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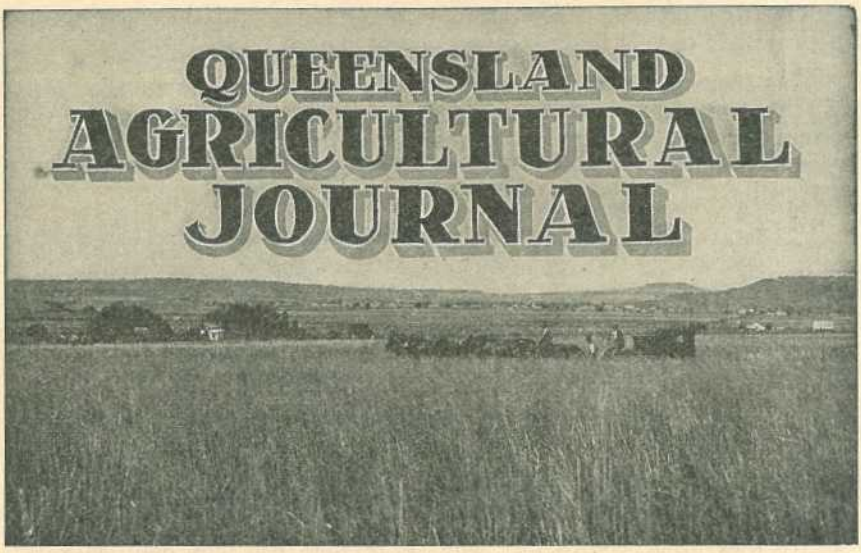

VOL. XLVI. 1 JULY, 1936. PART 1

Event and Comment

Tell the World!

A STRONG plea for Queensland to advertise her products, and to find out exactly what her potential customers want and then give them the very best quality that the State can produce, was made by His Excellency the Governor, Sir Leslie Wilson, when opening the Ipswich Show. "Queenslanders are too modest," said the Governor, "they do not let the world know what they can produce. This is a big fault. It is of vital importance in these days that we should let our potential customers know what we can produce, and then when we have got their orders that we should give them the very best that the State has to offer. To advertise is essential, but it is not right to send our customers something that is just 'good enough.' We must send our customers what they want."

His Excellency said that when he was in the East last year he heard a number of complaints regarding the packing and labelling of Australian goods, especially canned fruits.

"This is entirely due to carelessness," said Sir Leslie. "But it does us harm, as it does not give us a good reputation. I sincerely hope that from now on there will be more careful overseeing, so that this sort of thing cannot happen again."

Continuing, His Excellency said that there were many difficulties in the way of better marketing of Queensland products, but, after all, difficulties were only made to be overcome. Probably no State was faced

with greater marketing difficulties than was Queensland, but in his opinion Queensland had the greatest opportunities of all the States in the Commonwealth.

"It rests with this generation to show the world that Queensland can produce the very best that the world has to offer."

The Ipswich Show was one of the most important in the State, said the Governor, and he congratulated the committee and every person connected with the show on their efforts this year. That despite the dry season the standard of the show was so high spoke volumes for the fertility of the district and the enterprise of the people.

"It is at such shows that one sees the real wealth of Queensland," said Sir Leslie. "At the many country shows which I have visited here I have learned a great deal which I shall be able to use when I return to England."

The Premier's Return—Trade Prospects in Great Britain.

ON arrival at Fremantle from his visit abroad, one of the purposes of which was to attend the sugar conference convened by the British Government, the Premier, Hon. W. Forgan Smith, LL.D., said that the British Government had called the conference with the view of formulating a rationalised scheme of distribution of sugar throughout the Empire and other countries. The conference was not held, however, on account of the contributory countries asking, apparently, too high a quota of the British market. In the course of a press interview the Premier said that the people who were most active in the matter were those who were signatories to the Chadbourne agreement, and they evidently desired to prepare a modern version of the Brussels agreement of 1903. It is just as well, he said, that the conference was not held. Australia had nothing to gain from it. The proposal to hold the conference was based on limitation of output.

Mr. Forgan Smith added: "I investigated the position of the sugar-producing countries of Europe, and it was obvious that they were using sugar to build up their sterling credits in London.

"This was obvious from the fact that in Europe the price of sugar varies from 4d. to 7d. lb. When the conference fell through I, in company with Dr. Earle Page and Mr. T. de Waters, the South African High Commissioner, conferred with the Chancellor of the Exchequer and the Secretary of State for the Dominions, and put up a proposal for a five-year agreement based on the existing rebates in duty. We have an agreement with the British Government that no alterations will take place in the duty without eighteen months' notice. The position now, briefly, is that there is a maintenance of the status quo, and therefore Queensland can export sugar to the British and Canadian markets without limitation. The matter will probably be brought up again at the next Imperial Conference, but I am satisfied that there is no likelihood of any change in policy. If the sugar-producing countries of Europe were to use internally as much sugar per head of the population as, say, Great Britain, so far from there being a surplus of sugar in the world there would be a shortage of 5,000,000 tons annually. The problem is not one of over-production but one of under-consumption."

The Meat Industry.

ON the meat question, which he discussed at some length in Great Britain, the Premier said the Australian quota was likely to be increased because of the recent tariff action. The trouble was that in the past, with drought and such like, Australia had not been able to supply her quota. Regarding Queensland, he said, the meat export trade is having an investigation of marketing methods. Mr. Smith said he would make certain proposals on his return to Queensland. "One thing is quite certain; there is now a future for the frozen meat industry, and we must improve the quality. We must produce a better type."

Prospects for Queensland Butter.

MR. Forgan Smith spoke with emphasis and enthusiasm of direct trade, including direct shipping between Australia and the North of England and Scotland. He said he went into this question very thoroughly, and was convinced that Australia's primary producers had everything to gain by appointing direct representatives in Glasgow, Liverpool, Manchester, and Cardiff. There were wonderful opportunities there, and Scotland was friendly disposed to Queensland and the rest of Australia. Glasgow and Edinburgh were the only two places showing "Empire butter," except when it was a New Zealand product. The New Zealand publicity was better than the Australian in this respect. There was a great prospect of Queensland's butter trade being increased, the trouble at present being the appointment of sub-agents in Manchester from agents in London, with the result that the sub-agents pushed the Danish and Dutch product, for which they obtained a greater commission. Direct trade, he added, would counteract this.

Migration and Markets.

DISCUSSING migration, the Premier said that on this matter he had conferred with the committee established in Great Britain, and had found Great Britain very favourable to the resumption of migration; but he had explained that the subject was linked up with markets, and it was impossible on a large scale with limited markets. He had pointed out that Australia should not be expected to carry the cost of mass migration, and told them very bluntly that it was no good talking migration and at the same time applying a restriction quota on production. Great Britain had no plan, and all discussions were merely exploratory.

He declined to discuss the new tariff, as he had not had an opportunity of studying it, and wanted to be in a position to know the reaction to it in England.

A Commonwealth of British Nations.

ASKED how near Europe was to peace or to war Mr. Forgan Smith said a great deal depended on Great Britain's policy. There was a growing body of public opinion favouring Great Britain co-operating with the Dominions to build a real Commonwealth of Nations as against being the policeman of Europe and the protector of France. Speaking generally, he said, the whole thing was absurd. The League of Nations was like a government without a police force, and the problem was: Could Great Britain afford to be the policeman of Europe and continue being dragged at the coat tails of another country?

Discussing trade prospects generally, the Premier added that everything would depend on reciprocity, and trade could only be conducted on a two-way basis. There was a strong feeling in industrial circles in England, he added, that while Australia was entitled to build up her own industries that that portion of trade which goes to countries which purchase nothing from Australia should go to England.

The Tobacco-growing Industry in the United States of America.

L. F. MANDELSON, B.Sc.Agr., Plant Pathologist.

[*Continued from June*, 1936.]

LIGHT AIR-CURED TOBACCOS.

THE light air-cured types of tobacco are Burley (U.S. Type 31) and Maryland (U.S. Type 32). In both cases the tobacco is stalk-cut when harvested—that is, when the majority of the leaves are mature the entire plant is harvested by cutting the stalk near ground level (Plate 1). The stalks are either split with a knife, from the top towards the butt, and straddled over sticks, or are speared on to sticks.

PLATE 1.

CUTTING MARYLAND TOBACCO.—Light air-cured tobacco is harvested by cutting the stalk near ground level, and the entire plant is air-cured.

In the latter case a movable metal spearhead is placed on to the end of a stick and some half-dozen plants are forced over the point and on to the stick (Plate 2). The leaf is usually cured in large, well-ventilated sheds. At times the sticks are hung on scaffolds in the field (Plate 3) for one to five days in order to wilt the plants prior to curing. Another method is to set the sticks of tobacco in the ground at an angle of 75 degrees with the butts of the plants towards the sun (Plate 4).

Burley.

Burley is one of the most important types of tobacco grown in the United States, and almost a third of the total tobacco area is devoted to it. It is light in colour and body and has exceptional absorbtive capacity for flavouring materials used in the manufacture of plug tobacco. This type has an interesting history, since it developed from

a single plant which was selected in Ohio in 1864 and was given the name "White Burley." It has been further developed to meet changing manufacturing requirements as the demand for chewing tobacco has diminished. In order to produce thinner leaf, "stand-up" types, which may be closely planted, have been developed (Plate 5) and strains resistant to soil diseases have been selected.

Burley tobacco was originally grown mainly in Kentucky, and was then a dark air-cured type used for chewing and smoking purposes. With the great expansion in the cigarette industry and the adoption of

PLATE 2.

SPEARING TOBACCO PLANTS.—The cut plants are forced over a moveable metal spearhead on to a stick in preparation for curing.

this type for cigarette manufacture, the area under crop increased enormously. In 1912 there were 228,000 acres of Burley grown, but by 1931 the area had increased to 528,800 acres and had extended well into Tennessee and neighbouring States.

Deep, well-drained, rich soils are used for growing Burley. Its cultivation is associated with the fertile limestone soils typical of the blue grass country of Kentucky. In that state artificial fertilizers are rarely added to the soil. In the newer areas applications of 500 to

PLATE 3.

WILTING BURLEY TOBACCO.—Burley tobacco in Tennessee hung on scaffolds in the field to wilt prior to being carried to the curing barn.

PLATE 4.

TOBACCO WILTING ON STICKS.—Sticks of speared tobacco wilting in the sun in Maryland. In the background the wilted plants are being loaded on a wagon for removal to the barn.

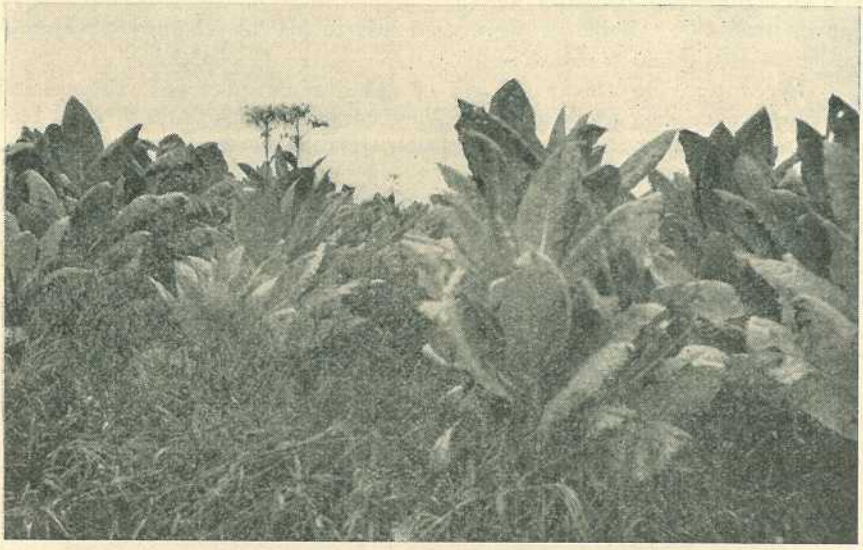

PLATE 5.

A FIELD OF BURLEY TOBACCO.—Note the "stand-up" character of this strain of Burley which permits close planting for the production of a thin type of leaf.

PLATE 6.

YOUNG BURLEY TOBACCO.—A field of Burley tobacco showing the flat method of cultivation which is practised with this class of tobacco.

800 lb. of a 8-4-4 or 8-3-5 mixture, depending on the soil, have been found profitable. Some growers used 300 to 400 lb. of superphosphate and 8 to 10 tons of stable manure.

In contrast to the seed-beds of the flue-cured areas, those used for Burley are long and narrow. They vary in width from 6 to 12 feet and are covered with cheese-cloth. Soil sterilization by burning over or steaming is recommended.

"Stand-up" varieties such as Judy's Pride, Kelley, and various root rot-resistant strains are becoming increasingly popular and are replacing the older varieties known as Lockwood, Twist Bud, Blue Ribbon, White Burley, and Rainbow.

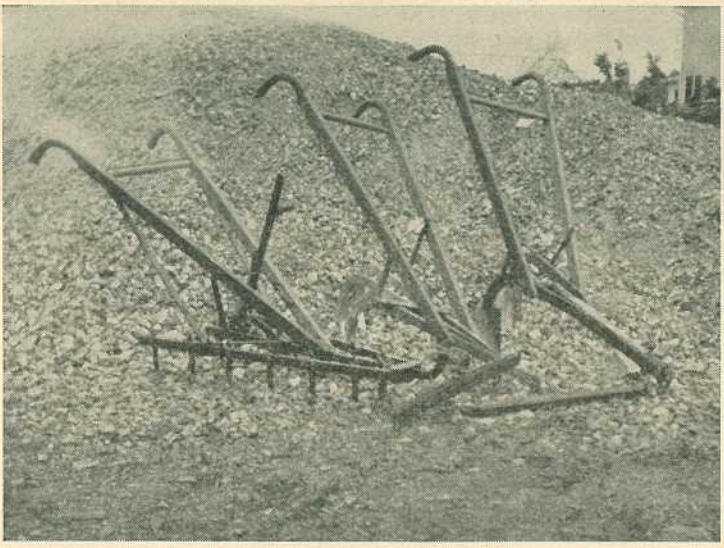

PLATE 7.

CULTIVATION IMPLEMENTS.—These implements are generally used in Tennessee for cultivating Burley tobacco.

Rows are made 3 feet 6 inches or 3 feet 8 inches apart, and the plants are set 12 inches to 18 inches in the row, depending on the fertility of the soil. They are usually set by hand.

Unlike flue-cured tobacco, Burley is not grown on hills, but is flat-cultivated (Plate 6). Methods of cultivation vary somewhat. In Kentucky the first cultivation is made with a six-tine spring-tooth cultivator and subsequently with a twelve-tooth implement which straddles the rows. About three cultivations are usually made. In Tennessee a fourteen-tooth cultivator is recommended for the first cultivation. A double shovel or three to five-shovelled cultivator (Plate 7) is then used, particularly after packing rain, and weekly shallow cultiation with harrows is practised subsequently.

As indicated above, the crop is stalk-harvested and air-cured. A barn 40 feet wide, 60 feet long, and 16 feet to the eaves is considered large enough for 5 acres. Curing barns vary considerably in construction, and frequently they are very crude (Plates 8 and 9). Where facilities permit (Plate 10) efforts are made to manipulate the ventilation so that the leaf dries out slowly irrespective of the prevailing

weather conditions. During wet weather small fires are usually made in the floor of the barn to reduce humidity and so obviate mould injury known as "house barn" or "pole sweat." When the web and midrib of the leaf has dried thoroughly, curing is complete. During subsequent warm damp weather, when the leaf has "come into order," it is taken down and bulked. It is eventually stripped from the stalks and sorted in to five to seven grades and tied in hands. Burley is marketed in the same fashion as flue-cured tobacco.

In the blue grass country the land is allowed to revert to blue grass sod after one or at most two seasons under tobacco. Elsewhere rotations with wheat, lespedeza, and other crops are practised.

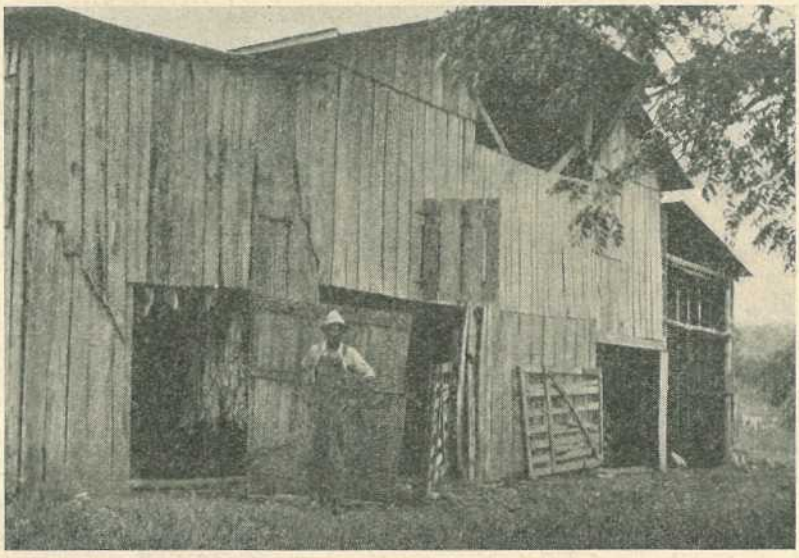

PLATE 8.

A CRUDE BARN FOR AIR-CURING.—In Tennessee Burley tobacco is frequently cured in makeshift barns of various kinds.

Maryland Tobacco.

The unique and valuable type of tobacco known as Maryland is only produced in a very limited area between the Potomac River and Chesapeake Bay in Maryland. Its outstanding characteristics are its excellent burning quality, due to the remarkably high percentage of cell wall-forming materials (cellulose and pectin) which it contains. The leaf is very thin, dry and chaffy, and is rather neutral in aroma. These characteristics make it very useful for blending with other tobaccos to improve the burning quality of a blend without disturbing the aroma and flavour sought. Its chaffy nature tends to "open up" tobaccos, and so makes for the more economical use of tobacco in the manufacture of cigarettes. Since the war its value has been appreciated by the cigarette industry, and there has been an expansion in production. The acreage under crop was increased from 22,000 acres in 1914 to 38,000 acres in 1931. Tobacco has been grown continuously in Maryland for a longer period than in any other area in the United States. Its cultivation dates back to the earliest colonial days, when an important trade was established with European countries. At the

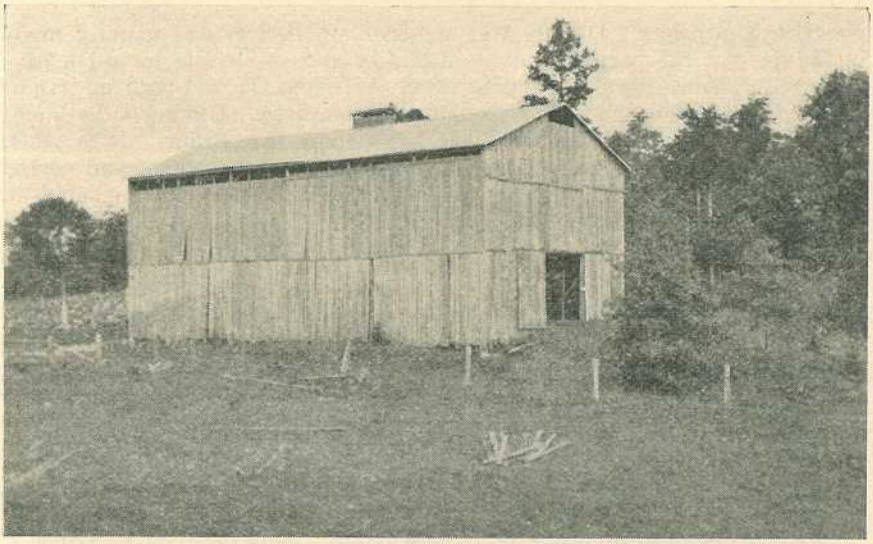

PLATE 9.

A BURLEY TOBACCO CURING BARN.—A type of barn commonly used for air-curing Burley tobacco in Tennessee.

present time almost half the crop is exported. It is grown in much the same way as Burley, on soil which is fairly fertile but rather deficient in humus. Manure gives satisfactory results when available, but in many cases nothing is added to the land, especially after it has been "rested." The use of fertilizers is increasing, and 500 lb. or more of various mixtures such as 8-4-10, 8-3-7, or 8-3-12 may be used. The

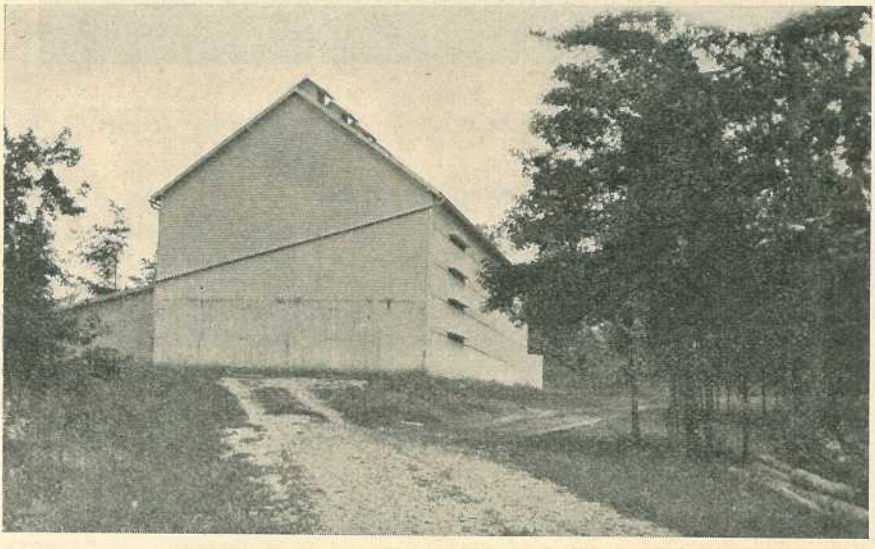

PLATE 10.

A MODEL AIR-CURING BARN.—An ideal type of air-curing barn at the Greenville Tobacco Experiment Station, Tennessee. Note the top ventilators and a few side ventilators which are open.

fertilizer is "listed in" with a plough and the ridge is smoothed off with a "drag," or, in many cases, a special implement (Plate 11) known as a "Planter Junior Lister" is used. This implement makes a ridge and has a roller attachment which smoothes it down in one operation. A more recent type is said to also have a fertilizer distributor combined with it. A "drag" with wooden "runners" is frequently used to mark the position where the plants are to be set by drawing it across the field at right angles to the rows. The plants are set by hand, by hand-setter machine, or by a horse-drawn machine midway between the depressions made by the "drag."

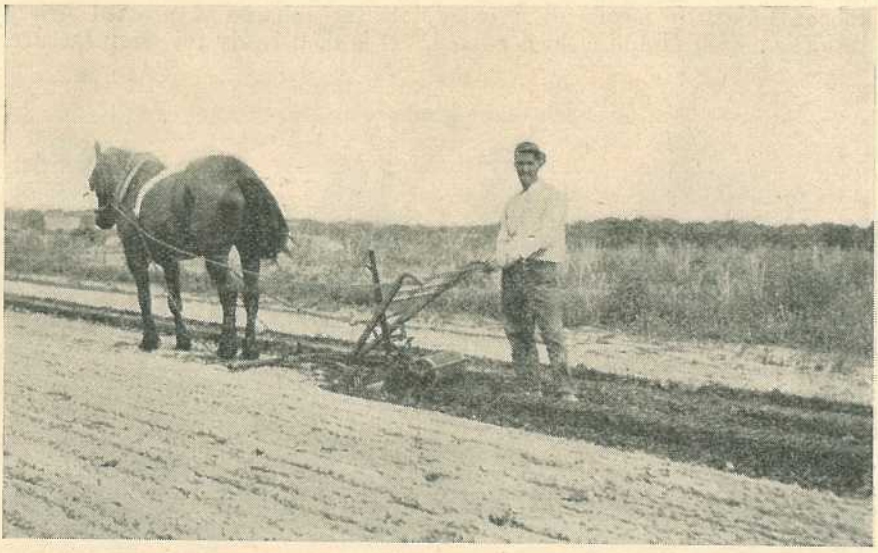

PLATE 11.

A "PLANTER JUNIOR LISTER."—A "Planter Junior Lister" in operation in Maryland. This implement "lists" a ridge about the fertilizer drill and smooths off the top of the hill in one operation.

The varieties grown are rather indefinite at present. The United States Department of Agriculture is endeavouring to improve the situation by supplying pure lines of seed, and is selecting strains resistant to black root rot. The tobacco grown is designated by its leaf characteristics as Maryland Broadleaf, Broadleaf Thickset, Narrowleaf, and Narrowleaf Thickset, &c. Maryland Mammoth is a giant variety which developed from a "sport" selection made some twenty-five years ago. It is found satisfactory on the more fertile soil types.

Plants are set in an equidistant fashion usually with about 34 inches between rows and between plants in the row. This arrangement allows plants to be cultivated in two directions. Flat cultivation is practised weekly with a spring-tooth cultivator similar to the Australian type of implement. The soil in Maryland does not appear to erode readily, and, although tobacco is cultivated on rather steep slopes, special precautions are seldom taken.

Maryland tobacco is harvested by cutting similarly to Burley. It is air-cured in large barns, but, unlike other tobaccos, it remains in the barn for close on twelve months before it is sold. During this period

it goes through a natural fermentation process and is then ready for permanent packing. On the other hand, other tobaccos are redried or are specially fermented subsequent to curing.

When weather conditions permit in the late winter the cured plants are taken down and the leaves are stripped and graded into about four grades. The leaf is tied into peculiar large fan-like hands, and is then placed in cylindrical stacks with the butts of the hands towards the centre. After two to four weeks the leaf is bulked with butts towards the outside, in the same manner as flue-cured tobacco, for about six weeks. It is then packed in hogsheads on the farm. A hogshead and a wooden cylinder slightly smaller in diameter are filled with tobacco, and, by means of a screw, all the tobacco is pressed firmly into the hogshead and a lid is affixed. It is then ready for manufacture.

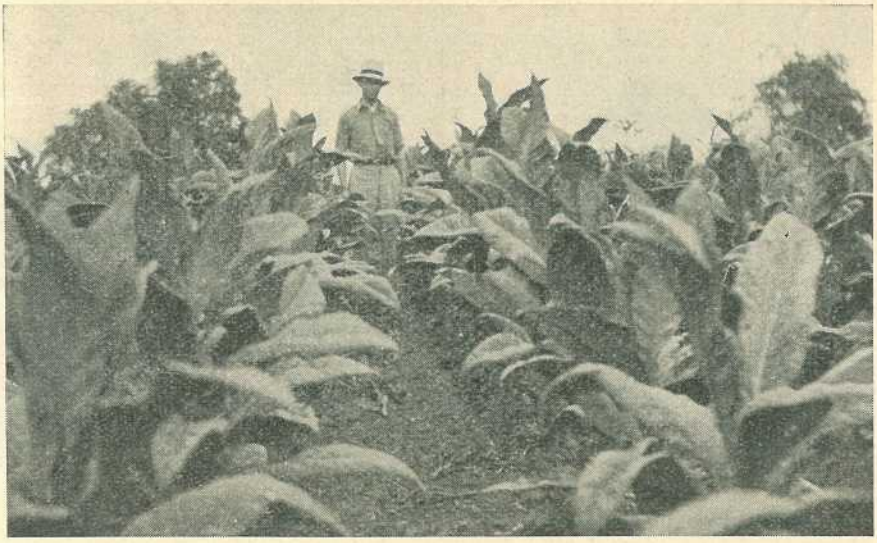

PLATE 12.

ONE SUCKER TOBACCO.—This type of dark air-cured tobacco has coarse narrow leaves with prominent veins and midribs.

The marketing and selling of Maryland tobacco is peculiar and different to that of any other type. It is all sent to Baltimore, where relatively small quantities are continuously being sold by sample throughout the year in the five tobacco markets situated there. Hogsheads as received from the growers are stored in large warehouses. A Government representative takes six samples from each hogshead, and so makes one representative sample hand, which is sealed and appropriately labelled. Each day buyers visit the warehouse and draw for the privilege of making the first examination of lots submitted for sale. Sample hands are made into "bulks" and placed before each buyer, who is given a sheet setting forth details of the samples. During the examination the buyer marks his price on the sheet alongside each lot for which he wishes to bid. The sheet is then placed in a ballot-box. At the end of the day the selling agent compares the sheets, and sells the respective hogsheads to the highest bidder, providing the price is considered high enough. Should bids be equal, the buyer who made the first examination is given the advantage.

DARK AIR-CURED TOBACCOS.

The dark air-cured types comprise Virginia sun-cured (U.S. Type 37), One Sucker (U.S. Type 35), and Green River (U.S. Type 36). They are not very important. Their total acreage is about 53,000 acres, which is approximately only 10 per cent. of that under light air-cured types. These tobaccos are mostly used for the manufacture of chewing tobacco.

Formerly Virginia sun-cured tobacco was hung in the sun for part of the curing process. It is now cured and harvested like Burley, but the name "sun-cured" still persists. Weight rather than colour is the main objective in the cultivation of this tobacco; consequently, it is grown on stiff soils, is set wide apart, and is "topped" low—to about nine leaves. The best results seem to be obtained when it is grown after

PLATE 13.

VIRGINIA FIRE-CURED TOBACCO.—Note the extremely low topping and wide spacing of plants and consequent heavy drooping habit of the leaf.

legumes in rotations. Many flue-cured varieties are grown in the production of this type. At the Bowling Green Experiment Station the best yielding variety appeared to be Kentucky Pryor. The acreage under this type has decreased as a result of changes in consuming habits. There were 15,000 acres under crop in 1913, whereas in 1931 there were only 6,000 acres. It is especially suited for the manufacture of plug chewing tobacco.

The name "One Sucker" tobacco is an allusion to the fact that only one sucker is supposed to develop in the axils of the leaves. One Sucker is a coarse type of tobacco with characteristic narrow leaves (Plate 12) which have obviously large midribs and veins. It is grown mainly in southern Kentucky, as well as in northern Tennessee and southern Indiana. It appears to be restricted to hilly, rough, and heavy soil. It is mainly used for chewing twist tobacco. Some also goes through a special process and is exported to the west coast of Africa, the West Indies, and Central America, where there is a demand for this tobacco by native peoples. As with other dark air-cured types, the production of One Sucker tobacco has declined in recent years.

PLATE 14.

DARK FIRE-CURED TOBACCO.—A field of dark fire-cured tobacco in Tennessee. Note the regular low topping of the plants and the coarse heavy type of growth.

Green River tobacco is grown in western Kentucky. It is apparently very similar in characteristics to Virginia sun-cured, and is handled in a similar manner. However, it was not actually observed during the tour of the United States under discussion.

PLATE 15.

WILTING FIRE-CURED TOBACCO.—Plants which have been harvested by cutting are frequently turned upside down in the field to wilt. Note the labourer straddling wilted plants on a stick for conveyance to the curing barn.

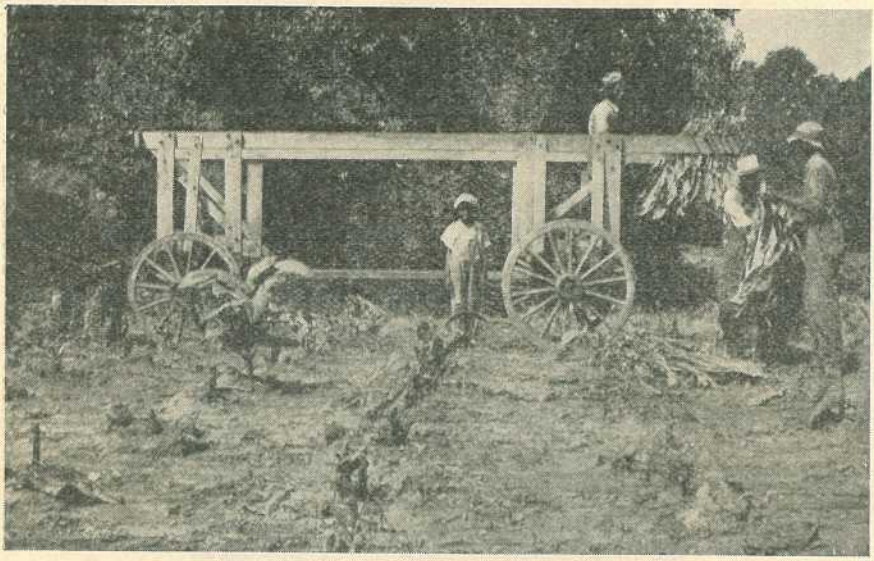

PLATE 16.

CONVEYING FIRE-CURED LEAF TO THE BARN.—After the plants have wilted in the field they are straddled on sticks, placed on a rack on a specially-constructed wagon, and hauled to the curing barn. Note the stalks still in the field.

DARK FIRE-CURED TOBACCOS.

This class of tobacco is cured in barns over open fires. It is characterised by its dark colour, heavy body, and the distinctive flavour which results from the method of curing. Dark fire-cured tobacco is

PLATE 17.

A TYPICAL FIRE-CURING BARN.—A barn in Tennessee for fire-curing. Note the tight construction and supply of firewood.

grown in western Kentucky and Tennessee, as well as in central Virginia. Four distinct types are recognised—viz., U.S. Types 21, 22, 23, and 24. Two of these types—namely, Virginia fire-cured and Eastern fire-cured —were observed in the field. Dark fire-cured tobacco is used for manufacturing snuff, and the better grades for plug wrappers. It is also used to some extent for smoking mixtures and plug fillers and for certain foreign cigars.

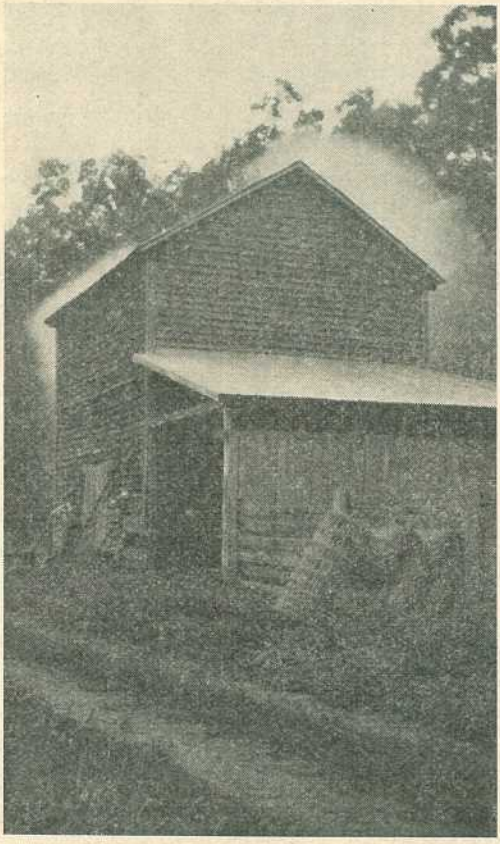

PLATE 18.

FIRE-CURING.—Dark fire-cured tobacco being cured in Virginia. Note the smoke issuing from the roof of the barn.

It is grown on heavy silt or clay soils and does well when grown on clover sod land. Fertilizers are not used to any great extent in its production. Amounts varying from 200 lb. to 600 lb. of 8-3-3 mixture are at times applied, or superphosphate alone may be used. Some of the varieties grown are Madole, Black Wax, Mammoth Yellow, and Little Crittendon. To develop a heavy-bodied leaf, plants are spaced widely apart and are topped to eight to twelve leaves (Plate 13). In Virginia the plants are usually set 2 feet 6 inches to 3 feet apart in the rows, with about 3 feet 6 inches between the rows, whereas in Tennessee plants are set at equal distances apart, with about 3 feet 6 inches between the rows and between the plants in the rows. The latter method permits

of cultivation in two directions. The plants are mainly set by hand. In the field leaves are characteristically heavy, dark-green, and gummy, with a drooping habit (Plate 14).

At maturity the plants are split from the top to within a few inches of the ground and cut off. They may then be turned upside down in the field to wilt or straddled on sticks to wilt in the field (Plate 15). Eventually they are loaded on to a wagon which in some cases has a special rack to carry the sticks (Plate 16) and are hauled to the barn (Plate 17). After hanging in the barns for about a week, and when the plants have thoroughly yellowed, numerous small wood fires are made on the earthern floor of the barn. The fires are covered with moist sawdust so as to maintain a slow smouldering fire (Plate 18). Constant care is required to cure the tobacco without injuring the leaf.

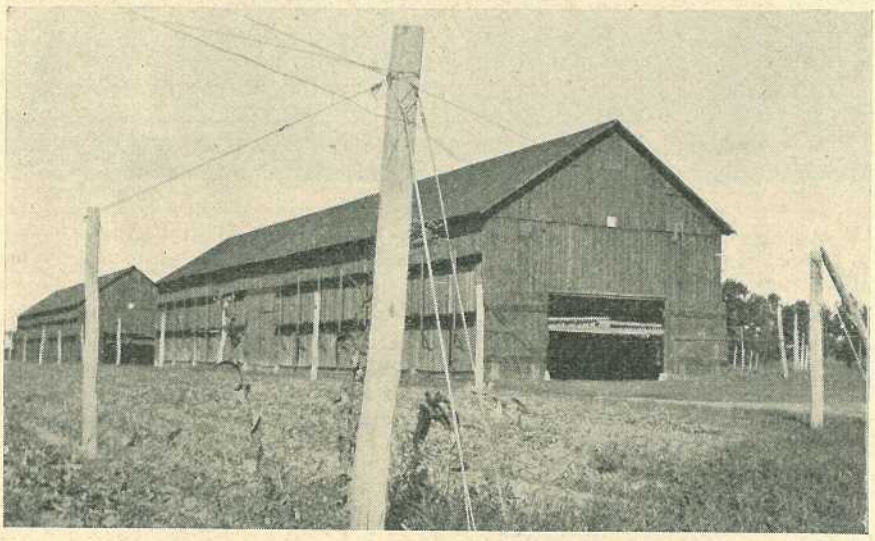

PLATE 19.

BARN FOR CIGAR WRAPPER LEAF.—Air-curing barns with horizontal ventilators used in the Connecticut Valley for curing cigar leaf. Note the poles in the foreground used for supporting the cheese-cloth shades under which the crop is grown.

In Tennessee the curing process may extend over one or two months, whereas in Virginia the period is much shorter and often less than two weeks. The Virginian leaf brings a lower price than the other types.

Dark fire-cured tobacco represents about 10 per cent. of the total tobacco acreage in the United States.

CIGAR TOBACCOS.

A cigar consists of three distinct portions—namely, the filler, the binder, and the wrapper—and a special class of leaf is grown for each. The bulk of a cigar consists of filler. Such tobacco must have desirable aroma, flavour, and burning quality, and it is usually a coarse-textured leaf. The filler is bunched into shape with binder leaf, which gives the core of the cigar, shape, and smoothness of surface, and so permits the use of a very thin and incidentally attractive wrapper. Binder leaf must have elasticity and is thinner and of finer texture than filler.

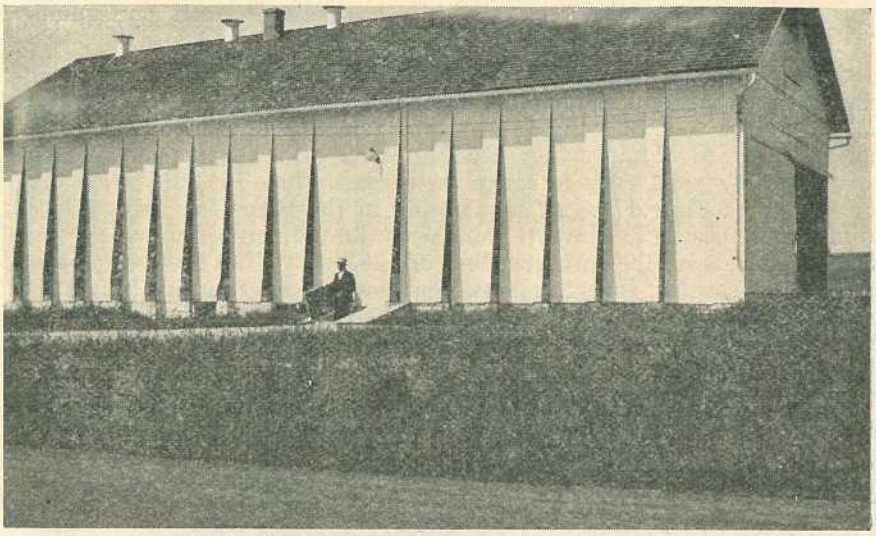

PLATE 20.

AIR-CURING BARN FOR CIGAR TOBACCO.—A barn with vertical ventilators used in Pennsylvania for curing cigar filler tobacco. Note the man ascending from cellar where leaf is handled.

