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PART 4.

Event and Comment.

Queensland Wheat.

QUEENSLAND has harvested her 1929 wheat crop and the deliveries of grain to the State Wheat Pool are practically completed. The result of the crop as a whole is highly gratifying. We are now faced with early preparations for the 1930 harvest.

In a recent report to the Minister of Agriculture and Stock, Mr. Harry F. Walker, the Director of Agriculture, Mr. H. C. Quodling, calls attention to the fact that within the Darling Downs and Maranoa districts, the recognised wheat belt of this State, considerable areas of land are lying idle which could be brought under grain production.

This State for the next few years has little to fear from over-production of wheat, for we are as yet far behind in our own requirements which approximate 5,000,000 bushels yearly. It is generally an uneconomic policy to buy from our neighbours that which we are capable of producing ourselves, but for years past this is what Queensland has been doing in order to supply her requirements in a class of grain which she can produce equal in quality to that of any other State in the Commonwealth.

Although wheat production is not at present Queensland's main rural industry, wheat is a primary product to which more attention could be given for the general welfare of the community. In this State, it is customary for the most progressive wheatgrowers who apply approved methods of cultivation, to commence summer fallowing operations immediately following on the previous harvest, and already most of these growers have made considerable progress in this direction. It is, however,

to a small minority who have as yet made no efforts in the direction of preparing their land that the advice to get busy has been tendered.

From a long series of experimental trials conducted by the officers of the Department of Agriculture, it has been shown that to attain success in wheatgrowing under average Queensland conditions, it is essential that early initial cultivation of areas intended for wheat should be carried out, or at least very far advanced, before the rainy season begins. The copious rainfall usually experienced between the months of December and April is thus more readily absorbed instead of being diverted or else almost entirely lost where compacted soil surfaces are existent.

On our black soils of the Darling Downs rain has the effect of rapidly breaking down and rendering friable a soil which, under dry conditions, is difficult to cultivate, but the use of improved implements and power has facilitated early and rapid cultivation and completely changed the old order of things. Once the fallows have received the benefit of good rains they should be worked immediately conditions permit. This practice controls weed and volunteer growths, and tends to create the soil mulch absolutely necessary where moisture is to be conserved.

Wheat favours a firm seed-bed and the first 4 inches of cultivated soil is that from which it largely draws its substance. Given a retentive sub-surface, in which the moisture has been conserved by a well-worked mulch, the wheat plant will carry on to maturity with the aid of occasional showers. Early and efficient cultural methods, combined with the selection of proved satisfactory varieties of wheat and seasonable sowing, are important factors in successful grain production; the rest can very safely be left to ordinary seasonal conditions.

Our Cotton Future.

AS has been previously indicated in statements which have been made on behalf of the Government since its assumption of office, very careful consideration has been given to the future of the cotton industry. An exhaustive examination has been made of the present position of the industry and of its future prospects. It has been ascertained that the yield per acre compares more than favourably with the yield per acre in the United States. The average quality of Queensland cotton is superior to that of the American crop, its average value being at least 85 points above American middling. The cost of production in Queensland also compares very favourably with that in the United States. The two directions in which the Queensland cotton growing industry has been handicapped, however, are in the cost of picking and the cost of ginning.

During the period of its establishment the industry has been assisted by Government guarantees and bounties, and it is obvious that such bounties cannot continue indefinitely. It has been found necessary, therefore, to devise means which will enable the industry to stand on its own feet under the protection of a tariff. A further bounty period may be necessary, but it is the desire of the Government to so arrange that during the remainder of the present bounty term readjustments will be made which will enable the industry to so reduce costs as to permit of its being carried on on a proper economic footing.

