and these can only be obtained by confining attention to the variety or a few varieties of recognised merit best adapted to the district or locality in which they are to be planted.

Plate 324.
Jaffa Orange.

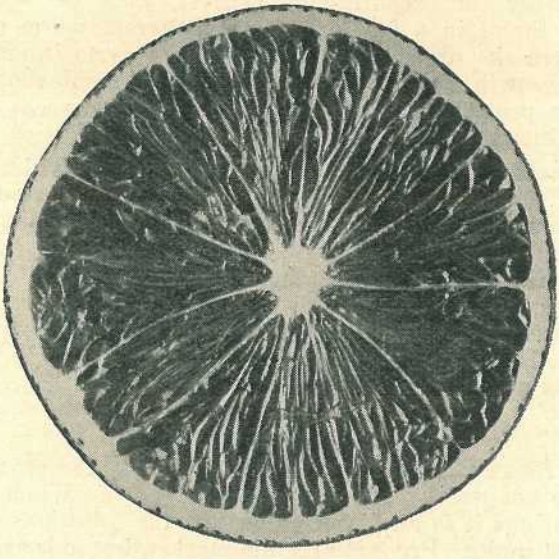


Plate 325.
Jaffa Orange. Cross-section.

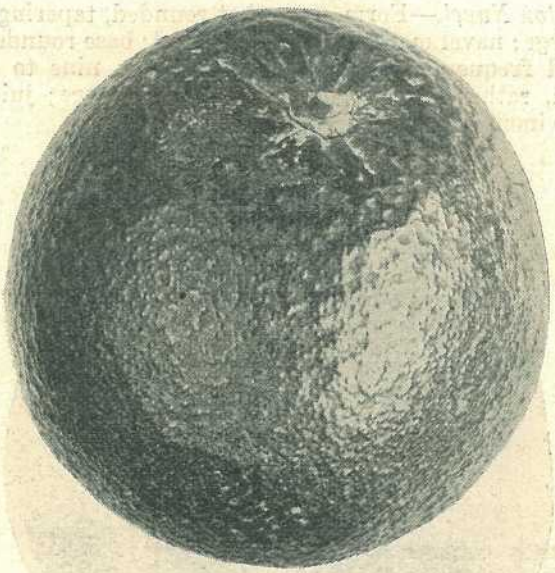


Plate 326.
Valencia Late Orange.

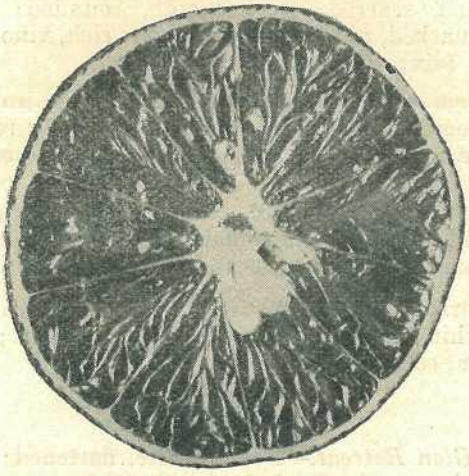


Plate 327.
Valencia Late Orange. Cross-section.

Oranges.

Washington Navel.—Form, somewhat rounded, tapering towards the apex; size, large; navel marking at blossom end; base rounded, somewhat flattened, and frequently creased; sections, from nine to eleven, well-defined; flesh, rather coarse; juice sacks rather large; juice plentiful; flavour rich, vinous; quality excellent.

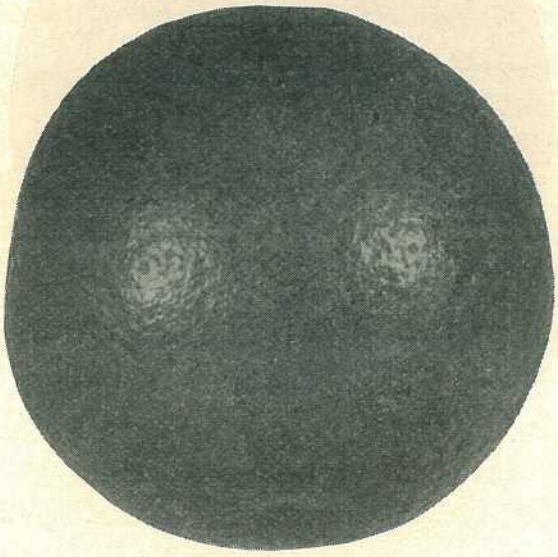


Plate 328.
Joppa Orange.

Valencia Late.—Form, round or oval; size, medium to large; apex rounded, flattened, scarred; base smooth, rounded; juice abundant; sections clearly marked, nine or more; flavour rich, vinous; quality excellent; seeds few (six), large, plump, and oval.

Joppa.—Form slightly rounded, oblong; base rounded, somewhat flat; sections, from ten to eleven, well defined, fairly regular; flesh fine-grained; flavour rich, vinous; seeds, about nine, short, rounded, and plump.

Jaffa.—Form, long oval; size, large; skin, smooth, but coarse and thick at stem end; colour light yellow; flesh, fine, rich, and juicy, with little rag; sections, from ten to eleven, regular; practically seedless.

Siletta.—Form rounded; medium firm; pale orange colour; rind smooth, fairly thin; flesh fine; juice of good flavour; seeds very few; divisions regular; season, early.

Mandarins.

Beauty of Glen Retreat.—Form oblate, flattened; sections showing through rind; size medium; rind smooth, glossy, very thin; sections, ten or more, clearly defined; rag almost entirely lacking; juice plentiful; flavour distinct, rich, vinous; acidity and sweetness well blended; seeds few, small.

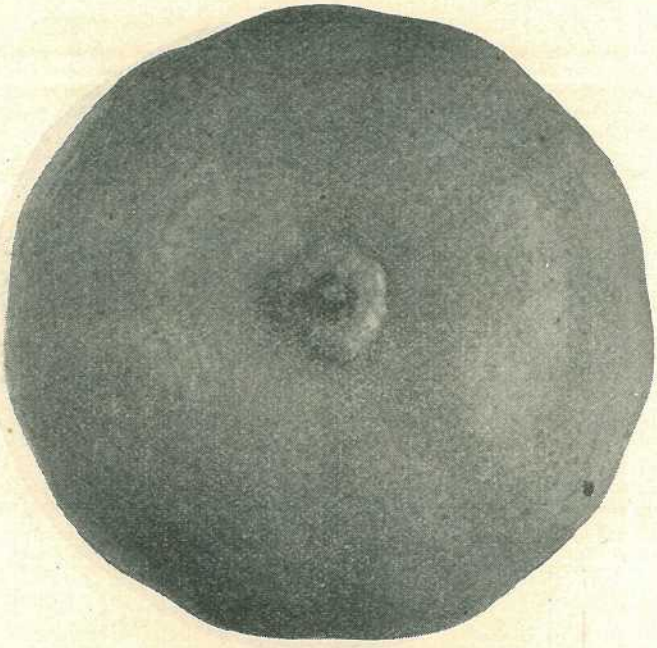


Plate 329.
Beauty of Glen Retreat Mandarin.

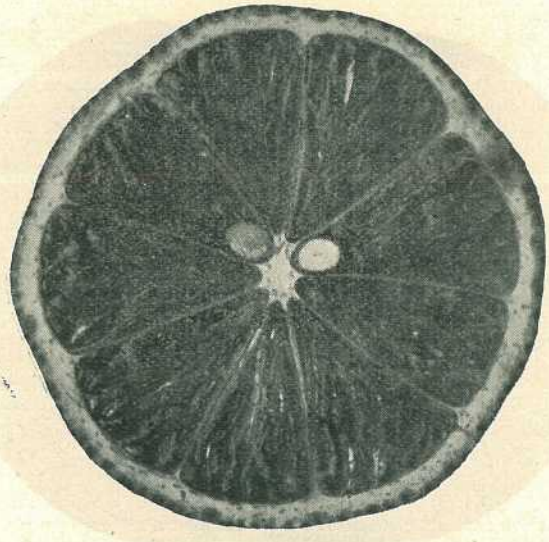


Plate 330.
Beauty of Glen Retreat Mandarin. Cross-section.

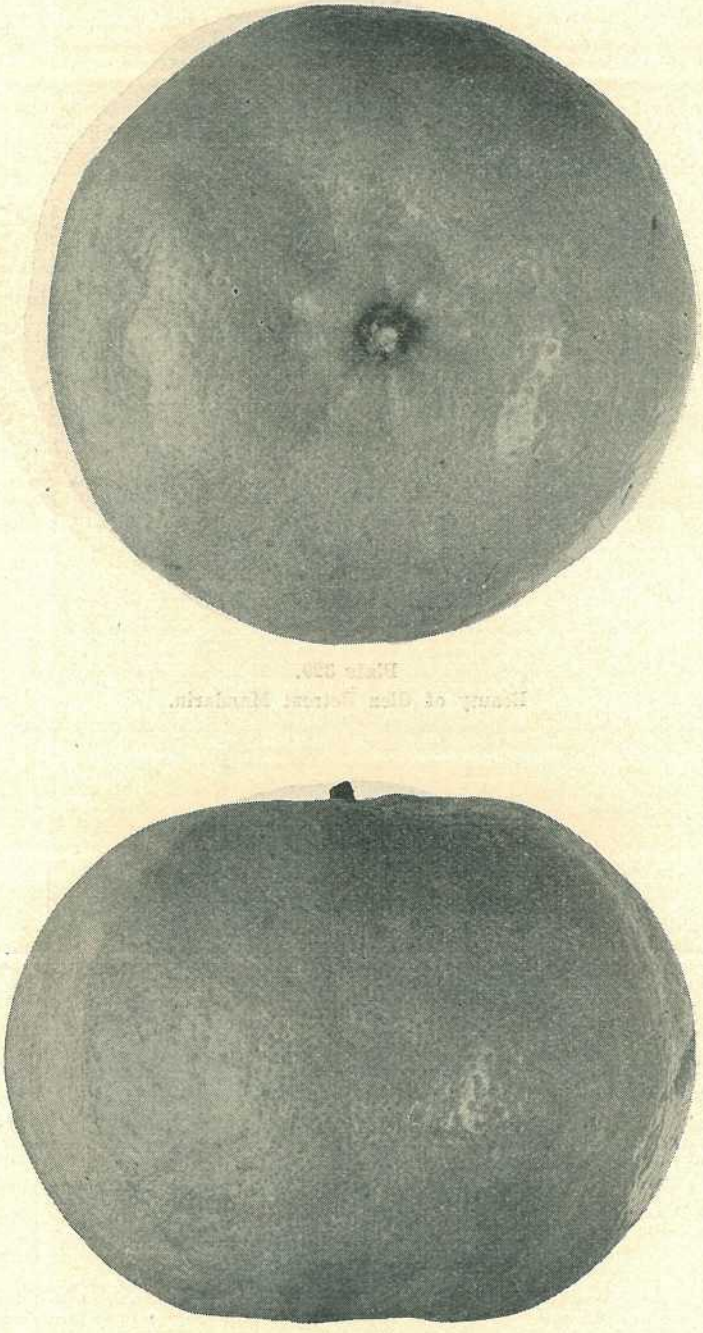


Plate 331.
Emperor Mandarin.

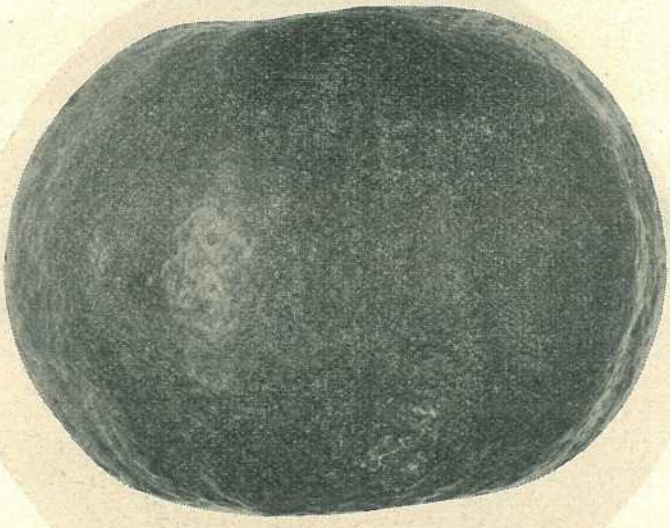


Plate 332.
Solid Scarlet Mandarin

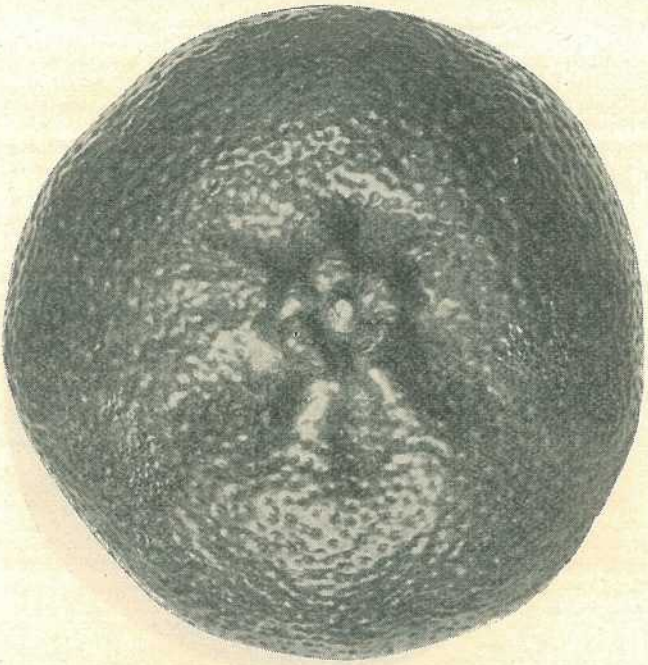


Plate 333.
Scarlet Mandarin.

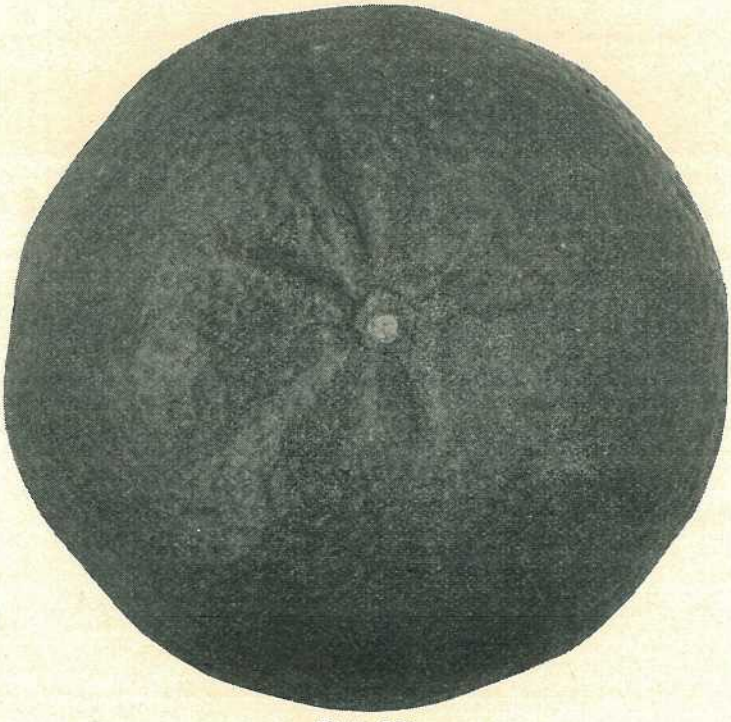


Plate 334.
Ellendale Beauty. Late Mandarin. Dry Districts Under Irrigation.

Emperor (*Emperor of Canton*).—Form roundish, flattened at ends; skin yellow in colour, brittle, medium to thick; parts readily from fruit; size, medium to large; rag plentiful; flavour good; seeds, few.

Scarlet.—Form oblate, flattened; size, medium; rind rough, thin, rich reddish-orange colour, more or less detached from flesh; distinct fibrous network between skin and pulp; flesh, dark orange colour; juice plentiful, sweet flavour; seeds numerous.

Grapefruit.

Marsh's Seedless.—Form oblate, roundish; colour, pale lemon-yellow; medium thick rind, smooth; sections, thirteen, regular; juice sacks, small; flesh, greyish green; flavour, good, bitter principle not very marked, acidity and sweetness good; seeds, from two to six, or none, large and plump.

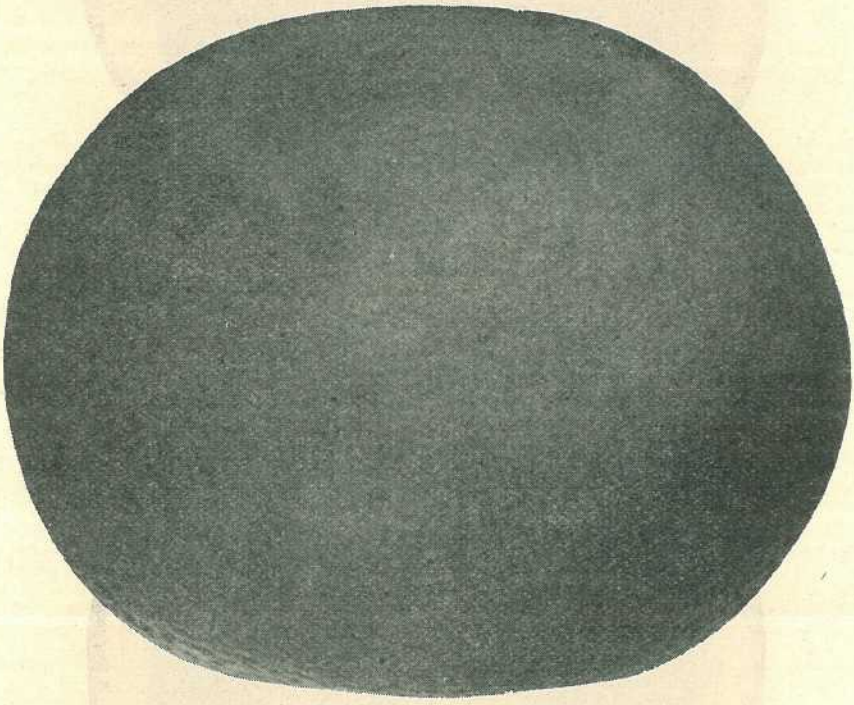


Plate 335.
Marsh Grape Fruit.

Thompson.—A pink-fleshed form of Marsh's Seedless, being a bud-sport of a Marsh tree; usually typical of Marsh's Seedless except for pinkish flesh.

Duncan.—Form oblate; colour, pale lemon yellow; rind smooth; sections, fourteen; large; bitter principle strongly marked; acidity and sweetness good; quality very good; seeds, fifty, large, plump, blunt, not winged. Duncan is a variety of superior quality. The large juice sacs make it possible to easily remove the pulp from the sections.

Foster.—Form oblate; stem small; colour pale yellow; rind smooth; sections thirteen, large; bitter principle strongly marked; flesh pinkish; acidity and sweetness good; seeds fifty-eight, large, plump, wedge-shaped or irregular; season early.