Satisfactory aroma and good burning quality with completeness of combustion are also desirable, and if lacking would tend to spoil an otherwise good cigar. The outside covering or wrapper of a cigar must be of exceptionally fine quality, since it gives appearance to the

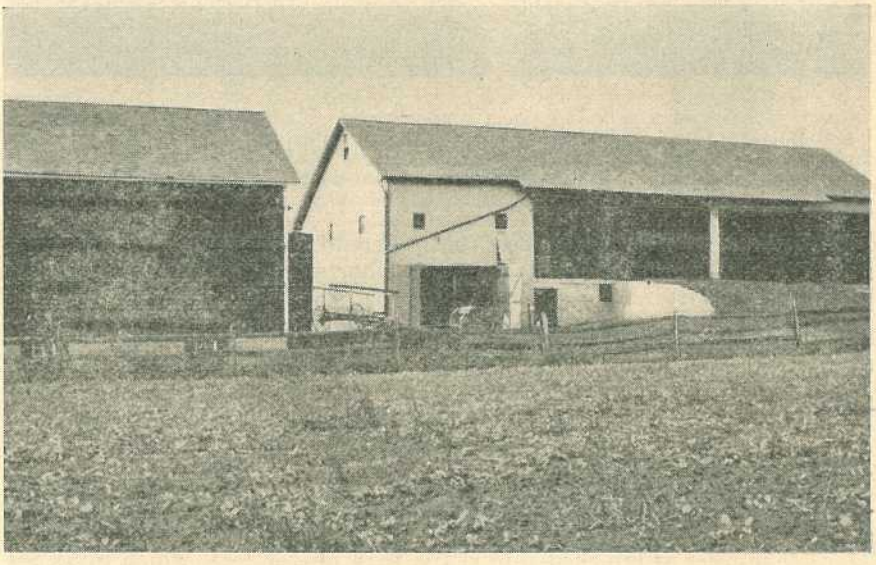

PLATE 21.

A "SWISS" AIR-CURING BARN.—The "Swiss" barn on the right is used in some cases in Pennsylvania for cigar tobacco. Note ramp and cellar beneath the floor of the barn. A more usual type of barn is shown on the left.

PLATE 22.

A HUGE SEED-BED.—A large company-owned seed-bed in Florida entirely enclosed with cheese-cloth. Note boiler-house on left for generation of steam for soil sterilization.

finished article. Wrapper leaf is thin, fine-textured, elastic, free from injury, has satisfactory aroma and burn, and, unlike filler and binder leaf, it must also be a desirable colour. The best grades of filler leaf may be used as binder, and binder and wrapper leaf may at times be used for all three purposes. Nevertheless, there is considerable specialisation in the production of these three classes of tobacco, both as regards

PLATE 23.

INSIDE SEED-BED TENT.—A view of the interior of the seed-bed "shade" shown in Plate 22. The plants are watered by a permanent overhead irrigation system.

methods employed in their production and the localities where they are grown. Leaf which is not good enough for cigar manufacture may be used as "scrap-chewing" leaf.

All cigar tobaccos are air-cured. The curing barns are large structures capable of housing several acres of crop. The ventilation system is elaborate. Ventilators are either horizontal or vertical and permit the partial opening-up of the side walls (Plates 19 and 20). Doors at each end of the barn are large enough for a wagon-load of leaf to be taken into the building. In the northern states cellars are frequently constructed beneath the barns for conditioning and handling the leaf (Plates 20 and 21).

PLATE 24.

SUN-GROWN SUMATRA CIGAR TOBACCO.—A field of cigar filler tobacco growing in Florida. In contrast with wrapper leaf, which is grown under shade, this type is grown in the open—*i.e.*, is "sun-grown." It is harvested by "priming" leaf as it matures.

Cigar tobacco soils are relatively rich, in comparison with those found in the flue-curing districts, and are heavily fertilized in many cases. In Connecticut and Florida cigar wrapper is grown on sandy loams. Cigar binder is grown in Wisconsin on sandy loams, light clay loams, and on dark rich loams. Cigar filler in Pennsylvania, Ohio, and New York is produced on loams which are stronger than those used for cigar wrapper and are well adapted for general farming.

Seed-beds in the cigar-growing sections are more elaborate than in flue-cured districts. They are usually about 6 feet wide and are frequently covered with glass-sash. Soil sterilization with steam is a fairly general practice. In Florida a huge seed-bed area entirely enclosed within a cheese-cloth tent was observed (Plates 22 and 23).

The variety Pennsylvania Broadleaf is grown for filler leaf in Pennsylvania. It is given a liberal dressing of about 10 tons of manure per acre and about 500 lb. of a fertilizer mixture, such as 8-3-12, may also be added. In order to produce a heavy-bodied leaf, there is a

tendency for wide spacing and low topping of the plants. The rows are 3 feet to 3 feet 6 inches apart, and plants are set about 24 to 30 inches apart. Sun-grown Sumatra, a filler tobacco produced in Florida (Plate 24) on a lighter type of soil, is given about 1,200 lb. of a mixed fertilizer in addition to manure, and is spaced about 14 inches apart. The plants are topped to twelve to sixteen leaves. In Pennsylvania a common rotation consists of tobacco, wheat, clover, and corn, followed by tobacco. Yields of 1,300 lb. to 2,000 lb. per acre may be obtained. The entire plants are harvested in Pennsylvania by cutting near ground level and spearing on to sticks (Plate 25), whereas in Florida individual leaves are primed as they mature. Length of leaf is of considerable

PLATE 25.

HARVESTING CIGAR TOBACCO.—Cigar filler tobacco being harvested in Pennsylvania. The plants are cut off near ground level and speared on to sticks for curing.

importance for cigar tobaccos, and consequently size is an important factor in grading. The variety Zimmer Spanish is another filler tobacco which is grown in Ohio, but its culture was not observed. Filler is a low-valued leaf, the parity price being about 11 cents.

After the tobacco has been harvested and cured, it is taken to a packer's warehouse, where it is fermented. Huge bulks of several tons are built on the floors and turned every week or so, according to the temperature of the bulk. Since the colour of the final product is of no consequence, higher fermentation temperatures can be used with filler than for wrapper leaf. After some months, when fermentation has been completed, the leaf is stemmed, packed, and despatched to cigar manufacturers.

The varieties Connecticut Valley Broadleaf and Havana Seed are cultivated in the Connecticut Valley for binders. In Pennsylvania the Havana Seed variety is grown for binder tobacco, whereas in Wisconsin this variety and Comstock Spanish have been largely replaced by Big Seed, Havana 38 and various disease-resistant strains.

Tobacco is produced in Wisconsin as a side-line on dairy farms, and artificial fertilizers are used sparingly or not at all, but heavy dressings of manure are applied. Tobacco is generally grown for a couple of years, followed by corn, lucerne, and timothy, or may be grown continuously on the same land. In order to produce a leaf of finer texture than filler, the plants are set closer together in the row, the spacing being 18 to 20 inches in Pennsylvania. The tobacco is harvested by cutting the entire plants and spearing them on to sticks.

Cigar wrapper tobacco is grown under the artificial shade of huge tents or shades in the United States (Plate 26), mainly in order to develop a fine-textured, thin leaf. This method of culture was apparently

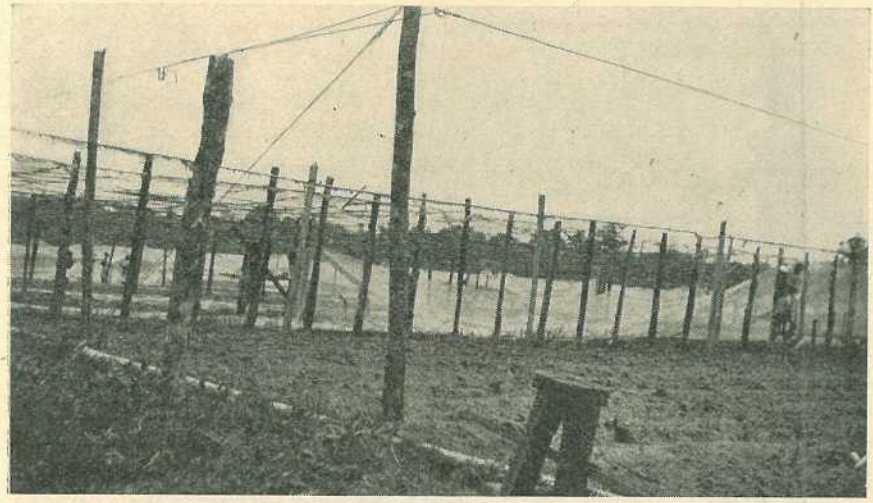

PLATE 26.

ERECTING A TOBACCO "SHADE."—A tobacco "shade" under construction in Florida. Cheese-cloth is used for the sides. The roof may be of cheese-cloth, of wooden laths, or of both cloth and laths. Cigar wrapper is grown under shade in order to produce a thin, fine-textured leaf.

discovered by chance in Florida when it was observed that plants growing under the partial shade of trees produced thinner leaves than when grown in the open; consequently, since 1896 various types of shades have been used for the cultivation of this crop. In the Connecticut Valley a very extensive area is grown under cheese-cloth tents. In northern Florida shades may be constructed of cloth, laths or slats, or a combination of cloth and slat. In all cases cloth walls about 8 feet 6 inches high are put up around the shades to protect the tobacco from strong winds and insects. Individual shades may be several acres in extent. The cost of constructing and maintaining shades makes the production of this class of tobacco very expensive, and the rotation of crops a difficult problem. The growing of wrapper tobacco is mainly in the hands of large companies, and consequently a large-scale type of farming is practised. In the Connecticut Valley Cuban varieties are grown for wrapper leaf, whereas in Florida specially developed strains for resistance to the black shank disease, such as No. 301, No. 94, and R.G., are extensively planted.

The soil is very heavily fertilized. Ten to 20 tons of manure is usually applied, and 2,000 lb. or more of mixed fertilizer may be added.

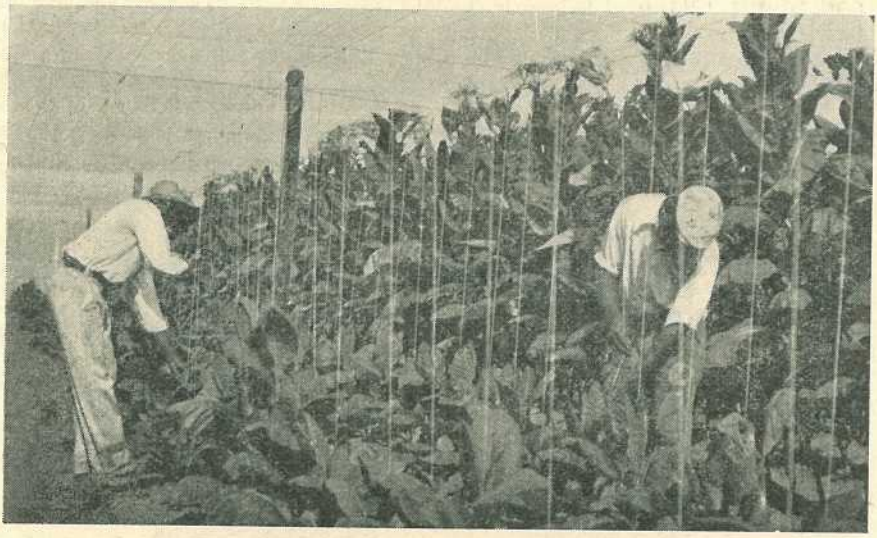

PLATE 27.

"WRAPPING" YOUNG CIGAR TOBACCO.—Young cigar tobacco plants being wrapped around strings tied from the stalks to the roof of the "shade" in order to support and protect the plants.

For thin wrapper leaf, plants are set close together at 10 to 15 inches, in rows about 3 feet 6 inches apart, and are topped high. A practically flat method of cultivation is practised. As soon as the tobacco is established in the field a piece of string is attached to the base of the plant

PLATE 28.

IRRIGATING CIGAR TOBACCO.—Water being led between rows of tobacco during a dry period in Florida. Note the post in the foreground for supporting the roof of the shade. Being in the roadway it is padded to obviate damage to leaf rubbing against it.

and to the roof of the shade (Plate 27). Each week the string is twisted around the stem in order to protect and support the plant. In Florida about 10 per cent. of the shade tobacco-growers have irrigation facilities, but plants are only irrigated during abnormally dry periods when they are suffering from lack of moisture (Plate 28). Tobacco under shade grows to a height of 8 feet or more and yields about 1,000 lb. of leaf per acre. When the leaf is mature, which is ascertained

PLATE 29.

HARVESTING SHADE-GROWN TOBACCO.—Cigar leaf in Florida being harvested by "priming," as with flue-cured tobacco.

by experience rather than by the colour of the leaf, it is harvested by priming (Plate 29), as with flue-cured tobacco. At the termination of the season plants are pulled out of the soil and laid in specially prepared furrows to dry out for a few days (Plate 30).

The harvested leaf is threaded on to string and attached to wooden laths which are hung in the curing barns. When cured, the leaves are tied into a hand with the same piece of string on to which they were threaded. It is then sent to a packer's warehouse for fermentation.

Wrapper tobacco is sweated or fermented in relatively small, neat bulks of about 7,000 lb., and, since colour is an important factor, the process is carried out at a lower temperature than with filler tobacco. The bulk is remade at regular intervals, and when fermentation is complete the leaf is graded, made into hands, and packed in bales for shipment to the manufacturers.

PLATE 30.

UPROOTING TOBACCO.—Cigar plants being uprooted and placed in furrows in Florida. Note the height of the plants. As a result of the crop control plan of the Agricultural Adjustment Administration, the top four leaves must be left on the plant.

The best-quality cigars are made by hand. A relatively recent development has been the manufacture of very cheap cigars by machinery, which are retailed as cheaply as two for 5 cents. Very ingenious machines fill, bind, and wrap cigars, and finally cover them with cellophane with great rapidity. In some factories machinery is also used to strip or remove the midribs from leaf.

[TO BE CONTINUED.]

CONTROL OF INSECT PESTS.

As long as indiscriminate slaughter of the natural controls of insect pests continues, so will we be forced to rely upon unnatural controls, such as arsenical baits and sprays. Is it not feasible that one of the chief factors contributing to the grasshopper plague in the north of Victoria last year was the slaughter of lizards, particularly the blue-tongue and stump-tail varieties which has been going on for generations? Any lout with a pea-rifle will pot them for the fun of it, and it is "awfully" good sport to cut them in two with a stockwhip at full gallop. Not that the losses of lizards by these means amount to much in the balance against grasshoppers; it merely indicates the popular attitude to useful creatures, for which the grasshopper plague is perhaps not an unjust punishment. If farmers as zealously protected insect-eating birds and reptiles as they do their own stock there would be no need to use poison.—"The Australasian."

Mushrooms.

THEIR CULTIVATION, DISEASES AND PESTS.

R. B. MORWOOD, M.Sc., Plant Pathologist, and J. A. WEDDELL, Entomologist.

GREEN plants derive their energy from sunlight and a considerable proportion of their nutriment from the air. Fungi derive the energy required for growth and the whole of their nutriment from organic matter; in the case of the mushroom, from manure in a certain stage of decomposition. The correct preparation of a well-fermented compost, as this is known, is the first essential in mushroom growing. It is made from manure—preferably horse manure—mixed with straw, as much as 70 per cent. of straw being permissible in the mixture.

Preparation of Compost.

In composting, the manure and straw are piled in heaps 4 to 6 ft. high. If at all dry, the mixture is sprinkled as it is being heaped. In a week or ten days the heap is turned by forking over, breaking up any clods and watering any dry portions. The outside of the old pile is brought to the centre of the new heap. The turning is repeated two or three times at intervals of about five days. The temperature of the heap should rise to about 150 deg. Fahr. and gradually drop. A well-made compost finally becomes a uniform brown colour with an even texture, being moist but not wet. When squeezed, it will moisten the hand without oozing excess water and will retain the shape to which it is moulded. When the temperature has fallen to 100 deg. Fahr. the compost is placed in beds about 4 ft. wide and 10 inches deep, which are usually enclosed in a hardwood or galvanised-iron frame. One ton of compost will fill from 30 to 40 square feet of bed.

Conditions for Growth.

Mushroom beds are located in a cellar, cave, specially constructed mushroom house, or other cool enclosed situation. "Under the house," with suitable enclosing, is popular locally. The chief requirements of the mushroom house is that the temperature may be maintained between 45 deg. Fahr. and 70 deg. Fahr., and the humidity at from 80 to 90 per cent. A certain amount of ventilation is necessary, but, except in tightly constructed houses, no special provision for this is needed. The temperature requirements are a somewhat exacting factor. In cold climates houses are provided with heaters, and in warmer parts some progressive growers even provide cooling systems for summer production. Local growers are advised to choose the coolest possible situation for mushroom beds. Towards the upper limit of the temperature range (60 deg.-70 deg. Fahr.) mushrooms will be produced for a short time only, and if the temperature rises above this for a few days then serious harm is done to the beds. At the lower temperatures production continues for several months. A further fall below 45 deg. Fahr. only slows up production for the time being.

The humidity is maintained by the exclusion of draughts, by light watering of the beds, and, when necessary, by sprinkling of the floors and walls of the mushroom house with water. Mushroom houses are usually dark on account of the amount of enclosing carried out, but when other conditions are suitable mushrooms will grow equally well in

the light. Well-built houses have the ventilation openings screened and are so constructed that they may be tightly closed for fumigation for the eradication of pests and diseases.

Preparation of Bed.

When the compost is placed in the bed it is firmed down and, if necessary, lightly watered. The temperature is then allowed to drop to 75 deg. Fahr., when the spawn is added. One pint of spawn is sufficient for 20 square feet of bed, the spawn being broken up into pieces about the size of a walnut and inserted at intervals approximately 10 inches each way. About one week later the bed is covered with an inch of friable soil and lightly tamped. Soil from below the surface, free from weed seeds, &c., is to be preferred. An acid soil is detrimental unless the acidity is corrected with lime. It is kept moist by light watering, excess water being as detrimental as drying out.

Mushroom spawn can be obtained as brick spawn or pure culture spawn. The former consists of blocks of compost penetrated by strands of the fungus and then dried. The latter differs in that sterilised compost is placed in bottles and seeded with a culture of mushroom obtained from spores or tissue with precautions against contamination with any other organism. It is consequently more reliable.

Cropping.

Strands of mycelium (fungus threads) from the spawn ramify through the bed and send up their fructifications—the mushrooms—in from four to six weeks. Given suitable conditions, beds continue to produce for several months, after which the spent compost is useful as garden manure.

Mushrooms are plucked rather than cut from the beds, pulling with a twisting action being most suitable. Any stub of the mushroom stalk left in the bed is carefully removed to prevent its becoming a centre of rot, and the soil is pressed into the hole left. The stalks are cut from the caps before packing, and all mushroom refuse is carefully removed from the vicinity of the beds and destroyed.

MUSHROOM DISEASES.

Mushrooms, like other cultivated crops, are subject to the attack of diseases. These, when first encountered, cause little loss, but they are liable to accumulate when mushrooms are grown over a long period in the same place without special precautions.

Bubbles.

The disease, bubbles, which transforms the developing mushroom into a distorted putrid mass, is the most destructive. It is caused by a parasitic fungus, *Mycogone perniciosa*. The parasite may gain entrance to the beds from a previously infected bed in the same house, with the casing soil, or in contaminated brick spawn. Spores of the disease may also be blown in from infected surroundings, but they do not come with the compost, as this ferments at a temperature sufficient to kill the spores. Measures are taken to deal with the disease when it is present in a district. Diseased material is removed from the bed and destroyed. After the spent compost is removed when the crop is finished, all fittings are sterilised with a solution of one pint of formalin to fifteen gallons of

water. Houses are at times fumigated with sulphur fumes or formaldehyde gas after the compost has been placed in the beds but before they are spawned. When the house can be made gas-tight, this is more effective. For sulphur fumigation 2 lb. are burned for every thousand cubic feet of air space. The sulphur is lit with a kerosene soaked wick, a deep tin being used to hold the material in order to avoid fire risk from spattering of burning sulphur. The house is tightly closed as soon as the sulphur is lit. Great care is taken in the selection of casing soil to see that it has not been contaminated with mushroom refuse or it is sterilised by heat or formalin. The environs of the house are kept clear of old compost, &c., and the formalin solution is freely used. The use of pure culture spawn obviates the risk of entry of bubbles with the planting material.

Other Diseases.

Bacterial spot is a disease which follows excess watering—particularly prolonged wetting of the mushroom caps. Green mould is liable to develop in patches around old mushroom tissue left in the bed if the picking has been carried out somewhat carelessly. Plaster mould may occupy a mushroom bed to the exclusion of the crop planted. It is usually introduced with contaminated brick spawn and is accentuated if the manure is wet and soggy at the time of filling the beds.

It will be seen that the precautions to be observed for the control of diseases of the mushroom consist in the maintenance of sanitary conditions around the mushroom house, the observance of all cultural details, the use of pure culture spawn, care in the selection of casing soil, and thorough sterilisation after any outbreak occurs.

MUSHROOM PESTS.

Mushrooms are subject to the attacks of a number of insects and related organisms, and where commercial culture is contemplated, it is both possible and advisable to plan the mushroom house or cellar in such a way as to minimise the risk of infestation and also to make control measures possible. The pests that have in recent years caused injury to mushrooms in the Brisbane district include mushroom maggots, woodlice, and slugs. As, however, in addition, mushroom mites and springtails are elsewhere serious pests, all five will be briefly dealt with.

Mushroom Maggots.

Mushroom maggots are the tiny creamy white larvæ of small blackish flies, usually referred to as fungus gnats. These insects breed very rapidly, particularly at the higher temperatures. The eggs, of which there are large numbers, are laid either on the mushrooms or on the bed itself, and the maggots, hatching in two or three days, tunnel into the mushrooms and cause a breakdown of the tissues. The adult flies may also convey mites and mushroom disease infection. The best method of control in commercial production is prevention by excluding the insects. The mushroom house should be well constructed and all ventilation channels should be screened against the adult flies with very fine wire gauze. It should also be possible to tightly shutter all openings to permit of fumigation. If the compost has been properly prepared, and fermentation has carried it to a high temperature, then there is little danger of the maggots being conveyed in it. Should the compost not be well prepared, and infestation suspected or observed, then the whole may be fumigated prior to spawning, either with carbon bisulphide used at a

dosage of 2 to 4 lb. per 1,000 cubic feet in the mushroom house, or by the use of sulphur fumes from burning sulphur as recommended for disease control. Carbon bisulphide should be handled with care as it is inflammable and explosive; full directions for its use are given in a leaflet on fumigation. Dusting pyrethrum powder over infested beds is also said to be beneficial, while the maintenance of the mushroom house at a temperature of about 55 deg. Fahr. or less will markedly reduce the breeding activity of the insect.

Mushroom Mites.

Mushroom mites are very similar to cheese mites, to which they are closely related. Like them, they are minute, whitish, and very prolific. They may infest a mushroom house through the transportation of migratory individuals in infested compost or in spawn from an infested house. The mites may damage all stages of mushroom growth—mycelium and young mushrooms, or, hidden in the gill folds, cause breakdown of more mature mushrooms. Mites are very difficult to deal with when once infesting a mushroom house. The infested compost should be carefully removed to a distance and preferably destroyed by burning. All adjacent timber work and floors should be thoroughly scalded and liberally dressed with a solution of creosote or carbolic acid.

Woodlice.

Woodlice are flattish oval organisms, greyish brown in colour, and having seven pairs of legs. They usually shelter in crevices in timber and other dark, damp situations and they feed at night on decaying vegetable matter, moulds, and fungi. Woodlice damage mushrooms by feeding on the fruiting bodies, thus spoiling the appearance of the product. Small infestations may be controlled by hand collecting at night. Alternatively, the poison bran bait, ordinarily recommended for cutworm control, may be sprinkled thinly, encircling the beds and about any situations in which woodlice are suspected, care always being taken to ensure that the poison bait does not come into contact with the growing mushrooms.

Slugs.

Slugs may also feed on the maturing mushrooms, eating unsightly holes in them. Control of the slugs may be obtained by the same baiting method as recommended for woodlice.

Springtails.

Springtails that have elsewhere been recorded on mushrooms are minute brown or black insects which, when disturbed, leap vigorously after the manner of fleas. They feed on the compost materials, and may cause damage either by feeding on the mycelium or by devouring the mushrooms. Large numbers may congregate on a mushroom and eat holes in the gills. Correct preparation of the compost will largely eliminate any springtails that may be present in the materials. Should infestation become evident prior to the appearance of the mushrooms, then fumigation with burning sulphur as previously mentioned should greatly reduce the numbers. The maintenance of the mushrooms at a temperature of 55 deg. Fahr. or less will slow up the breeding rate of the insects.

The Distribution of the Gastro-Intestinal Parasites of Sheep in Queensland.*

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

A CONSIDERATION of the prevalence of the gastro-intestinal parasites of sheep throughout Queensland, in so far as can be ascertained by the presence or absence of marked helminthiasis, shows that of all the climatic factors which might be responsible for any variation in incidence that of precipitation appears predominant.

In the South, on the Darling Downs (Toowoomba, Stanthorpe, Miles, Goondiwindi), the mean annual rainfall is high—25 inches to 36 inches—and is well distributed throughout the year. Unimproved pastures in this district may carry as high as a sheep per acre, and as a consequence of this high, well distributed rainfall, with its associated heavy stocking, the Darling Downs is probably more heavily infested than any other district in the State. In the South-West (Charleville, Cunnamulla), the summer rainfall is lower and the winter rains not so well distributed. In the Charleville district (19 inches) outbreaks are infrequent, whilst at Cunnamulla, the very scanty annual rainfall of about 14 inches is responsible for one of the most worm-free areas in the State.

In the Central-West (Emerald, Barcaldine), the summer rains are well distributed and useful autumn and winter rains occur. The mean annual falls vary from 20 to 27 inches. In the higher rainfall areas (Emerald, Clermont, Springsure), helminthiasis is extremely common, and in its intensity approaches that of the Darling Downs. The disease does not appear to occur west of Barcaldine, in which area the annual rainfall is about 20 inches. In the North-West (Hughenden-Cloncurry) and far West (Longreach), the rainfall is practically limited to the summer months, and here, although falls as high as 19 inches per annum are received, no cases of helminthiasis endemic to these districts have yet been observed. The mean monthly and annual rainfalls of the various sheep districts are given in Table 1.

TABLE I.

Locality.	Rainfall in Points.												
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Total.
Brisbane	651	625	571	375	283	285	223	204	200	256	368	486	4,527
Toowoomba ..	506	451	381	254	219	252	203	169	214	257	319	431	3,656
Stanthorpe	359	328	270	172	185	196	203	182	228	255	269	351	2,998
Goondiwindi ..	296	264	259	157	174	187	175	128	151	171	221	295	2,478
Mitchell	304	323	291	150	134	175	136	99	127	148	205	282	2,374
Charleville	245	278	234	143	128	137	119	76	86	126	160	243	1,975
Cunnamulla.. ..	133	215	142	114	109	120	89	70	86	90	98	160	1,426
Emerald	443	350	289	148	111	179	97	92	119	144	182	357	2,511
Springsure	427	409	298	161	127	180	106	108	126	163	203	327	2,635
Blackall	294	343	263	142	145	121	102	66	83	139	147	260	2,105
Barcaldine	328	302	250	154	124	111	89	55	70	111	128	244	1,972
Longreach	227	377	234	101	89	81	70	30	61	86	104	193	1,653
Winton	343	306	206	71	58	71	62	24	45	74	127	206	1,593
Hughenden ..	483	349	213	117	62	82	40	33	46	87	127	287	1,926
Cloncurry	459	432	242	72	36	44	34	18	33	47	126	319	1,862

* The various localities mentioned in this report will be found in the accompanying map of Queensland.

Prior to about 1932 the only species of gastro-intestinal helminths considered to be of any economic importance among sheep in Queensland were the stomach worm, *Haemonchus contortus,* the nodule worm, *Oesophagostomum columbianum,* and possibly the tapeworm *Moniezia expansa.* Various species of the small Trichostrongyles were known to be present, but up till then had been seen only in small to moderate numbers. At about this time serious outbreaks of trichostrongylosis occurred on the Darling Downs, since when this disease has become very prevalent and is spreading north and west. The distribution of practically all these gastro-intestinal species was unknown except from information secured when outbreaks were investigated. From about 1933, therefore, an attempt was made to obtain more accurate data regarding both the prevalence and distribution of the various species throughout the State, as it was considered that only in this way could some idea be secured of the economic importance of each species. This survey has been very materially assisted by an examination of viscera sent into the laboratory from all parts of the sheep areas. These sets of viscera were taken mainly from lambs and weaners, though in a few cases, where young sheep were not available, viscera from older animals were examined. In all cases, irrespective of age, the viscera specimens were taken from animals which had spent the whole of their life in the district they represented.

The frequency with which the respective helminths occurred in the 122 viscera specimens examined is given in Table 2.

The Twisted Stomach Worm (Haemonchus contortus).

This species is apparently the most frequent and most widespread helminth occurring in the gastro-intestinal tract of sheep in Queensland. It is most pathogenic on the Darling Downs and in the Central-West, whilst mortalities due to its presence may occur as far west as Charleville and Barcaldine. Odd specimens were taken from sheep from Longreach, Hughenden, Winton, and Cloncurry.

The distribution of *Haemonchus contortus* throughout Australia and other parts of the world shows it to be primarily a summer rainfall species. In winter rainfall areas such as England, New Zealand, and Southern Australia it is a parasite of comparatively little importance, whilst in South Africa and the summer rainfall areas of Australia it reaches decidedly pathogenic proportions.

Its distribution in Queensland shows that it attains its highest development in those areas in receipt of an annual rainfall of about 24 inches and more, more especially if the rainfall is distributed throughout the year. Apparently in the far West and North-West, the long dry periods, high summer temperatures, and rapid rate of evaporation prevent the species from becoming abundant, though its occurrence in small numbers in sheep in these areas indicates a high resistance to these adverse climatic conditions.

The Lesser Stomach Worm (Ostertagia spp.).

Three species of this genus have been found in sheep, namely *O. circumcincta, O. trifurcata,* and *O. ostertagi.* This latter species, which is normally found in cattle, was collected on two occasions in association with *O. circumcincta* from sheep from the Darling Downs. It is very prevalent in cattle on the South and North Coast, and very

TABLE II.

No. of Sheep Examined.	Per Cent. Positive for Helminths.	Per Cent. Positive For.																								
		H. contortus.	*O. circumcincta.*	*O. trifurcata.*	*O. ostertagi.*	*T. axei.*	*T. colubriformis.*	*T. vitrinus.*	*T. rugatus.*	*T. probolurus.*	*T. falculatus.*	*C. curticei.*	*C. oncophora.*	*C. punctata.*	*C. pectinata.*	*N. filicollis.*	*N. spathiger.*	*B. trigonocephalum.*	*H. giardi.*	*M. expansa.*	*O. columbianum.*	*O. venulosum.*	*C. ovina.*	*T. ovis.*
122	94·8	70·2	18·6	3	1·6	33	66·2	28·4	6·5	6·5	·8	16·1	6·5	9	10·8	33·5	32	·8	9·2	25·4	51·2	2·5	..	25

heavy infestations have been observed. As many as 12,000 specimens, for example, have been taken from young calves.

O. circumcincta was taken from sheep in the South, South-West, and Central-West. It was most frequent and most prevalent in sheep from the Stanthorpe district, though the numbers seen in any sheep did not exceed 1,250. Throughout the rest of the Darling Downs it was present in practically every sheep examined, but only in small to moderate numbers. The species is apparently rare in the South-West (Charleville), and in the Central-West it appears to be confined to the eastern areas only (Emerald, Springsure). It was not collected from sheep in any of the other portions of the State.

The third species, *O. trifurcata,* was comparatively rare. It has been seen only on the Darling Downs, and as many as 600 have been taken from a single animal from this district.

Very little is known regarding the distribution of *O. trifurcata,* but *O. circumcinata* appears to reach its highest development in winter rainfall areas. It is a very important parasite in England and on the highlands of Kenya. It is apparently of little importance in Queensland, though it may on occasions possibly become sufficiently numerous in sheep in the Stanthorpe district to be pathogenic.

Hair Worms (Trichostrongylus spp.).

Of the six species of this genus recorded from Queensland, *T. colubriformis* is undoubtedly the most common and most widely distributed, being almost as frequent and widespread as *H. contortus. T. colubriformis* appears to reach its highest development on the Darling Downs and adjoining portions of the neighbouring districts, where during the past few years it has been responsible for serious outbreaks of trichostrongylosis. In the South-West (Charleville), the species is very prevalent and as many as 4,500 specimens have been collected from a lamb. In the Central-West, numbers of 3,000 to 5,000 have been seen in sheep from between Emerald and Barcaldine. No cases of trichostrongylosis have yet been reported from either the South-West or Central-West, but the frequency and abundance with which *T. colubriformis* was observed in this survey in sheep from these areas, indicate that this species may at times reach pathogenic proportions. At Hughenden and Winton, the maximum number of *T. colubriformis* observed in any animal was approximately 200, whilst at Cloncurry and Longreach only odd numbers were taken.

The remaining species do not appear to be of any economic importance. *T. vitrinus* was very frequent on the Darling Downs, especially in the southern portion of this district, but only small numbers have been seen. This species is apparently widely distributed, as it has also been taken at Charleville, Barcaldine, and Hughenden. The third species, *T. axei,* was most prevalent in sheep from Charleville, practically every animal examined from this locality being infested, though the maximum number collected from any one animal was only 850. It was frequently seen on the Darling Downs, though only in very small numbers, and has also been taken from sheep in the Central-West as far out as Jericho. The three remaining species were of rare occurrence. Both *T. rugatus* and *T. probolurus* were collected from sheep from the Darling Downs and Charleville, whilst *T. falculatus* has been seen on one occasion only, one male occurring with a very heavy infestation of *T. colubriformis* in a lamb from Dalby.

The prevailing species of Trichostrongylus in northern New South Wales appears to be *T. colubriformis,* whilst in southern New South Wales *T. vitrinus* becomes very numerous. In Tasmania, heavy infestations of *T. colubriformis, T. vitrinus,* and *T. rugatus* may occur. In England, *T. axei* and *T. vitrinus* are most frequent, though *T. colubriformis* is also very common. In South Africa, trichostrongylosis is said

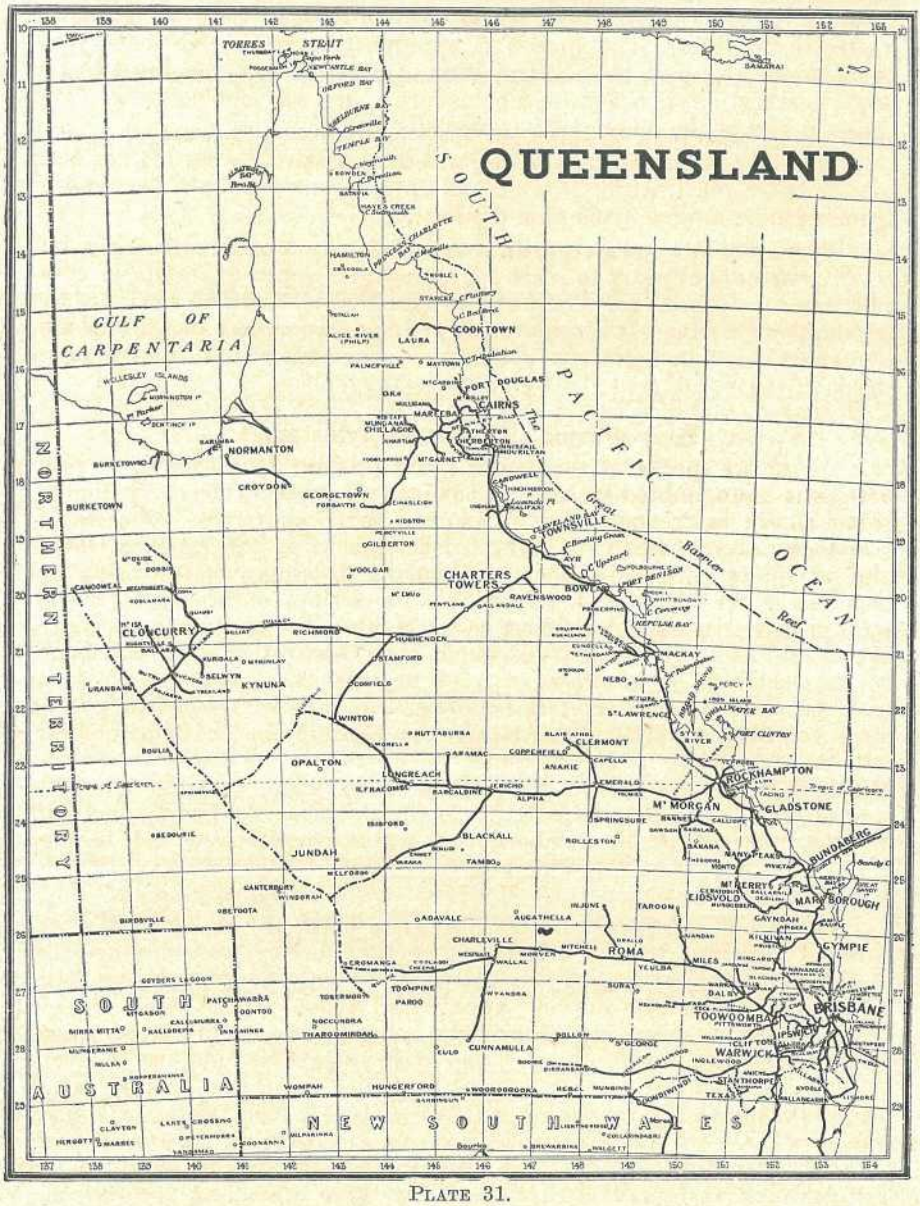

PLATE 31.

to be associated chiefly with *T. colubriformis* and *T. rugatus.* Apparently *T. axei* and *T. vitrinus* reach their highest development in temperate climates, whilst the distribution of *T. colubriformis* indicates a very resistant and very adaptable free living life cycle.

Nothing is known regarding the factors influencing the distribution of *T. probolurus* or *T. falculatus,* except that both species are rare in New South Wales and Queensland. The fact that *T. rugatus* may build up heavy infestations both in Tasmania and South Africa indicates highly resistant preparasitic stages similar to that of *T. colubriformis.*

Cooperia spp.

Of the four species of Cooperia encountered, the only one to be seen in any numbers was *C. curticei.* Two lambs reared at Yeerongpilly, Brisbane, yielded 5,000 and 8,500 specimens, respectively, whilst in two lambs from Caboolture as many as 3,000 to 4,000 specimens were seen. Both these localities are, however, outside of the true sheep-raising country. On the Darling Downs, *C. curticei* was frequent, but the highest number collected was only 236. *C. oncophora* was comparatively rare, and like *C. curticei* appears confined to the south of the State. Both *C. punctata* and *C. pectinata* have apparently a wide distribution, and have been taken from sheep in small numbers at Charleville, Longreach, and Cloncurry. Both these species are very common in cattle in the coastal areas, and up to 11,500 specimens have been collected from a calf.

Climatic conditions in Queensland do not appear to be very favourable to the development of *C. curticei* and *C. oncophora* except in the South-East, where the rainfall is very high and well distributed. Both species are apparently best suited by a temperate climate in so far as can be judged by their distribution throughout the world. In Kenya, for example, they are confined to the highlands. The two other species, *C. punctata* and *C. pectinata,* have a tropical and sub-tropical distribution, though their presence in the far West and North-West of this State indicates a high resistance to high temperatures and long dry periods.

The Thread-necked Trichostrongyles (Nematodirus spp.).

This genus was practically confined to the South and South-West, though a few specimens were taken in the higher rainfall areas of the Central-West. Only small to moderate numbers were encountered. On the Darling Downs, *N. filicollis* was most numerous, but towards Charleville *N. spathiger* appeared in increasing numbers. *Nematodirus spp.* occurs principally in temporate climates, and is a parasite of some importance in England, New Zealand, and probably Southern Australia. *N. spathiger* appears more capable of existing in drier climates than *N. filicollis,* as it is the common species in South Africa.

The Hookworm (Bunostomum trigonocephalum).

The sheep hookworm has not been seen in any of the true sheep areas, but the opportunity is taken here to record its presence in a lamb from Caboolture on the North Coast. As eighteen specimens were taken from this lamb, the parasite is regarded as being very prevalent in this locality.

In New South Wales the species is confined to the Hunter River Valley, and has recently been recorded from the southern areas of West Australia.

The species occurring in cattle, *B. phlebotomum,* is very abundant in the coastal areas, especially in the tropical portions, of Queensland.

Moniezia expansa.

The occurrence of *Moniezia expansa* in sheep from Cloncurry and Longreach indicates that the species has a very wide distribution and a high resistance to high temperatures and dryness. The species is, however, most prevalent in the higher rainfall areas, namely the South and Central-West.

The second species of this genus which has been recorded from sheep in other countries, namely *M. benedeni,* has so far been seen only in calves in the coastal areas.

Helictometra giardi.

This second species occurring in sheep in Queensland is not as common as *M. expansa,* but appears to have a similar distribution throughout the State.

Large Bowel Worms.

Both *Oesophagostomum columbianum* and *O. venulosum* have been seen. The latter species has been taken on three occasions only, at Dirrandandi and Goondiwindi, both localities being in the south-west corner of the Darling Downs.

O. columbianum is very widely distributed and reaches its highest development on the Darling Downs and in the higher rainfall areas of the Central-West. As it occurred in moderate numbers in sheep from Charleville and Barcaldine, its western distribution probably extends further than these localities, though it did not occur in sheep from Longreach or from any of the North-West areas.

O. columbianum has apparently the same climatic distribution as *H. contortus,* but its absence in the far West and North-West indicates that the free living stages are not so resistant to high temperatures and prolonged dry conditions.

The occurrence of *O. venulosum* in the south-western section of the Darling Downs is very interesting, as this species is essentially a parasite of temperate climates. In one lamb from Goondiwindi as many as 65 specimens were present, so it is probable that the incidence of *O. venulosum* in this district is greater than that recorded in this survey.

Chabertia ovina was not encountered in sheep from any of the districts surveyed, but a personal communication from the McMaster Animal Health Laboratory, Sydney, states that the species has been taken by them in a lamb from Dirranbandi.

The Whip Worm (Trichuris ovis).