The ginning and oil milling have so far been carried out by the British Australian Cotton Association. As is generally known, this concern established six ginneries at several centres in Queensland and also an oil mill at Whinstanes, near Brisbane, the capitalisation of the concern being in the region of £560,000. Unfortunately, some of the ginneries were erected in wrong locations. A large amount of money was spent by the concern in the initial stages on other than fixed assets, and generally the ginning rate of 1½d. per lb., which it has been necessary for the company to charge the growers, has been an onerous burden on the industry. Such a ginning rate is very much in excess of the charge which obtains in the United States; and this excess charge accounts partially for the necessity which the growers

have been under in asking for a continuance of Commonwealth bounties. A further important point concerns the efficiency of the Queensland ginneries in comparison with modern ginneries operating in America. An extensive development has taken place in recent years there in connection with the handling and cleaning of seed cotton prior to ginning, and the absence of this cleaning and handling equipment in the Queensland ginneries so operates as to necessitate unnecessarily fine picking in the Queensland cotton fields, which factor accounts for some of the excess cost in this phase of the industry. This handicap is being carried by the industry in addition to the burden of over-capitalisation of the ginneries and oil mill plant.

With the object of easing these burdens on the grower and placing the industry on a co-operative basis, the Cotton Board entered into negotiations with the Cotton Association for the acquisition of its physical assets in Queensland. The negotiations culminated in an agreement between the parties concerned by which the Board takes over the ginneries and oil mills at a valuation mutually agreed upon.

Commenting on this development recently, the Minister of Agriculture and Stock, Mr. Walker, said that the reconstruction of the ginneries and oil mills and the cheapening of the cost of picking and ginning which have been handicapping the industry, were necessary preliminaries to the carrying out of further important policies which the Government had formulated for its development. He forecast further Federal and State action towards stabilising the industry, and of establishing it firmly as one of our staple rural enterprises.

Questioned as to what his opinion was with regard to the extent of land available in the State for increased cotton production, Mr. Walker quoted from a report on the subject which he had called for from the chairman of the Land Administration Board (Mr. W. L. Payne), and which is summarised as follows:—

In the opinion of the Land Administration Board, if prices were stabilised over a period of years at a figure that would make cotton growing a payable proposition, greatly increased production of cotton in Queensland would immediately result.

Apart altogether from the question of new land settlement, there is at the present time in Queensland an immense area of land held under selection tenures which is eminently suited for the production of cotton. Evidence given before this Board in its various investigations establishes clearly that if the prices were stabilised at a rate attractive to growers, the production of cotton in Queensland would be increased at least tenfold. Everything depends on the stabilised rate being satisfactory and being applicable for several years in succession.

It is pointed out that if settlers have no guaranteed price for successive years they must utilise their lands for some industry that will give them an assured annual return, and hence it is that hundreds of thousands of acres in the Upper Burnett and Callide district alone, which are eminently suited for cotton production, are now being utilised for dairying.

As regards new land settlement, an area of 1,475,000 acres, being the remaining available land in the Upper Burnett and Callide district, will be opened for selection in the course of the ensuing twelve months. Much of this land is suited for cotton, and would doubtlessly be utilised for growing it if prices were stabilised.

A very large area, comprising hundreds of thousands of acres in the prickly-pear belt of the State, situated within easy range of existing railways, is also well suited for the production of cotton. The lands are held under prickly-pear lease tenure, and are resumable at any time for closer settlement, without compensation. These lands could be resumed and utilised for cotton production if the prices obtainable for that commodity were satisfactory to the growers and were stabilised over a period of years.

THE QUEENSLAND SUGAR INDUSTRY.

By H. T. EASTERBY, Director, Bureau of Sugar Experiment Stations.

PART IV.

(b) Review of the Industry since Federation.

It was stated in the last article that the federation of the Australian colonies brought tremendous changes to the Queensland sugar industry. It will now be attempted to show how these changes came about, and why.

The Federal idea of the bringing together of the colonies was not by any means a new one. As early as 1852 Dr. Lang, of New South Wales, advocated a great federation of all the colonies of Australia, and in 1857 the patriot Wentworth sought to bring about the creation of a Federal Assembly, and later in the same year the Victorian Assembly is stated to have appointed a select committee to consider the question, and the need for such a Union was unanimously affirmed. From time to time thereafter the matter was brought up, and the first National Australasian Convention sat in 1891. The Bill then drafted left out Queensland, Western Australia, and New Zealand. Nothing, however, was done then, and it was not until 1897-8 that a Convention was held which prepared the document that finally became the Constitution of Australia. At this Convention, Queensland was not represented, although Sir Samuel Griffith had been taking a very keen interest in the matter, but in 1899 when the subject was put to the people, Queensland voted for federation, but its majority was the smallest of any of the States, amounting to only 7,492 votes, whereas Victoria's majority was 142,848. There was not a great deal of opposition from the sugar-growers to federation, what little there was came principally from the older individual planters and millowners, who were concerned at the loss of Kanaka labour which they knew would come if federation was carried; for it was quite understood that if Queensland entered the federation the black labour system would end, and that the Commonwealth would make provision for protecting the sugar industry when it was deprived of labour from what was characterised as "an admittedly undesirable source." There is no doubt that this class of labour was always more or less distasteful to the majority of Australians.