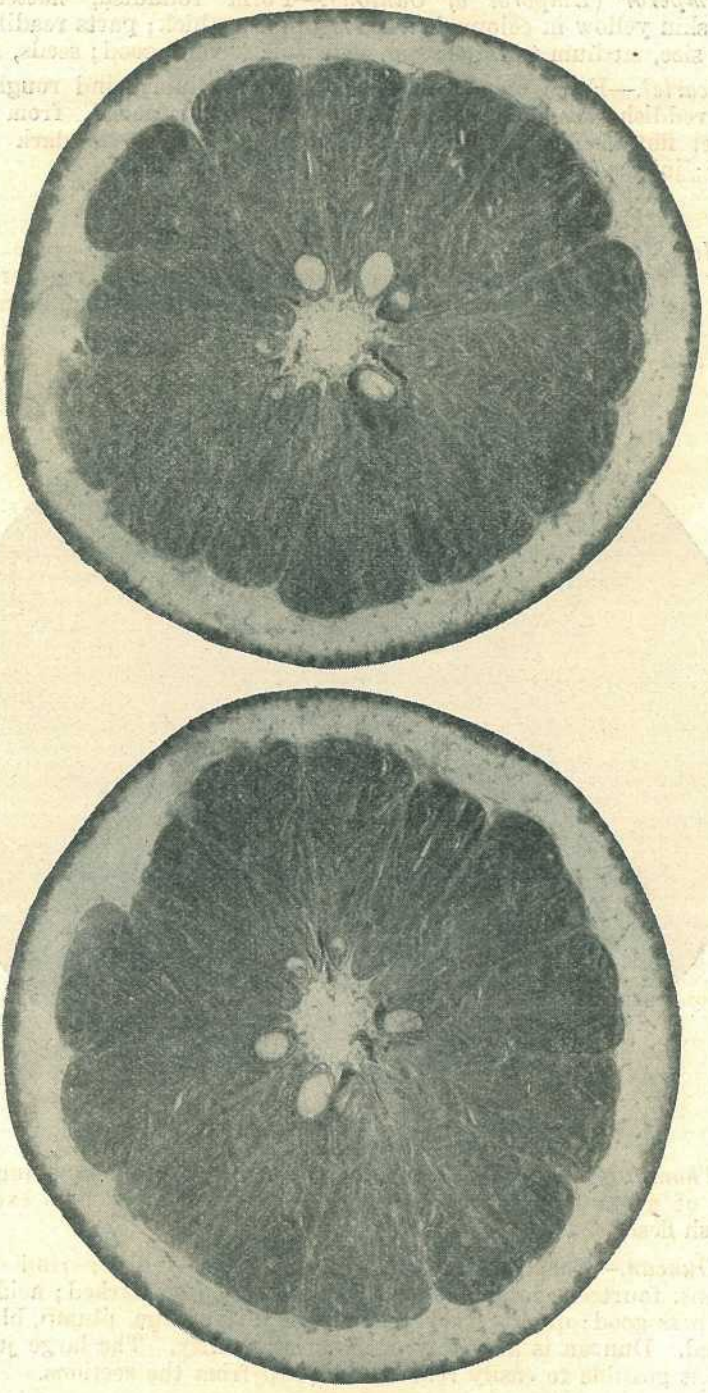


Plate 336.
Cross-section of Marsh Seedless Grape Fruit.

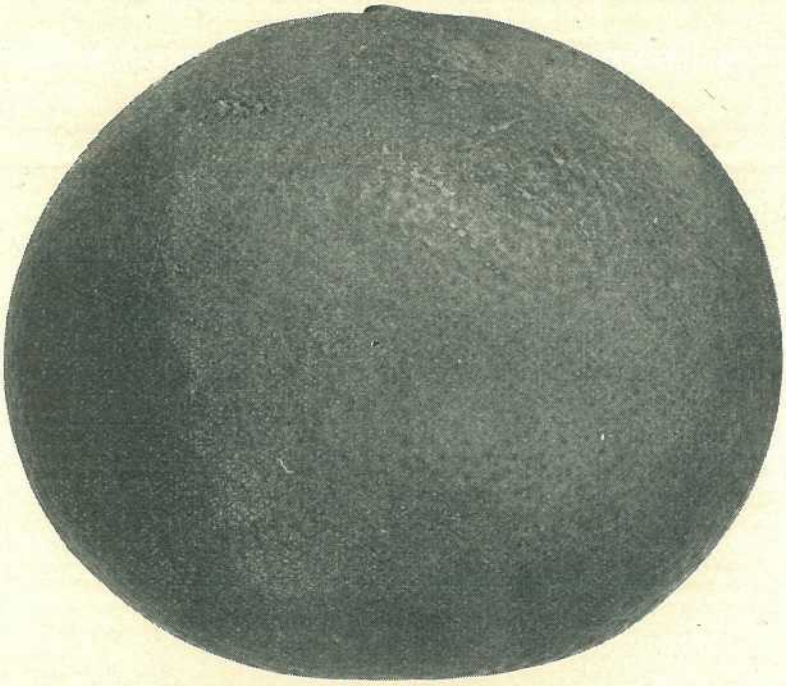


Plate 337.
Duncan Grape Fruit.

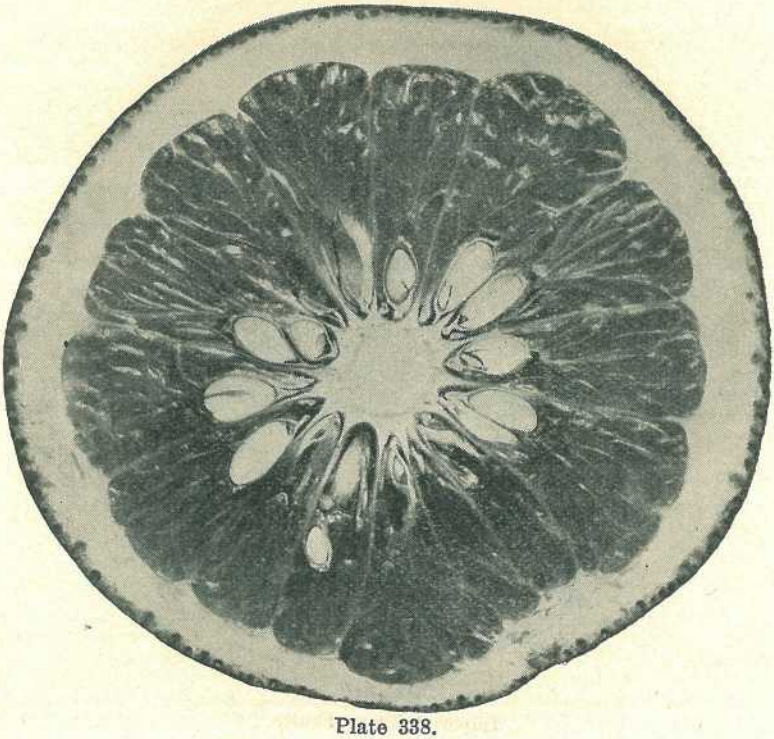


Plate 338.
Duncan Grape Fruit. Cross-section.

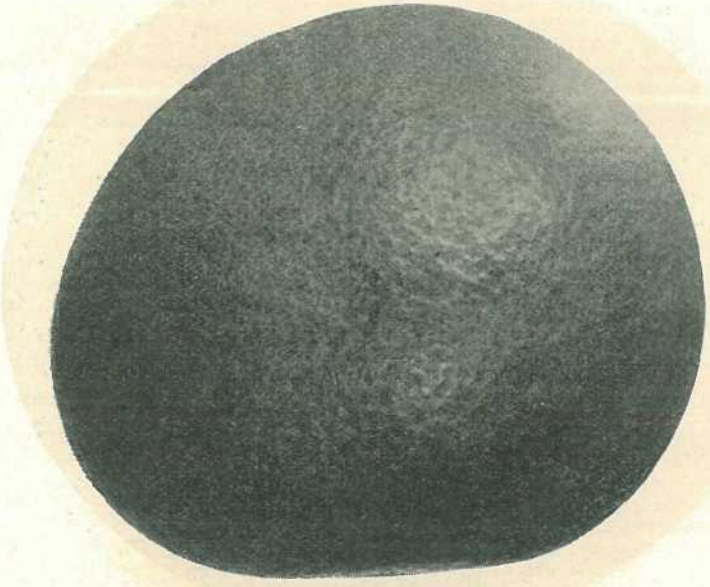


Plate 339.
Thompson Grape Fruit.

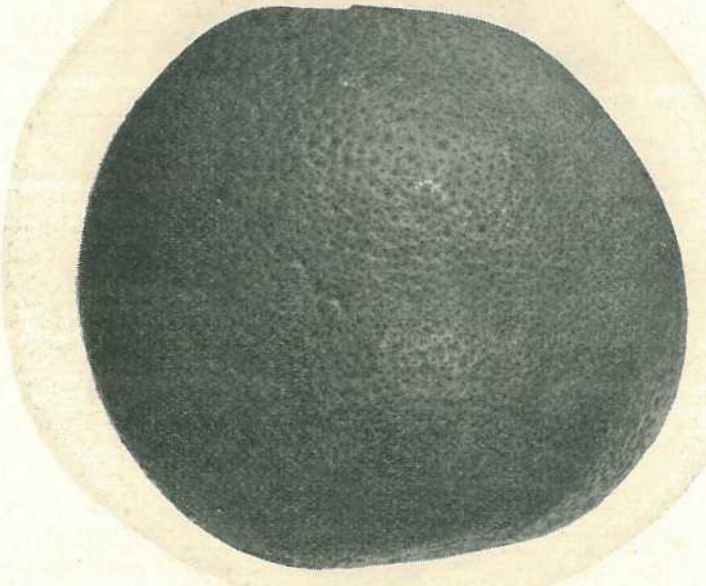


Plate 340.
Imperial Grape Fruit.

Lemons.

Villa Franca.—Form, oval oblong; size, medium to large; apex, pointed blunt, abrupt, about half in. long; base rounded; segments not distinctly marked; rind smooth; sections, eleven, well-defined and regular; juice colourless, abundant; flavour good; seeds, thirty, medium size, oval, pointed; tree has few thorns, is a good grower, and very productive, tending to summer fruits.

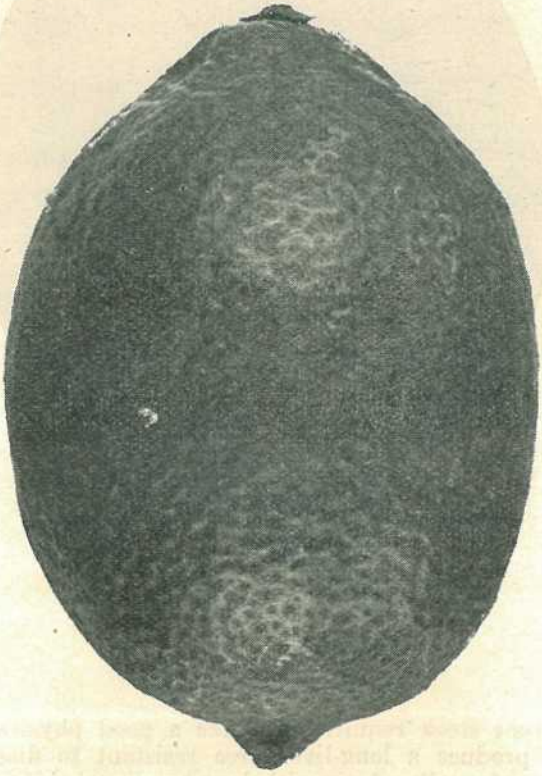


Plate 341.
Villa Franca Lemon.

Lisbon.—Form oblong; size, medium; apex nippled; base somewhat necked; rind fairly smooth; sweet; sections, from ten to eleven, regular, small; juice abundant; flavour excellent; seeds, from one to five, usually abortive, oval. This variety is a strong grower, prolific, thorny, and well-covered with foliage.

Genoa.—Form oblong, pointed at both ends; size medium; apex nippled; nipple small and rather pointed; rind smooth; sweet; sections, seven to ten, regular; juice abundant; flavour excellent; the tree is thornless, dwarf in habit, and fruit keeps well.

Eureka.—Form oblong; size medium; apex nippled, small and abrupt; base slightly tapered, frequently oblique; rind smooth; sweet; sections, ten, well-defined and regular; juice abundant; flavour excellent; seeds present, mostly abortive, elongated, somewhat wedge-shaped, and small.

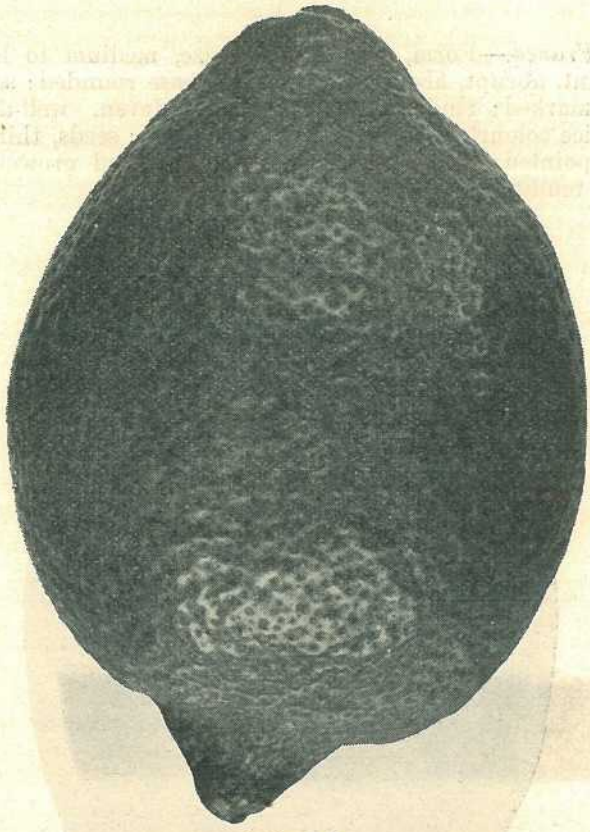


Plate 342.
Lisbon Lemon.

Stocks.

A good root stock requires to make a good physical union with the scion, to produce a long-lived tree resistant to disease, to assist the production of quality fruit with long-hanging habits from the first year of bearing, to be resistant to cold, and to be adapted to the particular soils on which the planting is to be made.

In Queensland the majority of citrus plantings have been made on either seedling sweet orange or rough lemon root stocks. The sour orange stock, although reputed to be somewhat hardier than the two former, has not been used to any great extent, perhaps on account of its somewhat slower growth.

The seedling *sweet orange* is an excellent stock on which to work oranges and mandarins, and even lemons give satisfaction when planted on perfectly-drained soils. Trees worked on orange stocks make a good bud union, and are thrifty and symmetrical; also the fruit produced is of good quality and fine texture. It is, however, susceptible to collar rot, and should not be planted in low and clayey soils where water is likely to lie for any period. Sweet orange stocks should be budded high, as the bud union is considered to be the weak point in relation to its susceptibility to collar rot.

The *rough lemon,* like the sour orange, is reputed to be more or less resistant to collar rot, although some authorities contend that this is not so. Although lemon roots show a wide variation, most trees worked on this stock have a well-distributed rooting system. The rough lemon induces a rapid growth on scions top-worked on to it, a tall upright type of growth usually being produced. First crop fruits are usually thick-skinned, deficient in juice and flavour, and poor hangers compared with fruits grown on sweet or sour orange stocks of equal age. Rough lemon stock is used on account of its resistance to collar rot, although this partial immunity is not as great as is generally believed. When planted too deeply, or when planted on clayey soils, trees budded on rough lemon stock frequently develop collar rot.

Sour Orange.—With the exception of Trifoliate, the sour orange is credited with being the hardiest of stocks, and is used to some extent in the Southern States. It is usually a good rooter, and penetrates well into the soil. Trees on this stock usually suffer less in periods of drought than trees growing under identical conditions on rough lemon stocks. This stock is also resistant to the attack of collar rot and allied forms of gum diseases. The sour orange is, however, susceptible to scab, which is frequently a drawback in the production of stocks for budding.

Propagation.

Only seed from clean healthy and vigorous seedlings of known performance should be sown in the seed bed. When large enough (about six inches high) the young seedlings are planted out in nursery rows at distances of up to twelve inches apart, the rows being about three feet apart. When the stocks have attained a diameter of some three-eighths of an inch at the base and have the sap flowing freely, they may be budded. In Queensland this operation is usually performed during the spring or autumn, but it may be continued as long as the sap in the stock is flowing freely.

When the stock is ready to receive the bud, a perpendicular cut is made in the bark at or near the base. The cut should be from one to one and a-half inches in length, and in depth through the bark to the cambium layer. The cut should preferably be made on the south side of the tree, as on that side the bud will not be so readily dried out by the sun. Another cut is then made horizontally across the top of the perpendicular one, so that the two together appear thus—T.

Budwood should be taken only from selected trees which are healthy and vigorous and noted for their consistent production of heavy crops of quality fruit. Budwood should be well-rounded, mature wood, about one-quarter to three-eighths inches in thickness, and not more than one year old. Before the buds are cut from the bud-stick the leaves are trimmed off so that a piece of the leaf-stalk or petiole is left in each case; the bud can thus be more easily handled after cutting.

The bud may be cut off the stick either from above or below the bud, but the general practice is from below the bud upwards, commencing about half an inch below the bud and ending about half an inch above. The cut must be made with a sharp thin-bladed knife, and be just deep enough to remove a very thin layer of wood. In the absence of thorns the wood may be carefully removed from behind the bud, care being taken not to damage the bud.

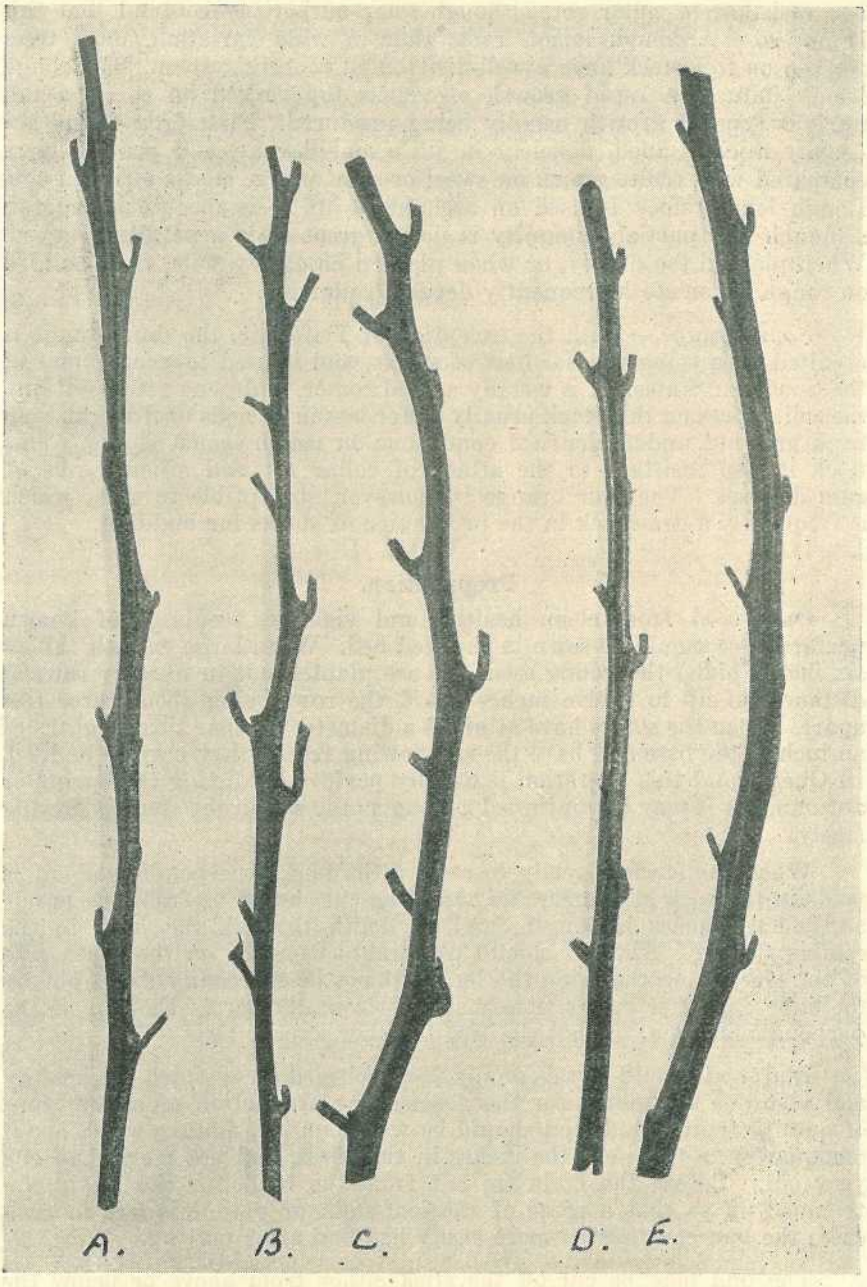


Plate 343.