One would expect this helminth with its resistant egg stage to be very prevalent and widely distributed. It was present, however, only in 25 per cent. of the animals examined, and the maximum number seen in any animal did not exceed 30. The species was absent in all sheep examined from the far West and North-West.

REFERENCES.

Bennetts, H. W. (1935)—"The Hookworm, *Monodontus trigonocephalus,* and Other Sheep Parasites not Recorded Previously from West Australia." Aust. Vet. Jour. Vol. XI. (2), 113-114.

Edgar, G. (1933)—"Some Observations on Trichostrongylosis of Young Sheep." Ibid., Vol. IX. (4), 149-154.

Daubney, R. (1933)—"Trichostrongylid Nematodes from Sheep in Kenya." Parasitology, Vol. XXV. (2), 224-241.

Gordon, H. McL. (1933)—"Some Ovine Trichostrongylids reported from Australia for the First Time, with a Description of *T. longispicularis* sp. nov. from a Sheep." Aust. Vet. Jour., Vol. IX. (1), 1-6.

Kauzal, G. (1933)—"The Seasonal Incidence of the Gastro-intestinal Parasites of Fat Sheep in New South Wales." Ibid., Vol. IX. (5), 179-186.

Kauzal, G. and Grahame, N. P. H. (1933)—"A Preliminary Survey of the Distribution of the Hookworm of Sheep in New South Wales." Jour. Coun. Scient. and Indus. Res., Vol. VI. (3), 189-190.

Mönnig, H. O. (1928)—"Check List of the Worm Parasites of Domesticated Animals in South Africa." 13th and 14th Rep. Dir. Vet. Educ. and Res. Pretoria, 801-837.

Ross, I. C. (1934)—"Parasitological and Other Problems in Sheep in West Australia." Jour. Coun. Scien. and Indus. Res., Vol. VII. (1), 1-8.

Taylor, E. L. (1934)—"Field Experiments on the Immunity of Lambs to Parasitic Gastritis Caused by a Mixed Infection of Trichostrongylid Nematodes." Jour. Helm., Vol. XII. (3), 143-164.

Tetley, J. H. (1934)—"The Nematodes Parasitic in Sheep in the Manawatu District, New Zealand. Ibid., Vol. XII. (4), 183-196.

STAYING POSTS OVER A SLIP.

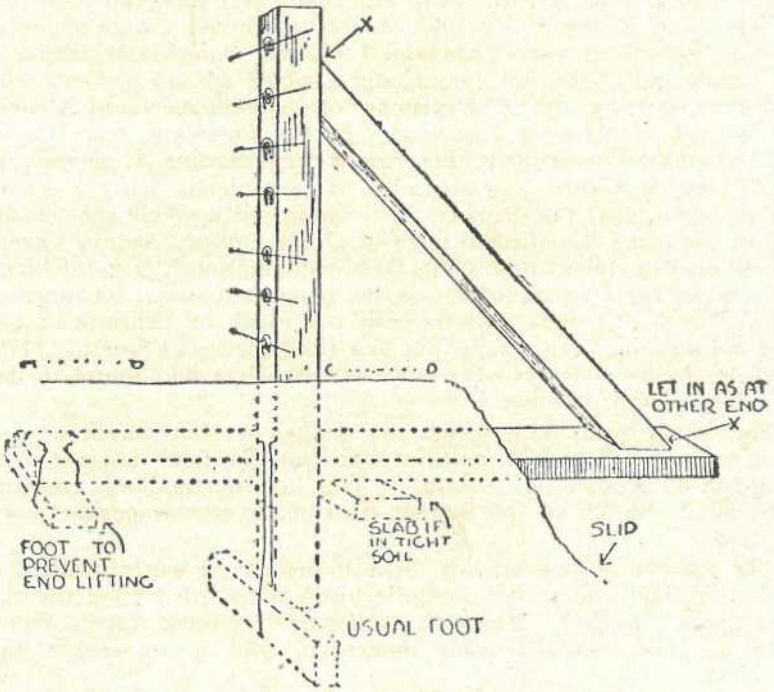

PLATE 32.

Many fencers are confronted with problems which often appear to have no solution. Here is an example of a suspended stay where the ground has fallen away. To take the fence lower down the hill is impossible. To bring it up nearer the road is also impossible. The distance between C and D is too narrow for a stay. The illustration offers a solution.—The "Cane Growers' Weekly" (Mackay).

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

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

PART I.

1. INTRODUCTION.

THE nematode with which these investigations are concerned is a large species of the genus Ascaridia parasitic in the small intestine of the domestic fowl. The taxonomy of this species has in the past been somewhat confused as it was considered that there were two distinct species of large roundworms of this genus parasitic in this host—namely, *A. perspicillum* (Rudolphi 1803), to which Freeborn referred the name *A. galli* in 1923, and *A. lineata* (Schneider 1866). Schwartz[94] considered the species present in the United States, the Philippine Islands, and Indo-China to be *A. lineata*. Cram[42] recognised the existence of both species, but degraded *A. perspicillum* to a synonym of *A. galli*, separating *A. lineata* on the basis of the smaller size of the preanal sucker and of the absence of well-defined lateral alæ. *A. lineata* has been recorded also from Wales by Lewis[73]; from Canada by Baker[26]; from West Australia by Bennetts[31]; from Queensland by Roberts[80]; and from Germany, Asia, Africa, North and South America, and the Philippine Islands by Sprëhn.[97] In 1931, Ackert[8] examined a large amount of material from Cambridge (England), Kansas, Tangiers, Uganda, the Gold Coast, and India, but found only a single species present, which he referred to *A. lineata*. The existence of a second species of Ascaridia was regarded by him as uncertain. In the following year, Baylis[29] published an article setting out his reasons for regarding *A. perspicillum*, *A. galli*, and *A. lineata* as synonymic. He considered that the common large roundworm of the domestic fowl comprised a single species only, to which the name *A. galli* had priority. This finding has not, however, been accepted by Ackert, who in his latest contributions[17–22] to the biology of this roundworm continued to use the name *A. lineata*, stating as his reason,[8] "while the name *Ascaris galli* was given by Schrank in 1788, he did not describe the parasite, but based the species on Goeze's (1782) composite species, *Ascaris teres*, a nematode Goeze had found in dogs, cats, chickens, and raptores."

The roundworm, with which the studies set out herein are concerned, was identified as *A. galli*, of which an excellent description has been given by Ackert (*A. lineata*).[8] This identification was confirmed by Dr. H. A. Baylis, of the British Museum, to whom specimens were submitted.

The species, as has already been indicated, is world wide in its distribution, and among the domestic birds is recorded from the fowl, *Gallus gallus*, turkey, *Meleagris galloparvo*, guinea fowl, *Numida meleagris*, duck, *Anas boschas domestica*, and goose, *Anser anser domesticus*.

I. Historical.

The most outstanding name associated with studies on the biology of *A. galli* is that of Ackert. Ackert commenced his investigations in 1919 and his contributions to the literature concerned with this roundworm include studies on the life history and pathogenicity[1 2 3 4 6 7 8]

and on the resistance of the fowl to infestation. His work on resistance is particularly interesting and has been responsible for much of the present knowledge of the resistance of a host to helminth infestation. These investigations of Ackert, many of which were conducted in collaboration with other workers—Graham, Porter, Nolf, Herrick, et al.—have dealt with the effect of age,[7 16 17 19 20 21] of repeated infestation,[14] of the loss of blood,[10] of diet, [7 11 12 13 15 18] and of the several varieties of the host[17 19] on the course of an infestation. He has been able to demonstrate that the resistance of the fowl to infestation increases with age; that repeated infestations may possibly induce an acquired resistance; that loss of blood and diets inadequate in vitamins A and B or entirely of a vegetable nature may lower the host's resistance; and that the light breeds of fowl are less resistant than the heavy breeds.

Guberlet[58] confirmed Ackert's early work on the life history of the parasite and showed that there is no extra intestinal migration of larvæ except in rare instances, thereby indicating the unsoundness of a report by the Oklahoma Experiment Station,[84] in which mortalities were claimed among chicks due to an invasion of the lungs by the larvæ. Itagaki[67] is responsible, so far as can be determined from the literature available, for the only work on the life history of Ascaridia carried out in any country other than the United States. Itagaki's experiments at Tokyo, Japan, indicate a nodular condition of the small intestine due to the penetration of the wall tissues by the larvæ. No such nodule formation was ever observed by Ackert.[8]

Herrick,[63] and with Ackert[6] studied the pathogenicity of infestation with Ascaridia, and in 1926[64] was responsible for a very fine contribution on the resistance of chickens to infestation.

Very little work appears to have been carried out on the effects of the environment upon the egg. Danheim,[46] Itagaki,[67] Ackert,[3 9] Hartman,[62] and McRae,[75] have published the results of various experiments dealing with the effects of temperature, sunlight, and moisture, while Chandler[41] and Beaudette and Black[30] have given some idea of the possible use of chemicals as ovicides.

II. Prevalence and Distribution in Queensland.

In 1866, Schneider described a large species of roundworm collected from the domestic fowl in South Australia by Schromburg, under the name *Heterakis compressa*. The measurements and description given by Schneider indicate that this species belongs to the genus Ascaridia and is most probably *A. galli*. A note by Perrie[79] in 1892 on the presence of *Ascaris* sp. in the domestic fowl possibly refers to this species also. It was not till 1912, however, that a species of large roundworm was recorded from the domestic fowl in Queensland, the species being recorded by Johnston[70] as *Ascaridia perspicillum*.

A survey of the incidence of *A. galli* in the domestic fowl was made by the writer in 1932[86] when of 128, mainly young, birds examined 76·6 per cent. were infested. A further survey in 1934-1935 showed that of 579 birds, the majority of which were over three years of age, 42·1 per cent. were infested.

This roundworm is probably well distributed throughout the State as the following locality records show:—Brisbane, Toowoomba, Dalby, Goondiwindi, Charleville, Rockhampton, Townsville, Atherton, and Normanton.

III. Economic Importance.

A. galli occurs normally in the small intestine and is usually restricted in its habitat to that portion of the intestine extending between the entrance of the bile duct and the remnant of the yolk sac. In the case of heavy infestations worms may be encountered anterior and posterior to this site, though there is a greater tendency for the parasites to move forward into the duodenal loop rather than to occupy the portion of the intestine posterior to the yolk sac remnant. Occasionally specimens have been seen in the gizzard and cæcum, and it is not unusual in the case of heavy infestations for individuals to migrate into the crop and œsophagus.

In Queensland, the principal host of *A. galli* is the domestic fowl. It has been seen also in the turkey and duck. In this latter host very heavy infestations were observed in two dead birds three to four months old sent into the laboratory.

Observations on birds examined in the laboratory and on poultry farms indicate that this roundworm is harmful chiefly to young stock. Among young birds mortalities are frequent and the symptoms exhibited include marked emaciation, weakness, and anæmia, infested birds having a decidedly unthrifty appearance. Diarrhœa may accompany an infestation, but is not always associated. The appetite may be good, but the birds do not grow. Enquiries have shown that there is some evidence that the egg production may be affected, especially that of birds in their first lay.

2. THE PREPARASITIC PHASE IN THE LIFE CYCLE.

I. Technique Employed.

(i.) *Method of Obtaining Eggs.*—Fresh eggs of *Ascaridia galli* were very conveniently secured by incubating female worms in physiological saline at 37 deg. C. Under these conditions worms have remained alive as long as seventy-two hours, but only eggs deposited during the first twenty-four to thirty-six hours were used.

(ii.) *Isolation of Eggs.*—The technique employed for the examination of droppings for eggs was a modification of that advocated by Sheather, concentrated salt solution being used instead of sugar.

Eggs were isolated from dried droppings and soil by means of the method recorded by Spindler (1929).

II. Description of the Egg.

Two types of Ascaridia eggs are seen in droppings—namely, fertile and infertile.

The Fertile Egg.—The fertile egg is single-celled when passed in the droppings and is broadly oval in shape. The egg consists of a rounded mass of protoplasm, not entirely filling the shell, in which a clear central spot—the nucleus—may be detected. Enclosing the egg are three separate coats—(1) an inner thin and delicate vitteline membrane, (2) a thick transparent shell, 4μ-6μ in thickness, and (3) an outer thin irregular and inconspicuous albuminous covering to which minute particles of debris may be attached imparting to the egg a somewhat roughened appearance. Fifty fertilized eggs selected at random measured 73μ to 92μ in length by 46μ to 57μ in width, with an average measurement of 81μ by 52μ. Rarely, fertilized eggs as large as 126μ by 50μ and 117μ by 57μ have been observed. At one end of the egg and

placed slightly to one side is a small plug-like structure, which appears to be of assistance in hatching. This plug, according to Ackert[8] is a solid conical appendage of the vitelline membrane and is free from the shell.

The Infertile Egg.—Two types of infertile eggs have been observed. The first type is very similar in appearance to the fertile egg, but no clear central neuclear spot is visible. In measurements this type of infertile egg approaches those of the fertile egg, but may be proportionally longer in comparison to its width. Such an egg, for example, may measure 93μ by 42μ.

In the second type of infertile egg the shell has lost its regular oval appearance and may be misshapen and more pointed at either end. The shell is much thinner, the polar plug is missing, and the shell may be entirely or partly filled with a heterogeneous mass of protoplasm, fat, and yolk.

III. Comparison of the Egg of Ascaridia Galli with that of Heterakis Gallinæ.

In fæcal examinations of fowls in this State the only other helminth egg with which the egg of *Ascaridia galli* could be confused is that of the cæcum worm, *Heterakis gallinæ*.

Two distinct kinds of fæces are passed by the domestic fowl, cæcal fæces and intestinal fæces. Fæces from the intestine is usually formed and contains relatively coarse particles, while cæcal fæces is brown and pultaceous. The eggs of *Ascaridia galli* may occur in both types of fæces, whilst those of *Heterakis gallinæ* are usually passed in cæcal fæces only. On rare occasions, however, cæcum worm eggs are retained among fæcal debris in the cloaca and are seen in intestinal fæces. Both types of eggs are very similar in general appearance, being thick shelled, and oval with an opercular plug at one end. The egg of Heterakis is more rounded at either end with its sides less convex than those of the egg of Ascaridia. The following table, in which measurements of the eggs of the two species are given, also shows that Heterakis deposits an egg of smaller dimensions than Ascaridia. In this table are included measurements made by the writer on fifty eggs of each species.

TABLE I.

Heterakis gallinæ.	Ascardia galli	Authority.
65μ — 70μ × 35μ — 40μ	..	Dorman [47]
63μ — 75μ × 36μ — 48μ	77μ × 47μ	Cameron [38]
63μ — 75μ × 36μ — 48μ	77μ × 47μ	Baylis [28]
70μ — 80μ × 38μ — 44μ	80μ — 85μ × 43μ — 50μ	Mönnig [77]
74μ — 78μ × 41μ	..	Graybill [56]
63μ — 71μ × 38μ — 48μ	75μ — 80μ × 45μ — 50μ	Cram (*A. galli*)
	80μ × 50μ	(*A. lineata*) [42]
70μ — 80μ × 38μ — 44μ	..	Clapham [44]
(73μ × 42μ)		
..	73μ — 88μ × 45μ — 50μ	Ackert [8]
	(76μ × 49μ)	
65μ — 79μ × 35μ — 46μ	73μ — 92μ × 46μ — 57μ	Roberts
(70μ × 39μ)	(81μ × 52μ)	

IV. The Influence of the Environment upon the Egg.

This was determined by a series of experiments in which eggs were exposed to experimental and natural conditions of moisture, temperature, &c.

(i.) The Influence of Temperature.

Danheim[46] found that eggs in the early cleavage stages were fairly resistant to low temperatures, surviving —12 deg. C. to —8 deg. C. for fifteen but not twenty-two hours. Itagaki[67] notes that at Tokyo, Japan, eggs may survive the severe cold of January to March, but do not develop completely. Fully-developed eggs were still alive in frozen water after four months' exposure. Ackert[8] says that fertile eggs after one month's exposure of 0 deg. C. did not complete their development when removed to 30 deg. C., the morula being the highest stage of development reached before death occurred. Ackert also notes that 10 deg. C. to 15 deg. C. is the lowest temperature at which development may commence. With Cauthen, Ackert[9] found that eggs exposed in 2 inches or less of soil failed to survive subzero weather, but could live through mild winters. At 0 deg. C. to 6 deg. C. the unsegmented ovum was most resistant, then the coiled embryo, the intermediate stages of development being least resistant. As regards higher temperatures, Itagaki[67] found that during the hottest part of summer in Tokyo eggs became infective in seven days. He also noted that eggs may survive five minutes' exposure at 50 deg. C. to 53 deg. C., but not at 54 deg. C. Ackert[8] records that at 30 deg. C. eggs became infective in sixteen days and at 33 deg. C. in ten days. Twelve hours' exposure at 43 deg. C. was lethal for eggs in all stages of development.

Experimental Observations.

In the following experiments the effects of low, medium, and high temperatures on the development and viability of the fresh egg were obtained. The eggs were exposed to the various temperatures in 2 mm. of tapwater in petrie dishes.

—7·5 deg. C. to —3 deg. C.—After nine days' exposure to this range of temperatures 55 per cent. of the eggs developed to the infective embryonated stage when removed to 30 deg. C. A further eight days' exposure was 98 per cent. fatal, whilst after twenty-one days no eggs survived.

4·5 deg. C. to 10 deg. C.—At these temperatures eggs survived four weeks' exposure, but no development occurred until removal to 30 deg. C.

25 deg. C. to 26 deg. C.—The early first-stage embryo appeared after seven days' exposure, and the second larval stage was reached on the twelfth day.

30 deg. C. to 31 deg. C.—At these temperatures development was more uniform than at 25 deg. C. to 26 deg. C. and the infective embryonated stage was reached on the ninth day.

32·5 deg. C. to 33 deg. C.—Development at these temperatures was always slightly more advanced than at 30 deg. C. to 31 deg. C., and the infective embryonated stage appeared on the seventh day.

35 deg. C. to 37·5 deg. C.—After three days' exposure to these temperatures, a few of the eggs were in the small blastomere morula stage. The majority, however, were sixteen-celled and many had not advanced beyond the two to six cell stage. After a further three days no advance in development could be detected, and on removal to 30 deg. C. all eggs were shown to be dead.

45 deg. C. to 46·5 deg. C.—Twenty-four hours' exposure at these temperatures was fatal to all eggs without inducing any development.

55 deg. C. to 56·5 deg. C.—Fifteen minutes' exposure to these temperatures was sufficient to kill all eggs.

Discussion.—The optimum temperature range for egg development is from 30 deg. C. to 33 deg. C. At 30 deg. C. eggs become infective in about nine days, and at 33 deg. C. in about seven days. Using 2 mm. of distilled water Ackert gives the periods required to reach infectivity at these temperatures as sixteen days and ten days respectively. The more rapid development of the eggs as observed by the writer may possibly have been due to the use of tapwater.

Temperatures slightly higher than 33 deg. C. whilst allowing development to proceed to a certain extent are fatal if the period of exposure is prolonged. High temperatures, as shown by the results obtained from exposures to 45 deg. C. to 46·5 deg. C. and 55 deg. C. to 56·5 deg. C. prohibit development entirely and are rapidly fatal.

Prolonged exposure to very low temperatures is also fatal, though eggs survived sixteen but not twenty-one days to —7·5 deg. C. to —3 deg. C. Lower temperatures, however, are, according to Danheim,[46] more rapidly fatal, fresh eggs not surviving twenty-two hours at —12 deg. C. to —8 deg. C.

Temperatures of 4·5 deg. C. to 10 deg. C. did not induce any loss of viability after four weeks, but were sufficiently low to prohibit development during the period of exposure.

In Queensland very low temperatures do not occur for any length of time in any of the poultry-raising districts, the mean minimum temperatures for June, July, and August in the coldest district—Stanthorpe —being about 2·5 deg. C., 1·1 deg. C., and 1·6 deg. C. respectively. High temperatures on the other hand, especially in unshaded areas, are frequently encountered, and these may be expected to possess some lethal effect in view of the comparatively slight resistance of the egg to temperatures in the vicinity of 55 deg. C. and over.

(ii.) The Influence of Sunlight.

Ackert and Cauthen[9] have noted that ova in less than half an inch of soil when exposed to the summer sun were killed in three weeks, whilst eggs in shaded spots remained viable from spring to autumn. Hartman[62] has recorded an experiment in which all eggs on the soil surface and down to a depth of 6 inches in unshaded soil were killed during July-August, a hot dry season, whilst eggs in shady spots maintained their viability for 100 days. Eggs on the soil surface died first, frequently within a few hours, but no eggs at any depth survived five weeks. Ackert[1] says that eggs exposed to sunlight at 23 deg. C. to 33 deg. C. continued to develop throughout seven days' exposure.

EXPERIMENTAL OBSERVATIONS.

In the experiments described below the influence of sunlight upon the egg of *Ascaridia galli* was studied in three ways—(*a*) upon fresh and embryonated eggs in liquid medium, (*b*) upon fresh and embryonated eggs under conditions of desiccation, (*c*) upon fresh eggs in droppings, associated with conditions of moisture and of desiccation.

(a) The Influence of Sunlight upon Fresh and Embryonated Eggs in Liquid Media.

In these experiments eggs were exposed to sunshine under 2 mm. of tapwater.

Fresh Eggs.—Fresh eggs in the one and two celled stages were exposed to bright sunshine for three, four, and five hours. The only eggs to develop to the embryonated stage after subsequent incubation at 31 deg. C. to 32 deg. C. were those exposed to sunlight for three hours, 22 per cent. of the eggs surviving the exposure, a control culture yielding 92 per cent. embryonated eggs. The maximum sun temperatures recorded during these periods of exposure ranged from 36 deg. C. to 42 deg. C.

Embryonated Infectious Eggs.—Exposure of eggs containing infectious embryos to bright sunshine with maximum temperatures 36 deg. C. to 42 deg. C. showed that after three hours' exposure 37 per cent. of the embryos were still alive, whilst a four-hour exposure was entirely lethal. Approximately 95 per cent. of the embryos in eggs retained in the shade as a control were alive after two weeks.

(b) The Influence of Sunlight upon Fresh and Embryonated Eggs under Conditions of Desiccation.

In order to determine the effect of sunlight upon fresh and embryonated eggs under conditions of dryness, eggs were dried out on glass slides for two days and then exposed to sunlight. Control eggs were similarly treated, but retained in the shade, and when remoïstened indicated that the short period of desiccation had been without any effect upon their vitality.

Fresh Eggs.—Fresh eggs in the single and two celled stages dried out on glass slides and exposed to bright sunshine with maximum temperatures of 37 deg. C. to 40 deg. C. did not survive two hours' exposure, though one hour's exposure did not give a mortality greater than 38 per cent.

Embryonated Infectious Eggs.—After one hour's exposure to bright sunshine and with a similar range of temperatures, practically all eggs in this stage of development survived, but a further hour's exposure proved completely lethal.

Discussion.—These experiments have shown that bright sunshine is inimical to the egg of *Ascaridia galli* and that in 2 mm. of tapwater all eggs, both fresh and embryonated, were killed after three to four hours' exposure. Under conditions of desiccation, however, the period of exposure necessary to give a 100 per cent. mortality was reduced to one to two hours. This latter experiment has also suggested that the egg containing an infectious embryo is more resistant to sunshine than the fresh egg. After one hour's exposure under conditions of desiccation 38 per cent. fresh eggs were killed, whilst practically all the embryonated eggs were still alive.

(c) The Influence of Sunlight upon Eggs Exposed in Fresh Normal Droppings.

Under Conditions of Moisture.—Six normal-sized droppings from infested chickens were exposed to sunshine on earth in small wooden boxes and kept moist by frequent sprinkling with water.

Six similar normal-sized droppings kept moist were retained in the laboratory as controls.

After various periods of exposure a single dropping was removed to the incubator at 31 deg. C. to 32 deg. C. and left there for ten days before being examined.

The results from this experiment are given in the following table:—

TABLE II.

SUNSHINE.			SHADE (Controls).		
Period of Exposure.	Number of Eggs Examined.	Per Cent. Survival.	Period of Exposure.	Number of Eggs Examined.	Per Cent. Survival.
7 days ..	154	62	9 days ..	250	89
14 days ..	310	57	22 days ..	210	94
23 days ..	177	2	24 days ..	476	91
28 days ..	206	3	43 days ..	155	93
40 days ..	239	..	54 days ..	328	82
45 days ..	116	..	54 days ..	334	90

Discussion.—By the end of the third week the frequent moistening had resulted in the disintegration of the droppings, especially of those exposed to the sun, and from this time until the conclusion of the experiment these were scattered in a thin layer over the soil surface. In taking samples for examination scrapings were made of the soil surface only.

During the total period of exposure there were many partly cloudy days and seven completely cloudy days with rain. Minimum temperatures ranged from 13·5 deg. C. to 21 deg. C. and maximum temperatures from 34 deg. C. to 45 deg. C.

Under the conditions governing the experiment, eggs survived for approximately twenty-eight days with a very marked mortality between the fourteenth and twenty-third days. When compared to an exposure of fresh eggs and embryonated eggs in liquid media, when death resulted after three to four hours, it is apparent that the protection of the egg from sunlight afforded by the moist fæcal and earth particles was responsible for the increased survival period. It would seem very probable, therefore, that had the degree of moisture been such as to promote development, without in any way resulting in disintegration of the droppings, the eggs would have resisted exposure to sunlight for a considerably longer period.

Under conditions of Desiccation.—In this experiment six normal-sized infested droppings were exposed to sunlight on earth and allowed to dry out. They were given approximately seven hours' exposure each day, except during week-ends, when they were retained in the laboratory. During rain and at night they were also not exposed.

As controls six similar droppings from the same chickens were kept in the laboratory and allowed to dry out.

The results of this experiment are given below as determined from subsequent moistening and incubation of the eggs at 31 deg. C. to 32 deg. C.

TABLE III.

SUNSHINE.			SHADE (Controls).		
Period of Exposure.	Number of Eggs Examined.	Per Cent. Survival.	Period of Exposure.	Number of Eggs Examined.	Per Cent. Survival.
7 days ..	222	76	7 days ..	128	90
14 days ..	254	35	14 days ..	304	80
20 days ..	361	..	21 days ..	296	65
21 days ..	278	..	29 days ..	472	20
21 days ..	102	..	37 days ..	264	2
21 days ..	316	..	42 days ..	292	..

Discussion.—During the total period of exposure there were many partly cloudy days and four completely cloudy days with rain. Minimum temperatures in the sun ranged from 13·5 deg. C. to 21 deg. C. and maximum temperatures from 34 deg. C. to 43 deg. C. Under these conditions eggs in droppings exposed to sunshine survived fourteen but not twenty days, whilst in the shade their longevity was increased to between thirty-seven and forty-two days. Eggs in droppings exposed to sunshine and in the presence of moisture maintained their vitality for about twenty-eight days, and it may therefore be concluded, especially as the two experiments were carried out at the same time, that the condition of desiccation were responsible for this greatly decreased survival period.

(iii.) THE INFLUENCE OF LIGHT.

Itagaki[67] noted that fresh eggs kept in pitch darkness did not develop and died within a few days. No such effect was observed by the writer among eggs which were exposed to darkness for a period of thirty-seven days. The percentage of embryonated eggs in the culture so exposed—namely 92 per cent.—compared very favourably with that in a culture left on the bench in the laboratory adjacent to a window—namely, 90 per cent.

(iv.) THE INFLUENCE OF OXYGEN.

That oxygen is necessary for egg development has been shown by Itagaki,[67] who says that freshly-discharged eggs kept in a culture medium free from oxygen failed to develop and died within a few days.

(v.) THE INFLUENCE OF DESICCATION.

The influence of dryness upon the egg has also been investigated by Itagaki,[67] who noted that fresh eggs maintained in a desiccator for forty-four days did not develop completely and subsequently died. Embryonated eggs on the other hand were still alive after sixty days. McRae[75] showed that at 22 deg. C. a minimum relative humidity of 82 to 86 per cent. was necessary for complete development. With a relative humidity of 40 per cent. to 50 per cent. development in some of the eggs reached the tadpole stage, but all eggs were dead after eight days. When the relative humidity was increased to 77 per cent. to 82 per cent., the eggs maintained their viability for from two to four weeks, but did not develop beyond the morula stage. Eggs kept in a saturated atmosphere at 30 deg. C. developed exactly as did those in water at the same temperature.

EXPERIMENTAL OBSERVATIONS.

In the following series of experiments the influence of desiccation was determined by:—

(*a*) Ascertaining the longevity of fresh and embryonated eggs dried out on glass slides and exposed to room temperatures and humidities.

(*b*) Ascertaining the longevity of fresh eggs in normal-sized droppings, allowed to dry out and remain dry under room temperatures and humidities.

The influence of desiccation in the presence of sunlight has already been discussed.

(*a*) *Eggs Dried Out on Glass Slides.*

Fresh Eggs.—Eggs in the one and two celled stages were allowed to dry out on glass slides. After various periods of exposure the eggs were moistened and were incubated at 31 deg. C. to 32 deg. C. for ten days before examination. The results of this experiment are given herewith in tabular form.

TABLE IV.

Period of Exposure.	Number of Eggs Examined.	Per Cent. Survival.
1 day (control)	554	94
7 days	786	78
14 days	642	70
21 days	754	25
26 days	903	5
30 days	859	..

The minimum and maximum temperatures recorded during this period were 15 deg. C. and 25·5 deg. C. respectively. Humidities were consistently high, rarely below 50 per cent. and on many occasions as high as 80 per cent. Under these conditions eggs continued to develop slowly, but did not reach the morula stage. During the first fourteen days the percentage of eggs unable to withstand the dry conditions showed a gradual increase. During the next seven days there was a marked mortality, so that only 25 per cent. of those eggs examined on the twenty-first day were alive. On the twenty-sixth day only 5 per cent. were viable, whilst all eggs exposed for thirty days proved to be dead. The fact that eggs submitted to the conditions of desiccation, &c., outlined above developed as far as the morula stage indicates that the moisture requirements for development are comparatively slight.

Embryonated Infectious Eggs.—Embryonated infectious eggs were subjected to the same conditions of desiccation on glass slides as fresh eggs. Examination after various periods of exposure gave the following results:—

TABLE V.

Period of Exposure.	Number of Eggs Examined.	Per Cent. Survival.
1 day (control)	1,084	93–90 after 6 weeks
7 days	886	95
12 days	972	72
15 days	985	35
20 days	728	45
25 days	1,210	12
30 days	956	..

Moistening of infectious embryonated eggs after periods of desiccation induces hatching, and it was noticed that although a large number of eggs appeared to have survived immediately after moistening many of these had hatched when examined again fifteen to thirty minutes later. It was therefore decided to delay examination till twenty-four hours after moistening, and only unhatched eggs containing live larvæ were considered as surviving the respective periods of desiccation. The temperatures and humidities were the same as those given for fresh eggs.

(*b*) *The Effect of Desiccation on Eggs in Normal-sized Droppings.*

This experiment has already been detailed as a control among the experiments conducted to ascertain the influence of sunlight and desiccation, and it was shown that under the conditions outlined eggs survived thirty-seven but not forty-two days.

Discussion.—The above experiments have shown that whilst the moisture requirements for development appear to be comparatively slight, conditions of dryness may eventually result in the death of all eggs so exposed. Both fresh eggs and embryonated infectious eggs dried out on glass slides survived twenty-five but not thirty days. Infectious embryonated eggs appear more resistant to desiccation than eggs in early stages of development. After twenty-five days' exposure an examination showed that immediately after moistening approximately 65 per cent. of the embryonated eggs appeared to contain live embryos, but after a further twenty-four hours, hatching had reduced this number to 12 per cent. It would appear that the eggshell is able to absorb water after periods of dryness, as in this instance hatching appeared to be definitely associated with remoistening, the shell swelling and splitting in the vicinity of the polar plug, irrespective of whether the contained larva was alive or dead, but more frequently in the case of live larvæ. Twenty-four hours after hatching such hatched larvæ were always dead.

Eggs in normal-sized droppings were alive after thirty-seven but not forty-two days, the increased survival period being due no doubt to a retention of moisture by the fæcal particles.

(vi.) The Influence of Chemicals upon the Vitality of the Egg.

In 1926 Beaudette and Black[30] conducted laboratory and field tests with various chemicals in order to ascertain their use as ovicides for the control of Ascaridia. Infested runs were treated with a 1–1,000 bichloride of mercury solution, with a 5 per cent. formaldehyde solution, with 5 per cent. hydrochloric acid, and with 5 per cent. phenol. Only in the case of treatment with 5 per cent. phenol did clean birds subsequently introduced to the runs remain uninfested. It has also been noted by Chandler[40 41] that an "iodine suspensoid" is an effective ovicide.

In the tests carried out by the writer the aim was to discover some solution which would be practically instantaneous in its lethal effects and be economical to use. Various dilutions of a large number of chemicals were employed over a period of twenty-four hours, but the only chemicals which gave any promise were carbolic and cresylic acid which in this period of time were effective in 2 per cent. and 1 per cent. dilutions respectively. Boiling water was instantly lethal, and it is considered that from these results a 5 per cent. boiling solution of a disinfectant with a high phenol and cresol content would be the most

efficient ovicide to employ. That such a solution is more effective than water alone at high temperatures has been demonstrated by the writer[88] in the case of the eggs of *Ascaris lumbricoides*.

Obviously such a solution could not be economically applied to runs of any size possessing earthen floors, but it is considered that it could be very advantageously used in houses with concrete or wooden floors. The solution should be used liberally and the time between the removal of the boiling solution from the fire and its application to the floors should be reduced to a minimum.

V. The Longevity of the Egg.

The only records of the longevity of the egg are those noted by Ackert and Cauthen,[9] when in an experiment involving out-of-door conditions eggs in shaded spots remained viable from spring to autumn, and by Hartman,[62] who in a similar experiment obtained a longevity of 100 days for eggs protected from sunlight.

The longevity of the egg of *Ascaridia galli* was studied by the writer under optimum conditions in the laboratory and also under conditions of exposure to the natural environment.

(*a*) Under Laboratory Conditions.

In this experiment eggs were maintained at room temperatures in 2 mm. to 4 mm. of tapwater. The media received frequent shakings in order to ensure an adequate supply of oxygen being always present. Some few weeks after the experiment was commenced the media contained a good growth of algæ, which was allowed to remain, as it was considered that the photosynthetic processes would assist in maintaining a supply of oxygen. Eggs were removed at intervals and the percentage of live eggs computed. These are given in the table set out below.

Table VI.

Date.	Number of Days.	Number of Eggs Examined	Per Cent. Survival.
1–10–34 ..	Fresh eggs	..	..
17–10–34 ..	17	325	88 embryos
8–2–35 ..	131	268	84
27–3–35 ..	178	454	80
26–4–35 ..	208	510	75
17–6–35 ..	260	510	55
5–8–35 ..	309	482	35
3–10–35 ..	368	316	6
4–11–35 ..	400	725	..

Thus in this experiment eggs survived 368 but not 400 days. The percentage shown on the seventeenth day refers to the percentage of embryonated eggs which developed in the culture used. Thereafter the percentages given refer only to the number of embryonated eggs that survived. In view of the much greater periods of longevity which have been recorded for eggs of other species of Ascaridæ, it is felt that the period of longevity for the eggs of *A. galli* as determined by the writer would probably be considerably increased by further experiments. On the other hand, although the eggs of certain species of Ascaridæ have been credited with surviving for a number of years, these records are based principally on the appearance of the embryo within the eggshell, and it seems possible that eggs kept for any great length of time may

not be infectious, due to a loss of vitality of the larvæ and their subsequent inability to establish themselves. For instance, in the case of *Ascaridia galli*, it was found that by feeding embryonated eggs 184 days old to young chicks numerous larvæ could be recovered. Embryonated eggs 230 days old were also found to be infectious, though the numbers of larvæ recovered was only a very small percentage of the eggs fed, but from a chicken to which eggs 368 days old were fed no larvæ were secured.

(*b*) Under Natural Conditions.

In this experiment wooden boxes were sunk into the soil to ground level. The boxes were without bottoms and their sides were pierced with ¾-inch holes in order to interfere as little as possible with drainage and soil moisture currents. Droppings containing fresh eggs of Ascaridia were spread over the soil in the boxes to a depth of ½ inch. Two such boxes were placed in a permanently shaded position under a tree, in which position the eggs would be protected from sunlight and at the same time benefit from any natural precipitation. Two other boxes were placed so that they would be continuously exposed to sunlight. At intervals surface scrapings to a depth of about ½ inch were taken from the soil and examined for eggs.

The conditions of sunlight, temperature, and rainfall prevailing during the experiment were practically normal for the Brisbane district, in which the experiment was carried out.

The droppings were exposed on 7th January and it was found that by 20th April a few live embryonated eggs still existed in the earth exposed to sunlight, but by 2nd June all eggs had died. This gives a longevity for eggs in this experiment of about 103 days.

In the boxes placed in the shade, however, a very small proportion of eggs were still alive on 13th September, but only dead eggs were seen in examinations made in October, a survival period of about 249 days.

[to be continued.]

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Clovers and Trefoils in Queensland.

* C. T. WHITE, Government Botanist.

THE most important group of fodder herbs in the world's agriculture are the clovers and trefoils. A very marked increase in the clover and trefoil content of the pastures during the past couple of seasons has been evident to dairymen and pastoralists in South-eastern Queensland. This increase has been going on steadily but surely for a number of years, and a couple of good winters and springs recently accelerated the process, with the result that in many pastures during July and September clover is now the predominant plant, so much so that some pastoralists have become alarmed lest the clover become too dominant, choking out what little spring grasses and other fodders might be available.

In some localities it is the exact reverse, and farmers claim they have tried to establish clovers for years in the pasture without any result. Why this should be is generally difficult to say, but the application of superphosphate at the rate of one to two hundredweight per acre before or at the time of sowing should help considerably. Once even a small stand is obtained this should gradually increase as stock are ideal spreaders of these plants.

The question often asked is what is the difference between a clover and a trefoil. In older countries the terms are synonymous, and no distinction is drawn between them, but in Australia the term "clover" is more or less restricted to plants of the genus Trifolium, and trefoils to plants of the genus Medicago, and to a lesser extent to allied genera.

Clovers or trefoils are not distinguished from their allies by the leaves alone, but mainly by the pods which are enclosed in the calyx or in the corolla. The flowers are mostly in heads. In the trefoils or Medicagos the pods protrude from the calyx, and the corolla is always caducous, that is, it falls off soon after the full development of the flower. The flowers may be in heads, but more often are in short spikes or racemes.

The clovers are divisible into two groups, the perennial and annual sorts. The perennial sorts seen in Queensland are the White Clover (*Trifolium repens*), Red Clover (*Trifolium pratense*), Alsike Clover (*Trifolium hybridum*), Strawberry Clover (*Trifolium fragiferum*), and the Shearman's Clover (a variety of *Trifolium fragiferum*).

The dominant clover in most places is the ordinary White clover or White Dutch, and this still remains the premier pasture clover for South-eastern Queensland. Various strains have been imported from England, New Zealand, and elsewhere, but so far as I know these have not shown under Queensland conditions any improvement over the common local one. White Clover is a native of the British Isles and Central Europe, but is now widely dispersed, being the commonest clover in cultivation over all the warm temperate countries of the world.

Red clover has never been cultivated in Queensland to any extent, but recent trials show it to stand the climate remarkably well. It is a much larger plant than White Clover, and is not of a creeping, but of an upright habit. It possesses very hairy leaves and stems, and the flowers are reddish purple, being borne in fairly large heads. It is not a general

* In a broadcast from Radio Stations 4QG, Brisbane, and 4RK, Rockhampton, by courtesy of the Australian Broadcasting Commission.

pasture legume in the same way as White clover, but is essentially a clover for sowing in small areas, say 2 to 5 acres, either on its own or mixed with other winter grasses such as Prairie, Rye, Cocksfoot, and Phalaris grasses for grazing off. When sown by itself it is more apt to cause bloat than when mixed with grasses. Autumn is the recognised time for sowing, though I have seen (on the property of Mr. J. M. Newman, Caboolture) a crop sown as late as August, showing an excellent stand some fifteen months later, having gone right through the summer. It is a very short-lived perennial, and its life in Queensland would probably only be two to three years. Preventing seeding by cutting or judicious stocking will lengthen the life of the plants.

Alsike Clover is similar to White Clover in general appearance, but is easily distinguishable by its pink or red flowers. Odd specimens of what is apparently this clover have been received from Obi Obi. These are the only Queensland specimens I have seen, and it probably has little future in Queensland, as it is said to prefer colder climates, and according to Breakwell, one-time Government Agrostologist in New South Wales, is one of the first clovers to succumb rapidly on the approach of hot, dry, summer weather.

Strawberry and Shearman's Clover have been tried to a very limited extent in Queensland. Mr. A. Francis, of Kin Kin, sent me specimens of the former a year or two ago, with a report that it did well in the wetter parts of the district, favouring creek flats and banks, and growing well into the water. Dr. V. R. Wilson, who is experimenting with grasses and fodders at Brisbane and Yandina, informs me that Shearman's is doing well in both places. Both clovers are quite unsuited for dry situations, but have marked possibilities for the wet coastal parts of South-eastern Queensland. Shearman's Clover is the more vigorous of the two, and in New South Wales is said to grow quite well on slightly saline coastal flats. Little or no seed is set as a general rule, but both clovers are easily spread by cuttings or divisions.

Of annual clovers, the Cluster Clover (*Trifolium glomeratum*), the Woolly Clover (*Trifolium tomentosum*), the Hop Clovers (*Trifolium procumbens,* and *Trifolium dubium*), and the Haresfoot Clover (*Trifolium arvense*) are all established in Queensland, never sown, but coming up spontaneously. Of these the best is the Cluster Clover. Authorities speak well of this species in the other States, and it has been recommended for sowing during the autumn months. It does remarkably well in Queensland, and during the past two or three years, judging from samples received for identification, is very much on the increase. Where it has been abundant in some pastures, stock have been noticed to show marked preference for it.