The Commonwealth of Australia came into being on the 1st day of January, 1901, on the first day of the first month of the new century. From that time the colony of Queensland became a State, and the Commonwealth Government began to take a large part in the control of the sugar industry.

At this time there were still a few of the old type of sugar planter owing small mills who could see nothing but ruin ahead in the entire replacement of the Kanaka by white labour. Most of these men, perhaps all, have now passed away; few of them lived long enough to witness the great expansion of the industry in the years since federation, and the upsetting of all their forebodings of calamity. Still they were men of the old school trained in their beliefs, but the present day sugar-growers are of quite a different type. Even before the days of federation the new spirit was being developed by the establishment of Central Sugar Mills.

The first change brought about by federation was that the sugar markets of the various States were now free to Queensland, while a

protective duty of £6 per ton was imposed by the Commonwealth Parliament on all foreign cane sugar while, as the beet sugar bogey was even then powerful, the duty in its case amounted to £10 a ton.

The Commonwealth authorities now had to consider the best method of bringing the sugar industry under white labour. It was generally considered by those persons who had given thought to the matter that the Kanaka labour had been eminently serviceable and of considerable use in opening up the country for sugar-growing, but the time had arrived, in view of the general opinion of Australia as to coloured labour, when a change had to be made. Before any legislation was introduced the Prime Minister of the Commonwealth, Mr. Barton, commissioned Dr. Maxwell, Director of Sugar Experiment Stations, to report on certain factors relating to the sugar industry in Queensland and New South Wales. In that report, attention was drawn to the fact that estates were being cut up and divided into small farms, more particularly since the advent of the Central Sugar Mills, which had brought about a condition of things that was unique and in a large measure peculiar to the Australian cane sugar industry.

The report went on to say:—

“The most highly important economic and social result of this change is found in the circumstance that the ownership and occupancy embrace a large number of strong, responsible, and progressive white settlers, with families of coming men and women, who are being planted over the sugar-growing areas. Those settlers are furnishing the cane which keeps the mills in operation, and it is not only apparent that the maintenance of the sugar industry, but also the settlement of the country, is to be very chiefly in their hands. At this time there are 2,610 canegrowers in the State of Queensland, with an average area, per grower, under sugar-cane of 42.6 acres. . . . As labourers, working for hire, many of those settlers would never have been found on the soil; but as free men, with a personal interest in the occupancy of the lands, they are the hardest performers of given kinds of work in the field; and by their labour they have already, to a very notable extent, modified the exclusive employment of subject labour, and in localities where hitherto the white labourer had hardly been found. As a result of this white settlement, the following table sets forth a decrease in the number of Pacific Islanders employed, yet a simultaneous expansion in the sugar production:—

Year.	Acres of Cane Crushed.	Tons of Sugar Made.	Pacific Islanders in Queensland.
1885	38,557	55,796	10,755
1890	40,208	68,924	9,689
1899	79,435	123,289	8,826

“If the present natural course of white settlement is not interrupted by any untoward economic changes, there is no apparent ground for considering that it will not go on. There is abundant room for more men and families upon the areas suitable for cane culture and contiguous to manufacturing centres.

“At the present time the labour power furnished by the canegrowers themselves, and by their families, is utterly inadequate to produce the bulk of cane demanded by the mills to keep them in operation. Hired labour is, therefore, engaged to supplement

the work of the growers; and not only are the few remaining large planters employers of such labour, but most the farmers pay wages to several hired hands.

“The labour employed embraced Europeans, chiefly of the Anglo-Saxon race; and other races, including the Asiatic, the Hindoo, and the Polynesian. The great majority of the alien labourers engaged in Queensland belong to the South Sea Island tribes.