A. B. D.—Too Angled.
C.—Well-rounded Desirable Budwood.
E.—Sleepy Buds.

The bud is then inserted down and under the bark of the stock, where the T cut has been made, by raising the bark with the budding knife. In order to bring the bud and stock into close contact they are then bound tightly together with a raffia tie. In from two to three weeks the bud, if it remains green, will have "taken"—that is to say, it will have united with the stock. The tie may then be cut, and the head of the stock shortened back. Later, when the bud has made good growth and is strong enough to support itself, the head is removed altogether. The young tree should then be staked.

Plate 344.
Well-planned Navel Orchard. Nine Months Planted.

Planting.

The two main systems for planting citrus trees are respectively the square, and the hexagonal or septuple. In Queensland the square system is more generally adopted. It is by far the most common of all systems of planting, and the ease with which a field can be laid out is greatly in its favour. The rows of trees intersect at right angles, so that cultivation may be carried out in either direction.

In the hexagonal or septuple system six trees are set equidistant from a seventh placed in the centre, the basis of the system being a circle. By this method approximately 15 per cent. more trees are planted to the acre than with the square system.

Citrus trees require plenty of room for growth and cultivation. The mistake of close planting has generally been a common one. In the drier areas, where the application of water can be controlled, plantings should be made at least 30 feet apart. This distance, of course, may be varied slightly according to soil and climatic conditions, but it should never be less than 25 feet.

The following table gives the approximate numbers of trees to the acre when planted at distances from 25 to 30 feet apart on the square and hexagonal systems respectively:—

Distance Apart.	No. of Trees Per Acre. Square System.	Hexagonal System.
25 feet	70	80
26 feet	64	73
27 feet	60	69
28 feet	55	63
29 feet	51	58
30 feet	48	53

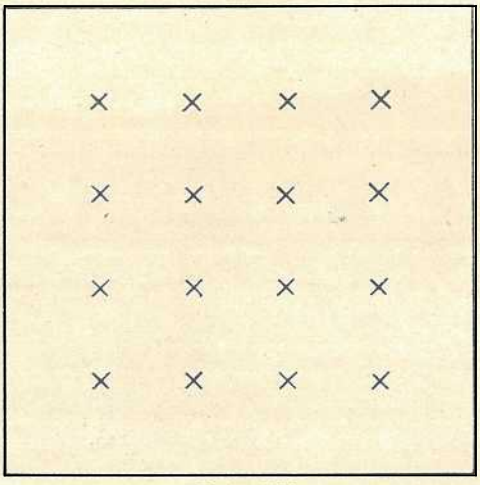


Plate 345.
Square System.

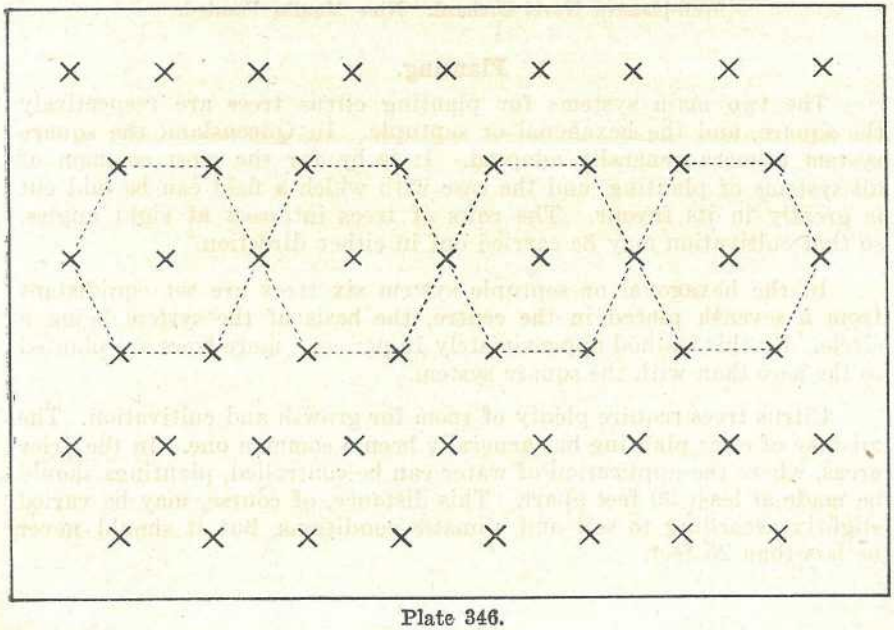


Plate 346.
Hexagonal or Septuple System.

In order to calculate the number of trees required per acre when planting on the square system, multiply together the distances apart in feet, and divide the result into 43,560, the number of square feet in an acre. When planting on the hexagonal system about 15 per cent. more trees than this number will be required.

Plate 347.
Well-planned Lemon Orchard. Twelve Months Planted.

The first essential in planting an orchard is to plough the land thoroughly and sub-soil it, always, however, avoiding bringing the sub-soil to the surface. This can be done by ploughing a furrow in the usual way, followed by a sub-soiler to loosen up the bottom of the furrow before the next sod is turned. Ploughing should be followed by harrowing, working down, and grading.

Having determined the distance apart at which the trees are to be planted, the first step is to measure the longest side of the proposed orchard and use it as a base line. This should be measured from at least 30 feet inside each boundary in order to leave ample headlands for turning purposes.

The base line is best pegged out by a length of fencing wire fitted with rings at each end, and with small buttons of solder fixed at distances along its length corresponding with the distance apart the trees are to be planted. When the base line is struck and the wire drawn taut, pegs should be driven into the ground at the buttons on the wire.

The simplest way to lay out a right angle accurately is by the 3—4—5 method.

With a box tape from the desired point "A" measure along the base line a distance of 15 feet, and insert a peg "F." Then, by holding the ring of the tape at "A" and the 45 feet mark at "F," and going in the desired direction drawing both parts of the tape taut at the 20 feet mark, the line at right angles "AK" will be found. When this right angle line is found, it should be similarly pegged. The pegging of

the square is then easily completed, and from it the rows for the whole orchard can be determined.

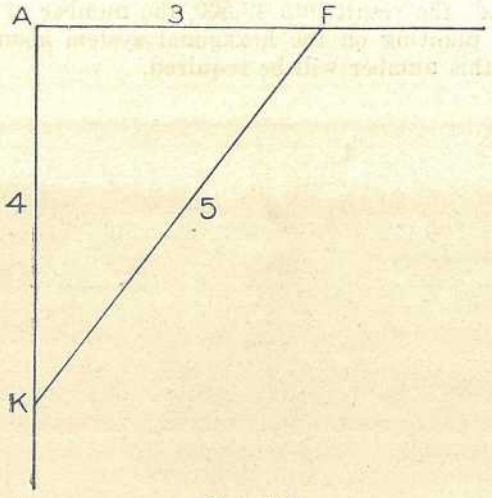


Plate 348.
The 3-4-5 Method of Laying Out a Right Angle.

In planting on the septuple system, lay off and stake the base line as described for planting on the square. Set off the two side lines at right angles, but instead of placing the stakes at the same distance apart as those on the base line, they should only be ·866 of the distance on the side lines, so that if the stakes are 30 feet apart on the base line, the pegs on the side line will be as nearly as possible 26 feet apart. Next place a mark 15 feet from one end of the planting wire, and stretch it across between the stakes on the side lines and parallel to the base line.

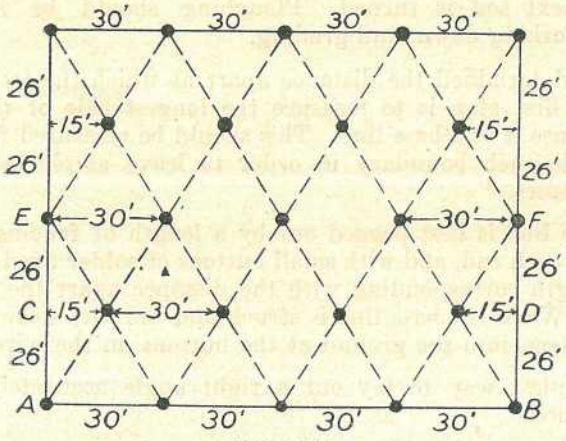


Plate 349.
Plan for Laying Out an Orchard on the Hexagonal or Septuple System.

The base row has already been staked 30 feet apart. On the second row, C D, bring the 15 feet mark on the planting wire to the point C; this will then bring each mark on the wire midway between the stakes on the base line, and stake. For the third row, stretch the wire full length between E and F, with the end of the wire at E. The marks on

the wire will then correspond with those on the base line. For the fourth row, carry on as in the case of the second row, and so on.

To ensure that the young trees are placed exactly in the position occupied by the pegs, a planting board will be found useful, and is easily constructed. A board some four or five feet in length, four or five inches in width and one inch thick, is used, and a "V" notch is cut in the centre, and a similar notch at each end.

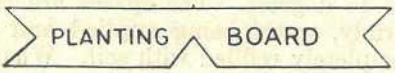


Plate 350.

In use, the centre notch is placed against the peg denoting the position of the tree, and pegs are driven in at the notches at either end of the board. The board and tree peg are removed, leaving the latter two pegs in place. The hole to receive the tree is then dug. The board is then brought into use again, being fixed as before at the ordinary soil level between the two remaining pegs. The tree is then placed in the hole at the centre notch in the board, taking the position formerly occupied by the tree peg, and the soil filled in.

Plate 351.

One-year-old Valencia, Late Planting. Note the paper collars to prevent sunburning the trunks.

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

The planting board serves another purpose in that it ensures planting the tree at the proper depth. The correct depth at which to plant the tree is the depth it was grown in the nursery; the mark can usually be distinguished on the tree. The union of the stock and scion is always a weak spot in a tree and liable to attack from fungus diseases; it should, therefore, be kept above the level of the soil. When using the planting board, the union, if kept level or slightly above the top of the board, will ensure the tree not being planted too deeply.

In digging the holes for the trees, the surface soil should be taken out and kept on one side. The subsoil at the bottom of the holes should be finely broken up. Provided the orchard has been properly prepared, there is no need to dig deep holes; so long as they are large enough to space the roots without cramping they will serve the purpose. A little top soil may be returned to form a small mound at the bottom of the hole. The roots, which should be carefully washed and trimmed, should be spaced as evenly as possible, and with a downward and outward slope of from 40 to 45 degrees. The spaces are then filled with fine soil, and pressed firmly, water being applied and allowed to soak in before the hole is completely refilled with soil. Where there is a danger of the trees being scalded by the sun, they should be protected by cylinders of paper placed around the trunks.

The season for planting will be determined by location and local circumstances. Where low temperatures are experienced, July or early August planting is preferable to autumn, but where there is no danger of frost injury, autumn planting is satisfactory, as it enables the trees to obtain a roothold earlier, thereby materially assisting the early spring growth.

[TO BE CONTINUED.]

RHUBARB-GROWING.

H. J. FREEMAN, Senior Instructor in Fruit Culture.

RHUBARB is indigenous to eastern Asia. It belongs to the buckwheat family, Polygonaceæ, and is a highly popular herbaceous perennial. The succulent stems are used for sauce, in pies, and take the place of stewed fruits in many dessert courses.

Climatic Requirements.

Temperate to subtropical. Occasional frosts during the winter do not damage the rooting system.

Soil.

Deep, rich sandy loams provide ideal conditions for rhubarb, which, however, may be grown successfully on all types of soil once such soil has been properly conditioned.

The large succulent stems require an enormous amount of soil moisture, so that irrigation is especially valuable for this crop.

The earliest marketings usually command the best prices, and warm soils gently sloping to the east are desirable when earliness is such an important factor.

Propagation.

The plants are readily propagated from seed sown under cover or in the open, but as only a small percentage of the plants produced in this way are true to type, the system should not be generally practised. Root division is the method ordinarily employed, and a piece of root containing a strong eye will grow, and under favourable conditions produce a good plant in one season.

In the colder districts gardeners often force a crop by lifting the roots from an old bed during the late autumn, planting good eyes in hot beds or under specially constructed cover, forcing throughout the winter, and planting these well-established plants in the spring.

Planting.

Spring planting is always preferable, and as early as possible, for the plants need the entire growing season for their full development. The usual distances for planting are 3 ft. x 3 ft. or 4 ft. x 3 ft. apart, and the roots are covered with several inches of soil.

Wilson's Ruby, Sydney Crimson, and Victoria Giant are excellent varieties.

Fertilizing.

When fertilizing rhubarb, the grower should consider the following facts:—

1. The plant luxuriates in soils abounding in vegetable matter (humus).

2. Large stalks usually count for better prices.

3. The earliest pullings are in most demand.

4. The crop of any given year depends largely upon the care of the plants during the preceding year.

Stable manure is especially valuable because it supplies humus, conserves moisture, and furnishes plant food. Some growers use up to 25 tons of stable manure per acre, and the general opinion seems to point to autumn being the best time for application.

Fertilizer made up on a 6-10-10 formula and applied at the rate of 1,000 lb. per acre is recommended.

With proper care plantations will produce for a number of years, but it is a mistake to maintain them once the stalks become materially smaller.

It is doubtful if the best profits can be realised in plantings over four years old.

Cultivation.

Thorough tillage throughout the season is highly important. Enormous quantities of water are used by the large leaves and succulent stems, and conservation of moisture is urgent.

At the first operation in spring the mulch of manure should be worked into the soil. Subsequent tillage should be frequent, but not too deep. Some hand weeding is necessary to keep the fields entirly free from weeds. The seed stalks, which generally appear on a small percentage of the plants, should be broken off.

Marketing.

Harvesting begins as soon as the stalks have attained a length sufficient to satisfy the market concerned. The largest stalks are pulled, no attention being paid to the smaller ones, although the smaller ones are far more tender for midsummer use. The second and third year usually provide the heaviest harvest, and harvesting in any year should not continue until the plants are largely exhausted. Rhubarb is essentially a late spring and early summer crop.

Ordinarily the season of marketing lasts for from two to three months. From two to eight stalks are tied in a bunch, and the use of either blue or red tape for tying greatly adds to the attractiveness of the product. The leaves of this plant are definitely not edible.

FRUIT MARKETING NOTES.

JAS. H. GREGORY, Instructor in Fruit and Packing.

Present prices are not a true indication of the returns to be expected at this period of the year. During the past month storms have afforded some relief from the prolonged dry spell, but notwithstanding this, fruit is still being marketed under drought conditions. It is therefore to be expected that prices for all fruits and vegetables will be subject to sharp fluctuations.

Stone fruits are now on the market in quantities. Early cooking apples have made their appearance, while early peaches from Stanthorpe are also obtainable. Pineapples are still scarce.

Prices on Interstate and Brisbane markets during the last week of November were:—

Papaws.

Only medium supplies were available in Brisbane, where prices for local fruit ranged from 2s 3d. to 4s 6d. per bushel, and for Yarwun and Gunalda fruit from 5s. to 6s. 6d. per bushel and from 9s. to 10s. per tropical fruit case. In Sydney prices were from 8s. to 15s. a tropical case, and in Melbourne from 10s. to 16s.

Mangoes.

The quality of this fruit is improving, and large quantities are coming on to the market. Prices in Brisbane for North Queensland mangoes were from 4s. to 7s. per bushel case; in Sydney selected varieties are selling well at up to 14s. per bushel, and in Melbourne from 14s. to 24s. per bushel.

It must not be forgotten that only selected varieties are suitable for the Southern markets, and it is also recommended to wrap each fruit and "nest" or pad with woodwool all around.

Pineapples.

Prices are still being maintained at a high level. In Brisbane Smooths realised from 8s. to 14s. per case, and from 2s. to 9s. per dozen loose; Ripley were from 9s. to 12s. a case and 2s. to 8s. a dozen, and Northern Roughs from 8s. to 12s. per case. Sydney prices ranged from 12s. to 16s. per case, Melbourne prices from 14s. to 20s., with special Bowen fruit to 24s., and Adelaide prices up to 30s. per case.

Woodwool, and not blady grass, should be used for packing material for pineapples.

Bananas.

Much poorly-filled and angular fruit is arriving on the market. Growers must remember that, if fruit is packed to a minimum length for each size, there is a great risk that the girth of this fruit will not be sufficient to pass the grade standard. Cases containing fruit of this grade have caused trouble in the markets during the last week or two. The shortage of some of the other fruits used in making canned tropical fruit salad has caused a stoppage in canning, resulting in the smaller bananas which are usually used for this purpose being hard to move on

the market. The great quantity of small, angular fruit going south presents a serious problem. Growers should remember the disastrous holiday markets in previous years and refrain from sending large quantities of fruit south for sale during the Christmas and New Year periods.

Brisbane prices were: For Cavendish, 8's and 9's from 7s. to 13s., 7's from 4s. to 11s. 6d., and 6's from 4s. to 7s. 3d. a case, with bunch lots from 1½d. to 6¾d. per dozen; Lady's Fingers sold at from 1½d. to 8d. per dozen, and Sugars from 1½d. to 4d. per dozen. In Sydney 8's and 9's sold at from 12s. to 15s., 7's from 11s. to 13s., and 6's from 9s. to 11s. a case. Melbourne prices for 8's and 9's were from 11s. to 12s., for 7's from 9s. to 11s., and for 6's from 7s. to 9s. a case. In Adelaide prices ranged from 10s. to 16s.

Passion Fruit.

The demand for this fruit is still good, but with the increased supplies prices have eased somewhat. Remember when packing to exclude from the first grade all crinkled fruit.

In Brisbane first grade fruit realised from 7s. to 10s. a half-bushel, and second grade from 5s. to 6s. Sydney prices were from 5s. to 14s., and Melbourne prices from 8s. to 12s., with a few specials higher.

Citrus Fruits.

Prices for all citrus fruits on the Brisbane market have been maintained, viz., oranges at from 7s. to 9s. a case, and lemons (local) from 4s. to 9s., and Gayndah from 10s. to 14s.

Tomatoes.

The quality of tomatoes generally has been poor. Brisbane prices for local fruit were: Ripe 3s. to 5s., choice 6s. to 8s., green 3s. to 8s., and firm coloured 4s. to 12s. In Sydney local fruit brought from 8s. to 12s., and Adelaide hothouse tomatoes from 12s. to 16s. In Melbourne local fruit realised 12s. to 24s. per bushel, and Adelaide hothouse fruit 12s. to 16s. a half-bushel.

Deciduous Fruits.

Stone fruits have made a welcome appearance, and some excellent lines have been handled.

Cherries.—These have been arriving in excellent condition. Some consignments have had fruit on the small side, but otherwise the condition has been good. Brisbane prices for New South Wales fruit have ranged from 4s. to 7s. per tray, and for Stanthorpe fruit from 7s. to 8s.

Peaches.—Prices for Mayflowers ranged from 4s. to 8s., with specials to 10s.; Sneyds brought from 3s. to 6s.; and China flats from 1s. to 2s. 6d. per tray.

Apricots.—Prices were from 2s. to 5s. a half-bushel, with choice fruit from 7s. to 10s.

Plums.—Small fruit sold at from 3s. to 4s. a half-bushel, and choice from 5s. to 6s.

When handling stone fruits every care must be taken to prevent skin abrasions which will provide a quick means of entry for Brown Rot. All sizing implements, etc., should be periodically sprayed with a 5 per cent. solution of formalin once a week.