The Woolly Clover is somewhat similar, but, I think, of less value. A number of specimens are received nearly every year for identification, but it is not nearly so common as the Cluster Clover. It is easily distinguished by the small globular heads borne in great abundance, and with individual flowers covered with short white cottony wool.

Trifolium procumbens and *Trifolium dubium* are two very closely allied species. The former is much larger in all its parts, and has many more flowers in the head. Both are known as Hop Clovers. They are very common in coastal Queensland, and have been much on the increase during the past few years, particularly the smaller one. They seem to be readily eaten by stock.

Haresfoot Clover is a very distinctive species, distinguished by having cylindrical flower heads, the individual flowers being small and pink. The corolla is covered with fine hairs, the whole appearance of the flower head resembling a small haresfoot, hence the local name. It is seen growing now and again on the Darling Downs and in the Granite Belt, but not in any great abundance. It is not regarded as having much value as a fodder.

Annual clovers not growing wild, but only growing under cultivated conditions in Queensland are Crimson Clover (*Trifolium incarnatum*), Subterranean Clover (*Trifolium subterraneum*), and Egyptian or Berseem Clover (*Trifolium alexandrinum*). The first of these, the Crimson Clover, is distinguished by its hairy stems and leaves, and red flowers. It is somewhat similar to Red Clover, but the flower heads are more narrow-cylindrical, and the plant is of annual duration.

I had received specimens from the cooler parts of the State at odd times, but last year received specimens from Mr. D. Kennedy, of Kilcoy, who has experimented with winter grasses and legumes, with a report that it had shown up the best of all the clovers he had tried. It apparently lasted well into the hot weather, as flowering specimens were received towards the end of November, and under date 23rd January, Mr. Kennedy wrote that it was just dying off.

Subterranean Clover is a native of Western and Southern Europe that plays no important part in agriculture in its native country, nor in North America, but in the Southern States of Australia has proved itself one of the most useful and important fodders ever introduced, especially for increasing the carrying capacity of second class country. From its natural range, one would expect it to grow under much the same conditions as the common Burr Trefoil, except that it would be more susceptible to heat, and this apparently is the case in Australia, and the reason why it has not succeeded in Queensland to the extent it has in the Southern States. It may yet, however, have a future in this State through the perpetuation of strains more suited to Queensland conditions, and that are gradually naturalised and increased.

Egyptian or Berseem Clover has been cultivated on the Darling Downs from time to time, and does fairly well. I have not seen it growing, nor have I received specimens for some years, so that it must have gone out of favour, probably for the reason that it is not suitable for grazing, but is mostly grown for hay. Where it will grow, generally speaking, lucerne does as well, and is much better for the purpose. The only slight advantage it may possess over lucerne is that it produces earlier winter feed, but it probably has not a future in Queensland.

The Medics or Trefoils can be divided into two groups—namely, those in which the pods are provided with spines, the other in which the pods are smooth and spineless. Of the burr-forming species three are naturalised in Queensland—namely, the common Burr Trefoil or Burr Medic (*Medicago denticulata*), the Woolly Burr Trefoil (*Medicago minima*), and the Toothed Medic (*Medicago laciniata*). All are annuals, and may start to grow any time from April to August, continuing into the spring months, dying off on the approach of hot weather. The most abundant and widely distributed is the common Burr Trefoil, and during the spring months in many places this is one of the commonest

fodders on parts of the Downs, Maranoa, and some other districts. In its green luscious state it is apt to bloat stock, though, generally speaking, stock prefer the plant when cut, wilted, or when it is dying off. When it has properly died off, about late October or November, stock greedily eat up the burrs, and these containing the seeds are in consequence very nutritious. The only disadvantage of the plant is that the burrs badly infest the belly wool of sheep, and on this account the value of the plant is minimised in purely sheep-raising areas, though on the whole its good qualities probably outweigh the bad.

The Woolly Burr Trefoil is much smaller in all its parts, and the leaves and stems are hairy, not smooth. Its properties are much the same as those of the common species, and it is very abundant on parts of the Darling Downs and Granite Belt.

The Toothed Medic is characterised by having the margins of the leaves cut by large irregular teeth. The pods are large and borne in great abundance. On the whole it comes up rather earlier than the other two species, and I have seen specimens one mass of nearly ripe pods as early as August. It is quite abundant in some parts of South America, and is there looked upon as a valuable fodder.

Of Medics or Trefoils with spineless, not burr-like, pods, the two commonest naturalised in Queensland are the Button Medic or Button Trefoil (*Medicago orbicularis*) and the Black Medic or Common English Trefoil (*Medicago lupulina*). The former is a very valuable species, coming up naturally every now and again on parts of the Darling Downs. The pods are flat with several spirals, and are somewhat button-like in appearance. Not being armed with hooks or spikes, they do not attach themselves to wool nor hair of animals, and so are not anything like so widely spread as the burr-bearing sorts. It is a species worth encouraging, and seed should be sown during the autumn months.

The Black Medic or Common English Trefoil is generally recognised as a perennial, though in Queensland, like a lot of European plants that become naturalised here, it is of annual character. It has generally been recommended for colder localities such as the Granite Belt, but seems much on the increase, being found as far north as the Atherton Tableland.

In conclusion, I might say that the Department is always anxious to receive specimens of legumes or pasture plants from farmers and pastoralists. Small numbered pieces in flower or pod should be sent and notes retained of the specimens or preferably duplicates kept similarly numbered, when names and reports on the value of the plants corresponding to numbers will be returned.

QUEENSLAND SHOW DATES.

July.

Proserpine, 3 and 4.
Kilcoy, 2 and 3.
Bowen, 8 and 9.
Townsville, 14 to 16.
Cleveland, 10 and 11.
Ayr, 10 and 11.
Rosewood, 10 and 11.
Nambour, 16 to 18.
Charters Towers, 21 and 23.
Cairns, 21 to 23.
Maleny, 23 and 24.
Atherton, 28 and 29.
Gatton, 29 and 30.
Caboolture 31 July and 1 August.

August.

Barcaldine, 4 and 5.
Pine Rivers, 7 and 8.
Royal National, 17 to 22.
Home Hill, 28 and 29.

September.

Tully, 11 and 12.
Innisfail, 18 and 19.
Malanda, 30 September and 1 October.
Southport, 26.
Imbil, 4 and 5.
Pomona, 11 and 12.
Beenleigh, 18 and 19.

Shade Trees.

PART I.

W. D. FRANCIS, Assistant Government Botanist.*

IT is not my intention to confine my remarks to the purely utilitarian aspect of trees. Even when trees are planted primarily as shelters for stock they exercise another influence. They contribute to the appearance of the farm or the home or the town where they grow. This effect of trees on appearances may be so far-reaching as to enhance the value of a farm or home by hundreds of pounds. Any homestead which is surrounded by trees of pleasing appearance and comfort-giving shade is clearly of higher monetary value than one in which the environment of the house is neglected. Until we come to think about them, many of us scarcely realise the part which trees play in our ordinary lives. In most cases trees have long lives. They often live much beyond the span of the average human life. So, from the earliest days of childhood's perception right through to old age, our eyes are accustomed to trees, unless, of course, we are unfortunate enough to live in a treeless land. Thus it is that trees are often taken, in the ordinary course, just as part of the landscape.

As trees have such an important influence on the farm, the home, and the town, we shall briefly consider some tree types. Side by side with this, reference will be made to the significance of these types. These considerations may be useful to those who are planning the cultivation of trees in the near future. They may help in the decision of the kind of trees to plant, whether native or exotic.

One can see the types of trees from other lands in parks and gardens. Or, when one has been abroad, generally excellent opportunities have presented themselves for seeing the kinds of trees growing in the countries visited. A few years ago, on a voyage to England, I noticed some of the types of trees growing in the countries at which we called. I shall briefly mention some of these impressions, although I am aware that many readers may have noticed the same things.

In Beautiful Colombo.

At Cocos Island, in the Indian Ocean, cocoanut palms are the chief feature of the vegetation. Like so many other palms, the cocoanut is remarkable for the elegant sweep of its long leaves. The impression it conveys is that of tropical luxuriance. This impression is an accurate one, for this palm does not flourish far from the tropics, a fact which is well exemplified on the Queensland coast. The cocoanut palm also dominates the view of Colombo from the harbour. But while driving about the streets of the town one is impressed by the number and variety of broad-leaved trees growing in the streets and around the bungalows of the European quarter. These beautiful trees contribute in a very large way to the charming effect of the setting of the bungalows. A fairly large percentage of these graceful and rest-giving trees belong to the legume family. While admiring these trees and their transforming effect it occurred to me that we have almost or quite equal opportunities for growing these types of trees in Brisbane.

A Treeless Land.

The next port of call, Aden, gives one a grim notion of a treeless land. Except for a small artificial park at the water's edge, the scarred,

* In a broadcast talk from Radio Stations 4QG, Brisbane, and 4RK, Rockhampton, by courtesy of the Australian Broadcasting Commission.

bold, rocky hills are treeless. In the fierce unrelenting glare of the tropical sun these rugged hills have a forbidding but wierdly impressive aspect.

Australian Gums at Gibraltar.

Upon entering the quaint little township of Gibraltar almost the first things one sees after leaving the pier are the gum trees in the small formal town square. So the Australian at Gibraltar very early comes into contact with trees of his own land.

Unter den Linden.

The chief thoroughfare of Berlin derives its name, Unter den Linden, from the double row of linden trees which grow along it. Perhaps my expectations conceived from the name Unter den Linden were too high. I was somewhat disappointed with the lindens. They looked rather small. However, it was winter time, and they were bare of leaves. The broad thoroughfare itself, however, is certainly impressive.

The Trees of the Old Country.

In England we see, in their own setting, the trees with which so many of our grandparents were familiar. With the exception of the beech forest specimens, most of the English trees are low set, bushy-headed types. Considered as shade trees they are certainly good examples, with their short stems and large heads of foliage. But to the appraising eye of the Queensland coastal timbergetter they would make no appeal, at least in the economic sense. Not only the timbergetter, but many other Australians, have become accustomed by their environment to trees with long, column-like, unbranched stems, carrying foliage high up in the air. It is the long stems of such trees which attracts the calculating sense of the timberman, as it promises many feet of millable timber.

However, the trees of the old homeland, such as the beech, the oak, and the elm, are types that are not readily forgotten by the immigrant. Through many centuries these kinds of trees have impressed themselves on the minds of British and European peoples. The beautiful English countryside derives much of its charm from these trees. So it is natural that those who cherish memories of their old homes beyond the sea might prefer to surround themselves with trees of the English and European type.

Even town and country people in Australia often have different ideas as to the types of trees which are desirable on the farm and around the home. In many of the towns exotic trees often figure largely in the prospect. Some of these exotic trees about towns are often useful shade trees, and add considerably to the pleasing appearance of the outlook.

The Charm of our Native Flora.

However, with those who have lived in the country for a very large proportion of their lives the conditions are different. Through many years of constant association with them, the forms of the native trees have become impressed upon the mind. Unlike the early immigrants from Britain, who found our trees weird and unfamiliar, the Australian country dweller mostly likes the trees with which he is surrounded. Actually, in many cases, the bushman's ideal of a tree has been moulded by his long experience out of doors. To him the Australian type of tree, in so far as it is characteristic, has become the most desirable of all.

Perhaps the most outstanding of all Australian trees are the gums or eucalypts, which are so familiar in most Australian bush lands. A fairly good example of a gum tree is furnished by the common blue gum. This tree is very common along many watercourses, such as the Brisbane River. It is also common on much of the flat land of coastal Queensland and New South Wales. At the base of the stem there is often some hard dark bark. The remainder of the stem, and all of the branches, are covered by a smooth pale bark. The foliage is pendent and graceful. Viewed in its natural setting, the whole effect of this tree is extremely attractive. As well, it is typical of very much of Australia's tree flora. The branching system of the blue gum, its pale smooth bark and narrow pendulous leaves, are all properties which are shared by a number of other very common and widely-distributed eucalypts.

The blue gum is a prominent feature of the famous Bega grasslands, situated in New South Wales towards the Victorian border. The rich pasture lands of the Bega district were exploited early in Australian settlement. They are well known for the quality of their dairy produce. Much of the Bega country is derived from a granitic soil. In contour it is gently undulating. Dotted about these beautiful slopes are many fine blue gum trees. The general effect is that of a pleasing well-kept park. Thus these unique park lands of the Bega district owe much of their charm and industrial utility to the native trees which grow on them.

Trees of the Queensland Jungle Lands.

Those who have lived in areas originally clothed with scrub or rain forest have become accustomed to the peculiar type of tree so prevalent in the rain forests. These trees are commonly seen in parts of the North Coast line. Their chief features are the very long unbranched stems, capped by a dense but not extensive foliage crown. These are extremely graceful types, but of only limited value as shade trees. Only very few of these rain-forest species will develop a long unbranched stem when grown in the open. The Queensland kauri pine is one of the exceptions. This handsome tree is a tall-growing kind, which produces a long stem in open situations. The hoop pine, another native species, makes a very decorative figure in open situations, and by its spire-like shape is well adapted to planting about a homestead for pleasing and formal effect. Its rather narrow shape precludes it from being an extensive shade provider.

Many of the scrub species make excellent shade trees when they are grown in the open. In areas of felled scrub, in which some of the tree stumps have not been killed by fire or exposure, these stumps often shoot and grow into trees again. In these instances the competition for light is no longer present, and the trees develop a spreading and dense foliage crown. In these partially burnt areas some magnificent specimens of scrub trees assuming the habit of open spaces are often seen. The special advantage of the scrub species as shade trees consists of the dense and dark-coloured foliage which they mostly possess. These trees mostly provide much better shelter from the sun and wind than the eucalypts or gum trees. Often they may not grow so quickly as the eucalypts, and in many cases they prefer better soil conditions. However, there are very few farms with soil conditions too impoverished to grow at least some species of the scrub trees. Although these trees grow to the best advantage in places with the rainfall approaching that of the coastal areas, some of them show themselves to be quite well adapted to fairly

dry areas. For example, one often sees the familiar white cedar as the commonest street tree in western towns with an annual rainfall as low as 20 inches.

Fodder and Shade Trees of the West.

In the western areas of the State there are also admirable and useful types of trees. These trees in many cases serve as fodder as well as shelter. Like the eucalypts and gum trees in their areas, the western trees are seen at their best in their own setting. As types of western trees, one can mention the kurrajong, the bottle tree, the wilga, the cypress pine, the bauhinias, and the emu apple. With the exception of the cypress pine, most of the western trees develop only a short stem and a fairly large head of foliage. In the wilga this foliage crown is often very dense and symmetrically rounded. The wilga is a beautiful tree. Its name has a pleasing sound, although it is reminiscent of the wild dark children who roamed the western plains and whom we have dispossessed.

[TO BE CONTINUED.]

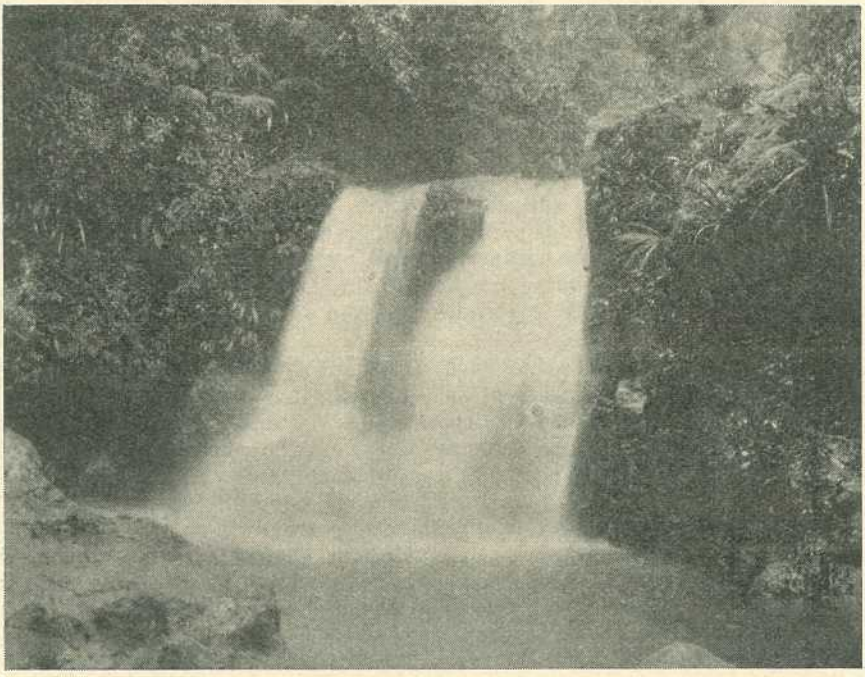


PLATE 33.

One of the many unnamed waterfalls in the Lower Coomera, near Binnaburra, Lamington National Park, Macpherson Range, Queensland.

THE VALUE OF GRASSLAND CULTIVATIONS IN COTTON ROTATIONS.

W. G. WELLS Director of Cotton Culture.

THE suitability of the newly broken up cultivations out of the original virgin state for profitable cotton production has been previously pointed out. The value of cultivations out of grasslands, as a whole, has also been studied carefully in recent years, and it would appear that substantial benefits are to be gained on most of the cotton soils of the State where cotton is grown in rotation with grasses of sufficient age of establishment.

Benefits Obtained from Grassland Cultivations.

The benefits that may be expected from growing cotton in rotation with grassland cultivations may be grouped under the general headings of increased yield per acre, improvement in quality of lint, and a reduction in the cost of production.

It has been ascertained in several seasons that new cultivations out of the original virgin state usually produce heavier yields of lint cotton than do adjacent cultivations on which crops of cotton have been grown for more than five years in succession. Gains varying from 50 to 735 lb. seed cotton per acre have been realised in experiments and also in demonstrations with farmers. It seems definite, therefore, that the newer cultivations on a wide range of soil types are more suitable for cotton production under the various climatic conditions that may be expected in the main cotton-growing districts of the State.

Experiments at the Cotton Research Station and results obtained by farmers indicate that if Rhodes grass is grown for a couple of seasons on the old cotton cultivations increased yields of cotton may also be expected during at least the first two crops grown following the ploughing of the Rhodes grass. This appears to hold true for either wet or dry seasons, if the cotton is planted in October and November. Later plantings than this may not realise any gain from the rotation, especially

on the softwood scrub soils which are usually of a rather high nitrate content, and therefore tend to promote rank growth of plant in late sown crops.

Some increase in yield may be obtained occasionally where cotton is planted following grassland that has resulted from an old cotton cultivation being allowed to revert back to grass. This practice is not recommended, however, for usually on the old cultivations in the first few seasons that they are not cultivated very heavy weed growth occurs before the native grasses become established sufficiently to smother most of the weeds. Such grasses are also of the rather quick-growing type, and therefore do not produce such a lasting beneficial effect as does a vigorous grower like Rhodes grass. In addition to this, the excessive growth of weeds in the first season after cultivation has ceased, infests the soil with such a seeding that there are always sufficient weeds to compete successfully with the grasses in following seasons. The subsequent weed growth amongst the cotton crops following the ploughing of the grass may thus be as heavy as where successive crops of cotton have been grown.

Indications have also been observed that the growing of cotton on the newer cultivations increases the chances of obtaining lint of higher quality than may be realised on adjacent older cultivations. In an experiment carried out at the Cotton Research Station in 1933-34 on two-year, five-year, and nine-year old cultivations there was a general tendency in five varieties, covering a wide range of types, with the exception of the least drought-resistant variety, to produce lint of better grade, less spot, and longer fibre on the newer cultivations. In the following season on the same soils, which were then in their third, sixth, and tenth year of cultivation for cotton, out of the virgin grassland condition no significant differences were observed in respect to the fibre characters just mentioned. The season was wet during the first half, but very dry in the second, which may possibly have accounted for the levelling influence. There was, however, a marked increase in percentage of lint obtained in favour of the three-year-old cultivation, as well as more lint per seed.

Reducing the Cost of Production.

Growing-cotton on the newer cultivations not only tends to reduce the cost of production through the increase of yield obtained in many seasons, but the actual cultural expenses are lessened by the reduction of the number of cultivations required to keep the fields clean in the first three or four seasons after they are brought under crop. Weed and grass growth is less and the surface does not compact with the occurrence of heavy storms, so it is not necessary to cultivate so often. Sufficient cultivations should be given, however, to keep down weed growth, particularly pig weed, for this will increase very quickly if allowed to seed, and will reduce appreciably the number of years free of high cultivation costs.

A rotation of three or four years of Rhodes grass and then cotton seems also to reduce cultivation costs, provided the seed bed is well harrowed before the cotton is planted and a further cross harrowing is given when the cotton seedlings are 3 to 4 inches tall. Growers have advised that where cotton is grown in rotation with Rhodes grass, and given early cultural treatment as just described, less cultivation is required than where cotton is grown on the old cultivations for several years in succession.

The Explanation of the Increase in Yields.

The explanation of the increase in yields obtained where cotton follows grassland may be bound up in several factors, but the outstanding ones seem to be that in the newly broken up grassland the ratio of carbon to nitrogen is more suitable for cotton production, there is less production of nitrate nitrogen, and there is better penetration of storm rains. The ratio of carbon to nitrogen in a soil has a very important effect on the fruit production of a plant, the favourable ratio varying with different crops. Cotton appears to be very sensitive to this factor, and under Queensland conditions requires a wide ratio. Carbon is the base product of organic matter, such as the roots and leaves of plants, grasses, &c. When organic matter is ploughed into the soil the various bacteria start the process of decomposition, and in the course of this work the plant food nitrogen is evolved as nitrate-nitrogen, the soluble form taken up by plant life. Cultivation and the further ploughings with each season's preparation of seed beds aerate the soil and thus provide suitable conditions for the continued decomposition of the organic matter until eventually it is depleted seriously—the rate depending to a large extent on the number of bacteria in the soil and the period of favourable temperatures and moistures experienced.

PLATE 34.

Sow Rhodes grass on the old fertile cotton cultivations. Excellent grazing will be provided for both horses and cattle—the protein content of the grass at hay stage being around 8 to 11 per cent. in the first two seasons of growth, while yields up to 2 tons of dry hay per acre may be realised. Two or three years' growth of Rhodes grass restores the state of the old cultivation sufficiently to allow of the production of profitable yields of cotton under conditions at all favourable.

Grasslands Have Low Nitrate Content.

The various grass crops are heavy feeders of nitrate-nitrogen, and usually in the cotton districts of this State soil samples taken in either virgin grassland or sown Rhodes grassland seldom yield more than a trace of nitrate-nitrogen unless in very fertile alluvial soils. With three or four successive seasons of cotton cultivation the nitrate content of the same soil, expressed as parts per million parts of soil, may rise most appreciably, depending on the time of season in which the samples are taken—the nitrate content usually being much higher in the cotton soils during the summer season November to March. The results obtained at

the Cotton Research Station in the midst of a very dry November in the 1935-36 season in a series of comparable soils illustrate nicely the effect of cultivation on an alluvial fertile clay loam, the samples being of the first 6 inches of soil, and the cultivations having four weeks' old cotton:—Grassland—trace; first year cultivation—seven parts of nitrate-nitrogen per million parts of soil; and eleven-year-old cultivation—13 p.p.m. In the same season, on other more fertile alluvial clay loam at the Cotton Station eleven-year-old cultivation, which had produced several crops of cotton and was in cotton for the fourth successive year, contained 22 p.p.m. in the first 6 inches at the same date, and two months later at midseason during optimum conditions reached around 40 p.p.m.

The Effect of a High Nitrate Content in Cotton Soils.

The effect of a high nitrate content in a soil, particularly the upper 6 inches of it, is to cause fairly rapid growth of plants if ample moisture is available. This is especially true of the cotton plant, and observations over several years have indicated that on old alluvial cultivations of high nitrate content there is always a tendency for the cotton plant to make rapid development, which may result in a rank growth, particularly if an insect attack destroys many of the flower buds or bolls just prior to a wet period. The flower buds and bolls utilise much of the uptake of nitrates, and when they are destroyed the nitrates stimulate a big growth of roots, which in turn effect a greater uptake of nitrates, thus causing the very rank development of plant often seen in wet seasons on old cultivations, especially where severe corn-ear worm attacks have been experienced. Such rank development seldom occurs in early planted cotton following grassland, for the lower nitrate content of such soils does not stimulate excessive growth. The result is that when the insect attack ceases, a new crop of squares is formed quickly if ample moisture is available.

Not only does the rapid increase of nitrates often have a detrimental effect on yield of the cotton plants, but the decomposition of the organic matter in the soil is hastened, which materially affects the physical condition, particularly the heavier clay types. In such soils organic matter is necessary to keep the fine clay particles from consolidating to such an extent that the surface layer of a cultivation sets into a nearly impervious condition following any hard, beating storms. Where successive crops of cotton are grown on the same site for several seasons this condition is reached in a few years, as is shown clearly in soil moisture determinations made in an experiment carried out at the Research Station to demonstrate this point. In the 1933-34 season a study of the rate of penetration of a continuous rain lasting over twenty-five hours and yielding 2·46 inches demonstrated that fifteen hours after the rain stopped, in a nine-year-old cultivation of a clay loam type on which mostly cotton had been grown, only 35 per cent. of the total precipitation had penetrated into the first 18 inches of soil, with most of the gain in the upper 6 inches. On a similar soil type in the first season of cultivation out of the virgin country condition 74 per cent. of the rain had penetrated into the first 18 inches of soil.

Conclusion.

It can thus be seen that farmers should grow their cotton crops in rotation with grassland. Where such a system is practised the crop is grown on soil which has a suitable carbon-nitrogen ratio for the

production of good yields of cotton and a physical condition that allows of the obtaining of a high degree of efficiency of penetration of even storm rains. In addition to these factors, the grassland rotation tends to suppress weed growth. The net result is the obtainment of an increased yield of lint per acre, an improvement of quality, and a marked reduction in cost of production, both through increased yield and lessened cultivation costs.

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

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

On Tuesday and Thursday of each week a ten minutes' talk, commencing at 7.5 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for July and August, 1936:—

SCHEDULE OF LECTURES

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

Thursday, 2nd July, 1936.—"Dategrowing in Queensland," Mr. H. J. Freeman, Senior Instructor in Fruit Culture.

Tuesday, 7th July, 1936.—"Interpretation of Labels attached to Stock Foods," Mr. R. A. Taylor, Inspector and Examiner, Fertilizers Branch.

Thursday, 9th July, 1936.—"The Giant Toad," Mr. A. F. Bell, M.Sc., Assistant Director, Bureau of Sugar Experiment Stations.

Tuesday, 14th July, 1936.—"Amended Regulations of the Dairy Produce Acts," Mr. G. B. Gallwey, Inspector of Accounts, Dairy Branch.

Thursday, 16th July, 1936.—"The Breeding of New Cane Varieties," Dr. H. W. Kerr, Director, Bureau of Sugar Experiment Stations.

Tuesday, 21st July, 1936.—"The Use of Drugs in the Treatment of Parasitic Worms," Dr. F. H. S. Roberts, Entomologist and Parasitologist.

Thursday, 23rd July, 1936.—"The Production of Choice Quality Cream," Mr. O. St. J. Kent, Dairy Research Laboratory.

Tuesday, 28th July, 1936.—"Fungi which Assist the Growth of Plants," Mr. H. E. Young, B.Sc.Agr., Assistant Plant Pathologist.

Thursday, 30th July, 1936.—"Herd Recording," Mr. L. Anderson, Dairy Instructor.

Tuesday, 4th August, 1936.—"A Plea for the Tree," Mr. J. F. F. Reid, Editor of Publications.

Thursday, 6th August, 1936.—"Timber Trees on the Farm," Mr. W. D. Francis, Assistant Botanist.

Tuesday, 11th August, 1936.—"Rotation of Crops." Mr. H. W. Ball, Assistant Experimentalist.

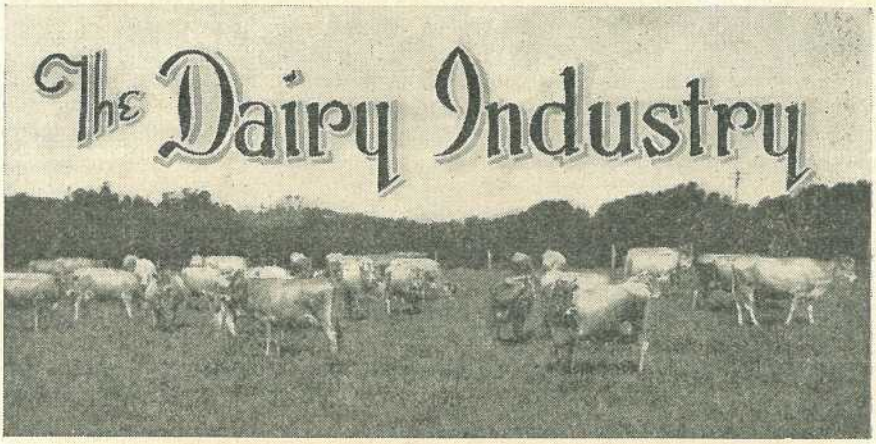
Thursday, 13th August, 1936.—"The Problem of Prices," Mr. J. F. F. Reid, Editor of Publications.

Tuesday, 18th August, 1936.—"Some Ways of the Soil," Mr. J. L. Foran, Analyst.

Thursday, 20th August, 1936.—"Some Plants Poisonous to Poultry and Pigs," Mr. C. T. White, Government Botanist.

Tuesday, 25th August, 1936.—"Our Debt to Denmark," Mr. J. F. F. Reid, Editor of Publications.

Thursday, 27th August, 1936.—"The Tick Fever of Cattle in Queensland," Mr. C. R. Mulhearn, B.V.Sc., Government Veterinary Surgeon.



THE ERADICATION OF TUBERCULOSIS FROM DAIRY HERDS.

J. C. J. MAUNDER, Government Veterinary Surgeon.*

TUBERCULOSIS of bovines is an infectious contagious disease caused by a germ, the tubercle bacillus, and transmissible from animals to man.

It is one if not the most serious of diseases found in dairy cattle, and unfortunately is one of the most common.

The importance of tuberculosis in dairy cattle can be discussed from two aspects—firstly, as it affects the health of live stock, and, secondly, the public health aspect.

In live stock tuberculosis is a chronic disease, usually fatal, and cannot as a rule be detected until infection has been present for some considerable period, sometimes years. Obviously, in considering methods of eradicating tuberculosis from a herd, accurate diagnosis of the disease is essential to ensure that in the process of eradication no diseased beasts are left behind and no animals free from tuberculosis culled from the herd. Several methods of diagnosis are available and are worthy of mention:—

1. The classical diagnostician in this country is the man who has been all his life among cattle and imagines he can pick them out easily from their general appearance, there being some supposed characteristics of a tubercular animal of which there can be no mistaking. Such method of diagnosis is dangerously unreliable, for many non-infected beasts will be labelled tuberculous while some tuberculous cattle will be passed over in the belief that they are healthy. When one realises that there are innumerable conditions that can make a beast unthrifty and miserable to behold, the danger of condemning all such as tubercular is obvious.
2. There are definite clinical signs of tuberculosis which, when observed in a beast, are sufficient justification for condemnation. Examples of such is the unthrifty beast affected with a

*From a broadcast talk from Radio Stations 4QG, Brisbane, and 4RK Rockhampton, by courtesy of the Australian Broadcasting Commission.

chronic, loose, or dirty cough, or the unthrifty beast showing definite enlargement of the lymphatic glands. It is necessary to point out that all enlargements of lymphatic glands are not tubercular, and this fact should be kept in mind when making a diagnosis. A typical symptom is the enlargement of the retro-pharyngeal lymphatic glands, exerting pressure on the larynx and causing the snoring respiration so often heard in infected herds. These are the commonest clinical signs, and time does not permit of further reference to this phase of the diagnosis.

3. Application of the tuberculin test is the most reliable method of diagnosing tuberculosis, and, at the present state of our knowledge of the disease, the one on which all eradication schemes must be based. For your information, I wish to state that the tuberculin test is applied with every confidence, and any beast reacting to the test can be slaughtered with the knowledge that it is infected.

4. Several laboratory methods of greater or lesser value may be employed in the diagnosis of the condition, these being in the nature of serological tests, use of experimental animals, and examination of excretions and milk samples from suspected animals. At present, however, such methods of diagnosis are of relatively small importance.

5. Indirect evidence often leads one to suspect the presence of tuberculosis in the dairy herd, and the most important example of this is the condemnation of pigs for tuberculosis. When a farmer rears pigs on his property, and on slaughter they are found to be tubercular, he may rest assured, in practically all cases, that tuberculosis exists in the dairy herd.

Having detected the presence of tuberculosis in the dairy herd by means of any one or more of the methods outlined, the next consideration is eradication and the establishment of tubercle-free herds.

Though much progress can undoubtedly be made towards the desired end by careful and regular examination of cattle, culling all beasts manifesting signs of tuberculosis, complete eradication, based on present knowledge, cannot be attained without the use of the tuberculin test.

Tubercle-free herds can be established by submitting the entire herd to the test, slaughter of reactors and disposal of the carcasses by burning, and retesting of the herd at least every twelve months.

The establishment of tubercle-free areas or shires is most desirable, and would entail the testing of all cattle within the area, destruction of reactors, and testing of all animals before introduction into the area.

It seems unlikely that wholesale testing of cattle and slaughter of reactors could be carried out on a voluntary basis, many farmers being unwilling and/or unable to risk the economic loss that would follow heavy condemnations. Therefore, it would appear that any comprehensive scheme for the eradication of tuberculosis must be founded on a basis of compulsory testing and compensation for diseased beasts.

I shall now discuss eradication of tuberculosis as it affects public health.

Human beings up to the age of about five years are definitely liable to infection with tuberculosis of bovine origin, and a certain percentage of tuberculosis in man has been found to be of bovine origin. The medium through which infection is transmitted is the milk, and in considering the problem of a pure milk supply the problem of eradication of tuberculosis from dairy herds supplying milk for human consumption is of paramount importance.

Many authorities consider that the only way to tackle this problem is by pasteurisation of all milk sold for human consumption, but it is rather significant that in all countries where pure milk supply is treated as a subject of major importance, active campaigns against tuberculosis are waged, and pasteurised milk is graded as a milk inferior to raw milk obtained from tubercle-free herds and produced under best conditions of sanitation and hygiene.

It is a mistake to think that pasteurised milk represents the ideal form of this necessary foodstuff, otherwise an ideal milk supply could be attained simply by pooling and pasteurising milk. Furthermore, pasteurisation fulfils its objective—namely, the destruction of all harmful bacterial contaminants—only so long as the processing is efficient.

There is no doubt that the most serious bacterial contaminants of milk, including tubercle bacilli, are not completely destroyed when the plant and/or supervision involved in the process of pasteurisation is inefficient. Therefore, where no official control or supervision of pasteurisation exists, the finished article may not be all that is claimed for it.

Do not imagine that I do not believe in pasteurisation of milk. I do, for it is a most valuable process whereby much milk that would otherwise be unfit for human consumption is rendered fit for human consumption, thereby avoiding economic loss.

I do, however, most definitely say that, in my opinion, raw milk produced from disease-free herds and handled under the best conditions of sanitation and hygiene is a definitely superior foodstuff to pasteurised milk produced from faulty herds and slovenly handled.

Unfortunately, it is most improbable that any great advances will be made towards our goal of the ideal milk supply until there exists a definite public demand for such a commodity. Producers of milk are conducting a business, and they cannot be expected to spend a great deal of money in an effort to put an improved article on the market unless the public is prepared to pay for it.

Therefore, it is up to the milk-consuming public to arouse itself from the present state of apathy, take an interest in the source of the milk supply, and create the demand for the article that can and should be supplied.

Just so long as the public fails to take an interest in pure milk and what it means, then just so long shall the efforts of science and legislation fail to accomplish the ideal milk supply, produced from tubercle-free herds, bred from tubercle-free stock in areas or shires free from tuberculosis.

A talk on tuberculosis in cattle would, at the present time, be incomplete without some reference to the work of Spahlinger, and it may not be the dream of an idealist to visualise a future where eradication of tuberculosis is based on the culling of clinically affected animals,

the remainder being treated with protective or even curative doses of a vaccine prepared along the lines suggested by Spahlinger.

Unfortunately, even though it is possible that Spahlinger may be right and his critics wrong, much work remains to be done before his work could be applied in the realms of everyday practice.

Meanwhile, we must adhere to our powers of observation and the tuberculin test to eradicate tuberculosis from our dairy herds.

It is essential that we realise that the eradication of tuberculosis is necessary to protect the human population against the well-recognised danger of tuberculous milk and the farmer from economic loss; that tuberculosis is a contagious disease, and as the country progresses, leading to more intensive farming and the increased contact of larger numbers of cattle running on smaller areas, then shall the incidence of tuberculosis increase, and the sooner the problem of its eradication is tackled the greater is the possibility of preventing a difficult problem assuming the proportions of a colossal one.

SOME ASPECTS OF MALNUTRITION IN DAIRY COWS.

By J. C. J. MAUNDER, B.V.Sc.*

IN dealing with this subject, I do not propose to describe any diseases caused by or attributable to malnutrition. I shall give you no details of rations to be fed to avoid malnutrition, but will endeavour to awaken you to the realities of malnutrition, for as soon as the dairy farmer begins to realise that malnutrition is a live and real thing, then shall the time be ripe to deal with the problem in greater detail.

Malnutrition can be defined as the inability of the animal to derive the raw materials necessary for maintenance of health and milk production from the available food supply.

The majority of holdings on which dairying is practised in Queensland do not satisfy the complete requirements of the dairy cow, and it is therefore necessary to supplement the grazing with hand feeding, or, on the better class of country, grazing on supplementary fodder crops such as oats, lucerne, cultivated grasses, &c.

Dairying "off grass" can only be successfully practised on the very best of our scrub lands, and to attempt it elsewhere is merely to court disaster, or, at best, a life of hard work and stagnation.

To understand the fundamentals of its requirements, it is essential to appreciate the fact that the modern dairy cow is an animal far removed from its wild prototype, and as careful breeding and selection has evolved an animal to produce a milk supply far in advance of that which nature intended, and as this factor of milk production is accentuated, so then is the necessity for supplementary feeding increased.

Nature intended cattle to roam at will with ample opportunity for selective grazing; they bred but once a year, and produced only sufficient milk to rear one calf. The modern dairy cow is confined to small areas, is expected to breed at any time of the year, having a regular oestrus cycle of approximately three weeks, and has to produce an amount of milk enormously greater than that necessary to rear a calf.

* In a broadcast talk from Radio Station 4QG Brisbane and 4RK Rockhampton.

It must be obvious that something far beyond the provision of natural pasture is essential to enable this modern dairy cow to perform the functions expected of her, and there is not the slightest doubt that the failure on the part of the farmer to recognise this state of affairs has paved the way for many of the troubles that beset stock to-day.

Let us consider, briefly, the requirements of a dairy cow.

Firstly, food stuffs must supply the energy necessary for the performance of all the vital functions, and this energy is, to a large extent, supplied by the grasses consumed in ordinary grazing.

To build up the tissues and to replace wear and tear, proteins are necessary, and, because of the additional protein requirements of the dairy cow to maintain the almost constant figure in the milk secreted, special efforts must be made to supply proteins in addition to that available in ordinary pasture plants.

A minimum mineral content of food stuffs is essential to maintain vital functions, and an additional supply of minerals is necessary to satisfy excessive demands of milk secretion and reproduction.

In determining a suitable ration to be fed to a dairy herd, it is not advisable to decide on a definite ration—so many pounds of this and so many pounds of that—rather decide on a basal ration, varying it according to the prevailing climatic and pastoral conditions, and amount of milk produced by the animal.

Where ample grazing is available, it would be unsound to feed large amounts of bulky fodders, chaff, hay, silage, &c. Protein concentrates are indicated such as the various meals, linseed meal, cotton seed meal, maize meal, cocoanut oil cake, plus small amounts of bulky food.

On the other hand, where grazing is poor, for example during winter, the ration must contain larger amounts of the bulky fodders necessary to distend the digestive tract, compensating for the defective grazing. In cold weather, with great loss of body heat, extra feed is needed to make good this loss and maintain body heat. This factor of additional feed to maintain body heat is a strong point in favour of rugging cattle in hard winters, the amount of feed thereby saved will amply repay the monetary outlay involved.

The mineral ration should remain constant throughout the season, varying only for individual cows according to the milk produced, as all our pastures tend to be deficient in essential minerals, particularly lime and phosphoric acid, irrespective of seasonal conditions.

With reference to minerals and the dairy cow, if you are to understand the particular requirements you must appreciate the following facts.

The percentage of minerals present in the milk secreted is almost constant. Take two similar cows producing equal amount of milk of equal quality, one getting a full mineral ration and the other a low mineral ration. Notwithstanding the difference in minerals supplied, the actual amount of minerals being secreted daily in the milk is approximately the same in both animals. Where then does the mineral content of the milk come from in the case of the cow receiving a low mineral ration; it is actually derived from the reserves stored in the tissues of the animal. It has been shown in one particular case, that a cow was secreting in the milk just five times the amount of lime present in the daily ration.

It is easy to imagine to what extent this animal's lime reserve would be drawn upon throughout the lactation period. This sort of thing cannot go on, and the inevitable happens in the fundamental breakdown of the animal, manifested by one or more of the particular conditions peculiar to dairy cattle.

I assure you, that even on the best of country where supplementary feeding has not been necessary, the feeding of minerals must be practised if the maximum efficiency is to be obtained.