“*Position of the White Labourer.*

“By reason of a legislative enactment, known as the Pacific Island Labourers Act, the white labourer in Queensland holds a unique and relatively protected position. In the citation of kinds of labour which the South Sea Islander may perform, the positions of ‘engineers, engine-drivers, engine-fitters, blacksmiths, wheelwrights, farriers, sugar-boilers, carpenters, sawyers, splitters, fencers, bullock-drivers, mechanics, grooms or coachmen, waggoners, or household servants’ are not included, all these several kinds of employment being reserved for the selection of the white labourer.

“*Compensation of the White Labourer in the Field.*

“The compensation of the white labourer in the field can be exclusively in wage; or it may be in wage with rations, these including board and lodgment. The latter mode of payment is the more usual. Instead of a fixed wage being paid, work may be undertaken by contract, which may or may not be made to include rations.

“In furnishing examples of the actual compensation of white labourers in the canefields of Queensland, these will be arranged in three main divisions in order to observe what differences, if any, obtain in the respective districts. It is explained that the examples given represent averages of conditions in sub-districts, and cover very ample ground, and are thus typical of the actual situation:—

District.	Number.	Rate of Wages per Week.	Rations per Week.	Compensation per Week.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bundaberg ..	1 ..	1 0 0	0 7 0	1 7 0
	2 ..	1 1 0	0 8 4	1 9 4
	3 ..	1 0 0	0 7 6	1 7 6
	4 ..	1 0 0	0 8 0	1 8 0
	5 ..	1 0 0	0 7 6	1 7 6
	Means ..	1 0 2½	0 7 8	1 7 10½
Mackay ..	1 ..	1 0 0	0 7 6	1 7 6
	2 ..	1 3 6	0 6 0	1 9 6
	3 ..	1 3 6	0 7 0	1 10 6
	4 ..	1 0 0	0 9 0	1 9 0
	5 ..	1 4 0	0 8 0	1 12 0
	6 ..	1 3 6	0 7 6	1 11 0
Means ..	1 2 5	0 7 6	1 9 11	
Cairns ..	1 ..	1 4 6	0 10 6	1 15 0
	2 ..	1 5 0	0 10 0	1 15 0
	3 ..	1 5 0	0 12 0	1 17 0
	4 ..	1 4 0	0 10 6	1 14 6
Means ..	1 4 7½	0 10 9	1 15 4½	



PLATE 69.—WHITE AUSTRALIAN CANE CUTTERS AT WORK, BABINDA, NORTH QUEENSLAND.
The efficiency of white labour in Queensland canefields is far superior to that of any class of labour employed.

“The compensation per week, as stated in the outer column, is made up of precise figures taken from business records. The cost of ‘rations’ is variable, even in the same district, and has had to be approximated, in relation to the wage factor, in the Cairns district.

“From the figures given it is seen that the compensation of the white labourer is 2s. per week greater in the Mackay district and 7s. 6d. per week greater in the Cairns district, than obtains in the district of Bundaberg. It may be of value to note the comparative rates of compensation of mill hands in the same districts. The figures given in this connection state only averages, and they are to be taken as close approximations, and not as precise statements.

WEEKLY COMPENSATION OF MILL HANDS.

Occupations.	District of Bundaberg.	District of Mackay.	District of Cairns.
	£ s. d.	£ s. d.	£ s. d.
Engineers	3 13 4	3 12 4	4 14 0
Boiler Men	1 19 8	2 1 9	2 8 4
Firemen	1 15 9	2 0 8	2 5 4
Sugar Boilers	4 3 6	3 14 0	4 16 8
Clarifiers	1 14 6	1 15 0	1 18 0
Centrifugalers	1 13 7	1 14 0	1 18 0
Cane Carriers	1 9 6	1 12 0	1 16 0
Labourers	1 7 9	1 10 4	1 15 0
Mechanics	2 14 2	2 17 6	3 0 0
Means	2 5 9	2 6 5	2 14 7

“In comparison with the rates paid to white labourers in the field the cost of the indented coloured labourer for the districts of Bundaberg, Mackay, and Cairns, is given as under:—

District.	Cost of Islander per Year.	Cost of Islander per Week.	Cost of Islander per Day.
	£ s. d.	£ s. d.	£ s. d.
Bundaberg	37 2 3½	0 14 3	0 2 4½
Mackay	32 0 10	0 12 4	0 2 0¾
Cairns	36 6 9	0 13 11½	0 2 4

COMPARISON OF AVERAGE COST OF WHITE AND COLOURED LABOUR.