Apples.—Some early cookers have arrived, and realised from 6s. to 7s. a half-bushel. There is only a limited market for fruit of this type, which must be of good size to command a price. Any great influx of immature apples will certainly spoil the market. Prices for other imported varieties were as follows:—Granny Smith, 14s. 6d. to 16s. 6d.; Sturmers, 11s. to 14s.; Democrat, 10s. to 14s.; Yates (2½ inch), 12s. to 13s., (others) 7s. to 10s.

Vegetables.

Brisbane prices for cucumbers ranged from 8s. to 11s. per bushel, and for beans from 14s. to 23s. a sugar bag. New South Wales peas realised from 5s. to 14s., and Victorian peas 20s. to 23s. per 50 lb. bag. Lettuce sold at from 6d. to 2s. per dozen. It is pleasing to note the increased quantities of lettuce now being packed in the tropical fruit case, much to the betterment of the article.

Publications.

A peach packing chart will be ready for distribution early in December, and a pamphlet covering the complete operations of marketing and harvesting will be available later.

Pamphlets on banana marketing and passion fruit marketing are now in the hands of the printer, and should also be available during December.

BOOKS BY POST.

What do you read? Do you like books from which you can learn something—say travel books or biographies? Do you like novels of the best authors? If you do want books of this nature, then the library you want to join is at the Department of Tutorial Classes, Brisbane. As a matter of fact, you can borrow books on almost any subject from that library. Another advantage of it is, too, that if you do join you will have a catalogue sent you containing the titles of all the books in the library listed under their respective subjects. It is usually very difficult to know just what books there are in a library, even when you can go and visit the library yourself. But when you can have a catalogue to take home, look through, and read at your leisure, you have a chance of picking out just the very books that you want to read. This catalogue is issued free to members. The cost per year for membership is only 18s. 6d. Members may borrow three books and a magazine at one time, and may exchange these as often as they like. The principle usually followed is to change one or two at a time, so that members may always have one or two books on hand, while the others are travelling to and fro by post or rail. Why not write and get more information about this library? Write to the Director of the Department of Tutorial Classes, corner Edward and Ann streets, Brisbane.

New Highways in Queensland.

THE Main Roads Commission is the major organisation in Queensland for applying the Government policy of building State highways, main, developmental, secondary, mining access, and tourist roads. The Fifteenth Annual Report of the Commissioner for Main Roads, Mr. J. R. Kemp, is an impressive record of rural road development under that policy during the past year.

Under the direction of the Government a vigorous constructional programme involving the completion and opening for traffic of 394·46 miles of new works was carried out.

In addition, 82·9 miles of previously improved roadway were converted to a higher type to meet the demands of increased traffic. At the close of the year 233·12 miles of new works and 113·2 miles of stage construction were in progress, the total mileage of constructed road being 3,627·78, inclusive of the sections which have been remodelled for increased traffic.

Bridges of all types to an aggregate length of 7,695 lineal feet were completed, many of them forming essential links in the road schemes undertaken; 4,192 feet of bridges were in hand at the 30th June. The total length of bridges completed at 30th June was 11·38 miles.

The maintenance programme for the year, in addition to providing for adequate attention to previously constructed sections, covered considerable assistance to local authorities for the purpose of maintaining traffic on unconstructed sections. In all, 11,500 miles of road were maintained.

This programme involved the continuous employment of an average of 3,229 employees.

Through the courtesy of the Commission we are able to reproduce in following pages a series of excellent illustrations taken from the report, and which give some indication of the immense importance of a great national service.

Plate 352.

LANDSBOROUGH SHIRE.—Bruce Highway Tourist Road (Landsborough-Beerwah Section). Two 3/30-feet span timber bridges over Back Creek.

Plate 353.

BAUHINIA SHIRE.—Carnarvon Highway No. 13—Connection between Maranoa District and Springsure, in Central District.

Plate 354.

BAUHINIA SHIRE.—Springsure-Bauhinia-Duaringa Highway No. 3. Staircase Range section. Replacing one of the few remaining bad sections between Springsure and Rolleston.

Plate 355.
MOUNT MORGAN SHIRE.—Dawson Highway No. 25. New road near Mount Morgan under construction.

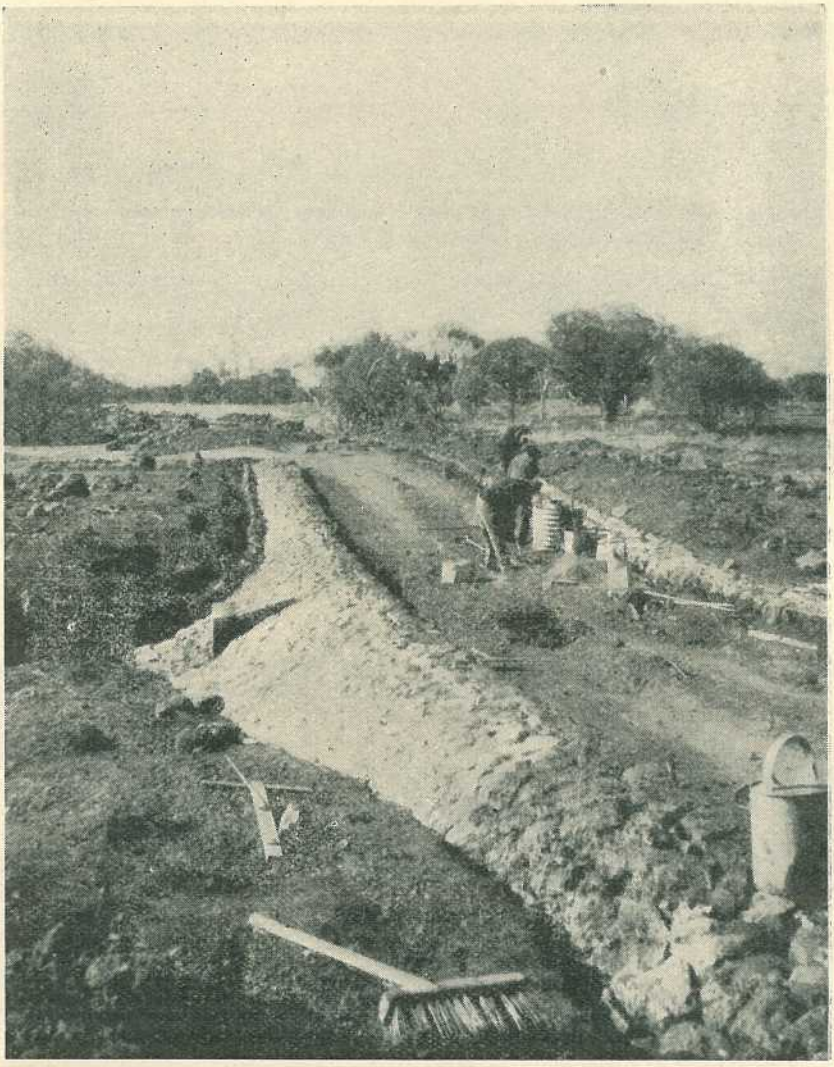


Plate 356.

Barcoo Shire.—Yaraka-Windorah Road. Deep Creek Crossing. Cement grouting of stone pitching on batters in progress on portion of Welford Deviation which will shorten the road 8 miles and avoid flooded flats near the Barcoo River.

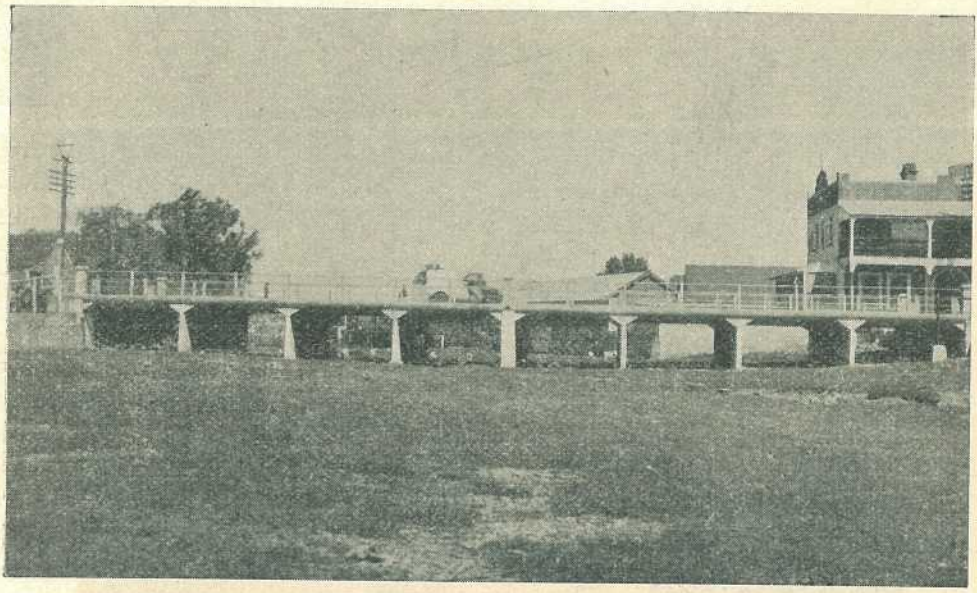


Plate 357.
Bridge over Bradley's Gully on the Charleville-Adavale Road at Charleville. This modern reinforced concrete slab bridge replaced an old timber structure.

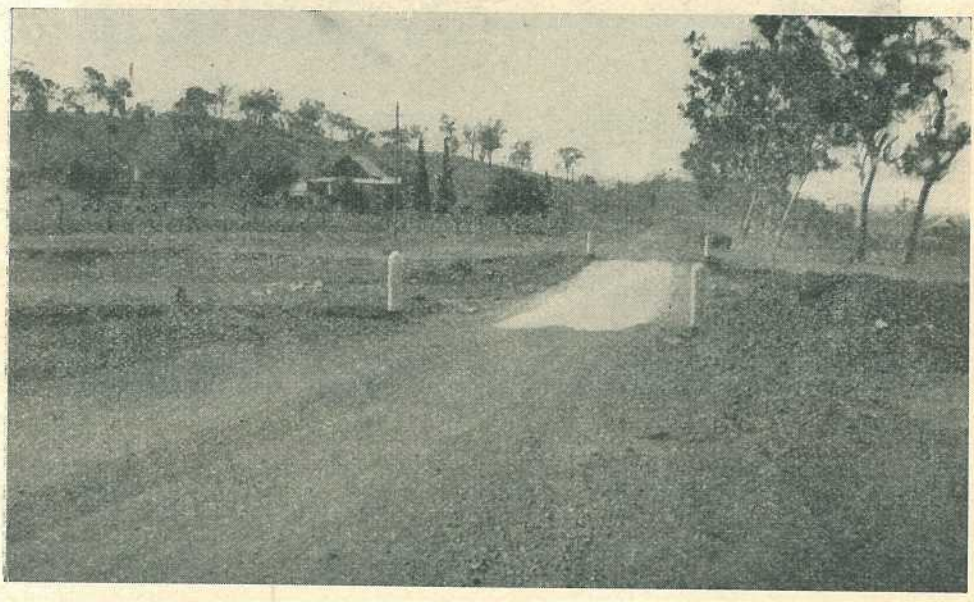


Plate 358.
FITZROY SHIRE.—Kabra-Stanwell Road. Cement penetration invert about 10 miles from Rockhampton. This road provides a link with farming districts immediately west of Rockhampton.

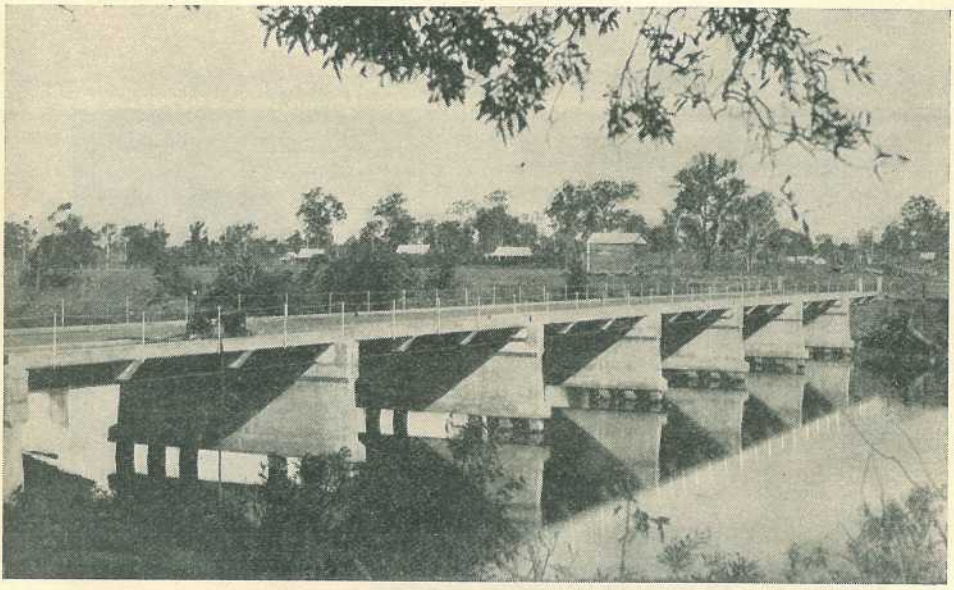


Plate 359.

Pine Shire.—New reinforced concrete and steel girder bridge over Pine River, which replaced an old timber bridge and avoided a bad alignment under a railway bridge.

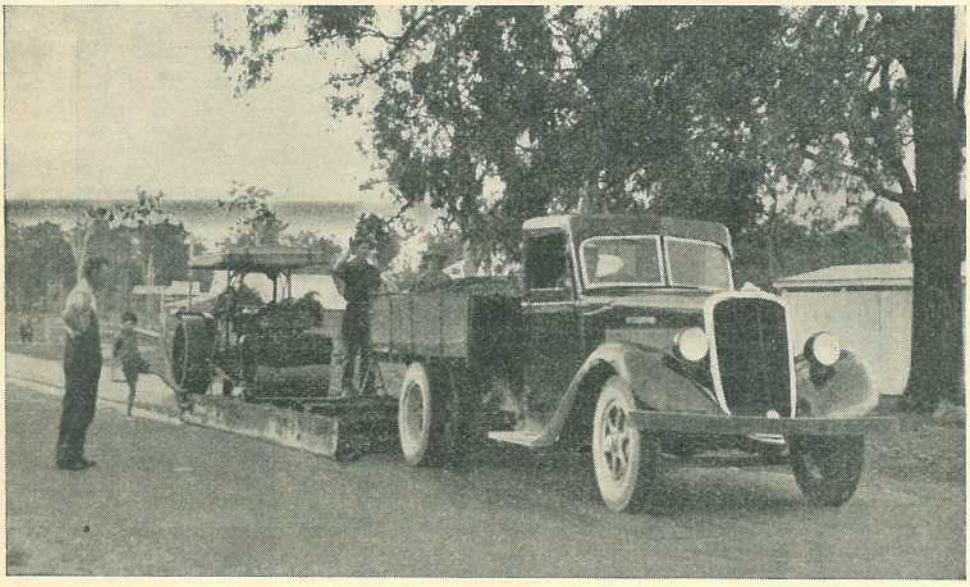


Plate 360.

Mechanised Road Construction.—Drag spreader for pre-mixed bitumen ready to be attached to tipping truck. The truck hauls the spreader and discharges the mix for dragging.

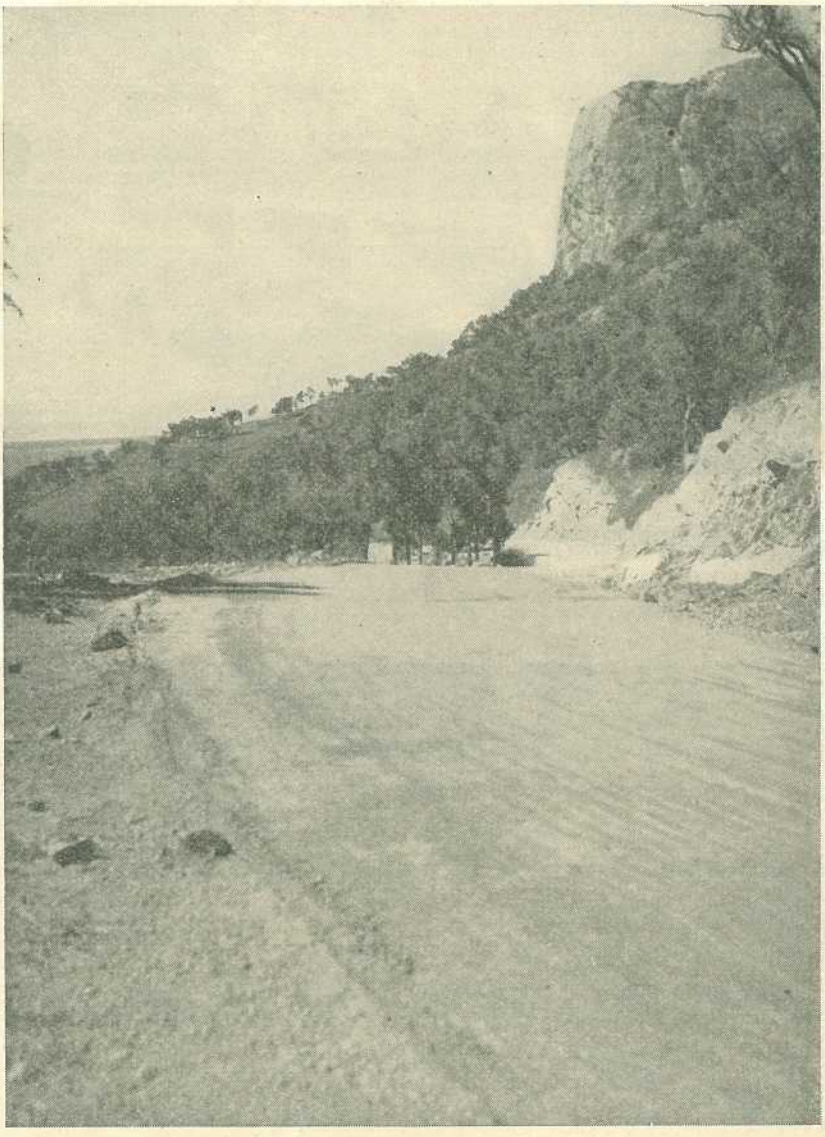


Plate 361.
TOWNSVILLE CITY.—Hynes Road to Castle Hill.

Plate 362.
View of Razorback, near Mount Morgan.

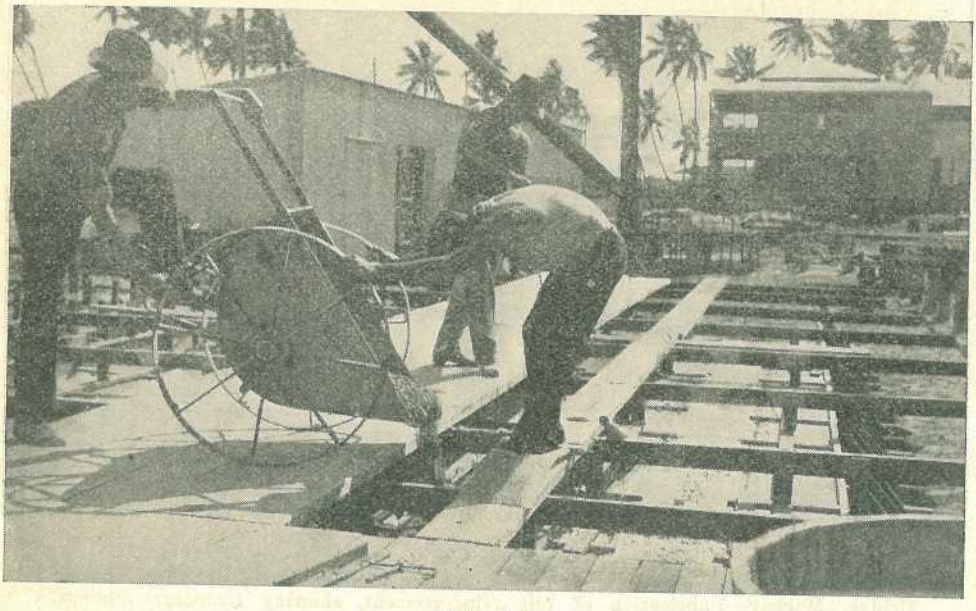


Plate 363.
Pile casting, Sydney Street bridge, Mackay-Habana Road.