The most important function of the dairy cow is that of reproduction, and if a cow fails in this obligation, she no longer becomes profitable, and must be culled.

Undoubtedly, a great economical loss is represented by the large number of dairy cows affected with temporary or permanent sterility. Remember my remarks pointing out the difference between the reproductive obligations of the undomesticated cow and those of our modern dairy cow, and you must realise that some particular attention is necessary if the unnatural demands of reproduction are to be fulfilled.

Undoubtedly many of the problems of sterility are directly associated with malnutrition, and the more readily the problem of malnutrition and its relation to regular reproduction is appreciated, the more successfully are farmers likely to combat sterility.

My final reference is to dry stock—remember that although the dry cow is not producing any milk, she is providing or attempting to provide sufficient nutrition to an embryo calf in the final stages of its uterine life, and considerable demands are therefore made on the maternal reserves.

I ask, therefore, that the dry cows receive the attention that is their due, when the problem of malnutrition is receiving the consideration that is essential for the successful practise of dairy farming.

OFF FLAVOURS OF MILK AND CREAM.

E. B. RICE, Dairy Research Laboratory.

THE flavour of milk and cream may be influenced by any pathological or abnormal physiological condition of the animal itself.

Mammitis Milk.

Disturbances of the udder causing inflammation, referred to as mammitis or garget, usually give a salty taste to the milk. The causative bacteria often prevent the normal souring of the cream separated from such milk, and it acquires a disagreeable flavour. Mammitis milk is also undesirable for cheese-making, owing to its slow coagulation with rennet.

Colostrum Milk.

The milk from cows for the first week after parturition, known as the colostrum, has a bitter taste and a strong odour, and is sometimes classed by graders as unclean, the term meaning that it does not possess the desirable taste of normal, cleanly produced milk. The cream from the colostrum also has a sickly, albuminous flavour, and the blending of it with other cream results in the whole delivery being graded lower

than choice quality by the factory. Colostrum is also quite unfit for human consumption or for cheese-making purposes. The protein lactoglobulin, which is present to the extent of only 0.3 per cent. in normal milk, varies in the colostrum from 16.0 per cent. immediately after calving, to 3.0 per cent. seventy-two hours later, and only reaches the usual amount in the milk after about seven days. It is because of the clotting of this protein upon heating that colostrum milk cannot be boiled. The function of the colostrum is of the utmost importance for the welfare of the calf during the first days of its existence, acting as a protection against certain bacterial invasions which might otherwise prove fatal.

Effect of Period of Lactation.

Milk from cows late in the lactation period possesses a bitter or salty taste, which is due to the effect of the salt content of the milk not being masked by the relatively low percentage of milk sugar at this stage. Similarly, owing to a drop in the sugar content, and a rise in the salt ratio, milk produced during a prolonged period of drought may be salty in taste.

Rancid Milk.

Certain animals habitually yield milk which turns rancid. As the principle causing the rancidty attacks the fat of any other milk with which that from affected cows is mixed, it is sometimes found necessary in countries where milk is produced for critical local markets, to remove such animals from the herd. Pasteurisation arrests the active principle, but this is hardly practicable or economical under the ordinary circumstances in which milk is handled.

Absorbed Flavours of Milk and Cream.

Milk fat, in common with other fats, but to a more marked extent, will readily absorb odours from its surroundings. Among the various sources of these flavours, the following are the more common.

Disinfectant Flavours.

Chemical odours, chief amongst which are the flavours derived from the use of strongly smelling carbolic disinfectants, about the dairy or for cleaning the animals' udders often taint the cream supply. Where a disinfectant is required for cleaning utensils or washing the udders, the chlorine compounds, such as bleaching powder, are more serviceable, for in addition to possessing a strong germicidal action, they will not leave any taint if made up in the proper strength. A dilute solution of condy's fluid is another useful and popular disinfectant for cleaning cows' udders before milking.

Other Common Absorbed Taints.

Fume or gasoline flavours in milk and cream arise frequently from the exhaust of a separator engine blowing back into the separator room. Odours of kerosene, petrol, paint, or the smoke from the fire under the dairy boiler, are sometimes encountered.

Musty or mouldy flavours, caused through storing cream in ill-ventilated, damp cellars, were of common occurrence some years ago, but are practically unknown nowadays.

The storage of cream, butter, or other milk products near fish, bacon, or any other odiferous foods in the home ice chest, frequently leads to spoilage by the absorption of the odour from the surroundings.

Tobacco Fertilizer Trials.

Subjoined is a report on tobacco fertilizer trials conducted in North Queensland during the 1934-35 *season by Mr. W. J. Cartmill, B.Sc., Bureau of Tropical Agriculture, Department of Agriculture and Stock.*

FOLLOWING on the work initiated during the 1933-34 season in the Mareeba district of conducting a series of fertilizer trials laid out on modern plans which permit of a statistical analysis of the results the scope of the work was extended, and a number of trials was conducted in the principal tobacco districts of the State. An effort was made to establish trials on all the principal soil types in each district. These districts comprised the Cairns hinterland (Mareeba and Dimbulah), Woodstock, Charters Towers, Bowen, Mackay, and Miriam Vale. Owing to the droughty conditions which prevailed in the Woodstock and Bowen districts until late in the season, and the lengthy intervals of hot weather between the subsequent falls of rain, it was found impracticable to establish the trial satisfactorily in these two districts. In the other northern districts dry conditions obtained for a time in the early part of the season, but with the advent of more favourable conditions later the trials were established satisfactorily.

Practically all the tobacco grown in this State is of the bright flue-cured variety such as is most easily produced on infertile sandy soils. Consequently the soils of the tobacco districts do not show a wide variation in type. They are mostly infertile sands of various textures and colours, and are mostly granitic in origin. The average depth of the top soil is about 10 inches; the subsoil in some cases is of considerable depth, while in others decomposed rock is struck at fairly shallow depth. Where alluvial sands occur they are in favour; as a rule they are medium to dark grey, fine-textured sands of good depth.

In the series of trials conducted during the past season concentration was made on phosphate trials. Most of our tobacco soils are very deficient in, in fact almost devoid of this plant food. As was indicated in the first series of trials (1933-34 season) on these soils, a very pronounced response is given to applications of phosphate, while practically no growth is made, other things being equal, when no phosphate is applied.

In planning trials of this nature one has to keep in mind that, in the case of tobacco, a balance between quantity and quality is the aim. Phosphates exert a pronounced influence on both, but the minimum amount required to produce optimum growth may not be that required for optimum quality. So that whereas no significant differences in yield might be obtained with applications of different quantities of, say, superphosphate, the differences in the quality of the resultant leaf might be pronounced. These expectations have been borne out in the results of these trials.

The trials were laid out on a uniform plan of a 5 x 5 Latin square of 1/50-acre plots, making the total area of each trial $\frac{1}{2}$ acre. The five treatments contained equal quantities of nitrogen and of potash, but different quantities of phosphate, and were as follows:—

Nitrogen.

This was applied to all plots at the rate of 30 lb. per acre of nitrogen, of which one-half was derived from dried blood at the rate

of 120 lb. per acre, and one-half from nitrate of soda at the rate of 97·5 lb. per acre.

Potash.

This was applied to all plots at the rate of 30 lb. per acre of K_2O derived from 62·5 lb. per acre of sulphate of potash.

Phosphate.

Treatment No. 1.—1P—25 lb. per acre of P_2O_5 derived from 125 lb. per acre of superphosphate.

Treatment No. 2.—2P—50 lb. per acre of P_2O_5 derived from 250 lb. per acre of superphosphate.

Treatment No. 3.—3P—75 lb. per acre of P_2O_5 derived from 375 lb. per acre of superphosphate.

Treatment No. 4.—4P—100 lb. per acre of P_2O_5 derived from 500 lb. per acre of superphosphate.

Treatment No. 5.—5P—125 lb. per acre of P_2O_5 derived from 625 lb. per acre of superphosphate.

The quantities of nitrogen and potash used were considered to be liberal but not excessive amounts as judged by experience of the requirements of most of our tobacco soils. The phosphoric acid was supplied as superphosphate, which is considered to be the most suitable form of phosphate to use for tobacco in these soils. It is hoped, nevertheless, to conduct a series of trials at a later date to determine the relative merits of phosphate applied in different forms.

The quantity of nitrogen used was determined on after a consideration of several factors, and it was finally considered that the quantity used would be likely to give the most satisfactory balance between yield and quality on most of the plots, the soils in nearly all cases being infertile sands. It is conceivable that, by using a smaller quantity of nitrogen, the proportion of bright leaf from the plots treated with the lower quantities of phosphate would have been increased, but the average yields probably would have been lowered, though the same relative differences in yield would most likely have persisted. Experience of the crops produced on the sandy soils as occur in most of our tobacco-producing districts shows that as a rule with small applications of nitrogen such as are added to the soil with moderate applications of the proprietary mixtures that are mostly used the resultant yield is not high, and the leaf, though bright, is usually small in size and often lacks body and texture, and, all things considered, returns but a meagre profit to the grower. The tendency now is to aim at producing a higher yield of good quality bright mahogany leaf and, consequently, less of the thin-bodied yellow (lemon-coloured) leaf. As well as a change in cultural operations, greater quantities of fertilizer are being used, and the practice seems to be a profitable one.

The quantities of the various fertilizers required for a plot were weighed and mixed together a short time prior to their application in the field. To ensure a uniform application the quantity required for each row was measured out in cylindrical vessels. Before applying the fertilizer the soil was partly ridged up. The fertilizer was then distributed by hand in a broad strip along the middle of the ridges and subsequently covered by and mixed with the soil by further ridging. The planting out was done by hand. The usual cultural practices as are ordinarily adopted by the grower were used during the growth of the crop.

The season just past is one that will go on record as being extremely dry in all the northern districts. Though the total rainfall for the season in the various districts is seemingly sufficient for the requirements of the crop it did not come at times when it would have been of most benefit, nor did it always fall in advantageous amounts. Transplanting operations were considerably handicapped by the absence of rain in the early part of the season. At that time, too, a moderate precipitation would usually be followed by a relatively lengthy period of hot, dry weather, which adversely affected the growth of the plants. In most districts the latter part of the season showed an improvement in conditions, but in one or two areas unfavourable conditions were maintained. In these areas the leaf either broke down physiologically or could not be cured to even a fair degree of quality.

In laying out trials on the modern plot arrangements and in all subsequent operations the greatest care has to be taken to ensure that reliance can be placed on the results obtained. It is essential to aim at getting significant differences between treatments; and these are not easily obtained when the experimental error is relatively large. In trials such as of phosphate or of potash a difference in fertilizer treatment may not cause any significant difference in yield, though the effect on quality may be marked. In such cases a statistical analysis of the quality of the leaf from the various plots would be desirable, but under the present arrangement of conducting these trials such detailed work is not practicable.

Causes that are difficult to control tend to increase the experimental error and so lessen the chances of obtaining significant differences. Chief amongst these are the depredations of insect pests and diseases which impair the growth and sometimes upset an even stand of plants. The weather plays a dominant part in determining yield and quality of leaf, and consequently the precision of an experiment is largely influenced by it. In this series of trials the stem borer was the greatest menace. In the northern districts, particularly, this pest was very severe, scarcely a plant escaping infestation. Its depredations were rendered doubly severe by being coupled with dry and hot weather conditions for a comparatively long period during the early stages of growth of the plants, so that they had little chance of making headway against the ravages of the pest. It was considered inadvisable at such times to use the practice frequently adopted of cutting back the plant and allowing a sucker to develop, for under the arid conditions prevailing there was a danger of bringing about the total destruction of the plant. However, with the advent of more favourable weather conditions later the plants made good development. Nevertheless, the delay in growth occasioned by this pest must reasonably be considered to have an adverse effect upon the yield and quality of the resultant crops.

One can understand, then, that because of pests and diseases and the vagaries of the weather the tobacco experimentalist receives many a setback, and that quite a few experiments are spoilt despite all care and attention. Deductions are drawn only from the most reliable results; and to be sure of these it is necessary to conduct a fairly large number of trials and to give each one proper care and attention. The co-operation of farmers is essential, and the public spirit of those farmers who have co-operated with this Department in this experimental work is much appreciated.

In selecting sites for these plots we aimed at choosing only land that had been cropped with tobacco and that had been allowed to lie fallow or that had not been treated with fertilizers for a year or two previous to the trials, as, for obvious reasons, such land would be in the best state for experimental work. However, most of our tobacco areas have been developed only in recent years, and some farmers have only recently attained a cleared area in excess of their annual requirements, so that the sites sought after could not in all cases be obtained. As the soils are mostly infertile sands, virgin areas were considered the best alternatives.

That the proper use of fertilizers is essential to produce tobacco of good quality is fundamental; and the best and most reliable way of determining the requirements of any particular soil is by conducting a series of experiments based on sound scientific principles, so that the degree of accuracy of the experiment can be estimated. At times it is found that the experimental error is too large to enable conclusions to be drawn from the results of the experiment. In such cases the causes are usually outside the control of the operator. A percentage of the experiments can be expected always to yield inconclusive results, and to make up for these there is a need to increase the numbr of plots. If only one plot is established on each soil type it is to be expected that the information sought after concerning a type will sometimes not be obtained in the particular series of trials. It is also desirable to confirm results by duplicating plots. At least the experiment on each soil type should be duplicated, having the plots on locations not in close proximity. Then, too, only a small number of problems can be dealt with in one series of trials. A further increase in the number of trials would enable a larger number of problems to be dealt with and, consequently, final conclusions to be arrived at earlier. However, as the trials are managed at present, it would be impracticable to give an increased number of plots the attention they would require. Extra labour would have to be made available—labour that we could rely upon obtaining whenever it was required. What suggests itself as likely to be the most satisfactory arrangement would be to enlist the co-operation of tobacco associations and farmers, and obtain the necessary labour from the farmers themselves, preferably from the farms on which experiments are being conducted. Some basis of remuneration for the little extra care and attention it would be required to give to the plots could be decided upon. With some such scheme in operation we could hope to achieve more in a shorter time than what is likely under the present working arrangements.

The conducting of a series of green manurial trials in conjunction with these fertilizer trials is a matter which should be kept in mind. Most farmers appreciate the importance of green manures and grow some crop for this purpose. However, it would be an advantage if the relative merits of various crops were determined by experiments.

It is considered important that a number of laboratory investigations relative to these trials should be carried out also. Such investigations would probably be of considerable assistance in the interpretation of the results of field observations. Data relating to the hydrogen-ion concentration of the soils, their varying nitrate content, the carbon-nitrogen ratios, and moisture determinations should yield useful information.

Discussion and Interpretation of Results.

An examination of the results of the trials indicates that the higher applications of superphosphate have significantly increased the yield over that of the lower applications in several cases. The tendency is for the red and brown soils to show an increase in yield for applications of up to 75 lb. P_2O_5 (375 lb. superphosphate) per acre; beyond 75 lb. increases in yield are shown in some cases, but they are not significant.

The grey and light-coloured sands are not uniform in their behaviour. In some cases there is an increase in yield up to 75 lb. P_2O_5 per acre; while in others there is no further increase beyond 50 lb. P_2O_5 per acre.

The yields from the plots are in most cases fairly high. There is no doubt that the so-called dry season contributed somewhat to this result.

The quality of the leaf generally was good; nearly all of it could be classified amongst the various grades of bright mahogany. However, the superior quality of the leaf from the higher applications of superphosphate compared with that of the lower applications was a feature of the trials. Leaf from No. 1 treatment (25 lb. P_2O_5) invariably contained a smaller percentage of bright leaf than leaf from the other treatments, and was inferior in general qualities. Leaf from No. 2 treatment (50 lb. P_2O_5) showed an improvement on the former, but in most cases it was evident that a still further improvement was shown, in colour particularly, by the leaf from treatments 3, 4, and 5, representing 75 lb., 100 lb., and 125 lb., respectively, of P_2O_5 per acre. Between these there was not always a marked difference discernible by an examination of the bulks, but in some cases where the leaf was graded in detail it was found that treatments 4 and 5 each contained a higher percentage than treatment 3 of the higher-grade leaf. It was noticed that this further improvement was manifested particularly by leaf grown on red soil.

Yield and quality, therefore, show a similar correlation in respect of the amount of phosphoric acid supplied. Quality improves with increasing yield, so that when phosphoric acid is made the limiting factor the plant must have a supply of this sufficient to enable it to reach maximum development before the best qualities of the leaf are exhibited. However, it is noticed that a further improvement in quality is effected when the amount of phosphoric acid supplied is somewhat in excess of that required for maximum growth.

Assuming that sufficient potash is supplied for the normal requirements of the plant and that greater quantities do not materially affect the quality of the leaf, the indications of these trials are that, with nitrogen supplied at the rate of 30 lb. per acre in a mixture of equal parts, nitrogen for nitrogen, of s. nitrate and blood, the minimum of phosphoric acid for best results varies a little with the soil type, being less for most of the grey and light-coloured sands than for the red sands; however, in most cases 75 lb. P_2O_5 seems to be a fair average of the minimum requirements, but a larger quantity, especially on the highly-coloured soils, is beneficial. It can be stated, therefore, that a fertilizer supplying at least 80 lb. per acre of phosphoric acid should be used, while in the case of the red soils up to 90 lb. might be found more beneficial. Considering the fertilizer 4-12-6, which is the Departmental formula, it would appear that a good balance between yield and quality should be obtained on the light, infertile, sandy soils if

this is used at the rate of 700 to 750 lb. per acre. On the same basis a fertilizer of the 3-8-3 formula would require to be used at the rate of 1,000 lb. per acre. These applications are higher than most farmers have been using in the past.

Of course it is not possible to deduce from one series of experiments what fertilizers are most likely to give the best results. The experiments must be carried on over a period of years. Nevertheless, useful indications are often given from which recommendations can be made. Eventually one should be able to advise on the most economical management of the various soils.

In cases where it was found to be practicable the leaf from each of the five treatments was graded in detail. Information on the prices received for the various grades will be obtained later, and from these prices some indication of the economic values of the different fertilizer treatments can probably be deduced.

RAINFALL RECORD OF MAREEBA DISTRICT.

Month.	1934.		1935.	
	Points.	Average.	Points.	No. of Wet Days.
January	1,350	948	373	8
February	1,397	737	502*	7
March	1,451	696	855*	10
April	267	272	49	5
May	62	60	271	5
June	101	50	5	1
July	29	31	..	..
August	4	16	..	..
September	34	19	..	..
October	15	58	..	..
November	239	125	..	..
December	28	439	..	..

* From 10 to 12 inches fall over a period of four days from February 27th—March 2nd.

RAINFALL MACKAY AND MIRIAM VALE DISTRICTS.

1934–35.	Mackay.		Miriam Vale.	
	Points.	Average.	Points.	Average.
November	338	299	763	285
December	207	729	635	586
January	434	1,448	847	989
February	1,659	1,139	580	883
March	520	1,181	202	486
April	317	1,239	295	334
May	1,080	371	204	203
June	68	265	27	285

Though affected a little early in growth by stem borers the plants subsequently made good, even growth on all plots. The leaf cured well, was, in general, of good size, body, texture, and colour. The leaf was graded, but details of prices received are not yet to hand.

TOBACCO EXPERIMENTAL PLOTS.

BOUNDY BROS., DIMBULAH.

Variety.—Cash.
Planted.—December.
Harvested.—May-June.
Soil.—Light pink, gravelly sand.
Subsoil.—Light red, sandy.

YIELDS :—Lb. of cured leaf per 1/50-acre plots.

2P 20·0	5P 23·1	4P 19·5	1P 20·8	3P 20·9
1P 17·4	4P 22·6	5P 20·2	3P 21·1	2P 18·3
3P 19·3	1P 15·8	2P 20·0	4P 23·6	5P 25·0
4P 18·9	2P 16·5	3P 22·0	5P 21·6	1P 17·9
5P 20·4	3P 23·7	1P 17·2	2P 19·9	4P 24·5

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	4	10·73	..	..
Columns	4	18·37	..	..
Treatments	4	72·80	18·200	1·4507
Errors	12	45·38	3·782	·6651
Total	24	147·28	..	..

Standard error (5 plots) = $\sqrt{3{,}782 \times 5}$
= 4·3
= 4·2 % of mean yield.

SUMMARY OF YIELDS.

Treatments.	1P	2P	3P	4P	5P
Yield (cured leaf), lb per acre	891	947	1,070	1,091	1,103
Cured leaf, percentage mean yield	87·3	92·8	104·9	106·9	108·1

Discussion.

The yields from plots with applications of superphosphate of 375 lb. per acre (treatment 3) or greater are significantly greater than those from plots with lower applications. Applications greater than 375 lb. superphosphate per acre have caused no further significant increases.

SHAW AND O'BRIEN, DIMBULAH.

Variety.—Hickory Pryor.
Planted.—Fourth week in January.
Harvested.—June-July.
Soil.—Pink, sandy.
Subsoil.—Light red, sandy.

The quality of the leaf from this plot was spoilt by adverse seasonal conditions. The rainfall over the section of country where this plot was located was sparse and not well distributed. Though the plants made good growth the leaf broke down physiologically before it was mature, and it could not be cured to a good degree of quality.

YIELDS :—Lb. cured leaf per 1/50-acre plots.

2P 19·6	5P 23·6	4P 20·3	1P 22·9	3P 24·4
1P 19·6	4P 21·0	5P 19·6	3P 22·4	2P 21·4
3P 22·1	1P 21·0	2P 19·7	4P 19·4	5P 21·9
4P 20·3	2P 23·2	3P 21·9	5P 22·1	1P 19·7
5P 20·6	3P 19·1	1P 19·0	2P 20·8	4P 25·3

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	4	6·67	..	..
Columns	4	19·12	..	..
Treatments	4	6·90	1·725	..
Errors	12	37·95	3·162	..
Total	24	70·64	..	..

SUMMARY OF YIELDS.

Treatments.	1P	2P	3P	4P	5P
Yield (cured leaf), lb. per acre	1,022	1,047	1,099	1,063	1,078
Cured leaf, percentage mean yield	96·2	98·6	103·5	100·1	101·5

Discussion.

The effect of treatment is not significant in this trial.

GODFREY AND MAY, CHEWKO, MAREEBA.

Variety.—Cash.

Planted.—20th November, 1934.

Harvested.—March-April-May.

Soil.—Grey, sandy.

Subsoil.—Yellowish-grey, sandy.

This trial was originally designed for a 5 x 5 Latin square. However, the planting up of the block was not completed in one operation, and one range of plants was not satisfactorily established. Consequently it has been treated as a 5 x 4 randomised block.

YIELDS :—Lb. cured leaf per 1/50-acre plot.

N2PK 13·1	N5PK 13·4	N4PK 14·6	N1PK 11·9	N3PK 11·0
N1PK 8·1	N4PK 13·6	N5PK 11·9	N3PK 15·0	N2PK 14·1
N3PK 11·4	N1PK 8·3	N2PK 12·0	N4PK 12·9	N5PK 15·5
N4PK 12·8	N2PK 12·9	N3PK 12·8	N5PK 12·1	N1PK 10·3
A	B	C	D	E

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Blocks	3	1·86	0·62	..
Treatments	4	39·25	9·813	1·1419
Errors	12	30·16	2·513	0·4607
Total	19	71·27	..	..

Standard error (4 plots) $= \sqrt{2 \cdot 513 \times 4}$
$= 3 \cdot 2$
$= 6 \cdot 5$ % mean yield.

SUMMARY OF YIELDS.

Treatments.	1P	2P	3P	4P	5P
Yield (cured leaf), lb. per acre	483	651	628	674	661
Cured leaf, percentage mean yield	77·9	105·2	101·3	108·8	106·8

Discussion.

The yield from plots receiving treatment No. 2 (250 lb. superphosphate per acre) is significantly greater than the yield from those receiving the lower application of 125 lb. superphosphate per acre (treatment No. 1). Higher applications of superphosphate have made no further significant difference to the yield.

F. RAYMENT, CHEWKO, MAREEBA.

Variety.—Hickory Pryor.

Planted.—First week in December.

Harvested.—April-May-June.

Soil.—Grey, sandy.

Subsoil.—Brownish-yellow sand.

The plants on nearly all of the plots made good growth. The yields of some of the individual plots were unusually high. However, growth in patches was irregular, due partly to nematode infestation and partly to adverse location, which, no doubt, have interfered with the effect of treatment.

The quality of the leaf was good. Statistics of the various grades and prices received are not yet to hand.

YIELDS :—Lb. cured leaf per 1/50-acre plot.

2P 26·9	5P 31·8	4P 29·4	1P 28·3	3P 38·8
1P 25·9	4P 28·0	5P 28·0	3P 28·9	2P 37·4
3P 19·4	1P 22·5	2P 23·1	4P 30·0	5P 29·7
4P 24·5	2P 25·9	3P 21·8	5P 28·1	1P 27·0
5P 15·3	3P 18·0	1P 14·3	2P 19·6	4P 21·1

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	4	546·52	..	..
Columns	4	222·01	..	..
Treatments	4	34·30	8·575	1·0744
Errors	12	56·67	4·722	·7761
Total	24	859·50	..	..

SUMMARY OF YIELDS.

Treatments.	1P	2P	3P	4P	5P
Yield (cured leaf), lb. per acre	1,180	1,329	1,269	1,330	1,329
Cured leaf, percentage mean yield	91·7	103·2	98·6	103·3	103·3

Discussion.

There is a tendency towards increased yields from the higher applications of superphosphate, but on the analysis of variance the effect of treatment is not significant according to the "Z" test in the 5 per cent. table.

DICKIE AND BOWER, PADDY'S GREEN, MAREEBA.

Variety.—Cash.
Planted.—January (second week).
Harvested.—April-May-June.
Soil.—Red sandy.
Subsoil.—Red sandy.

For the first two months of growth the development of the plants on this trial was retarded by the dry conditions. Consequently, when the plants reached maturity the leaf was inclined to be thin in body. However, rain fell after two harvests had been made, and the remaining leaf improved considerably in body and texture. The resultant yields were higher than had been anticipated. The different applications of superphosphate have made no significant difference to the yields, though probably the dry conditions were not favourable for the manifestations of their full effects. The quality of the leaf was good. The leaf was graded in detail, treatments 4 and 5 showing greater percentages of high grade leaf than the other treatments.

YIELDS :—Lb. cured leaf per 1/50-acre plot.

2P 14·6	5P 16·1	4P 22·6	1P 15·6	3P 17·8
1P 10·6	4P 18·0	5P 20·9	3P 18·2	2P 19·3
3P 13·1	1P 19·6	2P 17·6	4P 16·3	5P 17·1
4P 16·5	2P 17·3	3P 19·8	5P 19·6	1P 20·2
5P 18·6	3P 19·1	1P 18·2	2P 18·9	4P 19·4

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	4	16·76	..	..
Columns	4	73·96	..	..
Treatments	4	10·21	2·55	..
Errors	12	53·29	4·44	..
Total	24	154·22	..	..

SUMMARY OF YIELDS.

Treatments.	1P	2P	3P	4P	5P
Yield (cured leaf), lb. per acre	842	877	880	928	923
Cured leaf, percentage mean yield	94·6	98·5	98·9	104·3	103·7

Discussion.

The effect of treatment is not significant in this trial.

T. CRAIG, MIRIAM VALE.

Variety.—Cash.

Planted.—29th and 30th November.

Harvested.—February-March.

Soil.—White coarse sand.

Subsoil.—White coarse sand and partly decomposed granite.

Wet conditions for seven or eight weeks after planting caused a rapid growth and early maturity. The colour and general qualities of the leaf were good, though the size was inclined to be small.

YIELDS :—Lb. cured leaf per 1/50-acre plot.

3P 9·4	2P 8·4	5P 10·6	1P 9·3	4P 9·6
1P 8·6	3P 9·1	4P 10·6	5P 12·2	2P 10·9
4P 11·1	5P 8·7	2P 11·6	3P 14·4	1P 10·4
5P 10·8	4P 11·4	1P 12·6	2P 17·9	3P 13·9
2P 14·1	1P 10·9	3P 16·3	4P 20·9	5P 16·6

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	4	129·334	..	..
Columns	4	77·834	..	..
Treatments	4	19·882	4·996	·8043
Errors	12	16·096	1·341	·1467
Total	24	243·146	..	..

Standard error (5 plots) $= \sqrt{1·341 \times 5}$
$= 2·6$
$= 4·3\%$ of mean yield.

SUMMARY OF YIELDS.

Treatments.	1P	2P	3P	4P	5P
Yield (cured leaf), lb. per acre	518	629	631	636	589
Cured leaf, percentage mean yield	86·2	104·7	105·1	105·9	98·1

Discussion.

The yield from plots receiving 250 lb. superphosphate per acre (No. 2) is significantly greater than the yield from the plots receiving the lower application of 125 lb. superphosphate per acre (No. 1).

Higher applications of superphosphate have made no further significant difference to the yield.

B. ANDERSON, MIRIAM VALE.

Variety.—Cash.

Planted.—1st and 2nd December.

Harvested.—February and March.

Soil.—White sand—coarse.

Subsoil.—White coarse sand with decomposed granite.

Rapid growth was brought on by wet conditions in December and January. The leaf had a tendency to mature early. The quality of the leaf was good, although in size it was not as large as can be expected by reason of a steadier growth of the plants.

YIELDS :—Lb. cured leaf per 1/50-acre plot.

3P 10·9	2P 11·4	5P 15·4	1P 10·7	4P 13·9
1P 10·1	3P 9·0	4P 15·1	5P 14·6	2P 11·2
4P 11·3	5P 15·9	2P 12·4	3P 12·1	1P 11·9
5P 14·6	4P 17·4	1P 9·7	2P 13·4	3P 17·0
2P 10·3	1P 13·3	3P 13·7	4P 15·5	5P 16·2

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	4	19·972	..	..
Columns	4	18·892	..	..
Treatments	4	66·960	16·740	1·4089
Errors	12	34·476	2·873	·5277
Total	24	140·300	..	..

Standard error (5 plots) $= \sqrt{2 \cdot 873 \times 5}$.
$= 3 \cdot 8$
$= 5 \cdot 8\%$ of mean yield.

SUMMARY OF YIELDS.

Treatments.	1P	2P	3P	4P	5P
Yield (cured leaf), lb. per acre	557	587	627	732	767
Cured leaf, percentage mean yield	85·2	89·8	95·9	111·9	117·3

Discussion.

There is a progressive increase in yields with increasing applications of superphosphate, but the difference in yields between consecutive treatments is not significant. However, the yields from treatments 4 and 5 are significantly greater than the yields from treatments 1 and 2.

R. J. AND C. A. ATHERTON, KOUMALA.

Variety.—Warne.

Planted.—27th and 28th December.

Harvested.—March-April.

Soil.—Light grey, fine textured sand.

Subsoil.—Light grey sand, with decomposed granite.

Good even growth was made in all plots. The leaf was not graded, but was reported to be of good quality generally.

YIELDS :—Lb. cured leaf per 1/50-acre plot.

4P 23·0	1P 17·0	5P 24·0	2P 23·3	3P 30·3
2P 22·8	5P 25·3	4P 25·8	3P 19·5	1P 22·0
1P 27·5	3P 30·0	2P 23·5	5P 27·8	4P 22·0
3P 27·0	2P 24·5	1P 21·5	4P 23·5	5P 20·0
5P 19·5	4P 27·5	3P 25·0	1P 18·5	2P 22·0

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	4	40·338	..	..
Columns	4	15·330	..	..
Treatments	4	68·226	17·056	·2670
Errors	12	161·272	13·439	·1478
Total	24	285·166	..	..

SUMMARY OF YIELDS.

Treatments.	1P	2P	3 P	4P	5P
Yield (cured leaf), lb. per acre	1,065	1,161	1,318	1,218	1,166
Cured leaf, percentage mean yield	89·8	97·9	111·1	102·7	98·3

Discussion.

There is a tendency for the results to be in accordance with those found in other trials—viz., an increased yield with the higher applications of superphosphate. Nevertheless, no deductions can be drawn as the effect of treatment is not significant.

J. STOKER, CHEWKO, MAREEBA.

Potash Trial.

The treatments used were as follows:—

Treatment No. 1.—1K.: 25 lb. per acre of sulphate of potash.—12 lb. per acre of K_2O.

Treatment No. 2.—2K.: 50 lb. per acre of sulphate of potash.—24 lb. per acre of K_2O.

Treatment No. 3.—3K.: 75 lb. per acre of sulphate of potash.—36 lb. per acre of K_2O.

Treatment No. 4.—4K.: 100 lb. per acre of sulphate of potash.—48 lb. per acre of K_2O.

Treatment No. 5.—5K.: 125 lb. per acre of sulphate of potash.—60 lb. per acre of K_2O.

In addition all plots received an application of nitrogen and phosphate as follows:—

Nitrogen equivalent to 30 lb. per acre of nitrogen, half of which was derived from dried blood at the rate of 120 lb. per acre, and half from nitrate of soda at the rate of 97·5 lb. per acre.

Phosphate equivalent to 80 lb. per acre of P_2O_5 derived from 400 lb. per acre of superphosphate.

Variety.—Cash.

Planted.—21st January.

Harvested.—May-June.

Soil.—Reddish-brown loamy sand.

Subsoil.—Red sandy.

A good even growth was obtained on all plots with the exception of one, a large part of which suffered from nematode infestation. The quality of all the leaf was good. No difference of any significance was discernible in the quality of the leaf from the different treatments on examination of the bulks. It was intended to have the leaf graded in detail, and smoking tests made on samples of it, but, unfortunately, owing to a misunderstanding, the leaf from the different treatments became mixed in the grading process. It is interesting to note that the different applications of potash have had no different effects upon the yields from the various plots. This accords with the results of the

previous season's trials. Though no marked difference between the quality of the leaf from the different treatments was observed, it is possible that smoking tests on the leaf would have produced evidence of differences.

It is intended to conduct a series of trials with potash at a later date with the endeavour of determining the quantity required to bring out the best qualities of the leaf.

YIELDS :—Lb. cured leaf from 1/50-acre plot.

2K 21·7	5K 25·3	4K 25·3	1K 21·9	3K 22·1
1K 24·1	4K 24·8	5K 24·4	3K 23·1	2K 21·9
3K 24·4	1K 25·2	2K 24·6	4K 22·1	5K 24·0
4K 25·1	2K 29·1	3K 20·6	5K 17·3	1K 22·9
5K 24·1	3K 27·9	1K 26·7	2K 18·4	4K 26·1

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares	Mean Square.	½ loge (Mean Square).
Rows	4	8·478	..	..
Columns	4	89·906	..	..
Treatments	4	9·758	2·440	..
Errors	12	61·404	5·117	..
Total	24	169·546	..	..

SUMMARY OF YIELDS.

Treatments.	1K	2K	3K	4K	5K
Yield (cured leaf), lb. per acre	1,208	1,157	1,181	1,234	1,151
Cured leaf, percentage mean yield	101·9	97·6	99·6	104·0	97·0

Discussion.

The different applications of potash have had no significant effect upon the yields.

R. R. BROWN, BROUGHTON, CHARTERS TOWERS.

This trial was designed to test the effects both of nitrogen and of phosphate applied in different quantities.

It was laid out as a 5 × 5 latin square. However, it was found impracticable to properly irrigate a number of rows on the outside of the end column, owing to the land not having the necessary fall, and the plants in this section did not develop. The column has been left out, and in the analysis the plot has been treated as a 5 × 4 randomised block, as greater precision in the comparisons is to be gained by so doing. The five treatments were as follows:—

1.—N.P.K.

2.—N. 2P. K.

3.—2N. P. K.

4.—2N. 2P. K.

5.—2N. 3P. K.

where—

N. = 15 lb. of nitrogen per acre; of which half is derived from dried blood at the rate of 60 lb. per acre, and half from nitrate of soda at the rate of 48·8 lb. per acre;

2N. = Double the foregoing quantities;

P. = 40 lb. P_2O_5 per acre; derived from 200 lb. per acre of superphosphate;

2P. = 80 lb. P_2O_5 per acre; derived from 400 lb. per acre of superphosphate;

3P. = 120 lb. P_2O_5 per acre; derived from 600 lb. per acre of superphosphate;

K. = 30 lb. K_2O per acre; derived from 62·5 lb. sulphate of potash.

Variety.—Hickory Pryor.

Planted.—15th and 16th January, 1935.

Harvested.—May-June-July.

Soil.—Grey, fine sandy loam.

This crop was grown with irrigation. High temperatures and the absence of rain for some time after planting were not conducive to rapid growth. Subsequently conditions improved and the resultant growth was good. The leaf is being graded; details of grades are not yet available.

The crop received waterings on the 25th February and on the 29th March.

The rainfall recorded at Charters Towers was as follows:—

Month (1935).	Wet Days.	Points.	Average.
January	8	302	551
February	6	215	445
March	9	135	368
April	..	..	153
May	5	107	79
June	5	115	125
July	5	175	62

YIELDS :—Lb. cured leaf per 1/50-acre plot.

2N2P 20·5	N2P 29·7	NP 27·7	2NP 25·5	
NP 20·5	2N3P 31·2	2NP 28·5	N2P 26·7	
2N3P 28·2	2N2P 30·0	N2P 30·0	NP 29·2	
N2P 24·2	2NP 25·0	2N3P 28·0	2N2P 29·7	
2NP 18·2	NP 24·8	2N2P 27·5	2N3P 31·0	

ANALYSIS OF VARIANCE.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Blocks	3	134·31	..	..
Treatments	4	65·56	16·390	1·3983
Errors	12	56·82	4·735	·7775
Total	19	256·69	..	..

Standard error (4 plots) = $\sqrt{4 \cdot 735 \times 4}$.
= 4·4
= 4·1% of mean yield.

SUMMARY OF YIELDS.

	1.	2.	3.	4.	5.
Treatments.	NP	N2P	2NP	2N2P	2N3P
Yield (cured leaf), lb. per acre	1,278	1,383	1,215	1,346	1,480
Cured leaf, percentage mean yield	95·3	103·1	90·7	100·5	110·4

Discussion.

There is a steady increase in yield with increasing applications of superphosphate. The increases in yield due to consecutive increases in phosphoric acid are not significant, but the treble dressing of superphosphate (treatment 5) has caused a significant increase in yield over the single dressing (treatment 3).

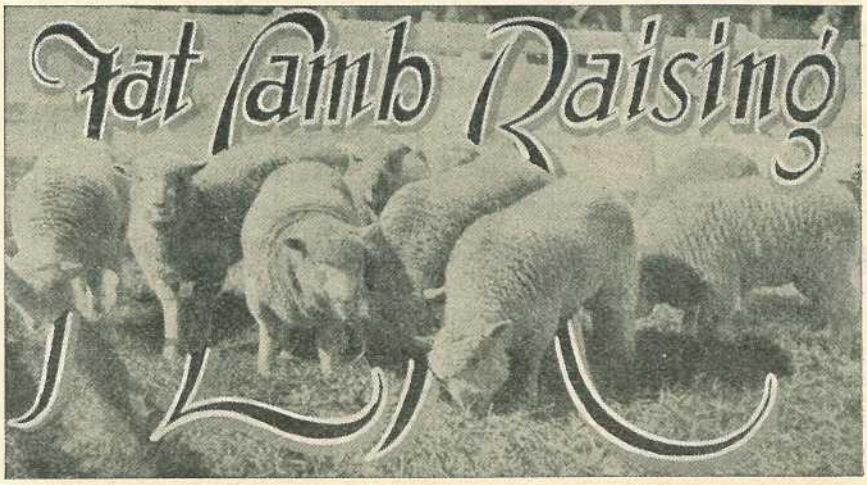
There is no significant difference between the yields of the single and double dressings of nitrogen.

EXPIRED SUBSCRIPTIONS.

A very large number of subscriptions to the Journal expired in June, and have not been renewed. A further large number expires with this issue.

Subscribers whose term has expired have been continued on our mailing list, and a yellow wrapper on this month's Journal (July) is an indication that their subscriptions are now due.

Address renewals without delay to the Under Secretary, Department of Agriculture and Stock, Brisbane.



FARMERS' WOOL SCHEME.

[*Continued from p.* 584, *June issue.*]

IT is thought that the advantages to be derived by farmers from the use of this scheme are not generally known. There is no doubt that a substantial financial loss is sustained by those farmers who send small parcels of wool for sale through the ordinary channels. Bags, for instance, are not even auctioned but are disposed of by private treaty. In nearly all cases these oddments are purchased by dealers who class and interlot, eventually making a substantial profit which should really be in the pockets of the producer.

The Farmers' Wool Scheme is for the assistance of such producers. No matter how small the lot it receives the same attention as larger lines, and eventually finds its way into a bulk line, thus meeting with the full competition such as is given by buyers to station lines.

To give some idea of the service rendered it should only be necessary to quote the results of a recent sale in Brisbane. The offering was one of 50,000 bales, and the average price received for the whole of the offering was 14·9d. per lb. In this sale the Department offered 107 bales of wool on account of farmers from all over the State. The average price received was 14·8d.

This season the number of farmers directly interested in the scheme is 103, and should be more. To give some idea of how the wool is treated, it is necessary to point out that whereas a station clip would probably be classed into fourteen or fifteen lines the wool handled by the Department's scheme last season classed up into eighty-six lines, including merino, comeback, and crossbred. It may be thought sometimes by an individual farmer that the charge for fresh packs is excessive. It must be borne in mind that in many cases bales are purposely made light so as to achieve a five-bale line, thus avoiding star lots.