Class of Labour.	Cost per Year.	Cost per Week.	Cost per Day.
	£ s. d.	£ s. d.	£ s. d.
White labour	80 7 10	1 10 11	0 5 2
Polynesian labour	36 14 10	0 14 1½	0 2 4½

“The Polynesian labourer or ‘boy’ worked on an average of 59½ hours per week and the white labourer 57½.

“It is noteworthy that at the time the inquiry was made—viz., in 1901—the co-efficient of value of labour of the white man was highest in the Bundaberg district and lowest in Cairns, while the reverse took place with the coloured labourer. The islander was worth the least and cost the most in the Bundaberg district. This was also found to be the case in New South Wales.”

This report was made for the information of the Commonwealth Government, who were then considering in which form they were to provide for the replacement of the Kanaka by white labour.

The problem the Commonwealth had to deal with was to find an equitable means of meeting the general Australian desire for the cessation of coloured labour in the industry, and at the same time make the sugar industry sufficiently profitable to render it easy for the growers to engage white labour for their farms. It was recognised that this could only be done gradually, and that there must be a transition period during which black labour would gradually diminish and white labour increase. How this was done will be dealt with in the next part.

[TO BE CONTINUED.]

Bureau of Sugar Experiment Stations.

ENTOMOLOGIST'S ADVICE TO CANEGROWERS.

By EDMUND JARVIS.

How to Destroy Cane Grubs.

The following points in connection with the control of grubs of our "grey-back" cockchafer will be useful to those growers in localities where beetles chanced to make a late emergence, and the work of fumigation has had to be delayed owing to prolonged wet conditions during the month of January and part of February:—

1. Before commencing soil fumigation, make sure that grubs be present by a systematic examination of some of the stools on the area believed to be infested. If finding grubs, make a note of the depth at which they happen to be feeding at the time.
2. Do not start fumigation work immediately after heavy rain, but wait until surplus moisture has drained away, leaving the soil aerated or "open" for the passage of poisonous fumes. Such procedure is imperative when using carbon bisulphide.
3. Whether employing liquid or solid doses of any fumigant the injections should be made, or the chemical buried, just above the level at which the grubs are feeding.
4. Remember that the fumes of carbon bisulphide are highly inflammable.
5. Do not inject bisulphide or paradichlorobenzene too close to stools of young plant cane, or material injury to the leaves may result, especially should the ground chance to be very dry.
6. When using paradichlorobenzene remember that small doses are better than large ones. From 1 to 1½ cwt. per acre should be sufficient for plant crops.
7. After injecting, drilling in, or otherwise burying soil fumigants, the disturbed ground above the doses should be lightly rolled in order to consolidate same.
8. Do not fumigate land broken up by cultivation, until subsequent rain has caused the friable surface to become caked over.
9. Do not defer treatment of the soil until such time as the cane leaves are starting to turn yellow, or appear to be dying.

Protect Your Beneficial Insects.

Do not destroy soil-frequenting larvæ, &c., of insect friends, which are parasitic or predaceous on grubs that injure your cane.

Some of the commonest of these may be easily recognised by the following brief descriptions:—

1. White maggot-shaped inactive larvæ, about an inch long, which when ploughed up are often found attached to dead or dying cane grubs. These spin cocoons, from which emerge digger-wasp parasites.

2. Dark-brown cocoons from $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, composed of silk hardened to the stiffness of paper. These are often exposed by the plough, and contain either male or female digger-wasp parasites.

3. Shining white maggots, about $1\frac{1}{2}$ inch in length, but more slender than larvæ of wasp-parasites, and able to tunnel with ease amongst soil by means of a pointed beak. These turn into larvæ of Robber Flies, and while underground pierce and suck the juices of cane grubs and other subterranean larvæ.