Plate 364.
A picturesque bend in Bee Creek Road, Mackay District.

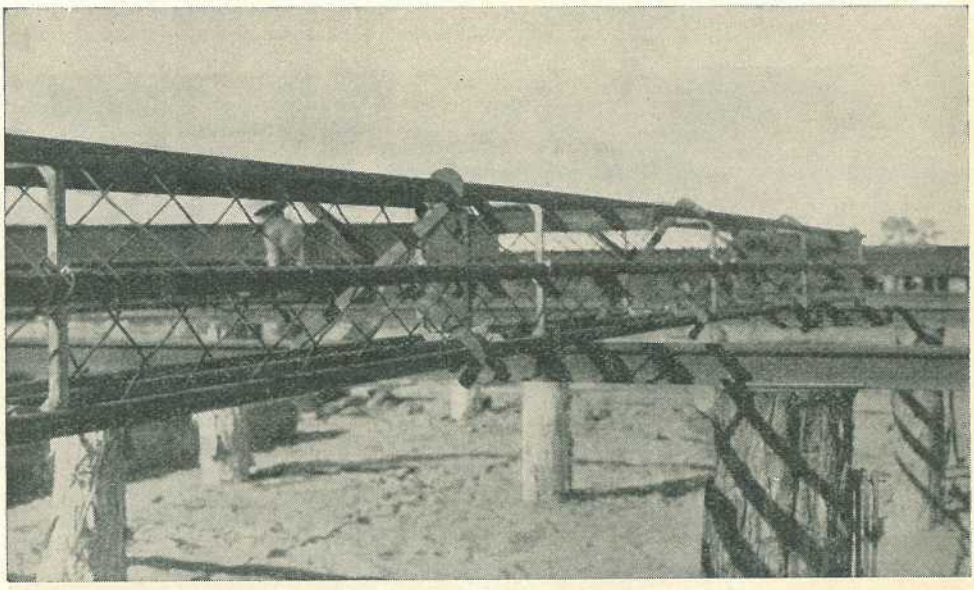


Plate 365.
PIONEER SHIRE.—Mackay City and Mackay-Habana Road. Sydney Street Bridge, Mackay—Fabrication of pile reinforcement, showing temporary clamps. The bridge will be 1,474 feet long, and overall width of roadway, including footpaths, 30 feet.

Plate 366.

Banana Shire.—Dululu-Bunerba Road. Bridge over Dee River, timber superstructure, bitumen deck-wearing surface on concrete cylinders.

Plate 367.

A straight stretch on the Biloela-Valentine Plains Road, Banana Shire.

Plate 368.

ON BLACKSOIL COUNTRY.—The Theodore-Cracow Road before construction. A formed and metalled all-weather highway now carries the heavy traffic to the goldfield.

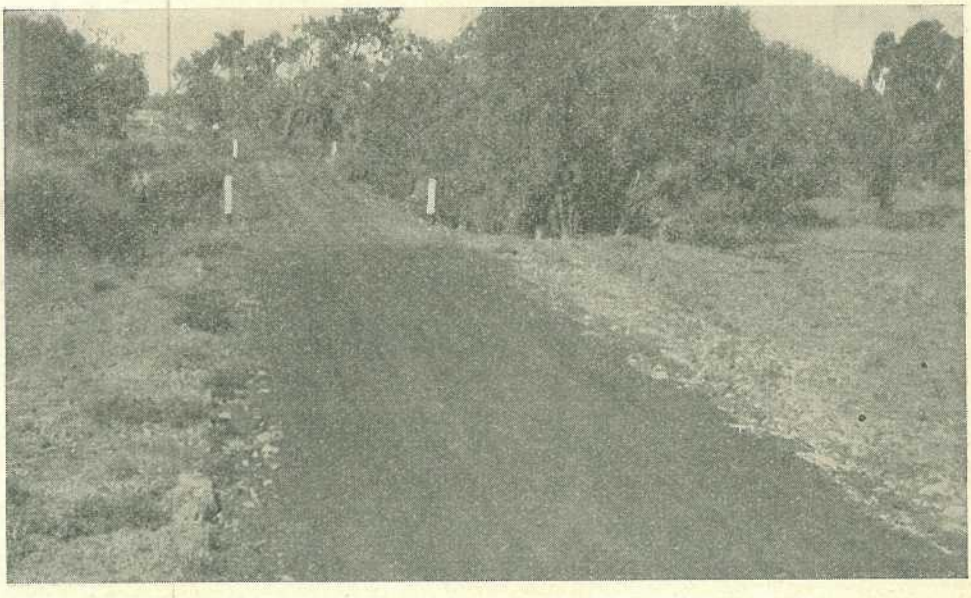


Plate 369.

Causeway over Yowah Creek on the road from Cunnamulla to Thargomindah.

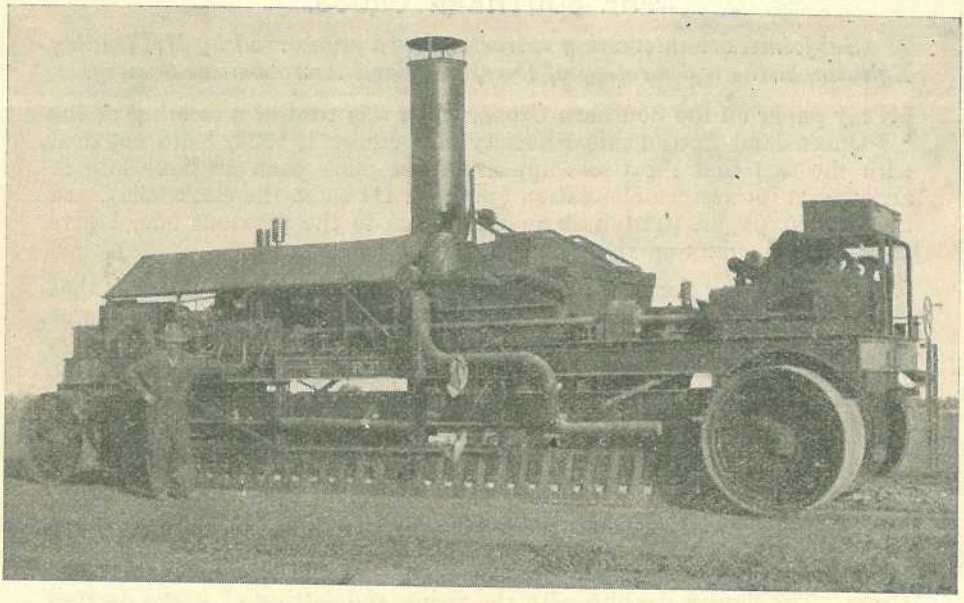


Plate 370.
New Heat Treatment Machine (Irvine Process) at work on blacksoil country in the West.

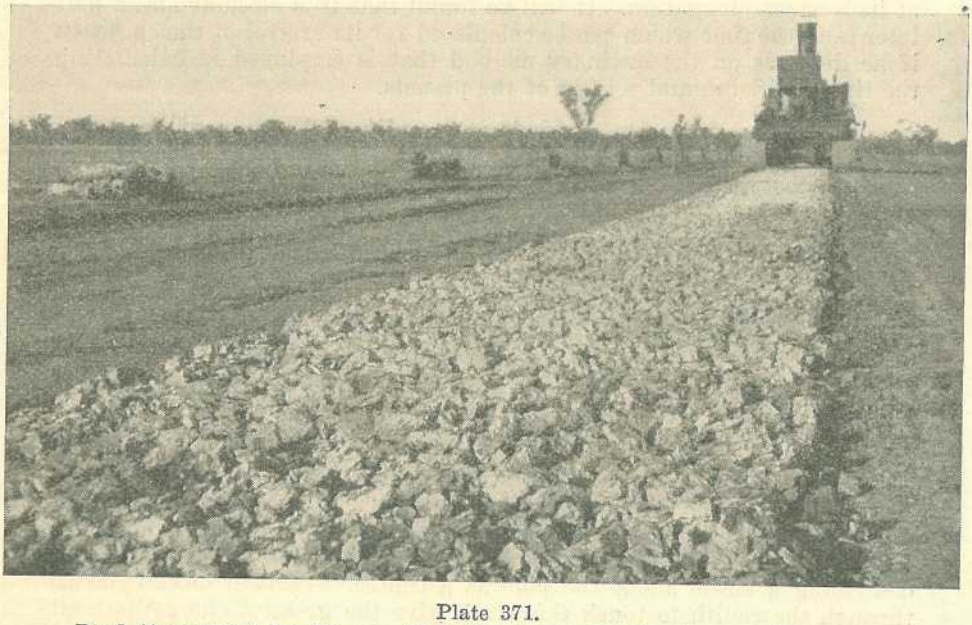


Plate 371.
Road "roasting" by the new Heat Treatment Machine between Bollon and Cunnamulla.

THE SOUTHERN CROSS.

Subjoined are interesting extracts from a paper read by Mr. Dudley Eglinton at the last meeting of the Queensland Astronomical Society.

IN my paper on the Southern Cross, which was read at a meeting of the Queensland Astronomical Society on October 1, 1927, I did not deal with the fact that the Cross appears to be more than an hour late in arriving at its western elongation (position III as on the clock-face). In the present paper, written as an addendum to the previous one, I give further particulars on that subject.

In discussing the matter with Mr. Chapman he seemed to think that he had arrived at a solution of the problem when he stated that it was owing to the difference of angle from which the observations were made. In his calculations (made a few months ago at his residence, Ellerslie, Munro street, Auchenflower), Mr. Chapman gives 92 minutes as the amount of retardation in the Southern Cross reaching its western elongation. This tallies exactly with particulars given in Mr. Baracchi's paper: "The Stars on the Ensign of the Australian Commonwealth."

In accordance with the dictum of Lord Kelvin, that he was never satisfied with each step in advance until he could prove it mathematically, I now supply the following calculations concerning the Southern Cross. The figures dealing with the rising and setting of it are derived from calculations made in working out the rising and setting of the planets in accordance with their relative positions with regard to the sun.

On September 23 this year the sun was at R.A. 12 Decl. 0·5 north. For the Southern Cross as a whole I have taken R.A. 12.25, Decl. 60 degrees south. Let anyone observe the time at which the Cross arrives at its western elongation. It will be found that it is an hour and a half later than the time which can be calculated for its arrival at that position if he depends on the ordinary method that is employed in calculating the times of rising and setting of the planets.

In a letter from Dr. Baldwin, Government Astronomer, Victoria, dated January 23, 1936, he says: If you allow for the difference in longitude between Brisbane and Melbourne the time agrees with that of Mr. Baracchi.

Let us consider for simplicity (what is actually very nearly the case) that the great circle through the pole and Alpha Crucis passes also through Gamma Crucis. This great circle crosses the meridian at the time given. Six hours earlier it passes through the east point of the horizon—that is, the line from Gamma Crucis to Alpha Crucis will be sloping downwards somewhat. A little later Gamma Crucis and Alpha Crucis will have the same altitude. Later still, five hours before it crosses the meridian, Alpha Crucis will be at its greatest elongation east.

Think of a circle on a plane with tangents drawn from a point outside. These tangents do not touch at the end of the same diameter, but the angle included between the radii drawn to the points of contact is less than two right angles. So in the present case Alpha Crucis is describing a circle about the pole as a centre. Vertical circles drawn through the zenith to touch this circle give the greatest elongation east and west. The angle between the great circles through the pole to these points of contact is not two right angles, but (for Alpha Crucis) about

150 degrees, which corresponds to ten hours in time. Half of this, five hours, is the time between greatest elongation and meridian passage.

This information, so courteously given by Dr. Baldwin, is of very great importance to me.

Thirty-three years ago I was shown by Mr. Sapsford, a printer, Adelaide street, Brisbane, a paper on the Southern Cross signed Pietro Baracchi, which he had obtained for his almanac conditionally on supplying Mr. Baracchi with a certain number of copies. I was much impressed by that paper, which contained the most valuable information on the Cross ever published. I asked Dr. Baldwin if he knew of any other paper on the Southern Cross at all comparable with it. In reply Dr. Baldwin wrote as late as January, 1936, that he knew of no other paper which could compare with it. I therefore feel that I am in possession of the best information on the Southern Cross that has been published.

For many years past I have made much use of that paper, especially through the Education Department, notably in March, 1915, in giving information on the Cross in Queensland. Up to the present time the "Agricultural Journal" and other publications in Queensland have spread that information month by month.

Mr. Chapman has spread valuable information on astronomical subjects in the past and still continues to do so. His early training in civil engineering is of great value to him at the present time and thus his monthly contributions are absolutely dependable, which is of great importance. Many must have noticed the inaccuracies in astronomical statements which are occasionally given to the public. When Mr. Chapman gives ninety-two minutes as the time of retardation in the Cross arriving at its extreme western elongation I accept that statement without a moment's hesitation.

For the last fifty years I have been in touch with anyone in Queensland having special knowledge of astronomical matters, such as Rev. Mr. Pringle, rector of Christ Church, Milton (who gave up astronomy to become a Church of England minister), Mr. R. H. Roe, of the Brisbane Grammar School, who became Director of Education in Queensland, Professor Priestley of the University, and many others in Queensland. Mr. Curlewis, Government Astronomer of Western Australia, was also one of those to whom I am indebted for valuable information on the subject of the Southern Cross.

The admirable way in which Mr. Chapman dealt with Peltier's Comet recently made it clear that Brisbane is especially fortunate in having his services.

CASE TIMBER.

From observations made in the markets it is evident that some fruitgrowers are not at all particular about the class of case timber cut and supplied to them by millers. The main fault encountered is that the sides of the boxes are cut too thin. Thin side boards bulge outwards when the cases are fully packed, and, as fruit cases when in transit are stacked on their sides, it can readily be understood that some of the fruit must be pressed and bruised. Badly-cut cases are often bought by growers because they are cheap, and in this instance the miller is not to be blamed, as the grower is fully aware of the quality of the cases when he purchases them.

It is false economy to purchase thin-sided boxes, be they ever so cheap, and in their own interests growers should insist upon millers cutting and supplying the best quality. Why spoil the returns from the year's labour through the false economy of trying to save a few pence on case timber?

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 Advance Register of the Herd Books of Australian Illawarra Shorthorn Society and Red Poll Cattle Society, production charts for which were compiled during the month of October, 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.				
Dolly 4th of Sunnymeade	E. C. Althouse, Cloyna, Murgon	10,365·15	372·252	Masterpiece of Oakdale
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Fairy Bower Sally	O. E. Jeynes, Raceview	9,929·81	402·081	Blacklands Safeguard
Burnlands Glory	Burnett Bros., Brookfield	7,246·0	248·573	Sunnyview Vain Prince
Highfield Pink 4th	J. A. Heading, Cloyna, *via* Murgon	5,775·05	236·83	Highfields Perfection
RED POLL.				
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Marshlands Ruby Far Eastern Springs	C. E. McConnell, Marshlands, Mondure	6,131·05	232·749	Severn Springs Bulwark

Answers to Correspondents

BOTANY.

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

Darling Pea.

Inquirer (Bundaberg)—

The specimen represents *Swainsona galegifolia*, Darling pea or indigo. This plant is found in several different forms in Queensland and New South Wales, the one you send being very common in coastal localities, usually in forest country on hillsides. This plant has been proved poisonous to stock by feeding tests, causing paralytic symptoms in sheep. Some time elapses before the onset of definite symptoms, mostly three to four weeks. Once the paralytic symptoms are established the animal will not recover, but if returned to proper feed will remain in the same condition, becoming neither better nor worse. We have seen cattle on the coast grazing on country heavily infested with your form of the plant, and have never noticed any ill effects, but of course the danger is there. The plant is a legume and should be quite a useful green manure, but there are other species, we should say, which are more easily handled and would give a greater bulk of material for turning in.

Plants from the Lockyer Identified.

D.S. (Project Club, State School, Clarendon)—

1. *Argemone mexicana*, Mexican poppy or prickly poppy (family Papaveraceæ), a native of the West Indies and tropical America, reputedly harmful to stock, but never eaten by them on account of its prickly nature and intensely bitter sap. It has been reported to us that calves have been poisoned by the plants when they were cut, allowed to wilt, and subsequently fed in a softened condition.
2. *Amaranthus viridis*, green amaranth (family Amarantaceæ). This plant is very widely spread over the warmer regions of the world. It is not absolutely certain whether it is a native of Australia or not, but it is believed to be so, as it was collected so many years ago by early botanists. It is not harmful or poisonous. The young shoots can be used as a substitute for spinach.
3. *Helichrysum ramosissimum*, small everlasting (family Compositæ), a native plant. It is not poisonous.
4. *Euphorbia Drummondii*, caustic creeper (family Euphorbiaceæ). The milky sap of this plant is sometimes used by bushmen for applying to sores, and is said to have healing properties. The sap is rather blistering. The plant is reported poisonous to stock, particularly hungry sheep that feed on it heavily on an empty stomach. Ordinary paddock or resting stock do not seem to be affected, or at least are affected very little by the plant. It is a native of Australia.
5. *Chenopodium cristatum* (family Chenopodiaceæ), a small plant of the salt bush or goose foot family, for which we have not heard a common name.
6. This looks like *Chenopodium triangulare*, fish weed, but fruits are necessary to be certain, as superficially it resembles another plant of the same family (Chenopodiaceæ).
7. *Lepidium* sp., a wild cress (family Cruciferæ). There are several species of lepidium native and naturalised in Queensland. They are commonly known as turnip weeds or mustard weeds, and although good fodder, give an exceedingly objectionable flavour to milk and cream. The genus is rather in need of revision, and we find difficulty in supplying specific names to specimens.
8. *Lepidium ruderale*, pepper cress (family Cruciferæ). Much the same remarks apply as to No. 7.
9. *Daucus brachiatus*, native carrot (family Umbelliferæ), a native plant.

Caustic Bush.

W.A.K. (Clermont)—

The specimen represents a very drawn-up form of caustic bush (*Euphorbia eremophila*), a fairly common plant in Queensland, distributed from the coast, where it grows right on the sea-beach, to the far inland. Generally it is left untouched by stock, but competent observers state that death has followed eating it in any quantity, the symptoms being similar to poisoning by caustic creeper (*Euphorbia Drummondii*). The head and neck of affected animals swell up to a considerable size, particularly with sheep, and if the swelling be pierced an amber-coloured fluid exudes and the life of the animal may be saved.

Plants from the North Identified.

T.H.C. (Townsville)—

1. *Raphanus Raphanistrum*, wild turnip, yellow flower, and *Raphanus Raphanistrum*, wild turnip, blue flower. Wild turnip is fairly common as a farm weed in Southern Queensland, and is seen occasionally on vacant allotments in North Queensland. It is quite a useful fodder, but like other members of the turnip or mustard family taints milk and cream rather badly.
2. *Eragrostis cilianensis*, stink grass. This is a small grass, mostly of annual duration, palatable enough in the young stage, but usually rejected by stock in the older. We have been informed, however, that at times horses will eat it readily enough. It has rather a peculiar odour, not objectionable to all people, but sufficient to make it apparently unpalatable to animals.
3. *Eleusine indica*, crow-foot grass. This is a grass very widely spread over the warm regions of the world. It is very common in coastal Queensland, particularly around cow-sheds and yards, vacant allotments, old cultivation lands, and, in fact, anywhere where the ground has been disturbed. It is quite palatable to stock, but, like sorghums and some other plants, it contains in its young and more luxuriant stages a considerable amount of a prussic acid-yielding glucoside. Very little trouble has been experienced with the grass in Queensland, but occasionally losses have occurred from stock eating this grass heavily on an empty stomach. Ordinary browsing stock do not seem to be affected to any great extent.
4. *Euphorbia heterophylla*, dwarf poinsettia. This plant is very common in coastal Queensland. The genus *Euphorbia* is a large one, and poinsettia is simply a section of it. The ordinary garden poinsettia is *E. pulcherrima*, a native of Mexico. The dwarf poinsettia is very widely spread as a weed in most tropical and sub-tropical countries, and is generally regarded as poisonous.