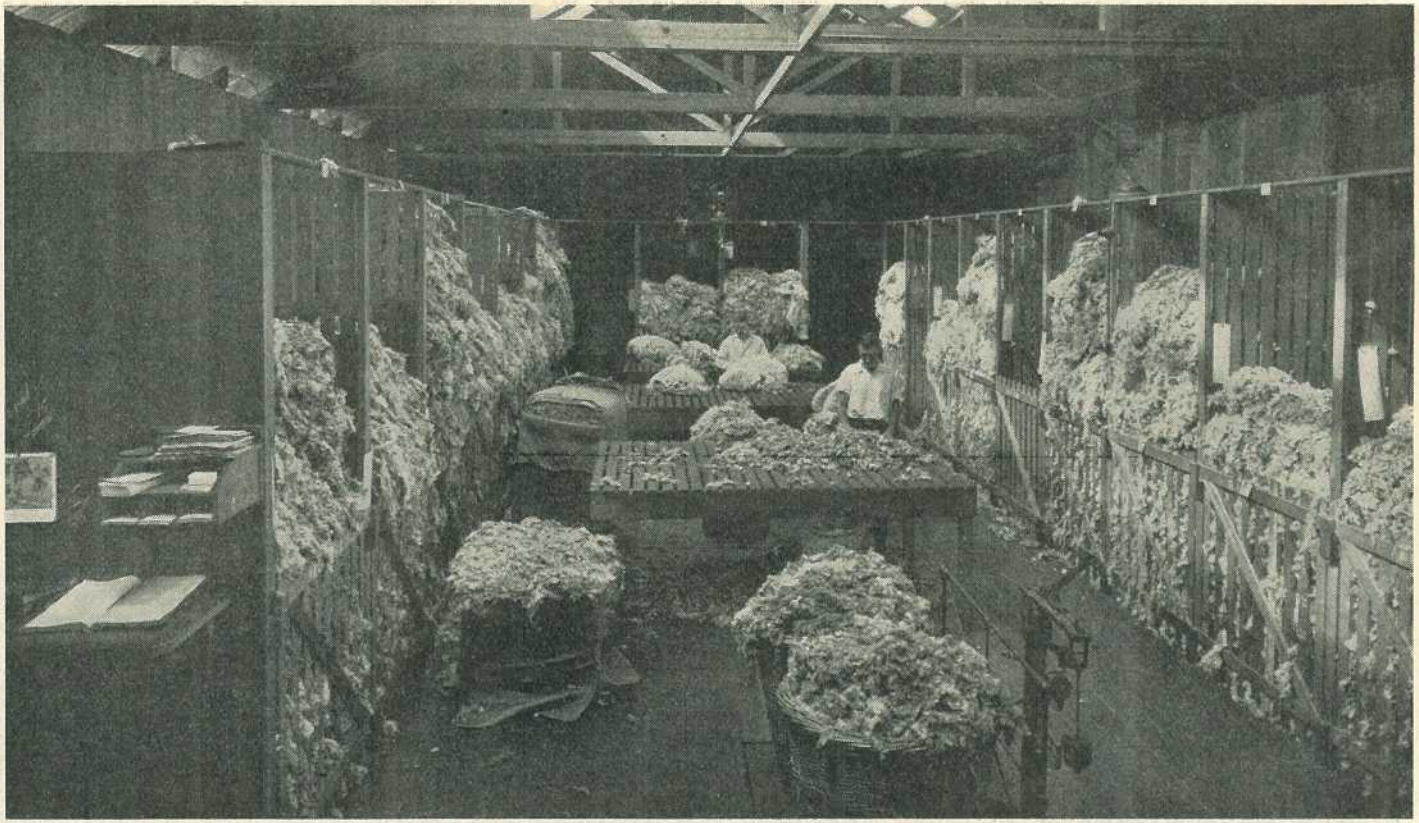


PLATE 35.

WOOL CLASSERS AT WORK.—General view of the Departmental Wool Room showing some of the bins of Classed Wool.

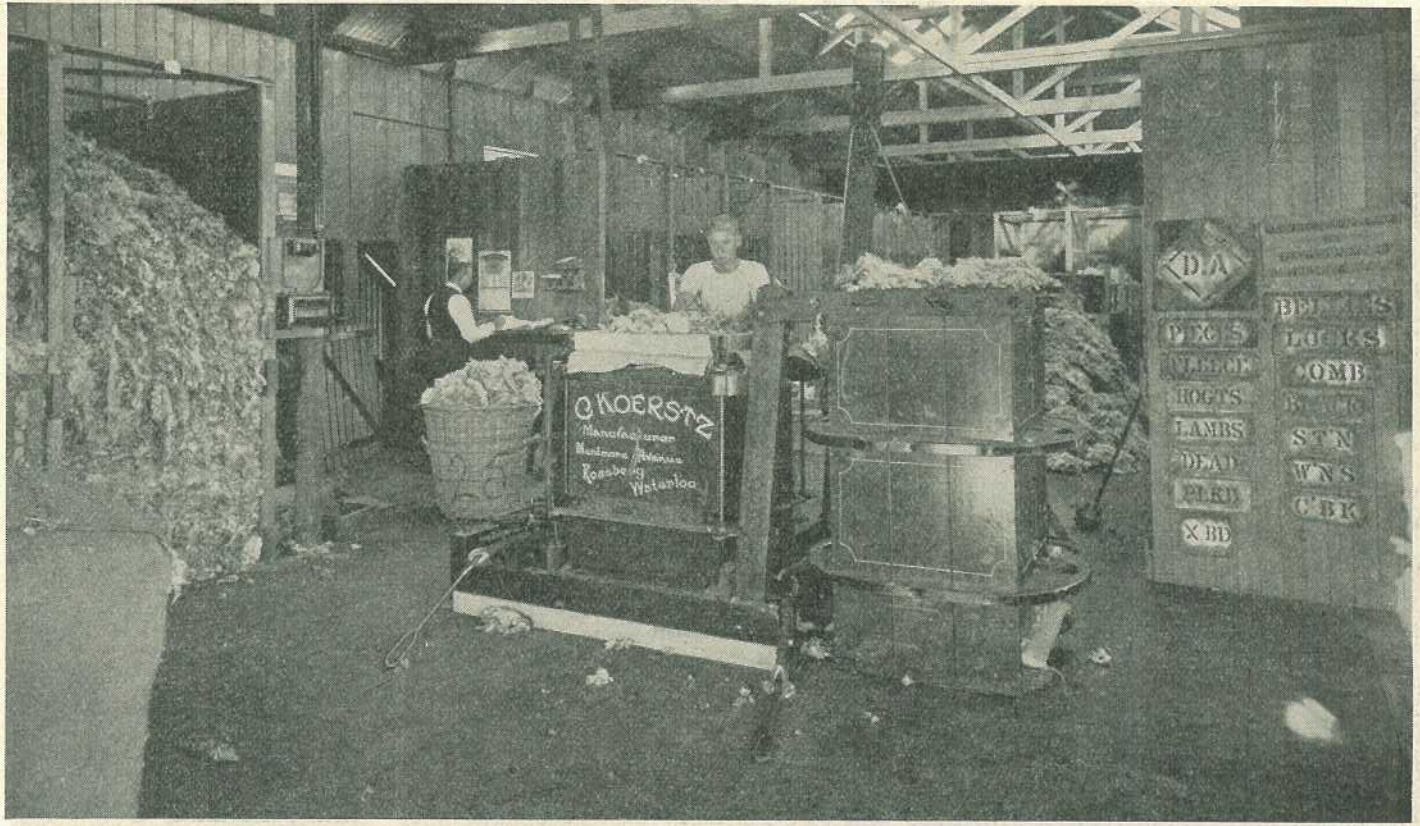


PLATE 36.
Filling the Bales for Pressing and Entering Up in the Bale Book.

PLATE 37.
A Load of Classed Wool Ready for Dispatch to the Selling Floor.

USE OF LICKS FOR SHEEP.

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

IT is a fact to be regretted, but nevertheless a fact that a great portion of the grazing areas of Queensland and Australia are deficient in phosphates. This fact being known and admitted, it is obvious that the deficiency should be made good with the well-being of the flocks at stake. The simplest way to supply this deficiency is in the form of a lick to which sheep should have free access during those periods of the year when it is likely to do most good.

The scientific use of the different ingredients in a lick should be determined by the analysis of the pastures and waters to which the flocks have access. The amounts used should be strictly in accordance with the deficiencies found. For instance, if the water is saline the proportion of salt used in a lick would be reduced, and in some cases the supply of salt should be reduced to a minimum. Conversely, where the entire absence of salt is shown the amount in the lick should be increased.

Apart from salt the greatest necessity amongst our flocks is phosphoric acid and lime. This may be supplied in a number of ingredients, such as nauru phosphate, sterilised bone meal and dicalcic phosphate being the principal ones. There is now on the market a preparation put up by the Queensland Meat Board called "Calphos." This is a sterilised bone flour, rich in phosphoric acid and lime and containing some small amount of protein and fats. It is prepared from selected bones only. Now that we are assured that the supply is continuous the preparation is to be highly commended.

Sulphate of iron is advisable in a lick in small proportions. It is tonic in its effect.

Epsom salts are invaluable as an ingredient and as it is comparatively cheap when bought in quantity a great deal more use should be made of it during those seasons when its presence in the lick is likely to do most good. I refer to such periods as hard winter feeding or when the sheep are on scrub.

During these periods, also, we have found the use of a good meal beneficial. Not only does it induce the flocks to take the lick more freely, but a direct benefit is derived from the protein contents.

The following lick is recommended, with the advice that proportions be changed to suit local conditions as the necessity arises:—

Calphos (obtainable from the Queensland Meat Board)	40 parts
Salt (Butcher's quality)	40 parts
Sulphate of iron	2 parts
Epsom salts	6 parts
Linseed meal (or some other good meal)	12 parts

The whole of this mixture may be bound with molasses. Although the feeding value of molasses is not high it is rather remarkable how fond sheep are of it. Its properties are chiefly appetising and laxative.

In the lick above given you have in the Calphos, phosphoric acid and lime an absolute necessity to the health and maturity of the sheep. Salt may be also regarded as a necessity, except in the case above stated where the water is sufficiently saline to dispense with its use. Sulphate or iron is a tonic. Epsom salts is a laxative, and the meal recommended is a protein.

It is necessary that the grazier should know the properties of the various ingredients so that he may be able to intelligently vary the proportions given to suit certain seasonal conditions.

For instance, with salt, as already stated, the greater the proportion of salt in the water the less of this ingredient would be prescribed in the lick.

The proportion of the phosphoric acid bearing ingredients may always be used. Epsom salts would naturally be cut down in a flush season or one in which young herbage has made its appearance.

The meal recommended should only be used when it is economically sound to do so, such as hard winter conditions or when the sheep are on scrub. Some graziers contend that it is economically sound and beneficial to use a lick all the year round, apart from seasonal conditions. I think, however, that most benefit is to be derived where there is a shortage of feed and when sheep are on scrub. It should be the object of the grazier to induce his sheep to take the lick as prescribed in a quantity varying from three to four ounces per head per week.

To save waste it is necessary to provide a special lick trough. The type recommended consists of a V-shaped trough, with an opening at the bottom to allow the lick free access to a lick board, which is bevelled at the edges to prevent the lick falling to the ground. The trough should have a hinged top to protect the mixture from the weather. The use of open troughs is not to be encouraged. Apart from the fact that there is the loss from weather conditions, the sheep themselves foul the mixture to the detriment of those following.

This advice against open troughs especially applies where blood meal is used as an ingredient in the lick. Should this mixture become wet there occurs a chemical reaction which is definitely dangerous to the sheep.

The effect of a good lick on the flocks is undoubted. Apart from the general health of the flocks a lick as prescribed enables the sheep to make better use of pastures to which it is confined. It should always be remembered, too, that the health of a flock has a deal to do with the resistance of the animal to internal parasites. The extra return from a healthy sheep more than pays for the cost of the lick.

Should the grazier prefer to have his lick mixed ready for use, this may easily be arranged with the various business houses dealing in the ingredients. For a small extra charge the very excellent machinery used for the purpose is at the disposal of the grazier.

To conclude, I should strongly advise graziers to give more attention to this important branch of animal husbandry, with benefit to themselves financially and to the flocks of the State.

A Hot-Water System for the Farm.

H. W. KERR.*

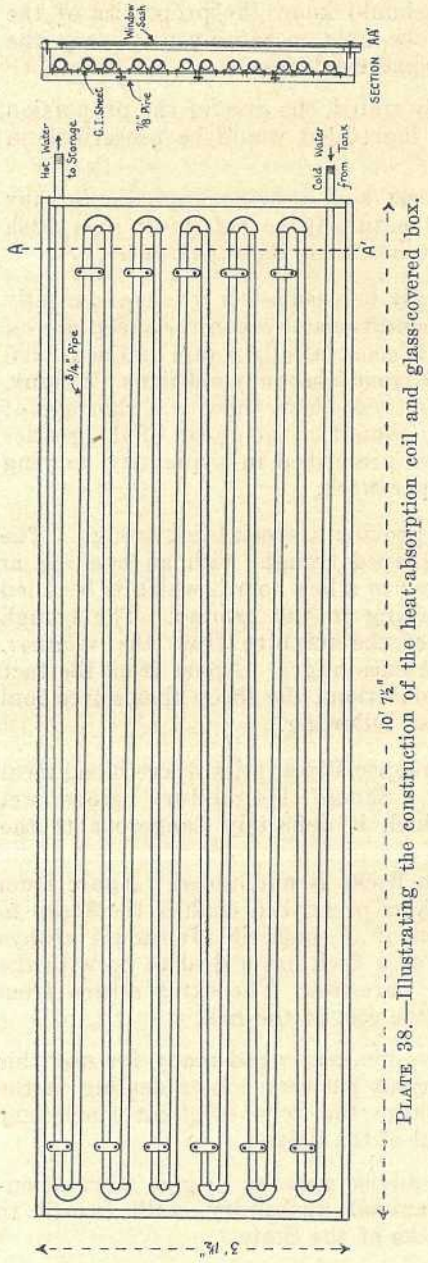


PLATE 38.—Illustrating the construction of the heat-absorption coil and glass-covered box.

THE average household needs much hot water for bathing and cleansing purposes, and this is particularly true on the farm. Yet the absence of conveniences for its provision at short notice generally means that it is not available as desired, and the farmer and his family must get along without it. For those who are prepared to expend a few pounds in the construction of a simple system in which operating costs are practically nil a description of the so-called "Solar Heater" is here supplied. It has been developed in America, and has also been widely adopted around the mills and plantations in Hawaii. It seems to offer a practical means of supplying hot water for the farm.

The system depends for its success on the ability of an exposed metal surface, when protected from the wind by a glass frame, to absorb heat from the sun's rays. If the metal surface takes the form of a continuous coil of iron piping the heat thus absorbed may be transmitted to water circulating in the coil; and if the heated water can be removed to a storage vessel and replaced by cold the process may be continued so long as the sun is shining.

The layout may best be described with reference to the accompanying diagrams (Plates 38 and 39). In Plate 38 is shown the plan of the heating coil, together with a section *AA'* through the box. The latter is 10 feet 6 inches by 3 feet internal dimensions, and is constructed of ¾-inch timber. The sides are 3 inches high. The bottom is lined with a sheet of

*Reprinted by courtesy of Dr. Kerr from the "Cane Growers' Quarterly" (Bureau of Sugar Experiment Stations).

galvanised iron. On this is clamped a coil constructed as shown from ¾-inch piping. The galvanised sheet and the piping should be painted dull black. The lid of the box consists of glazed window sashes, which prevent air currents from cooling off the pipes, yet allow free penetration of light. This box is set on the roof of a building or other suitable location at such an angle as to afford maximum exposure to the rays of the sun. In Queensland it will require a northern exposure, and should be tilted at an angle of 20 to 30° with the horizontal. In the far-northern areas the lower angle should be employed, while 30° would be most suitable in Southern Queensland.

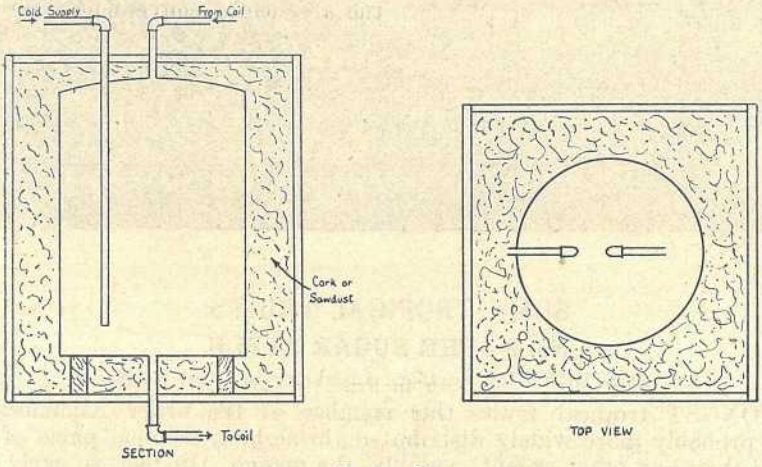


PLATE 39.

Showing the construction of the hot water storage tank and the manner in which it is insulated.

The free ends of the coil pipe are led to the water storage tank (Plate 39), which is placed either between the ceiling and the roof of the building or in a specially constructed chamber on the roof. Care should be taken to provide a tank of ample proportions—one of 50 to 60 gallons capacity is generally suitable. This should be placed in a wooden box which will allow of a thick insulating layer of fine cork, sawdust, or fine, dry bagasse all around. This is a most important factor in the retention of the water at a high temperature. A cold water supply from a high house tank or water main should be brought into the storage cistern, as shown, while the hot water connection for the household supply may be taken off from any convenient point near the top of the cistern. A tee on the pipe from the top of the coil across to the storage tank will prove satisfactory.

For those who wish to alter the dimensions of the installation suggested it may be taken as a useful guide that under normal conditions 1 square foot of surface area should be allowed for each gallon of water to be heated to a temperature of 150° F. It may be of interest to point out, also, that some heat is absorbed by this system even on hazy or cloudy days. Naturally the solar heater would be best suited to those districts which enjoy a high proportion of clear, sunny days, but its usefulness should also be considerable in the high rainfall areas, particularly during the winter season.

SOME TROPICAL FRUITS.

No. 9—THE SUGAR APPLE.

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

AMONGST tropical fruits this member of the order Anonaceæ is probably more widely distributed throughout tropical parts of the world than any other except, possibly, the mango. In fact, so early was its distribution and so well did it adapt itself to the various countries to which it was introduced, that its actual native habitat cannot now be proved. It is thought, however, to have originated in tropical America.

Amongst the Anonas it was the earliest introduction into Queensland, and became well established and widely spread throughout the coastal districts in a very short time. In 1911 A. H. Benson, in his publication "Fruits of Queensland," stated it was the species commonly grown. Since that time it has, however, been superseded in Southern Queensland by the Custard Apple (*Anona cherimolia*), which is a better commercial type of fruit and more suited to the sub-tropical conditions of the southern parts of the State.

In North Queensland the Sugar Apple still holds pride of place, and by most Northerners its fruit is considered to be in a class above the Custard Apple so far as delicacy of flavour is concerned.

The specific name applied to this fruit is *Anona squamosa*, which means "scaly anona," and refers to the skin of the fruit being composed of numerous scales or plates separated by deep corrugations or interstices. When the fruit becomes quite ripe the individual scales are easily detached and will fall apart, thus making the ripe fruit difficult to handle.

The tree is a small one, growing to a maximum height of 15 to 20 feet. It is extremely adaptable and grows over a wide range of conditions, but well-drained light soils and rather dry and hot conditions give the best results. In the Cardwell district of North Queensland, where the ideal conditions are most nearly approached, it is to be met

with growing in the black sand along the foreshore and successfully competing with the indigenous vegetation. On both forest and scrub lands in outlying parts of that district it may be seen thriving in gardens cared for or abandoned, but it seems to be more at home in the black sand, where the seeds germinate where they fall and the plants grow in profusion and fruit regularly and heavily. The wetter conditions farther north, between the Tully River and Cairns, are not so favourable, generally speaking, and although the trees will grow and fruit they do not actually thrive in the same way.

The tree is a deciduous one, but its fruiting habit is different to that of most other deciduous trees in that it fruits on the current season's growth as well as on the older wood. The flowers are produced singly and in clusters and are greenish-yellow in colour with thick outer petals about an inch in length. September to November is the usual flowering period here. Only a small proportion of the flowers set, but even so the trees are usually well laden with fruit. The crop commences to ripen during late January and usually continues to late April, but in some seasons odd fruit may be picked from the trees up to June. When fully grown the fruit is from 2 to 4 inches in diameter, deeply corrugated, with a dull, pale-green skin changing to yellowish-green as the fruit ripens. Maturity is gauged by the opening and lightening in colour of the interstices between the scales. When this occurs the fruit should be picked and stored for two or three days, when it will be fit for consumption.

The flesh is white, custard-like, sweet, and melting. Carpellary divisions are pronounced and each one normally contains a seed, consequently the seed in a fruit are usually numerous. However, it has been noted that some trees consistently bear fruit with less seed than others. Such points as flavour and productivity also vary in different trees, hence it follows that strict selection of propagating material is desirable if improvement in the general quality of the fruit is to be attained.

Both to maintain vigour of the tree and quality of the fruit regular pruning is recommended. In the early stages of growth this should be directed to forming the tree and will consist chiefly in heading back of the main arms to produce shape and rigidity and develop lateral growth. Once having obtained the framework subsequent pruning is mainly directed towards thinning out and shortening back to prevent overcrowding and to maintain healthy growth. As the tree is naturally more compact and upright in growth than the Custard Apple, pruning need not be so severe as is required to train that tree. The Sugar Apple is naturally precocious and will commence to fruit at three to four years of age.

In the pruning of Anonas there is an important point to be borne in mind. It is that pruning should not be commenced on a tree of this family until the sap is beginning to rise in the spring and movement is noticeable in the buds. Neglect to observe this rule will frequently result in the death of the tree.

The chief pest noted on Sugar Apples is the mealy bug. Its occurrence is mainly restricted to the fruits, the surfaces of which are sometimes completely covered with the insects. The usual spray of nicotine sulphate and soap applied with force will cope with this pest satisfactorily.

The green tree ant frequently establishes colonies in the trees, but these are easily destroyed with paris green. A method of application with which the writer has had excellent results is to make a strong mixture of paris green with water—about 1 lb. to the gallon. Dip small pieces of rag about 3 inches by 2 inches into the mixture, then push one piece into each nest with the aid of a stick. In about a fortnight's time the nest will disintegrate and the dead colony will be seen within it.

In addition to the name Sugar Apple, this fruit is known as Anona and Sweet Sop in various parts of the world. In North Queensland it is frequently but quite erroneously called Custard Apple, this name having been reserved to its cogener, *A. cherimolia.*

PACKING LETTUCE FOR MARKET.

JAS. H. GREGORY, Instructor in Fruit Packing.

IN a warm climate such as that of Queensland the populace in summer makes extensive used of salad foods, such as is provided by lettuce, to make their meals tempting and appetising. To walk through the markets and see the bags and heaps of lettuce displayed does not, however, encourage the thought that they are being given to the public in the best possible manner. A little care taken in packing would greatly improve their appearance and value to the public, and with this object in view it is suggested that more up-to-date methods of packing should be adopted. The tropical fruit case, as used for bananas and pineapples, is ideally suited for the purpose.

Harvesting.

The heads of lettuce should be carefully cut and not pulled as is often done. The cutting should be done as far as possible during the early morning before the sun and heat have had time to make the lettuces lose their crispness. The heads should be placed in heaps conveniently in the rows, or, if in large quantities, carted to a central shed to be packed.

Packing.

The lettuces should be sized for packing into sets of reasonably even size. They can be placed either in heaps ready for packing or, if more convenient, straight into the cases. When finished each case should contain a number of fairly evenly sized specimens.

The placing of the heads in the case is most important. The hearts fig. 1. Smaller sizes can be packed diagonally by placing them two and one alternately. (Fig. 6.) The second layer is packed by placing of the case. Large lettuces are placed side by side as illustrated in are placed downwards, the cut stalks pointing straight up to the top them upon the spaces of the first, in the same manner.

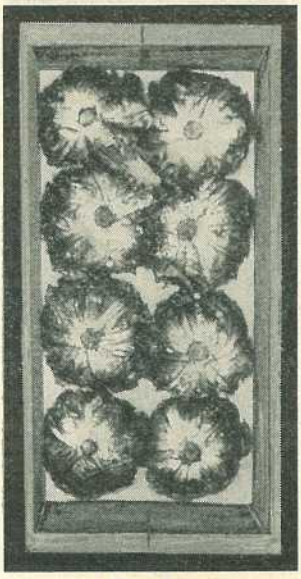


Fig. 1.
First layer, two across, 16 pack = two layers of eight.

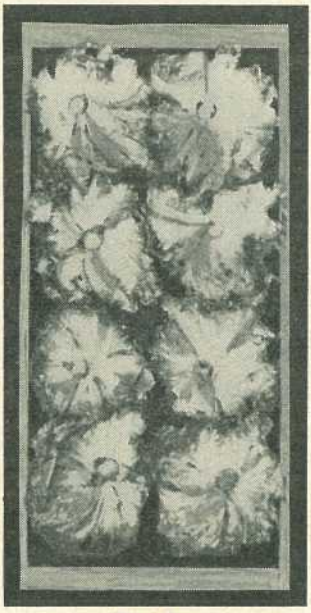


Fig. 2.
Finished case, 16 pack.

In this pack the lettuces are pressed tightly together. This makes each row higher, so that two rows will bring them to the top.

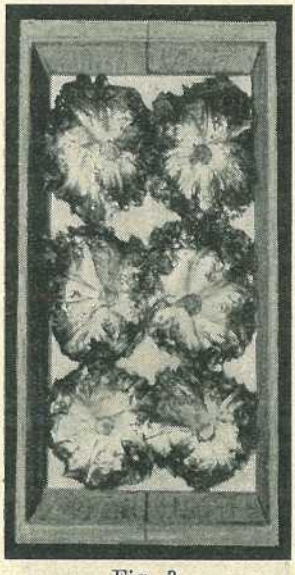


Fig. 3.
First layer, two across, 18 pack = three layers of six.

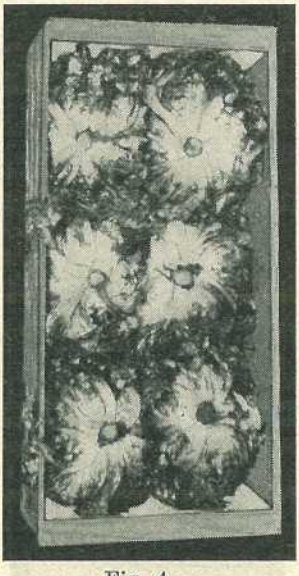


Fig. 4.
Finished case, 18 pack.

PLATE 40.

In this pack the lettuces are placed in the case in firm but not in tight rows, a little to one end of the case. The second layer is placed on the spaces between each of the twos, allowing each row to fit down, thus requiring three rows to bring them to the top of the case.

Fig. 5.
First layer, two across, 24 pack = three layers of eight.

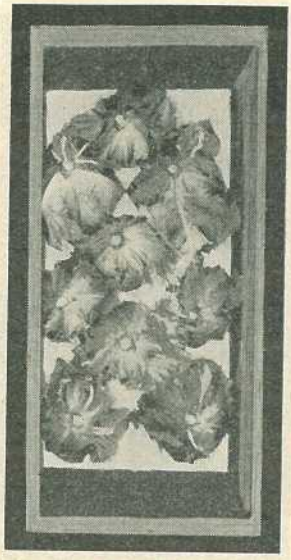


Fig. 6.
First layer, two and one, 27 pack = three layers of nine.
Pack firmly.

The lettuces are placed in firmly and three layers packed to fill the case.

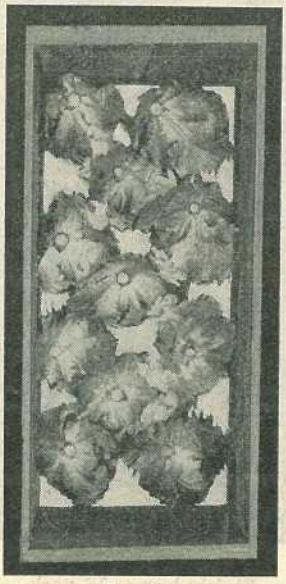


Fig. 7.
First layer, two and one, 32 pack = three layers (bottom layer 11, second layer 10, top layer 11).
Pack firmly.

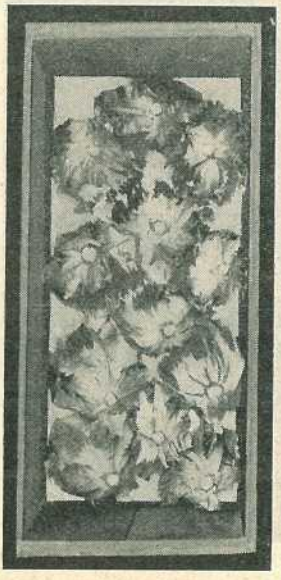


Fig. 8.
First layer, two and one, 36 pack = three layers of twelve.
Pack tightly.

PLATE 41.

The following is a table of counts that can be used:—

Type of Pack.	Number in each layer.	Number of layers.	Total heads in case.
Two across	8	2	16
Two across	6	3	18
Two across	8	3	24
Two and one alternately	9	3	27
Two and one alternately (See Fig. 7)	11, 10, 11	3	32
Two and one alternately	12	3	36

Smaller lettuce can be packed on the same system using different counts and being placed 3 across.

As no lids are placed upon the boxes when sending to local market, the rows of lettuce can be brought above the top of the case to the extent of about half a layer without running any risk of damage to the contents if the boxes are handled carefully.

CITRUS NOTES.

R. L. PREST, Instructor in Fruit Culture.

IN the warmer districts, where the harvesting of navels and early varieties of citrus has been completed, pruning may now be commenced.

With citrus, the pruning requirements of each tree are dictated by various factors, including the tree itself, the soil, and cultural conditions.

In the younger orchards, where well developed frameworks have been maintained, the pruning of the trees during their first years of bearing should be directed towards the removal of suckers and decadent first-fruiting shoots. Where pruning operations have been diligently carried out on young trees, they require very little pruning during several following years, although they should be gone through annually to remove suckers and dead wood.

In many of our older but well-cared-for orchards there is a lack of vigorous healthy fruiting wood. This condition points to the necessity for a periodical renewal of the fruiting wood, which can best be accomplished by thinning out, and at the same time shortening back terminal growths and twigs. The cuts should be made right back to strong new growths, removing weak shoots and those that have borne fruit. The thinning leaves space for the necessary subdivision, whilst the shortening back tends to force into growth dormant buds from behind, and at the same time stops the excessive growth of branches and renews supplies of fruiting wood. Where crowding is evident, the removal of entire branches is at times desirable. The entry of plenty of light and air assists the growth from behind the outside ring of foliage of healthy and vigorous shoots which make new fruiting wood. Any excessive growth of suckers or water sprouts arising well inside the tree as a result of heavy pruning require to be cut away, or they will absorb much of the vigour of the tree and crowd the centre.

In older trees, where vitality has been impaired, provision will require to be made for the renewal of old, crowded, and decadent limbs. In such instances pruning is of a much heavier nature, necessitating the removal of entire branches. Such branches should be cut right back to their source of origin, so that the sap will be readily diverted to the remaining limbs and encourage the formation of new fruiting wood. Under no circumstances whatever should stubbing be resorted to. In instances where it is necessary to replace the larger limbs, the work requires to be done gradually over two or more years in order to avoid excessive suckering.

Lower branches of trees should not be allowed to touch the ground, as fruit borne on such branches is generally blemished and of poor quality. On the other hand, trees should not be pruned too high from the ground. The height to which they should be lifted varies according to circumstances, but in most instances knee-height will prove to be satisfactory.

FRUIT MARKETING NOTES.

JAS. H. GREGORY, Instructor in Fruit Packing.

NOTWITHSTANDING the cold weather during the latter part of June, the general market prospects remained bright and prices for good fruit steady. From July onwards it will be necessary to watch closely apples and pears in cold storage. The writer examined some lines of Stanthorpe apples—Dunns, Granny Smith, and Delicious—in cold storage recently, and found them in a satisfactory condition. Large sizes should now be placed on the market in small, regular lots. It should be remembered that regularity of marketing is the only way to get the best a market can give.

In previous notes it has been pointed out that in quieter periods of the year it is desirable to put the packing house in order and make handy home-made equipment in readiness for next season.

Apples.

Stanthorpe Granny Smiths brought from 8s. to 12s. per case, and Southern Jonathans (2½ to 2¾-inch) from 11s. to 12s. Queensland growers with Jonathans in cold storage should now consider placing them on the market.

Pears.

Southern Packhams realised from 8s. to 11s., Josephines from 8s. to 13s., and Winter Coles from 7s. to 14s.

Many Southern consignments are now marketed with the brand printed nicely on the ends of the boxes in colours instead of a pasted fancy label. This method appears to be quite satisfactory.

Bananas.

Cavendish have maintained the rise in prices, choice lines selling as follows:—

Brisbane.—Sixes, from 6s. 3d. to 10s. 6d.; sevens, from 7s. 9d. to 12s. 3d.; eights and nines from 7s. to 14s. per case; bunches, from 3d. to 7d. per dozen.

Melbourne.—Sixes, from 13s. to 14s.; sevens, from 15s. to 16s.; eighth and nines, from 17s. to 18s. per case.

Sydney.—Sixes, from 12s. to 14s.; sevens, from 15s. to 16s.; eights and nines, from 17s. to 20s. per case.

Lady's Fingers were in good demand, up to 7d. per dozen being obtained for good fruit.

Provided fruit affected by the cold weather is not marketed prices should be maintained on this basis for some months to come.

Pineapples.

Brisbane prices of Ripleys will possibly show a tendency to ease during the cold weather, buyers being afraid of black heart. Prices are from 3s. to 5s. per case, and 1s. to 3s. per dozen.

Smooths realised from 4s. to 9s. per case in Brisbane, with a few specials at 10s.; loose sold at from 2s. to 6s. per dozen.

In Sydney the demand has been slow for the larger sizes, prices ranging from 7s. to 13s. In Melbourne Smooths brought from 9s. to 14s. per case.

Care should be taken not to send green fruit. When prices are low fifteens, eighteens, and twenty-ones are the most popular sizes, while when high prices prevail the buyers favour eighteens, twenty-ones, and twenty-fours.

Custard Apples.

This fruit is inclined to be slow of sale, 2s. to 3s. per half-bushel case being obtained. Mature fruit only should be marketed.

Melbourne prices range from 5s. to 7s. Care in marketing only matured fruit should also be applied to consignments to Victoria.

There is a fair demand in Sydney, with prices from 4s. to 5s. per case.

Papaws.

Brisbane prices range from 2s. to 4s. 6d. per bushel case for locals, 5s. 6d. to 6s. 6d. per tropical case for Gunalda, and 7s. to 9s. for Yarwun. During the winter months fruit should be left hang on the trees for a longer period in order to permit colouring.

Sydney prices are from 8s. to 12s. per tropical case, and Melbourne prices from 10s. to 14s. To maintain these prices only good fruit must be sent. Green fruit will soon reduce values.

Other Tropical Fruits.

It seems a pity that fruits such as the Granadilla, Sour Sop, Five Corners, and others are not placed on the Brisbane market in larger and more regular quantities.

Oranges.

Common oranges are slow of sale at from 3s. to 6s. Navels are in better demand at from 6s. to 8s. for locals, with Gayndah fruit bringing from 7s. to 10s. per case, and Benyenda from 8s. to 10s. Southern Navels of good packs sold at from 7s. to 8s. per case.

In Sydney Benyenda Navels brought from 8s. to 10s., and locals from 3s. 6d. to 8s.

Mandarins.

Some splendid fruit has been marketed. Some districts suffered from mould early in June as a result of the wet weather.

Brisbane prices for local Emperors ranged from 3s. to 6s. per bushel, for Gayndah Glens from 6s. to 11s., with Benyenda to 12s. and others to 7s. per case. Small-sized fruit are hard of sale. Scarlets brought from 3s. to 6s., and Fewtrells from 3s. to 8s.

Sydney prices for Benyenda Glens were from 10s. to 13s., and for other Queensland fruit 10s. to 12s. In Melbourne Emperors and Scarlets brought from 8s. to 10s., and Benyenda Glens from 12s. to 14s. per case.

Lemons.

Prices for locals are from 4s. 6d. to 7s. per case, with Gayndah realising 9s. to 12s. It is becoming more apparent day by day that only cured lemons can command top market prices.

Grapefruit.

There is still a good demand for good quality fruit, up to 9s. per case being obtained. In Melbourne there is good demand for choice Marsh type, which are realising up to 12s. per case.

Passion Fruit.

First quality fruit is in good demand in Brisbane, realising up to 10s. per case.

Tomatoes.

In Brisbane green fruit realised from 1s. 6d. to 3s. 6d., and firm coloured lines from 2s. to 5s. per case. In Sydney Bowen fruit realised from 6s. to 8s., and Cleveland fruit from 4s. to 6s.; local New South Wales fruit brought from 6s. to 10s. No green tomatoes are wanted on the Sydney market. In Melbourne green tomatoes brought from 4s. to 6s., with ripe fruit higher.

An inspection of the fruit arriving on the Cairns and Townsville markets supports the contention that tomatoes for those markets should be wrapped.

Wrapped lines opened up 200 per cent. better in quality and appearance.

Strawberries.

A better demand exists for good quality lines, 5s. to 9s. being realised for average quality, and 10s. to 14s. for choice fruit. On the Sydney market trays brought 2s. 6d. to 4s., and boxes from 9s. to 15s. per dozen.

Attention is called to the necessity for branding the grower's name and address on the boxes when marketing. This, coupled with a neat pack, is very helpful to the salesman, and saves many extra handlings, with consequent increased risk of damage.

Publications.

"Apple Packing for Home and Export" will be available for distribution in July.

A lemon packing chart is in course of preparation.

PAPAIN.

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

OF late several inquiries have been received requesting information on the method of obtaining papain from that well-known fruit, the papaw.

All varieties of papaws carry this enzyme, but perhaps the thicker-skinned type would yield slightly the greater quantity. The following extract from "Tropical Planting and Gardening," by H. F. MacMillan, a noted writer on tropical fruits, describes the method of preparation of this product:—

"Papain, a digestive enzyme valued in medicine and in the preparation of chewing gums, &c., is obtained from the white, thin latex or juice. The latter is extracted by making slight incisions with a bone knife or wooden splinter in the unripe fruit; the juice rapidly exudes from the cuts, and is collected in a cup held beneath. It is then spread on glass to dry in the sun or, if the weather be wet, over a stove or in a hot-air chamber. Drying should be effected without delay, but should not be too rapid, a temperature of about 100 deg. Fahr. being recommended. The process should be completed in about twenty-four hours. When the material is crisp-dry it is reduced to a fine powder or made into a granular form like vermicelli. It is then of a greyish colour, and has an unpleasant odour. It should be packed in hermetically-sealed tins or bottles for export. About 5 to 8 oz. of dried papain may be obtained per tree in a year, or an average of about 150 lb. per acre. The fruits may be tapped at intervals of two or three days, and are not removed from the tree until they cease to yield latex. Fair to good quality papain formerly fetched from 6s. to 10s. per lb., but the demand is limited and irregular. Papain, as already stated, is used in medicine, in invalids' and children's foods, in chewing gums, &c. The property of papaw leaves in rendering meat tender is well known, and is commonly made use of by native cooks, who wrap the leaves round fresh meat or place a piece of green fruit in the water in which the meat is boiled. One hundred and twenty-eight thousand four hundred and sixty-three pounds of papian, valued at £44,956 were exported from Ceylon in 1929."

TREES.

I think that I shall never see
A poem lovely as a tree.
A tree whose hungry mouth is pressed
Against the earth's sweet-flowing breast;
A tree that looks at God all day,
And lifts her leafy arms to pray;
A tree that may in summer wear
A nest of robins in her hair;
Upon whose bosom snow has lain;
Who intimately lives with rain.
Poems are made by fools like me,
But only God can make a tree.

—JOYCE KILMER.

THE month of June was ushered in with some good general rains which were of particular benefit to the Central and North-Western districts. The North and Central Coast also registered good falls, but the South Coast and Downs lands received only scattered showers.

Unsettled weather prevailed until 12th June, when the Darling Downs participated in the general rain, receiving from ½ to 1 inch. The season has been very unsatisfactory for the successful establishment of winter fodder crops and grasses which need to be sown during early autumn for the provision of winter feed. Some well-worked fallow lands, sown early, have benefited by the June rains, but the area of such is not extensive.

Wheat.

Sufficient rain was received to germinate areas sown dry, but further falls are necessary in the near future, particularly in the Warwick district, where subsoil moisture is negligible. Drilling has proceeded rapidly wherever possible, and although somewhat late in the season, the general sowing is ahead of the previous year, when planting rains were delayed until 30th June. Prospects are bright in the Dalby district, where seasonal conditions have been more favourable, and some large individual areas of both wheat and canary grass are in evidence. Indications point to a large proportion of the crop being derived from the Dalby and Pittsworth areas. The recent payment of 6d. per bushel on the 1935-36 crop brings the amount distributed to 3s. 6d. per bushel for Q1 wheat, which can be regarded as satisfactory.

Organisation of the Potato Industry.

A Federal Potato Advisory Committee has been formed, the first meeting of which was held in Sydney on 17th March last. Two Queensland delegates attended the meeting, at which a resolution was carried stressing the unsatisfactory position of the industry throughout Australia, and suggesting uniform State marketing and grading legislation. The chief objects of the Federal Potato Advisory Council are to advise on all matters affecting the welfare of the potato industry, to prepare and distribute propaganda on the need for orderly marketing, to distribute information and statistics relating to crops and markets, and to secure the co-operation of all States in the regulation of market

supplies. The regulation of supplies to the principal markets is particularly desirable, as at present farmers derive little benefit from a prolific harvest.