4. Large yellowish-brown shining and very active larvæ, from 1 to 3 inches in length, and somewhat resembling wireworms in general appearance. They have six small legs close to the head-end and a darker plate with serrated edges on the upper surface of the last body segment. These slippery pugnacious creatures remain about three years in the ground before transforming into "skip-jack" beetles. They are inveterate enemies of cane grubs, seizing them with their sharp sickle-shaped jaws, cutting deeply into the body, and greedily imbibing its succulent contents.

CANE PESTS AND DISEASES.

Mr. R. W. Montgomery, Assistant Entomologist, Bundaberg, has submitted the following notes (17th February, 1930) on mole-crickets, to the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby:—

NOTES ON MOLE-CRICKETS DAMAGING CANE.

During the autumn when a certain amount of planting is being carried on it is customary for us to receive complaints regarding the prevalence of mole-crickets in newly planted fields, these insects having the habit of eating into the centre of young cane shoots, thus producing dead hearts. Several insects have somewhat similar habits, and their effect on the cane plant is the same in all cases—i.e., the death of the young shoot which often results in a blank or "miss." Wireworms and the Black Beetle are two other insects which are notorious for this kind of damage, and since they all occur in the same situations, it is not surprising to find that the damage is attributed solely to one or the other of these insects, whichever first comes under the notice of the grower, whereas often poor strikes are the result of the combined activities of these three pests.

Mole-crickets differ greatly in appearance from the ordinary cricket, since they are possessed with very strong front legs, which are eminently adapted for burrowing in the ground. These front legs are fitted with teeth somewhat like a saw, and these appendages bear a striking resemblance to the hands or feet of a mole, hence the name of these insects. With these front legs they are capable of cutting through the underground stems and roots of grasses and of burrowing to great depths in the soil.

The mole-crickets most common in this locality are about $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in length, and are of a light brown colour. They are sometimes found flying into houses at night, being attracted by the lights. They have two pairs of wings, a small front pair which, when the insect is not flying, are folded over a larger hind pair. These hind wings fold up in a manner similar to a fan and project over the end of the body.

When they are active in a field, their presence can readily be ascertained by their burrows, which can be seen by the disturbed surface, radiating in all parts of the field. Eggs are laid throughout the spring months, in an oval-shaped earthen chamber at a depth of about 8 inches. These eggs hatch out about a month later, so that these insects are present in great numbers during the summer and autumn months.

Control.

These crickets are kept in check under natural conditions by a small black and white striped wasp, which paralyses them and lays an egg underneath the front leg at its junction with the body. The wasp larva which hatches out from this egg feeds at the expense of the cricket which it ultimately kills. These wasps may

often be seen scouting in freshly dug trenches for any crickets that may have been exposed during digging operations.

Despite this natural check, crickets are sometimes so plentiful as to cause annoyance in newly planted cane fields, and this is usually obviated by the time and method of planting. Do not plant with cane, fields that have recently been grass paddocks, or fields where paspalum grass has been allowed to grow in profusion, for crickets are often very plentiful in such cases, especially is this so if the area is normally a wet piece of land. Wet fields should be well drained and the cane planted with a minimum of covering, so as to secure a strike as quickly as possible.

Crude naphthalene placed in the soil near the plant is reported to be very efficacious in driving away these pests. This chemical has a slight retarding effect on germination, but once the cane is up and growing, it has no harmful effect on subsequent growth.

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report on the effect of prolonged wet conditions on the fumigation of cane-grubs, &c., January to February, 1930 from the Entomologist at Meringa, near Cairns, Mr. E. Jarvis:—

Continual Wet Weather Delays Cane Grub Fumigation.

The present season, which has been marked by the occurrence at short intervals of unusually wet conditions, offers much food for thought regarding the particular form of cane grub control which at the present time is occupying the thoughts of many of our growers.

On account of rainy weather experienced throughout the month of January, and its continuance to date (13th February) it has not only been out of the question to attempt starting fumigation work on soils of a heavy nature, but also inadvisable to treat even volcanic high lands.

Since the first emergence of cane beetles about the beginning of last month, only four dry days have been recorded at Meringa Station, while the precipitation here during January was no less than 37.35 inches—viz., 21.12 inches more than the average rainfall for this month registered for the district of Cairns during the last forty-six years.