Plants from the Brisbane Valley Identified.

D.C. (Toogoolawah)—

1. (Plant with red flowers) *Asclepias curassavica*, red head. The cestrum, a plant you associated with it has greenish or greenish-brown flowers. The red head or milky cotton bush is also poisonous, but rarely seems to be eaten in sufficient quantity to cause trouble.
2. (Plant like a thistle) *Argemone mexicana*, Mexican poppy, a thistle-like plant very common in many parts of Queensland. It is very rarely eaten by stock owing to its intensely bitter sap, but is reputed to be poisonous. The only cases that have come under our notice have been where the plants have been cut, allowed to wilt, and the subsequently softened plants eaten by calves.
3. *Polygonum hydropiper*, smart weed, a very common weed in swampy country and in low-lying places in South-Eastern Queensland. It is not known to be poisonous.
4. *Verbena bonariensis*, purple top, a verbena, a native of South America, now naturalised in many warm countries. It is not known to possess any poisonous or harmful properties.

If any of these plants were responsible for the trouble we should say No. 1 was the most likely cause.

Bitter Blue Grass.

E.A. (Calen, North Coast Line)—

The specimen represents the bitter blue grass, *Bothriochloa decipiens* (var. *cloncurriensis*), a large grass very common in Queensland. So far as we have observed, stock do not seem to care for it to any extent, although, of course, they will eat it in the absence of other fodder.

General Notes

Staff Changes and Appointments.

Mr. C. I. Mudd, East Brisbane, has been appointed an Inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Messrs. A. R. Nott and P. F. A. Hardman, Government Veterinary Surgeons, Department of Agriculture and Stock, have been transferred from Blackall to Gympie and Gympie to Blackall respectively.

Mr. J. E. Ladewig, Inspector under the Stock, Slaughtering, and Dairy Produce Acts, Department of Agriculture and Stock, has been transferred from Oxley to Monto.

Mr. F. C. Jorss, Inspecting Cane Tester, has been appointed also Cane Tester for the remainder of the sugar season at the Mount Bauple Mill.

Mr. S. B. Best has been appointed Millowners' Representative on the Tully Local Sugar Cane Prices Board, in lieu of Mr. C. P. Kemmis, resigned.

Mr. Thomas Mee has been appointed Chairman of the Inkerman, Invicta, Kalamia, and Pioneer Local Sugar Cane Prices Boards, vice Mr. A. M. Taylor, transferred. Mr. L. H. Roles has been appointed Chairman of the Isis Local Board, vice Mr. J. G. Fitzsimon, transferred, and Mr. J. G. Fitzsimon has been appointed Chairman of the Moreton Local Board. Messrs. Mee, Roles, and Fitzsimon have also been appointed Agents of the Central Sugar Cane Prices Board for the purpose of making enquiries under section 5 (2A) of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands.

Constables S. W. Flewell-Smith (Mirani), V. J. Buckley (Walkerston), and C. F. W. Danford (Kynuna) have been appointed also Inspectors under the Slaughtering Act.

Constable A. J. Sharp, Kajabbi, has been appointed also an Inspector under the Slaughtering Act.

Mrs. Nancy Yaun, Numinbah Valley, Upper Nerang, has been appointed an Honorary Ranger under the Native Plants Protection Act.

Mr. William Williamson, Canungra, has been appointed an Inspector under the Slaughtering Act, the Diseases in Stock Acts, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. P. F. Tierney, Innisfail, has been appointed Canegrowers' Representative on the Goondi Local Sugar Cane Prices Board, vice Mr. W. D. Davies, resigned.

Mr. Gordon Lindsay, Maryvale, has been appointed an Acting Inspector of Stock.

Constable J. V. McErlean, Goodna, has been appointed also an Inspector of Slaughterhouses.

Mr. J. G. Sinclair, Torquay, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Mr. J. H. Smith, Entomologist, Department of Agriculture and Stock, has been transferred from Nambour to Brisbane.

The Officer in Charge of Police, Sherwood, has been appointed also an Acting Inspector of Stock.

Acting Sergeant C. P. Doherty, Jundah, has been appointed also an Inspector under the Brands Acts.

Mr. T. W. Kear, East Feluga, has been appointed an Honorary Ranger under the Animals and Birds Acts. The Rev. W. P. F. Morris, Headmaster of the Church of England Grammar School, East Brisbane, and Mr. M. J. Farrington, East Brisbane, have also been appointed Honorary Rangers under the abovementioned Acts.

Hail Insurance.

A regulation has been issued under the Primary Producers' Organisation and Marketing Acts, empowering the Committee of Direction of Fruit Marketing to make a levy on fruitgrowers in the Granite Belt to raise moneys to be applied in establishing and maintaining a Fund for effecting insurance against damage or loss by hail of fruits grown in such area, subject to a poll of growers on the question of the establishment of such Fund.

Animals and Birds Sanctuary at Maryvale.

Timber Reserve No. 402, near Maryvale, has been declared a sanctuary under the Animals and Birds Acts.

Fruit Fly Control in the Stanthorpe District.

A Proclamation and Regulation under the Diseases in Plants Acts have been approved declaring the Stanthorpe, Killarney, and Warwick Districts to be a quarantine area on account of fruit fly for the current season, and prescribing the nature of the quarantine to be imposed in such area. This action is similar to that taken in the previous two seasons, and provides for the placing of traps charged with fruit-fly lure approved by an inspector.

Sugar Industry Ballots.

Regulations have been approved under the Primary Producers' Organisation and Marketing Acts providing for the compilation of rolls to be used in the conduct of ballots for particular levies by the Queensland Cane Growers' Council, Mill Suppliers' Committees, and District Cane Growers' Executives, and for the purpose of the election of Mill Suppliers' Committees and District Cane Growers' Executives.

Cane Growers' Council.

Executive approval has been given to the issue of an Order in Council under the Primary Producers' Organisation and Marketing Acts empowering the Queensland Cane Growers' Council to grant such retiring allowances, pensions, bonuses, or gratuities as it may determine.

Butter Board as a Manufacturer.

An Order in Council has been issued under the Dairy Products Stabilisation Act which will provide that on and after the 26th October, 1936, the Butter Board, constituted under the Primary Producers' Organisation and Marketing Acts, shall be deemed to be the manufacturer of all butter manufactured in Queensland, but not to the exclusion of the actual manufacturer thereof, and shall be bound by the provisions of all quotas from time to time promulgated under the Dairy Products Stabilisation Act.

Control of Brumbies.

A Proclamation has been issued under the Diseases in Stock Acts declaring the Petty Sessions District of Collinsville, comprising part of the Bowen Stock District, to be a district for the control of "brumbies" for the period from 1st November, 1936, to 28th February, 1937.

The Central Sugar Cane Prices Board.

Executive Council approval has been given to the constitution of a Central Sugar Cane Prices Board for a period of three years from the 13th November, 1936, to consist of the following members:—

His Honour Mr. Justice W. F. Webb (Chairman), Mr. T. A. Powell (Canegrowers' Representative), Mr. E. S. Smith (Millowners' Representative), Mr J. M. MacGibbon (Qualified Sugar Chemist), and Mr. A. R. Henry (Secretary).

"Three-day Sickness" a Disease under Stock Acts.

An Order in Council has been issued under the Diseases in Stock Acts declaring Ephemeral Fever or "Three-day Sickness" to be a disease under and for the purposes of such Acts.

Wild Life Preservation.

Picnic Point Reserve, near Rockhampton, has been declared a sanctuary for the protection of native animals and birds.

Stanthorpe Co-operative Hail Insurance Fund.

Executive approval has been given to an amendment of the Regulation made on the 5th November last covering the Stanthorpe Fruit Co-operative Hail Insurance Fund, to provide that notice of damage or loss by hail of fruit in the Stanthorpe area shall be delivered to the Secretary of the Board of Control at Stanthorpe within ninety-six hours instead of seventy-two hours, as previously provided.

Rural Topics

The Carob Bean—A Stock Feed in Drought.

The high value of the Carob bean as a fodder has been emphasised from time to time. The beans are imported into Britain from Mediterranean countries as food for stock, the tree being a native of these countries, and also cultivated there. The tree is considered drought-resisting, and does not appear to be particular as to soil conditions. Trees are thriving on the red volcanic soil of Toowoomba, the black soil of the northern downs, near Moola, and the marly soil north of Miles, Western Queensland.

The seedlings are tender for the first year or two, and require protection from rodents and other animals. Seeds should be sown in a box or bed in the house garden, and when a few inches high the plants may be planted in a permanent position. The roots should not be disturbed more than possible, and care should be taken in transplanting, and the plants protected with wire-netting guards or light hessian.

The virtues of the Carob appear to be becoming known among pastoralists, for requests from local nurserymen for seed to maintain their stocks have been received at the Toowoomba office of the department. Young trees of a fair size in pots are available at local nurseries, and now or up to the end of September is a good time to plant.

Points in Harrowing.

The entire absence of rain during the last few weeks has not been confined to one section of the State; consequently not only are the resultant dry conditions acting adversely upon the winter cereal and other crops already above ground, but are delaying the planting of sugar-cane, potatoes, maize, and other staples, as well as preventing the preparation of further areas intended for summer cropping. On holdings where the latter has not already been accomplished, all energies will be concentrated on the carrying out of such work when rain comes, and care should be exercised at the same time in seeing that the loss of soil moisture, which is more or less inevitable to some extent, is reduced to a minimum. This can be accomplished economically and effectively through the use of the tine harrows, running them to and fro over the field in the same direction after the ploughing or other cultural operation has been done at the close of each day's work. On areas which have already received their final preparation, but which for some reason cannot be sown after rain, it is advisable to adopt the same procedure to restore the surface mulch and prevent the loss of moisture.

It must be realised that tine harrows will produce satisfactory results only on friable soils, so should the soil be of a clayey nature and inclined to run together, a cultivator, tined for preference, should be used for stirring the surface, for on such soils it is inimical to the best result if the mulch is made too fine.

Growing crops—such as wheat, oats, barley, and maize—derive considerable benefit through being harrowed during the early stages of their growth but in all instances the operation should be carried out at right angles to the direction which the crop was sown—that is, across the drills. The harrow should not be allowed to collect rubbish, otherwise many of the young plants will be destroyed.

Growers should not fail to realise that maize is one of the crops on which harrowing can be practised with very beneficial results, although of necessity it can be only carried out during the heat of the day, when the plants are tough and not so likely to suffer injury.

The first harrowing may be given three or four days after sowing, and may be continued until the plants are 6 inches high, resulting in the conservation of moisture and the control of new weed growth both between and in the rows, thereby reducing scuffling and chipping to a minimum, with a commensurate reduction in production costs.

When the all-round benefits accruing from the use of the tine harrows comes to be realised, they will not continue to be the least used implements of a farmer's outfit. They are seen all too frequently propped up carelessly somewhere or lost temporarily in some corner of the cultivation. They should be the most used and highly valued implements in the farm equipment.

Castration of Colts.

The best time of the year to perform this important operation is the spring, when rain has fallen and green feed is available, and before the hot weather has set in.

The colts to be gelded having been yarded over night, it is desirable, before proceeding with the operation, to take precautions against losses through infection of wounds, and to this end the spraying of the grounds and surroundings of the yard where the operation is to be performed should be carried out. Crude carbolic acid or phenol in a solution of 7 ounces to 1 gallon is a suitable disinfectant, and should be sprayed over the ground and rails of the yard.

All instruments used should be sterilized by boiling for at least ten minutes, and should be wrapped in a sterile towel and kept in a box at the yard until required.

After each colt is done the instruments and hands of the operator should be washed in a weak solution of carbolic acid, this solution being kept in a separate vessel, and only sufficient for each disinfection being poured into a dish for the purpose, and then thrown away. The practice of using a petrol tin filled with disinfectant to wash instruments and hands time after time is dangerous.

For unbroken colts the rough and ready methods of roping, choking, and throwing as practised on many stations, is responsible for the loss of many valuable animals. These losses may be minimised if a crush with side gates is available, so that the colt can be haltered and side lines used on him before the gate is opened to cast him.

The colt, having been cast on his left side, the hind legs drawn up to the shoulders and made fast with half hitches; the fore legs can now be secured with the knees bent to the hind feet.

The scrotum, sheath, and penis should be washed with warm water and soap, care being taken to remove any suety deposit from the penis and the cavity at the end of the penis. The left or lower testicle (the colt being on his left side) is seized in the left hand, and pressed until the skin is tight over it; a bold incision from front to back, parallel with the median line is now made, penetrating the outer skin and the tunica, laying the testicle bare. As the incision is made, the cord should be grasped firmly in the left hand to prevent the retraction of the testicle upwards through the canal. When this happens it is sometimes difficult to recover, and the subsequent manipulation in an attempt to bring it down delays the operation, and causes unnecessary shock to the patient. The knife is now slipped between the anterior and posterior portions of the cord, and the latter (posterior), which the muscle retracts, is cut completely through.

The testicle now lies inert, connected by the anterior portion of the cord, which is composed of blood vessels, and should be drawn out until it is taut, without using force, when the emasculator (if that method is being used) should be used close to the belly, with a slow squeezing movement, taking care that the crushing part is nearest to the belly, and the cutting part to the testicle. The cord should be severed as short as possible so that it may not hang below the wound, and so cause complications.

The remaining testicle may now be removed in a similar way.

It is advisable to swab the wound with a solution—1 to 2,000—of chloride of mercury. The ropes may now be removed, and the colt allowed to rise and walk out of the yard, so as to be away from dust.

If the operation has been performed carefully, and all antiseptic precautions taken, recovery should be rapid and no further treatment is necessary, but if undue swelling is noted, the wound should be opened with the fingers, after washing the hands with carbolic solution, so that there may be free drainage, and the wound swabbed with disinfectant.

Some bleeding always occurs, but rarely lasts for more than half an hour, but if copious bleeding persists after that time—as is the case when emasculators have been used carelessly—the stump must be found, and the artery tied with silk thread. If the stump of the cord cannot be found, the canal should be plugged with pledgets of tow or wool soaked in muriate of iron of the same strength as obtained from the chemist, which helps to form clots, and so closes the artery.

Sudan Grass in the Maranoa.

Some excellent quality Sudan grass hay was harvested in the Roma and Wallumbilla districts during the autumn of this year. This plant is outstanding as a hay and grazing crop for the drier farming areas, as is indicated by its popularity on the Darling Downs and in the Maranoa. Lack of harvesting machinery and implements, such as the reaper and binder, or mower and rake, on many stock farms, is the retarding factor so far as the conservation of hay is concerned.

Despite the excellent growth of native grasses, dairy production declined considerably from April onwards, as dry, mature grass is unsuitable for milking cows. With the more extensive use of blue panic and Rhodes grass, the conservation of Sudan grass as hay and silage, and the more widespread utilisation of winter fodders, such as wheat and barley, it should be possible to carry on dairying in the drier country away from the coast right through the winter, even in the Maranoa. Many dairy farmers in those regions dry the cows off during the autumn, and may not milk again until the spring.

In recommending Sudan grass as a grazing crop, the risk of fatalities as a result of hydrocyanic acid poisoning must be kept in mind. This subject has been fully discussed in the *Queensland Agricultural Journal*, and, as mentioned therein, many farmers have utilised Sudan grass in all stages of growth as a grazing crop without ill effects. An effort should be made to procure pure seed, free from admixture with sorghum or Johnson grass hybrids. Full information regarding the cultivation of Sudan grass can be obtained from the Department of Agriculture and Stock, Brisbane.

Overripe Milk and Cream.

The only desirable change in milk or cream for cheese-making or butter-making is the production of lactic acid, which is derived from the breaking down of the milk sugar by the lactic acid bacteria. However, the development of too much acidity is not desired, as it causes difficulty in manufacturing choice quality cheese and butter. Setting overripe milk with rennet gives trouble in the subsequent stages of cheese-making. Excessive acidity in cream to be used for butter-making gives rise to neutraliser flavours in the butter and there is also the possibility of more serious faults developing in overripe cream, such as cheesy and curdy flavours.

The most important factor in the development of overripeness is undoubtedly holding the raw material at too high a temperature and where there is infrequent delivery to the factory this defect will yearly cause considerable loss of revenue to suppliers through failure to control the activities of the causal bacteria.

To overcome the effect of seasonal conditions much more could be attempted by progressive farmers than is done at present. The most favourable temperature range at which the proper changes take place in cream for butter-making is between 60 and 70 deg. Fahrenheit. The use of cooling devices, which are procurable for about £2, makes such temperatures attainable even in the hottest weather. The perusal of records kept by farmers who have installed such coolers has disclosed that even on the hottest days their cream was cooled after separation to within a few degrees of 70 deg. Fahrenheit. Furthermore, they have not had second grade cream since adopting the method.

A concrete water trough about 2 feet wide by about 8 inches deep at the southern end of the dairyhouse is another aid when filled to cooling and keeping cream cool; but the trough must be emptied and refilled regularly or it will become a menace.

Another way of preventing overripeness is to deliver the cream to the factory as frequently as possible. Also, do not separate cream to contain less than 38 per cent. butterfat between October and March, inclusive, as a cream of low butterfat test is prone to develop increased acidity in the summer months.

Variegated Thistle Poisonous to Stock.

On the Darling Downs recently, a dairy farmer reported the sudden death of three cows in his herd. Unfortunately, the carcases had been destroyed by burning, so it was impossible to conduct post-mortem examinations. A visit to the property disclosed that the evening preceding the mortalities, a quantity of variegated thistle had been cut, and on the following morning it was eaten by the affected cows. It had been expressly cut to provide feed, because of the dry times. Within a few hours, three head showed marked symptoms of wobbly gait and distress, and eventually they died. Animals in other paddocks were not affected.

Many plants are poisonous in certain stages of development. A warning is issued to beware of variegated thistle, and to refrain from cutting it as feed for hungry stock. This plant has been reported upon by New South Wales authorities as being extremely poisonous at times, and more particularly in respect of travelling and hungry stock.

Orchard Notes

JANUARY.

THE COASTAL DISTRICTS.

ALL orchards and plantations should be carrying a good cover crop—in the first place, to help to check erosion during the coming heavy rainy season; and secondly, to maintain the soil in good physical condition when cut down and turned under. This advice is especially applicable to citrus orchards and hillside banana plantations, which frequently suffer from severe losses of valuable top soil.

Pineapple plantations must be kept well worked to assist the main summer crop later on.

Keep pineapple plantations of all ages weed-free by shallow Dutch hoe cultivation.

Pineapple growers who have missed the spring planting will usually find it better to delay activities until the end of February. The idea is to wait until the main monsoonal rains have ceased. Then the ground will still be warm and moist; while there still remains a sufficiently long growing period to enable young plants to make a good development before the cold weather checks growth.

Bananas and pineapples may still be planted, though it is somewhat late for the former in the more southern parts of the State. Keep a good lookout for pests of all kinds, such as Maori on citrus trees, scale insects of all kinds, all leaf-eating insects, borers, and fungus pests generally, using the remedies recommended in Departmental publications. Bunchy Top in bananas will be most severe during February, March, and April in those districts in which it exists and growers should make regular patrols of plantations.