Victoria and Tasmania are the most important producing States and normally supply the deficiency throughout the Commonwealth. In Queensland the Lockyer Valley and Boonah districts are the chief sources of supply, with adjacent coastal areas and the Darling Downs also producing good tonnages. Elsewhere production is mainly for household and local supplies, although the area under crop is now increasing throughout the coastal farm lands. However, production has been considerably below average during the 1935-36 season, chiefly owing to unfavourable weather conditions and the increased activity of the potato tuber moth.

Peanuts.

The Peanut Pool Board reports increasing sales of the Virginia Bunch variety, so that farmers will be well advised to sow this type in preference to the Red Spanish during the forthcoming season. Sales for 1935 exceeded the previous record selling year by 25 per cent. The industry is now thoroughly established, Kingaroy peanuts being the hallmark of quality in the Southern markets.

Need for Early Cultivation.

Land intended for summer crops should now be receiving attention, as thorough winter ploughing, combined with subsequent cultivation, is invariably reflected in increased yields. This is particularly noticeable with the maize crop, deep early ploughing and winter fallow being far superior to the more general practice of allowing the land to be under old maize stalks prior to the spring ploughing.

Sugar.

Weather conditions throughout the cane areas were remarkably mild during the first half of the month, and beneficial rains were received in all areas. These were followed by cooler conditions, which have checked growth, and should assure a rapid increase in sugar content of the crop. To date no frost damage has been reported.

Those North Queensland mills which have already commenced crushing report a low sugar content for the crop due, doubtless to the continuance of favourable growing conditions; but the recent cool change should effect a rapid improvement.

Tobacco.

In spite of varied seasonal conditions Queensland's tobacco crop is on an average of better quality than has hitherto been produced, and the quantity of immature leaf now being marketed is limited. It is estimated that from 3,900 acres planted the yield will be in the vicinity of 2,000,000 lb.

Auction sales to date have been very successful, and at the June sales the values received for better class leaf are at least 5 per cent. above values ruling the previous season. No doubt exists that the increased demand for local leaf has been brought about by the higher tariff now operating on imported leaf, thus causing more buyers to operate and, incidentally, creating keener competition.

Cotton.

The harvesting of the cotton crop has continued through the month under fairly favourable conditions except two short periods of showery weather. The average grade has therefore held up well. Killing frosts occurred around mid-month, which will increase deliveries in the near future, as the top crop will now open rapidly.

The ginnings to the 24th June are as follows:—Glenmore 7,018 bales, Whinstanes 3,081 bales, total 10,099 bales.

Tung Oil Production.

A recent publication from the Imperial Bureau of Soil Science, England, reviews the present position with respect to tung oil production, and suggests that the future of the industry is distinctly promising. The oil has become an indispensable raw material of the paint and varnish trade throughout the world, while the aviation and electrical engineering trades have all tended to promote a marked interest in establishing the tung oil tree in countries other than China, which for years held the monopoly of the tung oil trade.

The oil possesses properties similar to those of linseed oil; it is considered, also, that the oil will always command a price at least £10 per ton above that of linseed oil. An acre of suitable land is stated to be capable of producing up to 1,200 lb. of tung oil. The tree has been established successfully on a commercial basis in Florida and neighbouring States, and in 1934 29,000 acres had been planted to the crop. Test plantings have also been made in India, South Africa, Australia, and other parts of the British Empire.

Many reports from these centres stress the significance of careful nursery management, and lack of attention to this would appear to be the cause of many avoidable failures. Two species of tree are cultivated—*Aleurites montana,* which appears to withstand heavier rainfall and requires higher temperatures than *Aleurites fordii,* from which the true tung oil is derived. The latter is generally regarded as yielding the superior oil, and this species is generally favoured wherever the crop is propagated successfully.

The search for alternative and profitable crops to supplement cane-growing, which is constantly engaging the attention of Queensland cane-growers, suggests that the tung tree is worthy of closer attention. The fact that no definite provision has been made for the construction of factories to treat the mature nuts should not be lost sight of, though this difficulty could probably be overcome by the installation of the necessary auxiliary plant at the sugar mills.

H.W.K. in the "Cane Growers' Quarterly."

Sugar Levies.

(Abbreviated Notice.)

1936 SEASON.

Regulations under "*The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1935," have been approved, providing for levies on suppliers of cane to sugar-mills at the following rates for the season 1936 (the figures for 1934 and 1935 are given for comparison purposes) :—

Name of Mill.	General Levy by Queensland Canegrowers' Council.	Administrative Levy by District Executive.	Administrative Levy by Mill Suppliers' Committee.	Special Levy by Mill Suppliers' Committee.	Total Levies for 1936.	Total Levies for 1935, given for comparison.	Total Levies for 1934, given for comparison.
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Mossman Central	¾	2	..	..	2¾	2¾	2¾
Hambledon	¾	⅛	¼	..	1⅛	1⅛	1⅛
Babinda Central	¾	⅛	⅛	..	1¼	1⅛	1⅛
Mulgrave Central	¾	⅛	..	..	1⅛	1⅛	1⅛
South Johnstone Central	¾	1⅛	⅛	..	2⅛	2¼	2¼
Goondi	¾	1⅛	⅛	..	2⅛	2¼	2¼
Mourilyan	¾	1⅛	..	..	2¼	2¼	2⅛
Tully River Central	¾	1⅛	..	..	2⅛	2⅛	2⅛
Macknade	¾	⅛	¼	..	1¼	1⅛	1⅛
Victoria	¾	⅛	¼	..	1¼	1⅛	1⅛
Kalamia	¾	..	¾	..	2¼	1¼	1¼
Pioneer	¾	..	1	..	1¾	1¾	1¾
Inkerman	¾	..	¼	..	1	1	1¼
Invicta	¾	..	1	..	1¾	1¾	2¼
Proserpine Central	¾	1	..	..	1¾	1¾	1¾
Cattle Creek Central	¾	¼	¼	..	1⅛	1⅛	1¾
Plane Creek Central	¾	⅛	¼	..	1¾	1¾	1¾
Marian Central	¾	⅛	¼	½	2	2¼	2⅛
North Eton Central	¾	⅛	⅛	..	1¾	1¾	1¾
Pleystowe	¾	⅛	⅛	½	2¼	2	2¼
Racecourse Central	¾	⅛	⅛	..	1¾	2¼	1¾
Farleigh	¾	⅛	⅛	..	1¾	1¾	1¼
Qunaba	¾	¼	⅛	..	1⅛	1¼	1⅛
Bingera	¾	⅛	¾	..	1⅛	1¼	1¾
Fairymead	¾	¼	¾	..	1¾	1⅛	1⅛
Gin Gin Central	¾	¼	⅛	..	1⅛	1⅛	2
Millaquin	¾	¼	¼	..	1¼	1¼	1⅛
Isis Central	¾	¼	..	..	1	1¼	1⅛
Maryborough	¾	⅛	..	..	1¼	1⅛	1¾
Mount Bauple Central	¾	⅛	..	..	1¼	1⅛	1¾
Moreton Central	¾	..	1	½	2¼	2⅛	2⅛
Rocky Point	¾	..	¾	..	1¼	1⅛	1¾
Eagleby	¾	..	..	..	¾	1	1

No poll will be taken in respect of the General Levy of ¾d. per ton (first column) for the Queensland Cane Growers' Council, or for the administrative levies by District Executives or Mill Suppliers' Committees (second and third columns).

In the fourth column, the levies on cane supplied to the Kalamia, Marian Central, Pleystowe, and Moreton Central Mills will be used in defraying the costs of employing farmers' representatives at those mills for the current season. In the case of these levies, growers may petition for a poll, and the petition must be signed by at least 100 or 50 per cent. (which ever shall be the less) of the cane suppliers to the four mills concerned.

In addition to the foregoing levies, the undermentioned Mill Suppliers' Committees are empowered to make particular levies on growers within each of the following districts, at the following rates :—

Name of Mill Suppliers' Committee and Mill to which Cane is Supplied.	Description of District upon the Growers wherein Levies will be made and description of Cane upon the Growers whereof Levies will be made.	Amount of Levy per ton of Cane Supplied.	Purposes of Levy.
		d.	
Isis Central ..	Pialba district within the boundaries of the parishes of Urangan, Vernon, and Bingham, county March	1¼	To be used for administrative purposes by Pialba Branch of Isis Central Mill Suppliers' Committee.
Isis Central ..	All cane consigned on the railway by Government trucks from Booyal, Junien, and Marule Sidings on the Dallarnil Railway.	¼	To be used for administrative purposes by Booyal Branch of Isis Central Mill Suppliers' Committee.
Isis Central ..	All cane loaded at Walligan Siding	½	To defray the costs of maintaining the cane growers' derrick at Walligan Siding by the section of growers concerned.
Mount Bauple Central	Mount Bauple district within the boundaries of the parishes of Gundiah, Tiaro, Gootchie, Curra, and St. Mary	¼	To be used for administrative purposes by Mount Bauple Branch of Mount Bauple Mill Suppliers' Committee.
Mount Bauple Central	Yerra district within the boundaries of the parishes of Gungaloon, Denison, Doongul, Woocoo, and Young	¼	To be used for administrative purposes by Yerra-Mungar district Branch of Mount Bauple Mill Suppliers' Committee.
Maryborough ..	Pialba district within the boundaries of the parishes of Vernon, Urangan, and Bingham, county March.	½	To be used for administrative purposes by Pialba District Branch of Maryborough Mill Suppliers' Committee.
Maryborough ..	Maryborough district within the boundaries of the parishes of Tinana, Maryborough, Bidwell, Elliott, Young, and Walliebum, county March.	¼	To be used for administrative purposes by Maryborough District Branch of Maryborough Mill Suppliers' Committee.
Millaquin ..	All cane delivered at Yandaran Siding	½	To be used for administrative purposes by Yandaran Branch of Millaquin Mill Suppliers' Committee.
Racecourse Central	All cane hauled over Silent Grove tramline	½	To be used for local defence purposes by Silent Grove Branch of the Racecourse Mill Suppliers' Committee.
Racecourse Central	All cane hauled over Silent Grove tramline	3	To defray the costs of employing a farmers' representative of the section of growers concerned at the Racecourse Mill for the current season.
Marian Central ..	All cane loaded at Dow's Creek and Langdon Siding	¾	To be used for insurance and weighbridge maintenance by the Dow's Creek and Langdon Branch of the Marian Central Mill Suppliers' Committee.

Growers are given the opportunity of petitioning for a poll to decide whether or not the above levies shall be made. The petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the cane suppliers within any of the areas concerned.

All petitions must reach the under Secretary, Department of Agriculture and Stock, Brisbane, not later than 10th July, 1936.

Full particulars of these Regulations appear in the *Government Gazette* of the 10th June, 1936, or may be obtained on application to the managers of the various sugar-mills in Queensland or to the undersigned—

E. GRAHAM, Under Secretary,
Department of Agriculture and Stock,
Brisbane.

PLATE 42.

HON. F. J. S. WISE, M.L.A., MINISTER FOR AGRICULTURE, WESTERN AUSTRALIA.

Mr. Wise, who is a Queenslander and a former officer of the Department of Agriculture and Stock, visited Queensland recently on a tour of investigation of methods of dealing with problems of rural industry common to several States of the Commonwealth. While here he visited The Queensland Agricultural College, at which he was formerly a student and dux in his final year.

The Cairns Hinterland was included in Mr. Wise's tour and a particular note was taken of the methods of handling and receiving maize in bulk at the silos at Atherton and Tolga. Inquiry into the Queensland tobacco industry was also one of the objects of the Ministerial tour.

Mr. Wise was accompanied by Messrs. G. L. Sutton, Director of Agriculture in Western Australia, and Malcolm J. L. Uren of Western Australian Press, both of whom expressed themselves as tremendously impressed with "the almost unbelievable fertility of North Queensland."

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 the Jersey Cattle Society, the Australian Illawarra Shorthorn Society, the Ayrshire Cattle Society, the Guernsey Cattle Society, and the Friesian Cattle Society, production charts for which were compiled during the months of April and May, 1936 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
JERSEY.				
MATURE COW (OVER 5 YEARS), STANDARD, 350 LB.				
Brooklands Choice Lady	W. S. Conochie, Sherwood	10,177·16	608·956	Duster 27 Brooklands
Lynahurst Molly	J. B. Keys, Gowrie Little Plains	11,606·17	549·203	Mercedes Noble King of Ogilvie
Westbrook Tulip 10th	Farm Home for Boys, Westbrook	11,199·31	553·247	Westbrook Councillor II.
Trecarne Rosella	T. A. Petherick, Lockyer	9,111·84	513·776	Trinity Officer
Trecarne Rosella 4th	T. A. Petherick, Lockyer	9,857·77	510·646	Trinity Officer
Fauvic Rejoice	H. Cochrane, Kin Kin	7,596·2	471·503	Yingara King
Kenmore Mouse	Wallace Bishop, Kenmore	8,288·56	458·078	Oaklands King Bee
Trinity Mariette	J. Sinnamon and Sons, Moggill	7,802·83	449·544	Trinity Jupiter
Greenstock Buttercup	J. B. Keys, Gowrie Little Plains	7,499·23	444·091	Carnation Larks Baron
Newhills Moya's Pride	J. Nicol Robinson, Maleny	6,218·65	417·364	Prudent of Brooklodge
Nobly Born Irondele	J. Sinnamon and Sons, Moggill	8,180·73	394·905	Nobly Born
Peg of Rosedale (266 days)	J. Schull, Oakey	6,876·42	375·989	Sovereign of Rosedale
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD, 310 LB.				
Glenview Starlight	F. P. Fowler and Son, Coalstoun Lakes	7,350·07	371·71	Trinity Officer
Trecarne Rosella 6th	T. A. Petherick, Lockyer	6,633·9	360·364	Trecarne Greden King
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD, 290 LB.				
Overlook Remus Fawn	E. Burton and Sons, Wanora	8,042·9	444·889	Overlook Favourite Remus

JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD, 270 LB.				
Brooklands Royal Cake	W. S. Conochie, Sherwood	6,541·55	394·991	Retford Earl Victor
Newhills Sybil	J. Nicol Robinson, Maleny	5,570·6	322·672	President of Brook Lodge
Carnation Victorious	W. Spresser and Son, Redbank	5,091·1	312·314	Vinchelez Gordon Victory
Carnation Fairy Lass	W. Spresser and Son, Redbank	5,157·38	308·348	Vinchelez Gordon Victory
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.				
Brooklodge Auburn	W. C. Dun, Wolvi	4,881·35	285·765	Brooklodge Minstrel
Brooklodge Ailsa	J. Cummings, Nerang	5,000·52	274·297	Brooklodge Mischief
Lermont Gordon Girl	J. Schull, Oakey	5,484·62	266·858	Trecarne Fern Lad
Kenilworth Una	H. T. Rowe, Kenilworth	4,895·85	265·031	Kenilworth Prince
Woodbine Model (198 days)	J. Williams, Wondai	5,022·95	259·397	Trinity Armlet
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Oxford Frances	E. Burton and Sons, Wanona	6,220·11	359·625	Oxford Golden Lad
Oxford Fawn	E. Burton and Sons, Wanora	5,691·54	346·84	Oxford Golden Lad
Pet of Calton	A. Gerity, Goomeri	4,987·87	341·065	Adrian of Calton
Newhills Syria 2nd	J. Nicol Robinson, Maleny	4,928·6	339·695	Prince Harry of Newhills
Pineview Royal Star	J. Humber and Sons, Borallon	5,355·04	321·432	Oxford Jeweller
Woodbine Daphne	J. Williams, Wondai	5,418·95	316·251	Armlets Corporal of Woodbine
Ascalon Tibby	C. W. Barton, Wyrelina	6,330·22	299·874	College Renovator
Lermont Rose	J. Schull, Oakey	5,345·42	293·577	Trecarne Fern Lad
Wyrune Peggy	J. R. Keys, Gowrie Little Plains	5,134·37	291·533	Lynahurst Majesty
Trinity Hopeful Blonde	J. Sinnamon and Sons, Moggill	5,445·86	288·556	Some Hope
Carnation Fairy Lass 2nd	Spresser and Son, Redbank	4,495·62	279·544	Vinchelez Gordon Victory
Trecarne Chimes 2nd	T. A. Petherick, Lockyer	5,158·53	276·533	Trelarne Golden King
Trinity Handsome Lady	J. Sinnamon and Sons, Moggill	5,006·31	274·065	Some Hope
Brooklands Royal Roseleaf	W. S. Conochie, Sherwood	5,618·93	271·076	Retford Earl Victor
Bellgarth Viola (257 days)	D. R Hutton, Cunningham	4,679·4	266·686	Airlie Thorn
Glenview Valda	R. P. Fowler and Son, Coalstoun Lakes	4,912·83	260·724	Carlyle Larkspur Empire

Production Recording—*continued.*

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Trecarne Jersey Maid	T. A. Petherick, Lockyer	4,852·4	255·704	Trecarne Victor
Queen of Toowoomba	C. W. Barlow	3,914·17	241·642	Trecarne Golden King
Curramore Marina	F. M. Burnett, Curramore	4,566·55	236·443	Norwood of Raleigh
Lermont Jeannette (268 days)	J. Schull, Oakey	4,573·8	231·835	Lermont Noble
Lermont Kate (268 days)	J. Schull, Oakey	4,459·5	231·434	Lermont Noble
Trecarne Colleen (268 days)	J. Schull, Oakey	3,894·9	230·849	Trecarne Barley King
AYRSHIRE.				
MATURE COW (OVER 5 YEARS), STANDARD, 350 LB.				
Fairview Ode	R. M. Anderson, Southbrook	10,277·28	388·801	Longlands Bonnie Willie 2nd
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.				
Myola Jollity	R. M. Anderson, Southbrook	8,711·63	395·712	Longlands Bonnie Willie 2nd
GUERNSEY.				
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Laureldale Olga	W. A. Cooke, Maleny	6,230·65	344·589	Linwood Favour
FRIESIAN.				
MATURE COW (OVER 5 YEARS), STANDARD, 350 LB.				
Towerlton Viola	F. C. Noller, Kumbia	11,641·15	404·048	Swastika of Towerlton
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (OVER 5 YEARS), STANDARD, 350 LB.				
Kyahram Marie	A. H. Black, Kumbia	13,783·35	597·183	Ledger of Greyleigh
Evelyn of Altavale (206 days)	W. H. Thompson, Nanango	11,870·4	505·539	Reward of Fairfield
Gentle 15th of Greyleigh	W. H. Thompson, Nanango	11,851·8	474·067	Gordon of Swanl a
Cameo of Braemar	A. H. Black, Kumbia	10,891·55	452·201	Victory of Balmoral

Blacklands Lady Ettie 3rd	A. B. Spiers, Wiyarra	8,630·2	418·762	Sultan the Second of Blacklands
Blacklands Ethel	A. Pickels, Wondai	10,558·8	400·591	Red Prince of Blacklands
Lorna of Greenfields	S. Henry, junr., Chatsworth	11,371·85	399·82	..
Thornleigh Pet 10th	C. O'Sullivan, Greenmount	10,609·5	382·381	Fussy's Pride of Fairfield
Waverley Fussy	R. A. Scott, Toogoolawah	8,466·35	354·231	Waverley Larry
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD, 330 LB.				
Model 3rd of Alfavale (365 days)	W. H. Thompson, Nanango	16,373·95	700·394	Reward of Fairfield
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD, 310 LB.				
Star 2nd of Alfavale	W. H. Thompson, Nanango	15,009·85	645·636	Reward of Fairfield
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD, 270 LB.				
Navillus Plum	C. O'Sullivan, Greenmount	8,687·8	380 225	Midget Shiek of Westbrook
Home Hill Gem	E. O. Althouse, Cloyna	9,687·17	360·213	Headlands Gordon
Home Hill Rose	E. Althouse, Cloyna	9,221·65	344·399	Headlands Gordon
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.				
College Doreen	Queensland Agricultural High School and College, Gatton	9,516·84	385·823	Premier 2nd of Hillview
Glenore Princess	A. M. Johnson, Gracemere	7,683·9	302·035	Sunnyview Union Jack
Applegarth Calm	A. B. Spiers, Wiyarra	7,265	295·595	Duchess Jellicoe of Fairfield
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Headlands Dolly 4th	Burnett Bros., Brookfield	10,317·2	413·515	Bruce of Gunvallis
Modern Favourite	R. Mears, Toogoolawah	7,856	340·778	Modern Stirling
Home Hill Nala 3rd	E. Althouse, Cloyna	8,647·65	307·572	Headlands Gordon
Euroa Bess	H. T. Lindenmayer, Mundubbera	8,178·41	295·488	Swagman of Clonagon
Melmerle Shadow	S. L. Holmes, Goomburra	6,521·3	275·955	Wunulla Utility

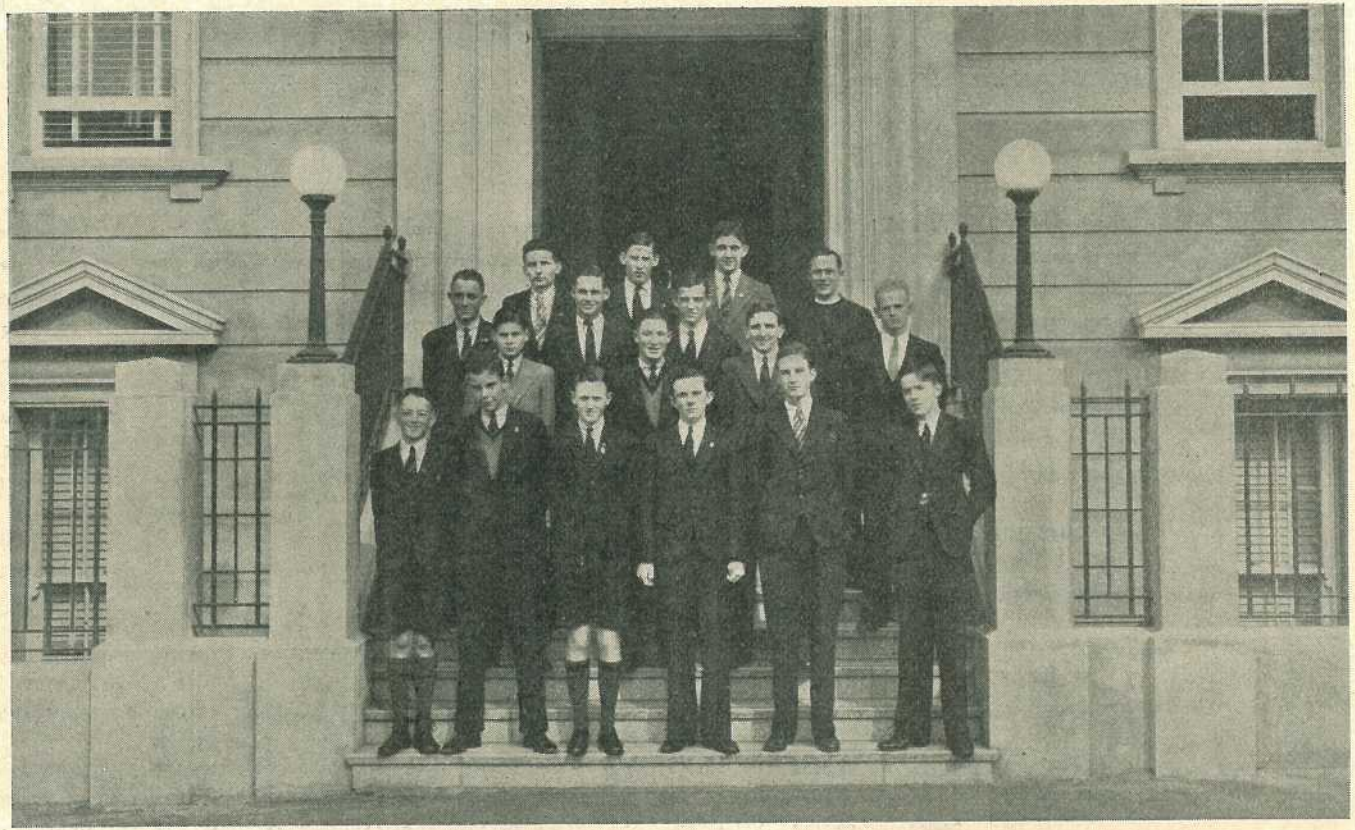


PLATE 43.

SCIENCE MEN OF TO-MORROW.

Group of Scholars from the Christian Brothers' College, Gregory Terrace, Brisbane, on the occasion of an instructional tour of the Laboratories of the Department of Agriculture and Stock. Rev. Brother R. Watson is the teacher in charge.

Answers to Correspondents

BOTANY.

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

Port Curtis District Plants Identified.

L.G.D. (Rosedale)—

1. *Cyperus Iria.* A sedge.
2. *Persoonia virgata.* One of the geebungs.
3. *Centauria melitensis.* Cockspur thistle or star thistle. A very common weed on the Darling Downs, and, generally, is a much more serious pest in Southern States than in Queensland.
4. *Euroschinus falcatus.*
5. *Linociera ramiflora.*
6. *Baeckea virgata.*
7. *Indigofera linifolia.*
8. *Amarantus interruptus.* A common little amaranth for which we have not heard a local name. We are surprised to hear that neither stock nor poultry take to it for green feed. We have cooked and eaten it ourselves, and found it quite a good substitute for spinach.
9. *Pseudomorus Brunoniana.*
10. *Malvastrum tricuspidatum.* A very common weed in Queensland for which we have heard no common name. It is usually called *Sida retusa*, which, of course, it is not, although it is closely allied to it.
11. *Olea paniculata.*
12. *Eranthemum variable.* Sometimes called love flower.
13. *Moschosma polystachyum.*
14. *Lespedeza cuneata.* It is rather interesting to hear that horses eat this plant. It is very closely allied to *L. sericea* which has been boomed as a fodder, under the name of Korean Clover, although it seems rather woody.
15. *Thesium australe.*
16. *Canthium coprosmoides.*
17. *Arytera divaricata* (*Nephelium divaricatum*).
18. *Chilocarpus australis.*
19. *Digitaria marginata* aff.
20. *Chloris ventricosa.*
21. *Arundinella nepalensis.*
22. *Paspalum distichum.* Water. couch. An excellent stock grass but a terrible pest in cultivations, particularly in damp situations.
23. *Danthonia sp.?* There are only glumes left and it is rather difficult to be sure without a complete spikelet.

A Poisonous Plant. Red Natal Grass. A Yam.

"Sap" (Townsville)—

1. The red prune-like fruit is *Ochrosia alliptica.* The tree is very common along the coast of North Queensland, but we have not heard a local name. The fruits are red and attractive but poisonous.
2. The samples of grass represent red Natal grass, *Rhynchelytrum repens.* Introduced into Queensland many years ago, and now very widely spread in the coastal parts of the State. In South Queensland it is very common as a weed on the fruit farms, and is used with some success, particularly when mixed with better fodders, as a chop chop for cattle and working horses. It is of annual duration, and once introduced into the locality generally spreads naturally very rapidly.
3. The third specimen is a variety of *Dioscorea bulbifera* or yam. The edible qualities of the aerial tubers produced vary very considerably. If the tuber is cut and it turns brown rather quickly, it is generally regarded as unfit for use, in fact rather dangerous. It is often very easy to grow and has quite an ornamental foliage. Otaheite or Tahitian Potato is a name sometimes given to it.

Roma Specimens Identified.

W.T.C. (Roma)—

1. *Tribulus terrestris.* Caltrops, also known as cat head, goat head, bull head, &c., names loosely applied to a number of burr plants in Queensland. It is very common throughout the whole of Western Queensland and is not known to cause any trouble here.
2. *Boerhaavia diffusa.* Tar vine, a very common weed in Queensland and generally regarded as quite good fodder for stock.
3. *Euphorbia Drummondii.* Caustic creeper. This plant is very common in many parts of Queensland and is widely spread through most of the Australian States. We have very little trouble with it with ordinary paddock resting stock in Queensland, but occasionally severe losses among travelling stock are reported. In New South Wales a prussic acid yielding glucoside has been found in the plant, but tests in Queensland have always given negative results. The symptoms stated by experienced drovers are that the head and neck of the affected animals, principally sheep, swell up very considerably and if the swelling is pierced an amber coloured fluid exudes and the life of the animal may be saved.
4. *Crotalaria dissitiflora.* A species of rattle pod very common in Queensland. Although some species of rattlepods both in Australia and abroad have been proved definitely poisonous to stock, nothing particularly is known about the present species. It is exceedingly common throughout the Maranoa and Western Queensland generally and is not known to possess any poisonous properties.
5. *Trianthema crystallina.* A plant allied to pig weed. It is very common and is generally regarded as quite a good fodder.
6. *Swainsona oroboides.* This plant is allied to the Darling pea, but is not known to possess any poisonous properties.
7. *Santalum lanceolatum.* This is the true sandalwood, but only the bigger trees have a good scented heart wood. It is very different from the so-called sandalwood of the Maranoa district, and is more frequently known as plum wood or Damson. The leaves are generally regarded as being quite good fodder for stock.

Murgon District Grasses Identified.

H.S. (Silverleaf State School, via Byee)—

1. *Echinochloa Walteri.* A wild millet. This tall grass is usually found in swampy situations and is generally regarded as a good fodder. It is closely allied to such well known cultivated crops as Japanese millet and white panicum.
2. *Arundinella nepalensis,* sometimes called rush grass. It can hardly be called a good fodder.
3. *Eulalia fulva.* Brown top. It is closely allied to the blue grasses and is quite a good fodder.
4. *Fimbristylis sp.* A sedge, not a true grass.
5. *Tragus racemosus.* Small burr grass.
6. *Brachiaria foliosa.* Leafy panic grass. This grass is fairly common in Southern Queensland and is usually regarded as quite a good fodder for stock.
5. *Tragus racemosus.* Small burr grass.
7. *Eragrostis cilianensis.* Stink grass. See reply to J.F. (Longreach).
8. *Eragrostis Brownii.* A love grass. This grass has no particular properties, but is quite common in the average native mixed pasture.
9. *Capellipedium parviflorum.* Scented top.
10. *Bothriochloa decipiens.* Bitter or pitted blue grass. This is also known in New South Wales as red leg. This grass is very common in some heavily grazed pastures, springing up where the better grasses have been eaten out. As cattle seem to leave it untouched, it soon gets a hold in the pasture.
11. *Sporobolus elongatus.* Rats tail grass.
12. *Stipa verticillata.* Bamboo grass. In spite of its rather cany stems, this grass seems to be eaten readily enough by stock.
13. *Eragrostis parviflora.* Weeping love grass.

General Notes

Staff Changes and Appointments.

Messrs. H. Lambert, R. J. Rollston, and F. C. Jorss have been appointed Assistant Inspecting Cane Testers for the forthcoming sugar season, with headquarters at Cairns, Mackay, and Maryborough, as from the 8th June, 1st July, and 1st July, respectively.

Mr. Thomas Mee, Clerk of Petty Sessions, Nambour, has been appointed Chairman of the Moreton Local Sugar Cane Prices Board in lieu of Mr. T. P. Shanahan, and also an Agent of the Central Sugar Cane Prices Board for the purposes of making inquiries in regard to sales and leases of assigned lands.

The following have been appointed Honorary Rangers under the Animals and Birds Acts:—

Messrs. C. H. Griggs (Giru), E. R. Marshall (Yuruga), W. D. McCloskey (Giru), and T. G. Peebles (Toobanna); L. Opperman (Ormeau), H. B. White (Percy Island), and W. M. Featherstone and A. H. Stone (Katoomba, Toowoomba).

Acting Sergeant T. Quinlan, Roma, has been appointed also an Inspector under the Brands Acts.

The Officer in Charge of Police at Stanthorpe has been appointed also an Acting Inspector of Stock.

Constable W. J. Randle, Roma, has been appointed also an Inspector under the Slaughtering Act.

The following officers of the Department of Agriculture and Stock have been appointed also collectors of royalty in the current opossum season:—

Messrs. S. E. Stephens, Instructor in Fruit Culture, Cairns; H. Coffey, Inspector of Stock, Mackay; D. Hardy, District Inspector of Stock, Emerald; W. D. C. McNeill, District Inspector of Stock, Toowoomba; W. C. Woodhouse, District Inspector of Stock, Maryborough; S. A. Green, Inspector of Stock, Wallangarra; and J. L. Bowman, District Inspector of Stock, Brisbane.

The undermentioned have been appointed honorary rangers under the Animals and Birds Acts in Northern sugar districts. They include members of the Pleystowe Mill Suppliers' Committee, the Victoria and Macknade Mill Suppliers' Committee, and the Herbert River District Executive:—

Messrs. W. A. Lyon (Macknade), H. Clay (Hawkins Creek, Ingham), T. J. McMillan (Bemerside), J. Miguel (Ingham), B. Parravicini (Halifax), F. Pavetto (Macknade), H. J. Hollins (Fairford, Ingham), L. L. Palman (Victoria Estate, Ingham), G. M. S. Robino (Victoria Estate, Ingham), J. A. Row (Stone River, Ingham), R. Smith (Long Pocket, Ingham), E. Kean (Habana), M. W. R. Bowman (Pleystowe), A. Breadsell (Pleystowe), J. Griffiths (Mirani West), A. Kippen (Wundaru), T. Madigan (Wallingford), W. Holding (Mount Pelion), R. Young (Walkerston), and C. McKinley (Walkerston).

Messrs. F. Prentice (Southbrook), S. R. Hockings (Toowoomba), and A. J. Lavender (Toowoomba), members of the Jondaryan Shire Council, have been appointed honorary rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. R. B. Morwood, M.Sc., Pathologist, Department of Agriculture and Stock, Brisbane, has been transferred to Toowoomba.

Mr. P. C. Boettcher (Annerley) and Mr. C. M. Martin (North Bundaberg) have been appointed assistant cane testers at the Kalamia and Isis Sugar Mills.

Sergeant A. Bahr, Blackall, has been appointed also an inspector under the Brands Acts.

Mr. N. F. Brincat, of Stockton, near Innisfail, has been appointed an honorary ranger under the Animals and Birds Acts.

Mr. J. L. Luke, Glen Aplin, has been appointed an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Members of the Goondi Pest Destruction Board, listed as under, have been appointed honorary rangers under the Animals and Birds Acts:—

Messrs. K. W. Maclean, R. T. Easterby, and J. R. Kerr (C.S.R. Co., Ltd., Goondi), W. C. Ah Shay (Mourilyan), W. J. Burke (Innisfail), H. Klarwein (Daradgee), A. Griggs (Innisfail), J. Kallaris (Daradgee), H. T. Stone (Innisfail), F. Wilderspin (Innisfail), and T. Bacalakis (Garradunga).

Mr. B. B. Brett, Manager of Mount Sturgeon Station, Hughenden, has been appointed an honorary ranger under the abovementioned Acts.

Mr. F. Caine, Inspector of Stock, Ipswich, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. W. T. Gettons, Sub-Accountant of the Department of Agriculture and Stock, has been appointed Accountant to the Department in succession to Mr. S. S. Hooper, who retired under the age limit conditions on the 30th June. Mr. Gettons joined the Department in 1910, and entered the Accounts Branch the following year. He was appointed Sub-Accountant in 1920. He has also been Registrar of Farm Produce Agents since 1919, and a temporary member of the Central Sugar Cane Prices Board since 1934. He became a member of the Australian Institute of Commonwealth Accountants on the formation of that body in 1920. Messrs. V. F. J. Bohan, E. C. R. Sadler, E. F. Keefer, and J. R. Winders secure consequential promotions in the Accounts Branch of the Department following on Mr. Gettons' appointment to the position of Accountant.

Acting Sergeant D. A. Campbell, Nambour, has been appointed also an Inspector under the Slaughtering Act.

Mr. G. F. E. Clarke, Inspector of Dairies, Ipswich, has been appointed also an Inspector under the Diseases in Stock Acts.

The Officers in Charge of Police at Chinchilla and Terror's Creek have been relieved of the positions of Caretaker of the Chinchilla Dip and Acting Inspector of Stock, respectively.

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

Acting Sergeants B. C. O'Sullivan (Mareeba), E. A. Puddle (Inglewood), and H. Winter (Thargomindah), and Constable W. C. Swain (Wyandra) have been appointed also Inspectors under the Slaughtering Act.

Mr. O. A. Christensen, junr., of Upper Freshwater, via Cairns, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Preservation of Wild Life.

In order to ensure that the preservation of native animal, bird, and plant life is maintained a number of Land Commissioners, Land Rangers, and Forest Officers stationed in various parts of the State have been appointed also Honorary Rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Northern Stallion District.

A Proclamation has been issued under the Stallions Registration Acts altering the boundaries of the Northern Stallion District so as to bring the Acts into force in the Petty Sessions District of Cape River. The Northern Stallion District now consists of the Petty Sessions Districts of Ayr, Cape River, Charters Towers, Ravenswood, and Townsville.

Regulations Relating to Fineness of Bone Dust.

Executive approval has been given, under the Fertilisers Act, to the amendment of a Regulation to provide that the size of the aperture of the sieve used for determining the fineness of bone dust shall be one-tenth of an inch square instead of one-sixteenth of an inch square.

Fruit Marketing Regulations.

Executive approval has been given to the repeal of all regulations previously made under the Fruit Marketing Organisation Acts and to the issue of new regulations in lieu thereof. These regulations do not embody any new principles; they are merely a reissue of all regulations at present in force, those which have expired by effluxion of time having been eliminated.

Extending Operations of Canary Seed Board.

An Order in Council has been issued in pursuance of the provisions of "*The Primary Producers' Organisation and Marketing Acts, 1926 to 1935,*" extending the operations of the Canary Seed Board for the period as from 1st June, 1936, to 31st May, 1939.

Davenport Downs—Palparara Holdings Road a Stock Route.

An Order in Council has been issued in pursuance of the provisions of the Diseases in Stock Acts, declaring the Davenport Downs-Palparara Holdings road, in the Jundah Land Agent's District, to be a stock route for the use of travelling stock.

Control of Brumbies in the Charters Towers and Cape River Districts.

A Proclamation has been issued under the Diseases in Stock Acts declaring the Petty Sessions Districts of Charters Towers and Cape River, in the Townsville Stock District, to be a district for the control of "brumbies," or wild horses, for the period from 1st August, 1936, to 30th November, 1936.

Unregistered Apiaries.

It has been reported to the Department of Agriculture and Stock that several beekeepers are failing to register their apiaries as provided for in "*The Apiaries Act of* 1931." A conviction has recently been obtained for this offence, and it is understood that further prosecutions are pending.

The Brisbane Show.

The organisation of the 1936 Queensland Royal National Show, to be held at Bowen Park, 17th to 22nd August, is rapidly nearing completion. An extensive works programme, involving an expenditure of some £20,000, has just been completed, and comprises important additions and improvements to the permanent Showground assets which will rank Bowen Park as one of the most modern and replete showgrounds in the Commonwealth.

The Show offices are already inundated with entries from all parts of the State for the various sections, and it is confidently anticipated that the various live stock sections will equal, if not eclipse, those of previous years. Live stock exhibitors who intend to leave with their teams of cattle prior to the date on which Excursion Railway fares would ordinarily apply are reminded that they should apply to the Secretary, Mr. H. W. Watson, Royal National Association, Courier Building, Queen street, in order that voucher certificates may be issued for presentation to the local station-master.

All further particulars may be obtained on communicating direct with the Secretary.

Appointment of Cane Testers.

The following have been appointed cane testers in pursuance of the provisions of the Regulation of Sugar Cane Prices Acts for the forthcoming sugar season at the mills indicated:—

Messrs. G. E. Becker (Babinda), C. J. Boast (Farleigh), T. Breen (Inkerman), T. P. Brown (Maryborough), J. Casey (South Johnstone), L. Chadwick (Mourilyan), P. H. Compton (Mulgrave), T. F. Corbett (Millaquin), T. D. Cullen (Bingera), L. G. F. Helbach (Proserpine), L. C. Home (Pioneer), J. Howard (Rocky Point), C. H. Humphreys (Cattle Creek), C. H. Jorgensen (Horston), J. Macfie (Racecourse), W. Richardson (Mount Bauple), G. Tait (Pleystowe), F. W. Trulson (North Eton), H. T. Whitcher (Invicta), R. D. Woolcock (Kalamia), V. F. Worthington (Plane Creek).

Misses D. Bowder (Mossman), E. Christsen (Marian), A. L. Levy (Qunaba), J. O'Flynn (Moreton), J. Orr (Tully), I. Palmer (Fairymead), M. T. Smith (Isis).

The following have been appointed assistant cane testers under the Regulation of Sugar Cane Prices Acts for the forthcoming sugar season at the mills indicated:—

Messrs. R. Anderson (Millaquin), C. Boone (Pioneer), A. Byrne (Bingera), E. J. Delaney (Plane Creek), St. C. G. Fanning (Tully), H. L. Holthouse (Pioneer), A. R. Hughes (Invicta), H. A. Laurie (Kalamia), R. A. Mahoney (Proserpine), S. McRostie (Isis), L. C. J. Clifton (Marian), J. Y. Taylor (Racecourse), P. A. Van Lith (Cattle Creek), D. Walton (Proserpine).

Misses D. Aldridge (Bingera), A. Anderson (Moreton), A. L. Dahl (Invicta), P. Eadie (Plane Creek), F. Foubister (Racecourse), N. Hooper (Pleystowe), C. Humphreys (North Eton), M. A. Lyle (South Johnstone), M. Morris (Pleystowe), T. M. Payne (Maryborough), E. Rowe (Marian), P. Southwick (Qunaba), M. Thorburn (Millaquin), M. E. L. Wassell (Babinda), S. Wilkinson (Farleigh), and Mrs. M. E. Nally (Inkerman).