Notwithstanding the abnormal climatic disadvantages experienced throughout January, however, it appears likely that similar adverse conditions may obtain until about the middle of February, since the rainfall to date (13th instant) for this month at Meringa has been 9.92 inches.

Grub fumigation cannot be carried out successfully until a spell of a few dry days has allowed time for excessive moisture to drain away. When this happens, the water which during wet weather fills the spaces between the tiny soil particles is gradually replaced by air, and the land is then said to be "open," that is to say aerated; the amount of air present depending, of course, on the size of the larger particles which make up what is known as the skeleton of the soil.

It follows then, that during seasons like the present there is always a possibility that our growers may be powerless to stop grubs of the greyback cockchafer from doing serious damage to cane roots throughout the period occupied by the second, and a portion of their third larval instars of development. Unless such injury can be prevented before or just after these larvæ have reached the third stage of growth, enough damage has usually been done to counterbalance much of the benefit likely to be derived from fumigation of the soil. When unable, through any cause, to treat grub-infested land during January there is always a likelihood, also, even in years of average rainfall, that such fumigation may be stopped or even prevented by the setting in of the wet season.

In cases where this form of control work may have been unavoidably delayed until about the end of January, it is worth noting that young cane plants from 18 inches to 2 feet 6 inches high, growing on well-drained land can often be successfully fumigated by using paradichlor. in dry crystalline state, as in the event of

rain falling a few hours after treatment, volatilisation from the nodules, although held in check temporarily while the soil continues water-logged, becomes operative again directly excess of moisture has drained away.

On such land, then, where the cane leaves have not met between the rows, thus allowing the sun to dry the surface soil, sufficient time is afforded between occasional wet spells for the paradichlor. to do its work, seeing that when applied in a crystalline form volatilisation even from injections of one-eighth of an ounce, remain operative in aerated soil for about three weeks or longer, and being practically insoluble in water do not lose weight during wet weather, the effect of which is simply to check evaporation of the chemical until such time as the weather clears up again and leaves the ground open for further permeation of the toxic fumes.

The lesson we hope to learn, however, from the present possibility of continued wet conditions interfering with grub fumigation work is the desirability of undertaking fuller investigation regarding certain effective methods of grub control which are likely to operate independently of adverse climatic influences.

Collecting Grubs and Beetles—A Common-sense Remedial Method.

In view of the possibility of our rainfall next season being of somewhat similar intensity to that experienced during the years 1909-11, 1915-17, and 1920-21—at which times the annual rainfall far exceeded 91 inches (average for Cairns district)—it appears advisable to consider the advantages likely to be derived next year from an organised campaign against our greyback cockchafer.

In the first place, it will be only fair to allude very briefly to work being done in this direction in other countries, where cane growers are faced with a problem very similar to our own—viz., the fight against various species of scarabæid grubs which feed upon the roots of cane and other plants. It is a mistake to assume, as some do, that because Australia happens to be a continent, attempts to control our indigenous insects, either by common-sense or biological methods, must necessarily prove of no avail. In Southern Central Europe, for instance, entomologists have found after fifteen years of investigations on the economy of *Melolontha melolontha*—a cockchafer beetle of practically similar size, habits, and longevity to our own greyback—that collecting these insects is still the best artificial measure known to scientists.

Referring, on the other hand, to an insular situation or habitat, we find that Mr. E. H. Barrow, the Entomologist in Porto Rico, reports as follows:—"The chief method of checking the numbers of *lachnosterna* (white-grubs) in Porto Rico is the collecting of larvæ and beetles" (Jnl. Dept. Agric. Porto Rico VIII., No. 2, pp. 22-26, Ap. 1924). In connection with such control work he states:—"The numbers of beetles were decreasing up to the date when collecting was stopped, and began to decrease when the collections were again made."

I may mention that beetles of the genus *Lachnosterna* much resemble our "Frenchi" cane beetle in size and appearance; while their white-grubs are like our own in general form, coloration, and root-eating habits.

Again, in Mauritius during 1925, we are told by their Chief Entomologist, Mr. d'Emmerez de Charmoy:—"The collecting of *Lachnosterna* beetles was continued in 1923-24 on the same lines as in previous years, a total of 52,000,000 insects being collected during the year." (Rev. Agric. de L'Île Mauritius, No. 19, pp. 388-390).