Fruit fly should receive special attention, and on no account should infested fruit of any kind be allowed to lie about on the ground to become the means of breeding this serious pest. If this is neglected, when the main mango crop in the South and the early-ripening citrus fruits are ready, there will be an army of flies waiting to destroy them,

Be very careful in handling and marketing of all kinds of fruit, as it soon spoils in hot weather, even when given the most careful treatment. Further, as during January, there is generally more or less of a glut of fresh fruit, only the best will meet with a ready sale at a satisfactory price.

Grapes are in full season, and in order that they may be sold to advantage they must be very carefully handled, graded, and packed, as their value depends very much on the condition in which they reach the market and open up for sale. Well-coloured fruit, with the bloom on and without a blemish, always sells well, whereas badly coloured, immature, or bruised fruit is hard to quit.

One of the greatest mistakes in marketing grapes is to send the fruit to market before it is properly ripe, and there is no better way to spoil its sale than to try and force it on the general public when it is sour and unfit to eat.

Bananas for sending to the Southern States require to be cut on the green side, but not when they are so immature as to be only partially filled. The fruit must be well filled but show no sign of ripening; it must be carefully graded and packed and the cases marked in accordance with the regulations under the Fruit Cases Acts and forwarded to its destination with as little delay as possible.

Pineapples should be packed when they are fully developed, which means that they contain sufficient sugar to enable the fruit to mature properly. Immature fruit must not be marketed, and if an attempt is made to do so the fruit is liable to seizure and the sender of the fruit to prosecution under the abovenamed regulations. Further, the fruit must be graded to size and the number of fruit contained in a case must be marked thereon. Immature fruit must not be sent. For canning, the fruit should be partly coloured; immature fruit is useless; and over-ripe fruit is just as bad. The former is deficient in colour and flavour and the latter is "winey" and of poor texture, so that it will not stand the necessary preparation and cooking.

Should there be a glut of bananas, growers are advised to try and convert any thoroughly ripe fruit into banana figs.

The fruit must be thoroughly ripe, so that it will peel easily, and it should be laid in a single layer on wooden trays and placed in the sun to dry. If the weather is settled, there is little trouble, but if there is any sign of rain the trays must be stacked till the weather is again fine, and the top of the stack protected from the rain. To facilitate drying, the fruit may be cut in half lenghtways. It should be dried till a small portion rubbed between the finger and thumb shows no sign of moisture. It can be placed in a suitable box to sweat for a few days, after which it can be dipped in boiling water to destroy any moth or insect eggs that may have been laid on it during the process of drying and sweating. It is then placed in the sun to dry off any moisture, and when quite dry it should be at once packed into boxes lined with clean white paper. It must be firmly packed, when, if it has been properly dried, it will keep a considerable time. It can be used in many ways, and forms an excellent substitute for raisins, sultanas, currants, or other dried fruits used in making fruit cakes and other comestibles. Banana figs will be found useful for home consumption, and it is possible that a trade may be built up that will absorb a quantity of fruit that would otherwise go to waste.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JANUARY is a busy month in the Granite Belt, and orchardists are fully occupied gathering, packing, and marketing the crop of midseason fruits, consisting of plums of several kinds, peaches, nectarines, pears, and apples. The majority of these fruits are better keepers and carriers than those that ripen earlier in the season; at the same time, the period of usefulness of any particular fruit is very limited, and it must be marketed and disposed of with as little delay as possible.

With the great increase in production, owing to the large area of new orchards coming into bearing and the increasing yields of those orchards that have not come into full profit, there is not likely to be any market for immature or inferior fruit. There will be ample good fruit to fully supply the markets that are available and accessible. Much of the fruit will not carry far beyond the metropolitan market, but firm-fleshed plums, clingstone peaches, and good firm apples should stand the journey to the Central District, and, if they are very carefully selected, handled in a manner to prevent any bruising, and properly graded and packed, they should carry as far as Townsville. Growers must remember that, given a market fully supplied with fruit, only such fruit as reaches that market in first-class condition is likely to bring a price that will pay them; consequently the grower who takes the trouble to send nothing but perfect fruit; to grade it for size and colour, to pack it carefully and honestly, placing only one-sized fruit, of even quality and even colour, in a case and packing it so that it will carry without bruising, and, when opened up for sale, will show to the best advantage, is pretty certain of making good. On the other hand, the careless grower who sends inferior badly graded, or badly packed fruit is very likely to find when the returns for the sale of this fruit are to hand that after paying expenses there is little, if anything, left. The expense of marketing the fruit is practically the same in both cases.

Then why "spoil the ship for a ha'porth of tar" after you have gone to the expense of pruning, spraying, manuring, and cultivating your orchard? Why not try and get a maximum return for your labour by marketing your fruit properly? The packing of all kinds of fruit is a fairly simple matter, provided you will remember—

(1.) That the fruit must be fully developed, but yet quite firm when gathered.

(2.) That it must be handled like eggs, as a bruised fruit is a spoilt fruit, and, when packed with sound fruit, spoils them also.

(3.) That only one-sized fruit, of an even degree of ripeness and colour, must be packed in a case.

(4.) That the fruit must be so packed that it will not shift, for if it is loosely packed it will be so bruised when it reaches its destination that it will be of little value. At the same time, it must not be packed so tightly as to crush the fruit.

If these simple rules are borne in mind, growers will find that much of the blame they frequently attribute to the fruit merchants or middlemen is actually the result of their own lack of care. Fruit that opens up in the pink of condition sells itself, whereas any fruit that opens up indifferently is hard to sell on any except a bare market, and on a glutted market is either unsaleable or realises such a poor price that the grower is frequently out of pocket, and would have been better off had he not attempted to market it.

If spraying with arsenate of lead and systematic bandaging has been properly carried out, there will be comparatively few codlin moths to destroy the later ripening pip fruits; but if these essential operations have been neglected or carelessly carried out a number of moths will hatch out and the eggs laid by them will turn to larvæ that will do much damage, in some cases even more than that caused by the first broods that attack the fruit as soon as it is formed. Where there is any likelihood, therefore, of a late crop of moths, spraying with arsenate of lead must be continued if the late crop of pip fruits is to be kept free from this serious pest.

Fruit fly must be systematically fought, and on no account must any fly-infected fruit be allowed to lie about on the ground and breed this pest, to do further damage to the later ripening fruits.

Citrus orchards will need to be kept well cultivated in the drier and warmer parts of the State, and, where necessary, the trees should be irrigated. If scale insects are present, the trees should be either sprayed or, better still, treated with hydrocyanic acid gas.

Western grapes are in full season, and if they are to be sent long distances by rail then they are all the better to be cut some hours before they are packed, as this tends to wilt the stems and keep the berries from falling off in transit. The fruit must be perfectly dry when packed, and should be as cool as possible. It must be firmly packed, as a slack-packed case always carries badly and the fruit opens up in a more or less bruised condition.

THE BLENDING OF CREAM.

The great importance of the operation of blending cream is evidently not well understood by many farmers, judging by the condition in which much cream reaches the butter factories. Lack of proper attention to this vital matter is often the cause of undesirable fermentations, which detract from the bright, aromatic flavour desired in choice cream, and results in the consignment being graded down.

The practice of holding the cream from each separation in a separate utensil encourages the development of faults like staleness and over-ripeness in the portions which are kept longest on the farm, and the mixing of these portions with the other separations just before despatching to the factory gives a bulk cream of inferior flavour. Adding the cream straight from the separator, without in any way reducing the animal heat, to a partly-filled can of cream from a previous separation is another practice which merits the severest condemnation.

The correct procedure to follow is to mix each batch with the bulk after the heat has been reduced, which usually takes about an hour, unless cooling devices are used, when the different portions can be mixed immediately. It is much easier to prevent off flavours from developing by keeping the cream in larger quantities than by retaining each separation in a separate container.

Some farmers consider that by keeping each separation apart the risk of getting second-grade cream is minimised or, at any rate, that only part of the supply is likely to be graded low. However, modern methods have demonstrated very definitely that correct blending of cream, by ensuring an even souring, helps to achieve choice quality.

Stirring of the cream at regular intervals throughout the day may be regarded as an essential point in the correct blending of cream. It assists to obtain even ripening and even consistency. Finally, it should always be the rule to deliver to the factory as frequently as transport arrangements will permit, for the longer that cream is kept on the farm the more difficult control of ripening becomes.

Farm Notes

JANUARY.

FIELD.—The main business of the field during this month will be ploughing and preparing the land for the potato and other future crops, and keeping all growing crops clean. Great care must be exercised in the selection of seed potatoes to ensure their not being affected by the Irish blight. Never allow weeds to seed. This may be unavoidable in the event of long-continued heavy rains, but every effort should be made to prevent the weeds coming to maturity. A little maize may still be sown for a late crop. Sow sorghums, *Setaria* Sp. (panicum), teosinte, and cowpeas. In some very early localities, potatoes may be sown, but there is considerable risk in sowing during this month, and it may be looked upon merely as an experiment. Plant potatoes whole. Early-sown cotton will be in bloom.

On coastal and intercoastal scrub districts, where recently burnt-off scrub lands are ready for the reception of seed of summer-growing grasses, sowing may commence as soon as suitable weather is experienced. Much disappointment may be saved, and subsequent expenditure obviated, by ensuring that only good germinable grass seed is sown, of kinds and in quantities to suit local conditions, the circumstances being kept in mind that a good stand of grass is the principal factor in keeping down weeds and undergrowth.

In all districts where wheat, barley, oats, canary seed, and similar crops have recently been harvested, the practice of breaking up the surface soil on the cropped areas should invariably be adopted. Soil put into fit condition in this way will "trap" moisture and admit of the rains percolating into the subsoil, where the moisture necessary for the production of a succeeding crop can be held, provided attention is given to the maintenance of a surface mulch, and to the removal, by regular cultivation, of volunteer growths of all kinds. If not already seen to, all harvesting machinery should be put under cover, overhauled, and the woodwork painted where required.

Where maize and all summer-growing "hoed" crops are not too far advanced for the purpose, they should be kept in a well-cultivated condition with the horse hoe. Young maize and sorghum crops will derive much benefit by harrowing them, in the same direction as the rows are running, using light lever harrows with the tines set back at an angle to obviate dragging out of plants, but the work should not be done in the heat of the day.

Quick-maturing varieties of maize and sorghum may still be sown in the early part of the month in coastal areas where early frosts are not expected.

Succession sowings may be made of a number of quick-growing summer fodder crops—Sudan grass, Japanese and French millet, white panicum, and liberty millet (panicum). In favourable situations, both "grain" and "saccharine" sorghums may still be grown; also maize, for fodder purposes.

Fodder conservation should be the aim of everyone who derives a living from stock, particularly the dairyman; the present is an important period to plan cropping arrangements. Exclusive of the main crops for feeding-off (when fodder is suitable for this purpose), ample provision should be made for ensilage crops to be conserved in silo or stack. As natural and summer-growing artificial grasses may be expected to lose some of their succulence in autumn, and more of it in winter and early spring, the cropping "layout" to provide a continuity of succulent green fodder throughout the season calls for thorough and deep cultivation and the building up of the fertility and moisture-holding capacity of the soil. Planter's friend (sorghum) may be sown as a broadcast crop at the latter end of the month for cutting and feeding to cattle in the autumn and early winter. Strips of land should be prepared also for a succession sowing about the second week in February, and for winter-growing fodder crops.

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.

A WISE MOTHER.

HOW fortunate are the children of a good mother! Of her more than of anyone else it may be said that her work lives after her. Very seldom does she discuss her methods in print. We therefore do not hesitate to reprint the following article.*

Freedom and Discipline.

"I am a firm believer in discipline for baby from the earliest cradle days. By that I mean that baby must be taught automatic obedience and must learn to respond to a regular rhythm, and not find that, by the power of the lungs, he can bring himself extra attention or other delights. But, while discipline is one side of the picture (and a very important side), and while it is my belief that if obedience has not been taught by the second birthday it will be very, very hard for it ever to be taught, yet I would plead with mothers to give their children the maximum amount of freedom possible.

"Children are not small replicas of their mothers, nor are they miniature adults, and we must always beware of seeking to regulate their lives from an adult standpoint. Nothing to so likely to blight and spoil a budding personality as a too rigid and unimaginative authority.

"Take the question of freedom in physical action. Almost incessant movement on the part of the pre-school child is both right and

* From a New Zealand paper, which reprinted it from the "Women's Pictorial" eight years ago. The name of the writer was not given.

necessary. The law of growth and co-ordination of the muscles depends almost entirely on such movement, and every natural activity and impulse gives practice to the muscular and sensory systems, enabling them to develop to the full.

"Any training which cuts across this natural law is both cruel and foolish. If you cannot have both flowers and children in your garden, sacrifice the flowers.

Legitimate Outlets.

"When legitimate outlets are provided for this activity, there will be no need for endless strings of 'Don'ts' from morning to night, which are so wearing to both mother and child. The best outlay a mother can make is to erect in some way an outside shelter or veranda, to provide outdoor tables, chairs, and sleeping places, and to install a large sand pile, while a see-saw and a box of wooden bricks are excellent outdoor equipment. With such simple arrangement the toddlers will be happy, healthy, and content, and the garden a far more radiant place than any number of flowers could ever make it.

"Even when activity is directed into some dangerous channel, it should not be sternly repressed, but merely redirected into an equally delightful but harmless one. All commands should be, as far as possible, positive, not negative, and with a little imagination, many of the child's natural desires can be legitimately satisfied. For instance, all children love playing with scissors, and there is no reason why round-topped, bluntish ones should not be provided, and the child carefully taught how to use them.

"With regard to freedom of choice of action, experience shows that it is usually more kind to the child to allow this, but rarely. A child has so little experience, and often takes life so seriously, that he will exhaust his supply of nervous energy in trying to decide for himself which of two pleasures he would choose.

"To plan the day so that there is no hesitation will make for restfulness.

"The wise mother will refrain from speaking until any plan that is in her mind is quite matured and settled, while undoubtedly the fewer changes which are made in the everyday routine the better it is for character and content. We should find such a routine boring, but a small child delights in law and order, and in frequent repetition—as any nursery story-teller can witness!

Example Counts.

"When we come to the question of character and morals, the crux of the whole situation is the atmosphere which we ourselves are creating. Baby's sharp eyes are ever watching and striving to imitate the beloved adult, and he can have no experience of any moral tone except that which is in his own home. Hence the importance of self-control in home life, and of being scrupulously careful in the choice of any deputy who is much with the child. Sometimes daddy, tired from the office, is a stumbling block to his little one, for it is useless to speak of the value of politeness, chivalry, cheerfulness, and so on if the man of the house lolls at table or permits himself to be grumpy or disagreeable. One of the most important of childish instincts is the longing 'to be big,' and if virtues which are instilled into him are connected solely with the

nursery, he will, sooner or later, desire to show his emancipation by practising the opposite. If virtues, however, are the adult things, and wilfulness, rebellion, untidiness, and so on, signs of babyhood, then we have a powerful incentive to help him to acquire the former and outgrow the latter."

COMMON DANGERS ON REEF AND SHORE.

IT is especially desirable that children and adults should be warned of the dangers awaiting the unwary on sandy beaches or on the reefs along the seashore, for with the coming of the warmer season and the holidays of Christmas and New Year the beaches and coastal waters will be thronged with many thousands of people to whom such a warning might come very opportunely.

Some of these dangers are listed as follows:—

THE PORTUGUESE MAN-OF-WAR.

Blue-tinted sausage-balloon often found in the water or on the beach near the edge. It has several long blue strands which may sting a person so severely that paralysis and even death may follow.

Cure.—Apply sal volatile as quickly as possible to the affected parts. Sal volatile may be used also for jelly-fish stings.

CONE-SHELL (GEOGRAPHUS).

Usually found under large boulders. It is a pretty shell, which should *never* be handled except with tweezers. It was one of these shells that caused the death of a man some time ago.

CONE-SHELL (TEXTILE).

This textile cone is the commoner of the two cones and is considered not quite so deadly.

STONEFISH.

Sluggish in habit. When danger threatens it raises its thirteen dorsal spines. Usually hidden among weed and sand. Causes excruciating pain, relieved only by morphia, and lasting in effect for as long as six months. Sometimes found in Moreton Bay.

Cure.—Relief may be obtained by applying heated onion. Medical aid should be summoned immediately.

CUTSHELL (OR RAZOR SHELL).

Usually so embedded in the muddy sand as to have its sharp razor edges just level with the surface. If a wound has been inflicted by a razor shell (or an oyster), care should be taken to clean the wound of all pieces of shell and then cover with collodion, which will form a seal over the injured part.

GENERAL ADVICE.

Never go wading unless stout shoes with thick leather soles are worn; sandshoes are not a really suitable covering.

Never touch any strange object in the water or on the beach.

IN THE FARM KITCHEN.

USES OF MACARONI.

Macaroni provides a welcome change from the usual meat dishes, and can be combined with other foods to form an appetising course.

To Boil Macaroni.

Place the macaroni in a saucepan containing enough boiling water to cover it well. Boil uncovered for about twenty minutes. Turn into a colander. Run the cold tap on it for a second or so, then drain again, and use as required.

Macaroni and Cheese Scallops.

Take 4 oz. macaroni, ¼ pint milk, 2 oz. cooked ham, 2 oz. grated cheese, 2 eggs, 1½ oz. butter, stale breadcrumbs, pepper, and salt to taste.

Boil macaroni, drain well, and chop. Stir in half of the butter, melted cheese, chopped ham, beaten eggs, milk, pepper and salt to taste. Butter as many scallop shells as are required. Sprinkle them with stale breadcrumbs. Fill with the mixture. Sprinkle lightly with stale breadcrumbs. Place small pieces of the remaining butter on top, and bake till crisp and brown.

Tomatoes with Macaroni Stuffing.

Take 6 large tomatoes, 4 oz. cooked macaroni, 4 large tablespoonfuls grated cheese, 1 egg, 1 teaspoonful chopped parsley, breadcrumbs, ¾ cupful tinned tomato soup, 2 tablespoonfuls butter, pepper, salt to taste.

Put the soup into a saucepan. Cut up and add macaroni. Bring to boil, cook for a few minutes, then cool and drain. Add parsley, pepper, and salt to taste. Beat the egg lightly, add cheese, mix well, and stir into the macaroni. Remove a slice from blossom end of tomatoes, and carefully scoop out pulp. Fill tomatoes with mixture, cover with a layer of breadcrumbs. Dab with tiny pats of butter. Bake till brown.

Spinach and Macaroni.

Take ½ lb. macaroni, 2 tablespoonfuls melted butter, 2 tablespoonfuls meat gravy, grated nutmeg, 2 bunches English spinach, 1 oz. flour, 1 gill white sauce, pepper and salt.

Cook macaroni in boiling water till tender. Meanwhile, boil the spinach. Drain, chop, and sieve. Return spinach to pan. Season to taste with salt, pepper, and grated nutmeg, if liked. Stir flour into the melted butter, then add gravy. Bring to the boil and add spinach. Stir hot white sauce into drained macaroni, and place in a border round a hot fireproof dish. Pack the spinach in the centre. Garnish spinach with chopped macaroni.

Macaroni Eggs.

Take 2 eggs , 1 onion, ½ lb. tomatoes, ½ oz. butter, ½ gill water, sprig parsley and thyme, ½ clove garlic, 1 teaspoonful cornflour, 2 oz. macaroni.

Peel and mince the onion, cook it for a few minutes in the butter, but do not let it brown. Add the sliced tomatoes, also the water, herbs, and garlic, and cook them gently till tender. When ready, remove the herbs and garlic, and rub sauce through a sieve, then thicken it with the cornflour smoothed in a little cold water, and add seasoning to taste. Meanwhile, break up the macaroni, leaving two long pieces. Wash it and cook it in boiling water with salt, drain it when tender, and mix with half the tomato sauce. Turn this into a fireproof dish, make two hollows and break an egg into each, season them well, pour the remainder of the sauce carefully over them, and put the dish in the oven long enough to cook the eggs. Garnish the dish with the two long pieces of macaroni.