Rural Topics

British Pedigree Pigs.

The National Pig Breeders' Association of Great Britain (Victoria House, Southampton Row, London, W.C.1, England) advises that it will be pleased to send to any pig breeder in Australia illustrated literature about British pigs, also specimen copy of "Pig Breeders' Gazette" (issued quarterly, price 9d. post free, annual subscription 3s.). The N.P.B.A. also issue "Pig Breeders' Annual" (3s. per copy post free), a book for breeders throughout the world. Write the secretary above address.

Good Feeding Essential.

In a two-minute talk with the secretary of the Friesian Association, it was gathered that during a recent tour amongst breeders of the Black and Whites in the South Island, Mr. Kalaugher had been tremendously impressed with the value of adequate feeding. "Good breeding is a great factor," he said, "but good feeding is equally essential." Mr. Kalaugher found that the dairy farmers, whose herds recorded the highest average milk and butter-fat returns, were invariably the farmers who fed their cows in the most liberal fashion, and with the most suitable rations. Professor Wilber J. Fraser, of the University of Illinois, recently contributed a striking article on "The Forlorn Cow," and declared that a general survey of dairy farms in the eastern half of the United States revealed the terrible underfeeding of thousands of thin dairy cows. Sixty per cent., he said, were underfed. The professor had counted in Illinois and Wisconsin the thin cows in a total of 234 herds containing 4,235 cows, 2,548, or 60 per cent., of which were too thin to do their best work. One year 62 per cent. of the cows counted were too thin in sixty-four dairy herds containing 1,000 cows. In the best-fed fourth of these herds only 16 per cent. of the cows were too thin, whereas in the poorest-fed fourth, 99 per cent. were too thin to do their best work. In fourteen herds, or 21 per cent., every cow was too thin. Yet the owners of both well-fed and poorly-fed herds had practically the same conditions for producing feed. The difference in the flesh and production of the cows was due almost entirely to the way they were fed—or starved.

Improved breeding, says the professor, has given us higher producing, more potentially profitable cows than we ever had before. But what is the use of all this effort and expense to get better producers if we don't feed two-thirds of them enough to allow them to produce abundantly. Apparently many dairymen think that, as soon as they give a cow some feed they get some milk from that feed, and, as quick as they get some milk they think that they get some profit from that milk. Nothing could be farther from the truth. Every cow on earth must use the feed required for maintenance first, because she cannot live if she does not have the nutriment necessary to support her body, and this requires far more feed than most farmers realise. Cows are kept for profit, and yet there is no profit under average farm conditions until a cow has produced 4,000 lb. 4 per cent. milk, or 160 lb. fat, to pay for all expenses of the cow, her feed, care, and housing up to this production. After this production is reached, two-thirds of any milk and fat produced above this goes for clear profit, under ordinary farm conditions.

As Mr. Kalaugher truly remarked in the two-minute conversation referred to, the best feeders in New Zealand get the biggest returns. That is the experience in every country under the sun. "Breed, weed, and feed," is a slogan that should be pasted in the hat of every dairy farmer.—From "Things We Talk About," by "Himi" in "The New Zealand Farmer."

Shearing Records.

The record for blade shearing is credited to Jack Howe, who, at Alice Downs Station (Queensland) in 1892, shore 321 sheep. In the same or following year he shore 276 sheep with machines at Barcaldine Downs Station (Queensland). The next tally of importance, and which is probably one of the highest, if not the highest, in Australia, was Dan. Cooper's performance at Bundooran Station (Queensland) in 1910, when he shore 316 sheep with machines in eight hours and ten minutes. The record for one day at any individual shed was at Brookong (N.S.W.), where, in 1902, approximately 170,000 sheep were shorn, the daily tally being over 10,000 and the highest tally 10,361.—"The Australasian."

Orchard Notes

AUGUST.

THE COASTAL DISTRICTS.

IN many centres the bulk of citrus fruits, with the exception of the late-ripening varieties, will have been harvested, and cultural operations should be receiving attention.

Trees which show indications of impaired vigour will require a somewhat heavy pruning, both in respect to thinning and shortening the branches. Where the trees are vigorous and healthy a light pruning only will be necessary, except in the case of the Glen Retreat mandarin. The densely-growing habit of this variety leads to a profusion of weak shoots, which, if allowed to develop, will be responsible for overbearing and resultant small and inferior fruit at an early age.

Where trees show signs of failing, investigations should be made at or near ground level for the presence of collar rot. The roots should be examined for disease, and in the North Coast districts for the presence of the citrus root bark channeller. A light application of paradichlorobenzene buried a few inches deep in circular drills around the tree and with the surface stamped firmly has been recommended for controlling this pest. The distance between the circular drills should be not more than 18 inches, and care should be taken to prevent the crystals of paradichlorobenzene from coming into contact with the roots. It may be necessary to repeat the application after an interval of three or four weeks.

Where it is necessary to control Black Spot, Melanose and Scab, the fungicide should be applied at the correct time. The control measures recommended are—

For Black Spot.

Bordeaux of 3-2-40 strength or Bordeaux of 3-2-40 strength + 1 per cent. of oil emulsion—

(1) As soon as the fruit has set;
(2) About a month to six weeks later;
(3) If Black Spot has been serious previously, another application just prior to the February rains.

For Melanose.

The use of a similar fungicide—

(1) Immediately the fruit has set;
(2) A month to six weeks later, or more often if the weather conditions are exceptionally wet.

For Scab.

(1) Bordeaux mixture 6-4-40 or Bordeaux 6-4-40 + 1 per cent. oil emulsion immediately before the new growth commences; this will help to clean up fungus on the old scabs;

(2) Bordeaux 3-2-40 or Bordeaux 3-2-40 + 1 per cent. oil emulsion at about the middle of the flowering period; this and subsequent applications are for the protection of young foliage and fruit;

(3) Bordeaux as soon as the fruit has set;

(4) If the season is exceptionally wet, it is advisable to give one or two further applications in order to keep the young fruit and foliage well covered.

Where for any reason healthy trees of vigorous constitution are unprofitable, they may be headed back—in fact, have the whole of the top removed—leaving a few selected arms. All other branches should be cut away at their source of origin. The three or four remaining arms, whose lengths will vary from 2 to 4 feet, will form the future framework of the tree. Care must be taken to cover the whole of the exposed bark with a suitable coating of whitewash to prevent sunburn. The numerous shoots which will grow from the main arms are suitably reduced, leaving from two to four on each arm. Under favourable conditions these will be in a fit condition to receive selected buds from desirable trees by the following autumn.

It is desirable that, when shoots intended for budding have attained a length of from 6 to 9 inches, their terminals should be nipped off in order to stiffen their growth and guard against the possibility of damage by strong winds.

Fertilizing should be completed as early as possible, the mixture for the spring application being high in readily available nitrogen. Ploughing should then be completed, the depth of which will be regulated by local conditions and the nature of the original preparation of the land. Following upon the ploughing the land should be worked down to a fine state of tilth. On hillside orchards attention should be given to the care of possible storm waters. Cultivation should be so arranged as to form shallow drains or banks along the tree rows and across the heaviest slope, leading into suitable side drains which may be grassed to prevent erosion.

The planting of trees may be continued and, with the exception of custard apples, expedited. The attention of citrus growers should be confined to varieties suited to their local conditions.

The pruning of grape vines should be completed, and where cuttings for planting are required these should be selected, trimmed, and heeled-in in slightly dry soil. Canes intended for cuttings should not be allowed to lie about and dry out, but should be treated the day they are severed from the plant. Cuttings are frequently made of excessive length; however, from 10 to 12 inches is a suitable length which allows for insertion in the soil so as to permit of the top bud, with a short section of the internode, protruding above the surface.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL pruning other than that applied to peaches and varieties which are late in coming into growth should be completed this month, and the planting of young trees, if not already done, should no longer be delayed. Early planting is preferred, the sooner after the fall of leaves the better. The time is opportune (when there is indication of the buds swelling) to work over (where the stock is reasonably vigorous) unprofitable trees. Strap grafting, as advised by the local field officers, is the most satisfactory method of top-working deciduous trees.

The pruning of vines should be postponed as long as circumstances permit, and these can only be gauged on actual observation as they are subject to much variation.

The usual winter working of the land is essential for the retention of moisture and aeration of the soil, but in shallow soils in which many orchards are planted deep working is most detrimental. The matter of seedling stocks for apples and the inferior plants frequently received from Southern nurseries prompts a query as to how many seeds have been stratified for spring planting, and if any effort is being made towards raising a local supply of nursery stock.

Farm Notes

AUGUST.

THE most important work during August will be the preparation of the land for all spring-sown crops. The better the cultivation the better the results that can be expected. Potato planting will be in full swing this month, and in connection with this crop the prevention of diseases calls for special attention. Where possible, seed potatoes should be selected from localities which are free from disease; they should be well sprouted, and, if possible, should not exceed 2 oz. in weight. Seed potatoes of this size are more economical to use then those large enough to necessitate cutting. However, if only large-sized seed are procurable, the tubers should be cut so that at least two well-developed eyes are left. The cut surfaces require to be well dusted with slaked lime or wood ashes as soon as possible after cutting. If considered necessary to prevent possible infection by scab, potatoes should be treated with hot formalin or acid corrosive sublimate. Details of the method employed may be obtained from the Department. When treatment has not been carried out prior to sprouting it should be delayed until a day or so before planting. Where cut tubers are to be sown, they should be dipped before cutting.

In localities where all danger from frosts is over, sweet potato cuttings may be planted out. This crop deserves more attention owing to its value for both culinary and stock food purposes.

Arrowroot may also be planted this month in suitable localities.

With the advent of warmer weather weed growth will increase, and cultivators will be kept busy in growing crops, and land being prepared for sorghums, millets, maize, cotton, and summer growing crops generally.

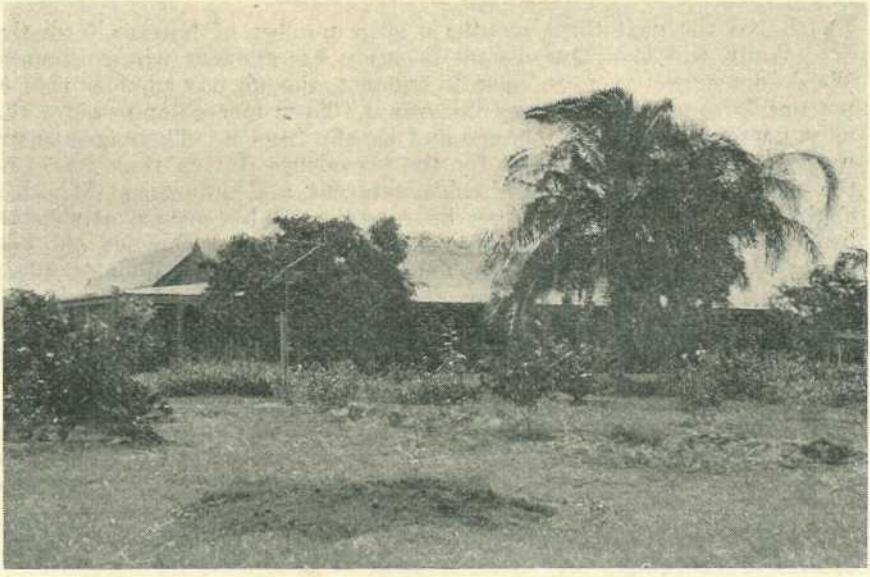


PLATE 44.

Coreena Station Homestead, Barcaldine District, Western Queensland.

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.

WINTER INFECTIONS.

DURING the next three months a large number of tourists from the South will visit Queensland to enjoy our glorious winter climate. We do not expect them to come in summer, though our summer heat is not nearly so terrible as many imagine it. Even Queenslanders, for the most part, enjoy the cool change and benefit from it. Their enjoyment would be flawless were it not for the prevalence during that season of the infections commonly called colds, catarrhs, and influenzas. Whether slight or severe, all these may be complicated by serious attacks of bronchitis and pneumonia. The aggregate disablement, expense, and loss of time from these infections are enormous, and they appreciably affect our death rate. The extremes of life—that is, the elderly and the children—among us suffer most.

How These Infections are Spread.

Some protection may be obtained from vaccines, but these are advised chiefly for the elderly. We seldom use them for children. For them the avoidance of infection, as far as possible, is the way of safety. In schools little can be done beyond free ventilation, avoiding only direct currents of cold air, and the free admission of sunlight. For the pre-school child and the infant much might be done by the mother, but owing to lack of knowledge very little is done.

Let us endeavour to supply as much of this knowledge as every mother should possess. These infections are caused by living germs present in the mouth, nose, throat, and air passages. They are spread

mainly by coughing in the form of an extremely fine invisible spray, which floats around the sufferer, until it is dispersed by ventilation. They may be spread also by the moist fingers of young children smearing the secretions of mouth and nose on to the person or clothes of other children. This, like other bad habits, is easily prevented before it becomes a habit. The spread of coughing is less easily controlled.

Massive Infections.

Whether exposure to infection will cause illness depends on two things—the massiveness of the infection and the resistance of the person attacked. By massiveness we mean the number of disease germs making the attack; by resistance, the powers of the body attacked to kill or disable the germs, and so render them harmless. With good resisting power a child may resist the infection, unless the dose of the germ is sufficiently large to overcome his resistance.

Prevention of Infection.

These infections are more prevalent in winter, because then we live more indoors, often in closed rooms with little or no ventilation. There is no excuse for this in Queensland. The infections are carried about by persons who have slight attacks, or are recovering from attacks, or though themselves protected, distribute the germs to others. The danger is greatest in crowded ill-ventilated halls, where carriers are sure to be present during an epidemic. It is a very simple and easy thing to keep babies and young children away from indoor crowds.

If a child returns from school with a cold, how seldom is any attempt made to prevent his communicating it to the younger children! The mother may not be able to protect the younger ones from the germs absolutely; but she can do much to diminish the massiveness of the infection.

"Colds" are Not Caused by Cold.

Cold by itself can never cause these infections. This has been well shown by the immunity of those exposed to extreme cold on polar expeditions. Chilling may temporarily lower the resistance, and if the person chilled happens to be a carrier of the infection, may bring on an attack; but this probably rarely happens. The chilly feeling at the commencement of an attack is part of the disease, not its cause. In young children we may always assume that the infection has been received from some other person. Winter infections are not caused by going out into the fresh air, but by sitting in stuffy rooms with other people, one of whom happens to be a carrier.

It must be remembered that once a child has a cold he must be protected from chills, which increase the risk of pneumonia. If he is chilly or feverish, keep him in bed. When he is well, to overclothe him and keep him indoors will only make him more susceptible.

To Increase Resistance.

Good wholesome food containing everything necessary for health, including all the vitamins, is the main thing. The breast-fed infant has more resistance if his mother takes enough milk, wholemeal bread, wholemeal porridge, and green vegetables, together with some butter, cheese, and eggs. The artificially-fed baby should have some codliver oil emulsion, and when he is old enough some cerevite porridge. The toddler should have plenty of milk (one pint daily), wholemeal or cerevite porridge, some butter, egg, fresh vegetables, and fruit. For a delicate child we may add some codliver oil emulsion.

IN THE FARM KITCHEN.

SOUPS.

Cold Weather Recipes.

Stock is the foundation of all soups, so the making is simple. Stock is the liquid obtained from boiling bones in water to draw as much nutriment out of them as is possible. The bones should be broken up and washed, then put into cold water with a little salt; about two quarts of water to two pounds of bones is an average allowance.

Bring the water slowly to the boil, then remove the scum and simmer gently for three or four hours. A flavouring of carrot, onion, and turnip is usually added. These vegetables are washed and prepared and put in whole, after the water has come to the boil.

Veal bones contain more gelatinous matter than either beef or mutton, so veal bones are used for making jellied stock. Fish stock is made from fish bones; vegetable stock from vegetables only; white stock from veal, rabbit, or chicken bones; and brown stock from beef bones. First stock is the liquid obtained from the first boiling, while second stock is the liquid obtained from re-boiling the bones with a second lot of water. Pot liquor is the liquor in which a joint has been boiled. This does not contain as much goodness as stock, but makes a very good foundation for soup. If very greasy, leave it to get cold, then skim off the fat before using it.

Mulligatawny Soup.

Take 1 quart stock, 1 oz. butter, 2 teaspoonfuls curry-powder, 1 tablespoonful flour,, 1 turnip, ½ teaspoonful curry-paste, 1 oz. ham, 1 onion, lemon juice to taste, 1 apple,, 1 small carrot.

Peel and cut the onion into rings. Dice ham. Heat the butter in a saucepan. Add onion and ham and fry until brown. Add peeled, sliced apple, scraped, sliced carrot, and diced, peeled turnip. Stir in curry-powder, curry-paste, and stock. Cover. Bring to the boil and simmer very gently for one hour. Rub through a sieve. Thicken with a tablespoonful of flour, mixed until smooth with a little cold water, and stirred very gradually into the soup. Bring to the boil, boil for a few minutes, then serve at once.

Cream of Oats Soup.

Take 1½ pints stock, 6 peppercorns, ½ pint milk, small piece of turnip, 1 onion, ¾ cupful oats, piece of carrot, blade of mace, ½ oz. butter, salt, and pepper.

Melt the butter in a saucepan. Add peeled and sliced onion and carrot. Cook until brown for a minute or two. Carefully add stock, peeled turnip, and herbs. Season to taste with pepper and salt, then add the oats. Cover the pan and simmer for forty-five minutes. Remove from the gas, strain, stir in the milk, gradually reheat, and serve at once.

Haricot Bean Soup.

Take 1 lb. haricot beans, 1 peeled turnip, 2 oz. dripping, 2 tomatoes, 2 large onions, 1 stick celery, 1 pint milk, 2 quarts water, sprig of parsley, pinch of mace, salt and pepper to taste.

Soak the beans overnight in cold water. Next day, drain and add to water with mace, diced vegetables, pepper, and dripping. Bring to the boil and boil for three hours, adding the tomatoes half an hour before the soup is cooked. Rub through a wire sieve. Add milk, minced parsley, and salt to taste. Reheat and serve.

Cock-a-Leekie.

Take 1 boiling fowl, 1 bunch of leeks, 1 carrot, 1 turnip, 1 onion, 2 sticks celery, 3 oz. rice, salt, pepper, 2 bay leaves, 2 quarts cold water.

Wash the leeks and peel the carrot, turnip, and onion. Cut the leeks into four and the other vegetables into dice. Cut up the fowl and put it into a pan with the cold water and one teaspoonful salt. Bring very slowly to the boil and add the vegetables. Simmer very gently for two hours or until the fowl is tender. If it is allowed to boil it will be hard and tough. Remove the fowl and bay leaves. Wash and add the rice and simmer for twenty minutes. Cut the white meat off the fowl and put the pieces in the soup to re-heat. Season with salt and pepper and serve. Water is simmering when a bubble rises now and then at the side of the pan.

Pumpkin Soup.

Take 2 lb. pumpkin, ½ head celery, 1 leek, 2 oz. butter, 1 cupful milk, 1 quart stock, salt, pepper, and a little grated nutmeg.

Cut up the leek, pumpkin, and celery, and put them in the boiling stock. Simmer for one hour and rub through a very fine sieve. Re-heat and add milk, salt, pepper, and nutmeg to taste. Put in the butter and serve.

Rice and Tomato Puree.

Take 1 large tin tomatoes, 1 carrot, 1 onion, 1 pint stock, a few celery seeds, pepper, salt, 2 oz. rice.

Peel and slice the onion. Scrape, wash, and slice the carrot. Wash the rice well. Put all these ingredients into a saucepan, add the tomatoes with their liquor, the stock, and the celery seeds tied up in a small piece of muslin. Season well with pepper and salt. Bring to the boil and cook slowly until the rice and vegetables are quite tender. Stir occasionally to prevent the rice from sticking. Take out the celery seeds and rub soup through a sieve. Rinse out the saucepan, pour the soup back into it, and re-heat. Taste to see if well seasoned, then serve. If the soup is not a good colour, add a few drops of cochineal. If liked, this soup may be thinned down with some more stock.

Vegetable Broth.

Take 1 lb. gravy beef, ½ lb. beef or veal bones, 1 small turnip, 2½ pints cold water, 1 large onion, 1 carrot, 1 clove, 1 bay leaf, salt, and pepper to taste.

Cut the beef into small pieces and place it with the broken bones in a saucepan. Add the water. Stand aside for one hour, then bring slowly to boiling point. Skim and simmer gently for two hours, and strain. Add peeled and chopped onion, carrot, turnip, clove, bay leaf, and seasoning to taste. Cover and simmer till vegetables are tender.

Cream of Pototo Soup.

Take 3 potatoes, 2 slices onion, 1 quart milk, 2 tablespoonfuls flour, ¼ teaspoonful celery salt, 3 tablespoonfuls butter, 1 tablespoonful chopped parsley, salt and pepper to taste, cayenne.

Cook the potatoes until they are soft, then scald the milk and onion in a double boiler. Drain potatoes and add milk after removing the onion. Rub through a sieve, and return to the double boiler over the heat. Melt the butter, add flour, and continue stirring all the time. Pour some of the hot milk mixture over the thickening, then return to the saucepan and cook altogether for five minutes. Lastly add the parsley and seasoning, and serve very hot. If the soup is too thick, dilute it with a little hot water or milk.

Gravy Soup.

Take 1½ lb. shin of beef, 1 carrot, 1 medium onion, 1 stalk celery, 1 tablespoonful cornflour, 1½ quarts water, ½ turnip, 1 oz. butter, 2 bay leaves, pepper and salt to taste, 3 tablespoonfuls water.

Wipe the meat and cut into dice, then place in a saucepan. Pour over the water. Cover and bring to the boil and allow to simmer gently. Fry the sliced carrot, turnip, and celery in the butter (or dripping) till brown, then add to the soup. Put in the bay leaves. Simmer for three hours, then rub through a sieve. Dissolve the cornflour in three tablespoonfuls of water and stir into the soup. Boil four minutes, stirring constantly. Season to taste and serve.

Crecy Soup.

Take 2 bunches of carrots, 2 quarts stock, ½ pint milk, salt, pepper to taste, 1 tablespoonful plain flour, ½ oz. butter.

Scrape the carrots, and cut each into about eight pieces. Melt the fat in a stock pot and add to it the carrots. Fry gently, about 10 minutes, but do not brown the carrots. Then add the stock and simmer till tender (about one hour). Rub all through a sieve, re-heat the puree, then add the milk. Blend the flour to a smooth paste with a little cold milk or stock, stir in with a wooden spoon, and cook gently for about five minutes. Season to taste and serve very hot.

Celery Cream Soup.

Take 1 head celery, 1 pint water or stock, 1 pint milk, salt and pepper, 1 dessertspoonful butter, 1 dessertspoonful sago.

Wash the sago, and put it to soak in the milk. Dice the celery and put on to boil with water or stock and seasoning. Simmer gently for ¾-1 hour, then add the milk, the butter, and sago. Simmer till the sago is clear, then serve.

Kidney Soup.

Take ½ ox kidney or 2 sheep's kidneys, 1 dessertspoonful butter, level tablespoonful flour, ½ onion, 1 quart of good stock, pinch mustard, pepper, and salt.

Peel and dice onion, and skin and dice kidneys. Make the butter hot in a pan, and add the onion. Fry till lightly browned, then add kidney and fry about five minutes, stirring to prevent overbrowning. Add the flour, mustard, and seasoning and fry a few minutes longer. Then add half the stock and stir till the stock boils. Simmer about half an hour, then add remainder of stock, and cook another 20 minutes. If necessary, thicken with a very little cornflour blended with cold water.

Artichoke Soup.

Take 2 lb. artichokes, 1 tablespoonful butter, 1 pint stock, 1 onion, 1 pint milk, 1 heaped tablespoonful flour, 1 blade mace, pepper and salt.

Scrape artichokes and put on to boil in sufficient cold water to cover. Cook till soft enough to be rubbed through a rather coarse sieve. Drain and rub through sieve with a wooden spoon. Heat the milk with the mace and seasoning. Then melt butter, stir in flour till smooth, add the stock, the milk, and last the artichoke puree. Bring to boil and serve.

Cauliflower Soup.

Take 2 quarts stock, 1 white cauliflower, Parmesan cheese, chopped parsley.

Soak cauliflower, then cut into very small pieces. Plunge into boiling water and boil rapidly till quite tender, adding sufficient salt to season. Strain into soup tureen or soup plates, and pour over the stock, which has been well seasoned and brought to the boil. Grate a little cheese over each soup plate of soup, or into the tureen, and add a pinch of chopped parsley to decorate.

Rice Soup.

Take 3 cups chicken or rabbit stock, 1 cup milk, 1 teaspoonful rice, pepper, salt, 1 egg yolk, blade of mace, little finely chopped parsley, shallot or ½ onion.

Wash rice, and cook in sufficient water to cover, till grains are swollen and tender. Drain, pour cold water over, then drain and place in saucepan. Add the stock, the finely sliced onion or shallot, pepper and salt, and cook a little longer, then rub through a sieve. Heat the milk with the mace and seasoning, and pour the milk on to the rice puree. Reheat, and just before sending to table stir in the egg yolk, which has been beaten with a little cold milk. Add the parsley, and serve. Do not boil after addition of egg, as soup will curdle.

Potato Soup.

Take 1 lb. potatoes, 1 large onion, 1 tablespoonful butter, 1 dessertspoonful chopped parsley, 1 tablespoonful flour, 1 quart stock, 1 teaspoonful cream, pepper and salt.

Slice the prepared onion, and fry in the butter (without browning) for 15 minutes or so. Add the potatoes (pared and sliced) and the stock. Bring to boil, skim, and continue boiling till potatoes are tender. Rub through sieve, add seasoning, and reheat. Mix flour with a little cold milk, stir into soup, and just before serving add the cream and the chopped parsley.

IN THE KITCHEN GARDEN.

Should showery weather be frequent during July, do not attempt to sow seeds on heavy land, as the latter will be liable to clog, and hence be injurious to the young plants as they come up. The soil should not be reworked until fine weather has lasted sufficiently long to make it friable. In fine weather get the ground ploughed or dug, and let it lie in the rough until required. If harrowed and pulverised before that time, the soil is deprived of the sweetening influences of the sun, rain, air, and

frost. When the ground has been properly prepared, make full sowings of cabbage, carrot, broad beans, lettuce, parsnips, beans, radishes, leeks, spring onions, beetroot, eschalots, salsify, &c. As westerly winds may be expected, plenty of hoeing and watering will be required to assure good crops. Pinch the tops of broad beans which are in flower and take up peas which require support. Plant out rhubarb, asparagus, and artichokes. In warm districts it will be quite safe to sow cucumbers, marrows, squashes, and melons during the last week of the month. In colder localities it is better to wait till the middle or end of August. Get the ground ready for sowing French beans and other spring crops.

The continued production of rhubarb may be greatly assisted by giving a heavy mulching of manure and hoeing it well into the soil. Keep the beds well watered, and give regularly a dressing of liquid manure, say, once a week.

It is not necessary to use forcing manures on the young stock, as plants are ruined if forced in the early stages of growth.

The rhubarb makes rapid growth during the autumn and spring, and when stalk cutting has been started liquid manuring and manuring may be given.

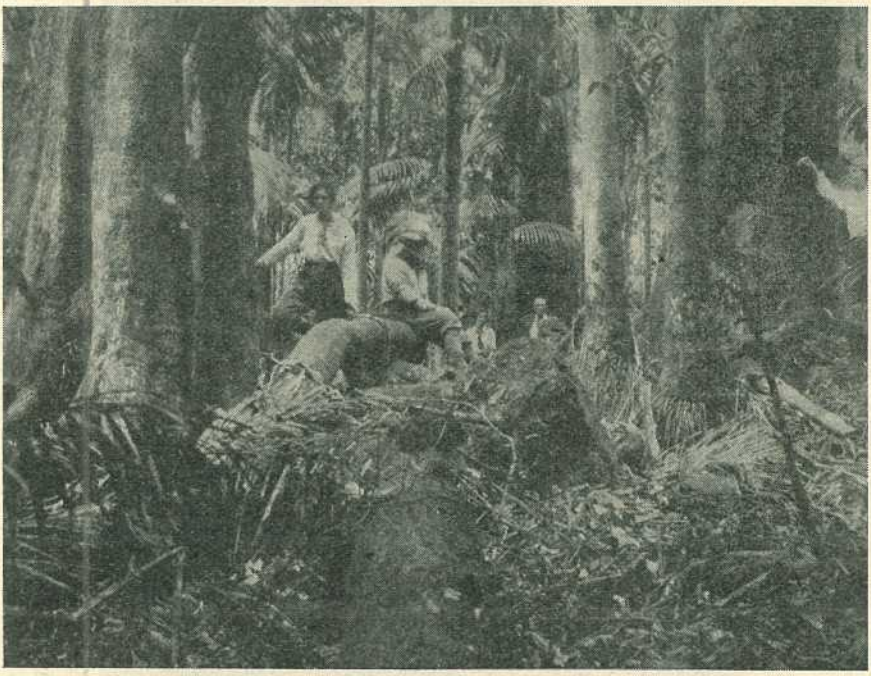


PLATE 45.

Giant scrub box-trees along the bottom of Nixon's Gorge, Lamington Plateau.

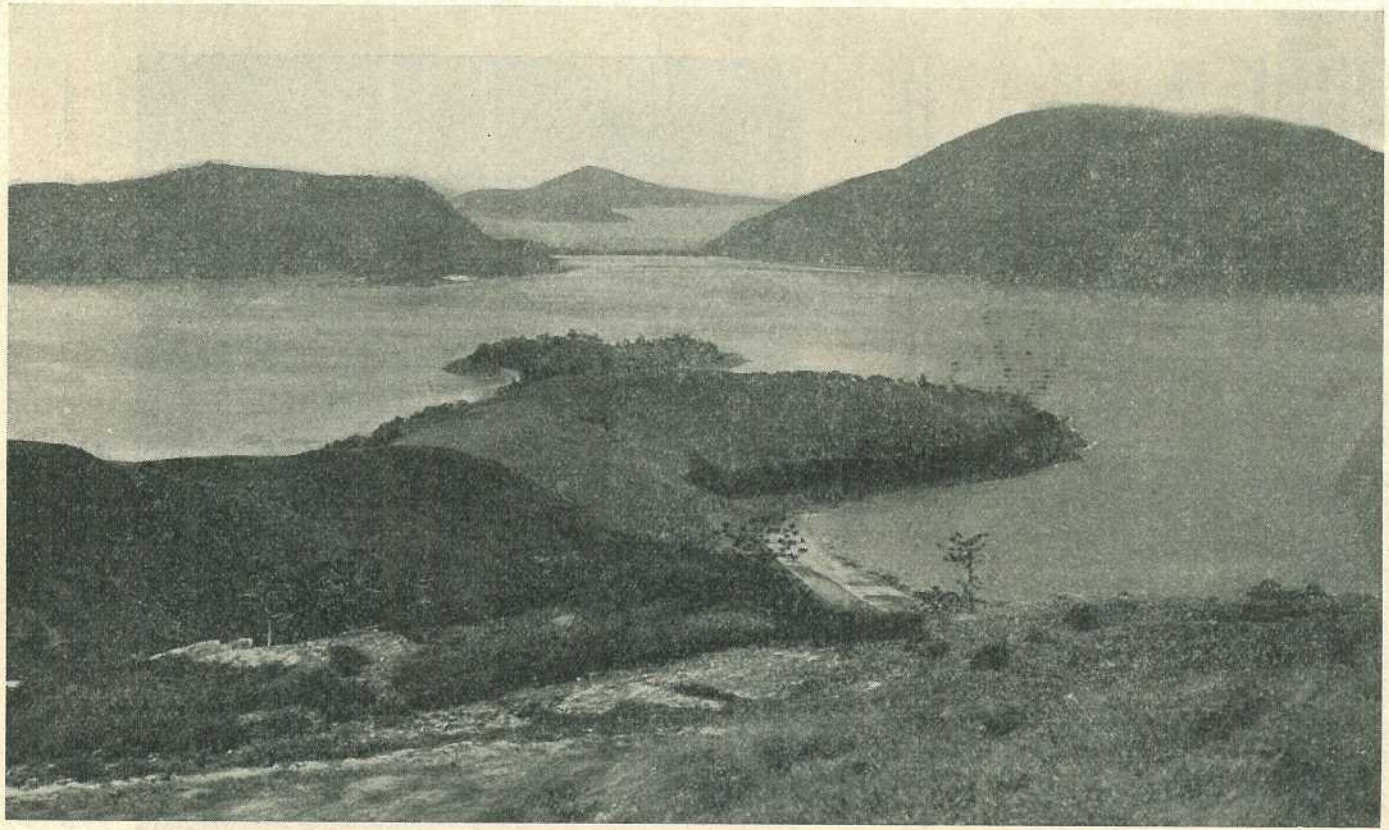


PLATE 46.

Eastern entrance to Kennedy Sound, Whitsunday Passage, from Oldfield's Hill (412 ft.), on Lindeman Island. This scene is typical of the beauty of more than a thousand miles of Coastal Queensland. In these quiet waters innumerable species of edible fish abound.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MAY 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.	
	May.	No. of Years' Records.	May, 1936.	May, 1935.		May.	No. of Years' Records.	May, 1936.	May, 1935.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	2·24	35	3·47	5·07	Clermont	1·27	65	1·03	0·15
Cairns	4·56	54	4·81	7·52	Gindie	0·88	37	..	..
Cardwell	3·64	64	3·51	4·99	Springsure	1·23	67	1·08	..
Cooktown	2·84	60	3·28	3·53					
Herberton	1·76	50	1·60	4·40					
Ingham	3·68	44	2·69	5·69					
Innisfail	12·54	55	14·49	14·88					
Mossman Mill ..	3·94	23	4·09	7·67	*Darling Downs.*				
Townsville	1·30	65	0·54	2·37					
Central Coast.					Dalby	1·31	66	0·49	1·81
					Emu Vale	1·15	40	0·56	1·10
Ayr	1·14	49	0·10	1·73	Hermitage	1·16	30	..	0·81
Bowen	1·31	65	0·38	1·82	Jimbour	1·22	48	0·31	1·81
Charters Towers ..	0·80	54	0·38	1·15	Miles	1·48	51	0·15	0·81
Mackay	3·82	65	4·09	10·80	Stanthorpe	1·82	63	0·82	1·03
Proserpine	4·41	33	2·61	5·87	Toowoomba ..	2·16	64	0·43	1·73
St. Lawrence ..	1·76	65	2·65	1·03	Warwick	1·51	71	0·71	0·95
South Coast.									
					Maranoa.				
Biggenden	1·71	37	1·59	2·55					
Bundaberg	2·58	53	2·91	2·34	Roma	1·38	62	0·23	..
Brisbane	2·75	85	1·14	1·55					
Caboolture	2·78	49	3·82	1·28					
Childers	2·10	41	2·28	1·33					
Crohamhurst	4·81	43	4·42	2·88					
Esk	1·93	49	0·71	1·33					
Gayndah	1·56	65	1·91	1·65					
Gympie	2·81	66	1·71	2·36	*State Farms, &c.*				
Kilkivan	1·81	57	2·80	1·68					
Maryborough ..	2·99	65	2·95	2·54	Bungeworgorai ..	0·85	22	0·06	0·08
Nambour	4·66	40	5·34	2·80	Gatton College ..	1·61	37	0·62	5·13
Nanango	1·52	54	0·96	1·37	Kairi	2·06	22	..	..
Rockhampton ..	1·62	65	1·06	1·09	Mackay Sugar Experiment Station	3·37	39	3·32	8·36
Woodford	2·85	49	2·48	1·65					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MAY, 1936.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean 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	81	67	84	4	52	26	328	15
Herberton	..	71	58	77	5	43	22	160	18
Rockhampton	30·09	79	61	83	14	50	21	106	10
Brisbane	30·17	73	57	80	31	51	29	114	11
Darling Downs.									
Dalby	30·15	75	48	80	12, 13	35	6	51	4
Stanthorpe	..	66	41	77	2	25	20	83	6
Toowoomba	..	70	47	77	9	37	20	43	7
Mid-Interior.									
Georgetown	29·94	85	63	90	12, 13	43	22	47	2
Longreach	30·06	80	53	86	13	41	21	180	4
Mitchell	30·14	74	43	79	12, 13, 14	29	21	53	5
Western									
Burketown	29·94	85	65	91	18	55	21, 22	232	5
Boulia	30·03	80	55	88	10	46	22	321	3
Thargomindah	30·11	75	50	82	1, 10, 11, 12	39	7	68	1

ASTRONOMICAL DATA FOR QUEENSLAND.

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

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	July. 1936.		August, 1936.		July. 1936.	Aug., 1936.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·45	5·7	6·35	5·21	2·1	3·26
2	6·45	5·7	6·34	5·22	2·49	4·29
3	6·45	5·7	6·33	5·23	3·43	5·33
4	6·45	5·8	6·33	5·23	4·40	6·38
5	6·45	5·8	6·32	5·24	5·40	7·41
6	6·45	5·8	6·31	5·25	6·43	8·44
7	6·45	5·9	6·31	5·25	7·45	9·47
8	6·45	5·9	6·30	5·26	8·47	10·56
9	6·44	5·9	6·29	5·26	9·50	..
					a.m.	
10	6·44	5·10	6·28	5·26	10·53	12·4
11	6·44	5·10	6·28	5·27	11·57	1·5
12	6·44	5·11	6·27	5·27	a.m.	2·8
13	6·43	5·11	6·26	5·28	1·3	3·5
14	6·43	5·12	6·25	5·28	2·8	3·59
15	6·43	5·12	6·24	5·28	3·12	4·44
16	6·43	5·13	6·23	5·29	4·13	5·25
17	6·42	5·13	6·22	5·29	5·11	6·1
18	6·42	5·14	6·21	5·30	6·6	6·33
19	6·42	5·14	6·20	5·30	6·48	7·5
20	6·41	5·15	6·19	5·31	7·31	7·36
21	6·41	5·15	6·18	5·31	8·1	8·9
22	6·41	5·16	6·17	5·32	8·34	8·41
23	6·40	5·16	6·16	5·32	9·6	9·15
24	6·40	5·17	6·15	5·33	9·36	9·52
25	6·39	5·17	6·14	5·33	10·7	10·33
26	6·38	5·18	6·13	5·34	10.40	11·21
					p.m.	
27	6·38	5·18	6·12	5·34	11.17	12·13
28	6·37	5·19	6·11	5·35	11·55	1·10
					p.m.	
29	6·36	5·19	6·10	5·35	12·41	2·9
30	6·36	5·20	6·9	5·36	1·32	3·13
31	6·35	5·21	6·8	5·36	2·27	4·17

Phases of the Moon, Occultations, &c.

5 July	○	Full Moon	3 22	p.m.
12 ,,	☽	Last Quarter	10 5	p.m.
19 ,,	●	New Moon	3 14	p.m.
27 ,,	☾	First Quarter	5 22	a.m.

Perigee, 16th July, at 7 a.m.

Apogee, 28th July, at 6·36 a.m.

Jupiter and the Moon will be within 2 degrees of one another at 4 a.m. on the 3rd, when both are about an hour below the eastern horizon.

On the same date the Earth in its orbital revolution round the Sun once a year, will reach its greatest distance attainable from it. Taking 93 million miles as the ordinary distance this will be increased by about 1½ million miles on that date.

On the 6th of July Saturn will cease to move eastward from our point of view and from that time until nearly the end of the year it will apparently have a westward motion, amongst the stars of Aquarius.

A partial eclipse of the Moon will take place in the early morning hours of 5th July. At 2·27 the Moon will enter the Umbra or darker part of the Earth's shadow, which will increase until 3·25 and leave it at 4·24 a.m., about 2 hours before the Sun rises and the Moon sets.

Saturn will be technically in conjunction with the Moon on the 10th, but as it will be 8 degrees from it, more than the length of the Southern Cross, and as it will occur only an hour before midday a popular spectacle cannot be expected.

On the 16th the planets Mercury and Mars will apparently approach one another so closely that they will appear to be touching. However, the Sun rising about half an hour after the planets a flood of daylight will spoil this extraordinary phenomenon.

On the 24th the swift planet Mercury will be in the part of its orbit farthest from the Sun, and so nearly in a line with it from the Earth that it will escape a transit of the Sun's face by only 1 degree 36 minutes; this, however, is more than a diameter and a-half of the Moon. On this occasion Mercury will be almost 1¼ times its ordinary distance from the Earth.

A second conjunction of the Jupiter and the Moon in this month will occur on the 30th at 9 o'clock in broad daylight.

Mercury rises at 5·9 a.m., 1 hour 36 minutes before the Sun, and sets at 3.41 p.m., 1 hour 26 minutes before it on the 1st; on the 15th it rises at 6.2 a.m., 41 minutes before the Sun, and sets at 4.23 p.m., 49 minutes before it.

Venus rises at 6.48 a.m., 2 minutes after the Sun, and sets at 5.8 p.m., 1 minute after the Sun on the 1st; on the 15th it rises at 7.2 a.m., 20 minutes after the Sun and sets at 5.31 p.m., 18 minutes after it.

3 Aug.,	○	Full Moon	1 47	p.m.
10 ,,	☽	Last Quarter	6 59	a.m.
17 ,,	●	New Moon	1 21	p.m.
25 ,,	☾	First Quarter	3 49	p.m.

Perigee, 7th August, at 1.48 a.m.

Apogee, 22nd August, at 7.12 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.