Baked Macaroni and Tomatoes.

Take ½ lb. macaroni, 2 lb. tin tomatoes, 1 oz. butter, 3 tablespoonfuls breadcrumbs, 1 small onion, pepper, and salt.

Arrange boiled and drained macaroni in a greased, fireproof baking dish, season to taste with salt and pepper, and sprinkle with half the chopped onion. Cover with the tomatoes, the remainder of the onion, season with pepper and salt, then cover with the crumbs. Place tiny pats of butter on top. Bake in a moderate oven on the top shelf for half an hour.

Macaroni and Oysters.

Take 2 oz. macaroni, ½ oz. butter, ½ oz. flour, 1 gill milk, 1 dozen oysters, juice ½ lemon, salt and cayenne.

Break the macaroni into pieces an inch long, and boil till tender in fast-boiling water, to which a little salt has been added; then strain, melt the butter in a saucepan, add the flour, and mix well. Stir in the milk with the pan off the gas. Replace over the heat, and stir till it boils. Season with lemon juice, salt, and cayenne. Remove the beards from the oysters, and put the oyster liquor into the sauce with the macaroni. Cut six of the oysters in half, and add them to the macaroni mixture. Pour into a fireproof dish, and lightly brown in a hot over for five minutes. Put six whole oysters on top, and serve.

Italian Macaroni Pie.

Take ½ lb. to ¾ lb. cold cooked beef or mutton, ½ onion, 3 firm, ripe tomatoes, ¼ lb macaroni, salt, pepper, nutmeg, a little sauce or stock, breadcrumbs, cheese.

Cut the meat into thin slices, peel and slice thinly half an onion, and the tomatoes. Boil the macaroni till tender in slightly salted water. Drain and cool the macaroni, and cut it up rather small. Line a buttered baking dish with macaroni, and range the meat, onion, and tomato slices on the baking dish. Season with salt, pepper, and nutmeg; pour over a little sauce or stock, and cover top with macaroni. Sprinkle over some breadcrumbs and grated cheese, and bake for about half an hour in a hot oven.

PUMPKIN PIE.

Here are three ways of making pumpkin pie:—

1. 1½ grammas or a very dry, ordinary pumpkin (steamed); ¾ cup sugar; juice of two lemons; ½ packet of spice; ½ lb. currants.

When the pumpkin is cold, mash it well. Add sugar, lemon, juice, spice, and currants. Cover with a flaky crust and bake till golden brown.

2. 1 large gramma (steamed); ¾ cup sugar; juice of 1 lemon; juice of three passionfruit; an ounce of butter.

Mash the pumpkin with butter and sugar. Add lemon and passionfruit juices. Cover with a good short crust. Bake until golden brown. Serve with whipped and sweetened cream.

3. One large cup mashed, cooked pumpkin; one cup hot milk, ¼ teaspoon nutmeg; ½ teaspoon cinnamon; ½ teaspoon ginger, ½ cup brown sugar; one slightly beaten egg.

Mix all together. Have ready two pieces of good pastry. Lay one on round pie-dish. Spread mixture evenly, cover with second piece of pastry, mark for slicing, brush with white of egg, sprinkle with sugar, and bake about half an hour in a moderate oven. Serve hot, with custard or cream.

FACTS ABOUT THE PAPAW.

The papaw tree takes a prominent place among the many tropical fruits that thrive in Queensland. The papaw originally came from Central America and is known there by the natives as the "papaya" or "mamai" (father and mother) tree, according to the sex of the plant. Introduced many years ago, the papaw gradually became acclimatised until it found conditions so congenial that it now thrives on the coastal areas of Queensland.

Papaw trees grow from seeds. The tree is a small one seldom exceeding twenty feet in height, is of spongy texture and is usually hollow in the middle. It resembles a bamboo in this respect. It is practically branchless, and is surmounted by a crown of large palmate leaves, at the base of which fruit is produced. Of late years some growers have adopted the practice of stopping the growth of the main stem and forcing the tree to throw two or more branches. By this means, the tree bears a far greater quantity of fruit close to the ground than is the case if it is allowed to develop naturally.

The trees are sexed. The male tree flowers profusely, bearing flowers at the end of long stems which hang down and suspend vertically any fruit if formed.

As the fruit borne by male trees is small and of no commercial value, the trees are usually cut out as soon as the sex can be determined, a few only being left for the purposes of fertilization of the seeds in the fruit of the female trees.

The female tree bears flowers at the base of the stem of each leaf and a profusion of fruit forms close to the stem. The fruit are often so thick on the stem of the tree that many of the papaws are crushed as they develop, and ripen in a misshapen condition.

The papaw tree, being of tropical origin, is particularly liable to damage from frost, and must be grown in positions sheltered from heavy winds and frost.

Seeds are planted in beds in the spring and early summer, and the small seedlings transplanted to the field when from six to twelve inches in height. In order to make full allowance for the cutting out of the male trees, two and at times even three seedlings are planted to each stool, but of these not more than one tree is allowed to bear fruit. Trees are spaced from eight to ten feet square. The young plant develops rapidly and, given suitable growing conditions, the female will at times commence to bear fruit within two feet of the ground. Particularly vigorous trees will at the one time have from four to six feet of the stem literally covered with fruit. Trees will bear in approximately twelve months, and although their commercial bearing life is short, seldom exceeding four years, the actual weight of fruit produced per tree is high. The fruit ripens from the base upwards, and no part of the stem ever bears more than one crop. As the tree ages the fruit is developed higher and higher from the ground, and it is a common sight to see branchless trees so high that ladders must be used for picking.

The crop usually commences to mature in April, and continues heavily until Christmas, with light supplies available through January. The papaw has thick yellow flesh with a small cavity in the centre, which usually contains a number of black seeds.

The skin of the papaw is very thin and particularly delicate when the fruit is fully ripe. The thinness of the skin makes it peculiarly susceptible to outside influences, and accounts for so many of the ripe papaws showing blemishes. These, however, do not detract from the eating quality of the fruit.

Gradually the health-giving properties of the papaw are receiving wider recognition, and the acreage under papaws is increasing. The papaw is grown throughout coastal Queensland.

As a table fruit the papaw is delicious and wholesome. Some palates may not appreciate the flavour at first, but the papaw habit is well worth acquiring in such cases. The addition of a little orange or lemon juice or passion fruit greatly improves the flavour.. For salads, papaws are especially valuable. The size of fruit varies on each tree, but most fruit marketed will provide from 1 to 5 lb. of succulent flesh, which, by the addition of sliced oranges and pineapple, quickly makes a delightful salad, and one that will allow generous helpings. Papaws are in season from April to December. Every fruit shop in Queensland sells papaws, and cafes serve them daily during the season. Iced papaw is very popular. Papaws should not to be eaten until the flesh is soft.

The papaw is used in various forms:—

(*a*) In its ripe state as a breakfast fruit, for which purpose it is cut lengthwise into individual portions, and the seeds are removed. It is flavoured to suit the taste by the addition of lemon or orange juice and sugar—or with sugar only.

(*b*) As a dessert fruit, when it is sliced and eaten with sugar and crushed ice, or diced and incorporated with other fruits as a fruit salad.

(*c*) As a salad combined with lettuce or in mayonnaise; or served with green celery and onions.

(*d*) The green fruit may be boiled or baked and served as a vegetable.

(*e*) As a crystallised fruit, and it is sometimes made into pickles, marmalade, jelly, pie, jam, ice cream, and sherbet.

(*f*) As the main constituent of the following commercial lines: Tropical Fruit Salad and Papaw Chutney.

Nearly all parts of the papaw have some medicinal value. The most important medicinal properties are said to be found in the milky juice which occurs most abundantly in the green fruit. These properties of the juice are due to the active

principle called "papain," which has been long recognised as of considerable value in dyspepsia and kindred ailments. Its digestive action is undoubted, and it is a not uncommon practice to rub a slice of green juicy papaw on tough meat to make it tender. Another practice is to wrap the meat in crushed papaw leaves over-night preparatory to cooking it.

The papaw is a valuable aid to digestion, and many sufferers from dyspepsia have obtained relief by eating this fruit. Papaw juice contains papain, a powerful digestive ferment, which is often used instead of pepsin. For dysentery the ripe fruit is a sovereign remedy. The seeds have the flavour of watercress, and are an efficient vermifuge.

The late Lord Harris, who visited the West Indies with a team of English cricketers a few years ago, was a sufferer from digestive troubles. Such was the relief that he obtained from the eating of papaws, that he subsequently wrote in a local journal, urging that greater attention should be paid to the medicinal value of the papaw, and stressing his view that the importance of this wonderful fruit should be far more widely recognised.

In a recent report of the proceedings of the Agricultural Society of Trinidad, a contributor of a paper on the papaw said: "I have no greater authority than myself who am a constant sufferer of stomach troubles for which medical science has proved to be of very little use. Persuaded by a friend, I am now making use of the papaw in all recognised forms together with a tonic bearing the following recipe:— 'To a bottle of wine use about two green thinly skinned grated papaws, allow the composition to soak for a period of four days, after which it is strained and then used by taking a wineglass full before meals.' I am, indeed, gratified with the results."

Papaws contain no sucrose, but contain lævulose, which is specially suitable for diabetics.

HOUSING COCKERELS.

The housing of a large flock of cockerels, which are being reared either for stud or for table purposes, causes some concern, owing to the number which are injured through fighting. Fighting is more prevalent among light breeds, such as white leghorns, than among heavy breeds, such as australorps.

The rearing of a large number of cockerels in one unit could be arranged to great advantage by the provision of a special house, rather than making use of the usual type of fowlhouse. Cockerels of the same age should be placed in the same unit. The type of house recommended is one in which the walls do not reach the ground, thereby eliminating corners. For efficiency, economy, and simplicity of construction, a building of the gable-end type should meet requirements. The size, naturally, will depend on the number of birds to be accommodated. A building 12 feet long by 8 feet wide will accommodate, as a maximum, 100 white leghorns or 80 australorps. It will be noticed that, approximately, 1 square foot of floor space is allowed each bird. It is essential, however, that hens should be provided with double that area under the same system. Such a small floor space allowance is practicable, because the cockerels only occupy the house for a short period.

In the construction of such a building, the four corner posts may be 3 feet, and the two centre posts 7 feet high. By using 8-feet iron for the roof, it would extend to within 2 feet of the ground. The gable-end should face to a point between north and east. This will permit of the front being left uncovered, while the rear or westerly end should be covered with iron to within 2 feet of the ground. Perches are the only fittings necessary. These should be all on the same level, and 3 feet above the floor, run lengthwise, and spaced 2 feet apart. Such spacing will obviate fighting on the perches.

It is essential for a building of this type to be erected in the centre of a large netted run, or a distance from other buildings if the birds are to be reared on free range. In addition, it is advisable to erect a number of perches in different parts of the run. Such perches should be 3 feet high and situated away from boundary fences.

The advantages of this system of handling cockerels are that there are no corners or walls in the building, and on being chased the bird can escape easily by getting on a perch. An old cock bird placed in the pen, before the cockerels are three months of age, will materially assist in preventing the young birds fighting.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF OCTOBER 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.	
	Oct.	No. of Years' Records.	Oct., 1936.	Oct., 1935.		Oct.	No. of Years' Records.	Oct., 1936.	Oct., 1935.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	0·95	35	0·71	1·75	Clermont	1·33	65	0·32	1·04
Cairns	2·17	54	0·16	5·47	Gindie	1·41	37	Nil	1·41
Cardwell	2·08	64	0·18	2·99	Springsure	1·66	67	0·32	2·14
Cooktown	1·05	60	0·15	0·77					
Herberton	0·99	50	0·87	1·46					
Ingham	1·94	44	0·05	1·73					
Innisfail	3·33	55	0·19	9·94					
Mossman Mill ..	3·15	23	0·11	5·55	*Darling Downs.*				
Townsville	1·35	65	Nil	0·19					
Central Coast.					Dalby	2·06	66	0·50	1·72
					Emu Vale	2·20	40	0·53	2·17
					Hermitage	1·92	30	..	2·15
Ayr	0·94	49	Nil	0·08	Jimbour	1·90	48	0·75	2·32
Bowen	1·02	65	Nil	0·05	Miles	2·05	51	0·28	2·34
Charters Towers ..	0·73	54	3·0	1·53	Stanthorpe	2·56	63	1·73	1·89
Mackay	1·71	65	2·09	2·53	Toowoomba ..	2·58	64	0·25	3·89
Proserpine	1·65	33	0·15	0·12	Warwick	2·32	71	0·47	2·91
St. Lawrence ..	1·79	65	0·56	2·73					
South Coast.									
Biggenden	2·45	37	0·61	3·44	*Maranoa.*				
Bundaberg	2·11	53	0·93	1·40					
Brisbane	2·57	84	0·16	4·93	Roma	1·78	62	0·36	2·72
Caboolture	2·54	49	0·51	4·18					
Childers	2·73	41	1·32	3·19					
Crohamhurst	3·31	43	1·53	4·92					
Esk	2·54	49	0·22	3·61					
Gayndah	2·41	65	1·62	2·20					
Gympie	2·72	66	0·92	3·34	*State Farms, &c.*				
Kilkivan	2·62	57	2·34	1·88					
Maryborough ..	2·78	65	1·10	1·94	Bungeworgoral ..	1·50	22	Nil	..
Nambour	3·12	40	1·05	5·64	Gatton College ..	2·01	37	0·15	2·81
Nanango	2·28	54	0·72	4·24	Kairi	1·02	22	..	..
Rockhampton ..	1·79	65	0·86	0·74	Mackay Sugar Experiment Station	1·44	39	2·47	2·62
Woodford	2·58	49	0·42	4·60					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—OCTOBER, 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	29·91	85	72	91	30	61	16	15	1
Herberton	..	83	57	91	13	49	14	87	5
Rockhampton	29·98	90	66	101	27	57	1	86	4
Brisbane	30·00	83	63	99	28	56	1	16	4
Darling Downs.									
Dalby	29·97	88	56	99	13	47	14, 20	50	3
Stanthorpe	..	79	47	86	18	36	31	73	5
Toowoomba	..	82	53	92	18	42	14	25	3
Mid-Interior.									
Georgetown	29·92	97	67	103	11	58	3	112	3
Longreach	29·94	95	63	102	17, 18, 27	53	14	18	3
Mitchell	29·96	89	53	99	18	46	13, 14, 15, 31	25	4
Western									
Burketown	29·92	93	70	102	21	63	14	Nil	..
Boulia	29·94	95	65	105	17	57	1	6	1
Thargomindah	29·95	87	59	102	8	50	12	60	1

ASTRONOMICAL DATA FOR QUEENSLAND.

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

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	December, 1936.		January, 1937.		Dec., 1936.	Jan., 1937.
	Rises.	Sets.	Rises.	Sets.	MOONRISE. Rises.	MOONRISE. Rises.
					p.m.	p.m.
1	4·49	6·31	5·0	6·50	9·10	9·32
2	4·49	6·32	5·1	6·50	9·54	10·21
3	4·49	6·33	5·2	6·50	10·35	10·45
4	4·50	6·34	5·3	6·51	11·6	11·16
5	4·50	6·35	5·4	6·51	11·42	11·51
6	4·50	6·36	5·5	6·51	..	..
					a.m.	a.m.
7	4·50	6·37	5·6	6·52	12·15	12·27
8	4·50	6·38	5·7	6·52	12·46	1·2
9	4·51	6·38	5·7	6·52	1·17	1·47
10	4·51	6·39	5·8	6·52	1·49	2·35
11	4·51	6·39	5·9	6·51	2·29	3·28
12	4·51	6·40	5·9	6·51	3·8	4·24
13	4·52	6·40	5·10	6·51	3·53	5·28
14	4·52	6·41	5·10	6·51	4·43	6·21
15	4·52	6·41	5·11	6·51	5·37	7·21
16	4·52	6·42	5·12	6·50	6·32	8·22
17	4·53	6·42	5·13	6·50	7·32	9·21
18	4·53	6·43	5·14	6·50	8·30	10·32
19	4·53	6·43	5·14	6·50	9·30	11·26
20	4·54	6·44	5·15	6·50	10·29	12·29
21	4·54	6·44	5·16	6·49	11·26	1·35
					p.m.	
22	4·55	6·45	5·17	6·49	12·28	2·40
23	4·55	6·45	5·18	6·49	1·32	3·42
24	4·56	6·46	5·19	6·49	2·38	4·40
25	4·56	6·46	5·19	6·48	3·48	5·34
26	4·57	6·47	5·20	6·48	4·54	6·17
27	4·58	6·48	5·21	6·48	5·55	6·59
28	4·58	6·48	5·22	6·48	6·55	7·36
29	4·59	6·49	5·23	6·47	7·44	8·10
30	4·59	6·49	5·24	6·47	8·27	8·44
31	5·0	6·50	5·25	6·47	9.7	9·18

Phases of the Moon, Occultations, &c.

6 Dec.	☽	Last Quarter	4 20 a.m.
14 „	●	New Moon	9 25 a.m.
21 „	☾	First Quarter	9 30 p.m.
28 „	○	Full Moon	2 0 p.m.

Apogee, 10th December, at 6.6 a.m.
Perigee, 26th December, at 6.36 a.m.

On the 22nd, the day of the Australian summer solstice, the Sun will reach its furthest distance, 23½ degrees south of the points due east and due west, and it will be found useful to note these points carefully on the horizon. In all places 23½ degrees south of the celestial equator the Sun will be directly overhead at noon, and a telegraph-pole will cast no shadow.

On the 27th Jupiter will rise and set with the Sun, and be lost to the evening sky. Observers may remember the interesting sight afforded when, in April last, the great, wonderfully luminous planet had risen above the eastern horizon and the curves of Scorpio stretched out above it. Watching the planets rising and setting night after night with this notable constellation (the result of the Earth's rotation), many would at the same time take note of its own proper motion by its increasing distance eastward from Alpha Scorpii (Antares) until it crossed the border of Sagittarius about the middle of November.

On the 29th Mercury will reach its greatest elongation, 20 degrees eastward of the Sun, and on that date remain above the horizon for nearly an hour and a-half.

Mercury rises at 5.13 a.m., 24 minutes after the Sun, and sets at 7.5 p.m., 34 minutes after it, on the 1st; on the 15th it rises at 5.51 a.m., 59 minutes after the Sun, and sets at 7.48 p.m., 1 hour 7 minutes after it.

Venus rises at 7.32 a.m., 2 hours 43 minutes after the Sun, and sets at 9.24 p.m., 2 hours 53 minutes after it, on the 1st; on the 15th it rises at 7.55 a.m., 3 hours 3 minutes after the Sun, and sets at 9.36 p.m., 2 hours 55 minutes after it.

Mars rises at 1.39 a.m., 3 hours 10 minutes before the Sun, and sets at 2.1 p.m., 4 hours 30 minutes before it, on the 1st; on the 15th it rises at 1.8 a.m., 3 hours 44 minutes before the Sun, and sets at 1.43 p.m., 5 hours 1 minute before it.

Saturn rises at 12.2 p.m. and sets at 12.44 a.m. on the 1st; on the 15th it rises at 11.11 a.m., and sets at 11.50 p.m.

Although the Southern Cross will be absent from the evening sky, Orion, the Hyades and Pleiades, Sirius and Canopus, with Jupiter and Venus, will form a most wonderful picture at Christmas time.

4 Jan.	☽	Last Quarter	12 22 a.m.
13 „	●	New Moon	2 47 a.m.
20 „	☾	First Quarter	6 2 a.m.
27 „	○	Full Moon	3 15 a.m.

Apogee, 7th January, at 1.0 a.m.
Perigee, 22nd January, 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.