In the Philippines, where beetles are collected by shaking them from the trees, in a manner very much like that adopted in the Herbert River district, such capture of both the beetles and grubs by hand "is considered the best method of control, and especially recommended."

Many other illustrations of the advantages resulting from the practice of this common-sense remedy could be quoted, from such countries as America, Russia, France, &c. As already pointed out in previous reports, Queensland canegrowers should never lose sight of the fact that in problems such as that now confronting us, entomologists have always considered ideal control methods against cockchafer beetles to be essentially those by which we succeed best in capturing or destroying as many females as possible, before they have had time to deposit eggs.

At various farmers' meetings, I have more than once stressed the importance of collecting beetles and grubs of the greyback cane beetle (*Lepidoderma albobirtum* Waterh.), but, whilst consistently advocating this common-sense remedy, wish it to be clearly understood that although urging our farmers to personal effort along such lines of activity, it behoves us also to continue assiduously to investigate those primary forms of artificial and biological control which are most likely to be effective despite any possible occurrence of adverse weather conditions.

LIFE HISTORY NOTES ON THE BANANA FRUIT-EATING CATERPILLAR (*Tiracola plagiata* Walk.).

By MARGARET E. TEMPERLEY, B.Sc.*

The noctuid moth, *Tiracola plagiata* Walk. has a wide distribution in tropical and sub-tropical regions, where it has been recorded as feeding, in the larval stage, on an extensive number of food plants, including many of economic importance.

In Queensland the earliest known reference records it as having been collected by Tryon in a Stanthorpe orchard during the departmental year 1895-1896. It is recorded as "gnawing bananas" at Currumbin during June, 1916, and there are numerous other instances of its having been recorded as a banana pest. An outbreak occurred in the Gympie district in 1919 which assumed plague proportions, the caterpillars attacking a wide range of plants. On this occasion the banana-growers suffered heavy losses. A similar outbreak occurred in 1927 in Southern Queensland, bananas being most heavily infested, and urgent requests were received by the Chief Entomologist from banana-growers and others for assistance in controlling this pest.

Acting under the instructions of Mr. Veitch, Mr. J. A. Weddell, of the Entomological Branch, visited some of the most heavily infested areas in order to collect material and to conduct field investigations and control experiments, while the writer commenced life history studies in the laboratory in Brisbane.

Information regarding the life history of this insect does not appear to have been previously published; certainly there are no Queensland records. The material received from the field and which was to form the nucleus of life history work, consisted of larvæ and pupæ, no larvæ being received at an earlier stage than about the fourth instar. In the initial field trip no eggs were found, neither were any moths observed.

It was hoped that the moths bred from this material could be induced to oviposit under laboratory conditions. As the moths emerged they were released in a small gauze breeding-cage in which young maize plants were placed to act as oviposition sites. The moths all died without laying. Later some moths were confined in small glass jars with inkweed leaves, and three sets of oviposition records were obtained, but the eggs proved infertile and shrivelled up.

However, the writer was extremely fortunate and captured a gravid female moth at Sandgate in June, 1927, which commenced laying within twenty-four hours. The eggs hatched and the caterpillars were successfully reared to maturity. A second failure to obtain fertile eggs from these moths resulted in the termination of the work on account of the inability to procure material for further study.

The results published in these notes are very inadequate as they only embrace the study of a single complete generation, and must therefore be regarded as a preliminary study until an opportunity presents itself of acquiring further details.

* Miss Temperley, who was formerly on the entomological staff of this Department, completed these notes shortly before her resignation from the Public Service.

The nature of injury occasioned by this pest, its geographical distribution, the records of previous outbreaks in Queensland, and a full list of its food plants were given in detail in the article last month by Mr. J. A. Weddell, entitled "Field Notes on the Banana Fruit-eating Caterpillar."

GENERAL DESCRIPTION.

The Egg.

The egg (Plate 70, fig. 1) is cream coloured with a greenish tinge, and measures about one-forty-second of an inch in diameter. It is dome shaped with a ribbed surface.

The Larva.

The newly emerged larva is about one-sixteenth of an inch long and is greyish in colour, the body being clothed with long fine hairs. The farmer is likely to observe the difference in colouration between the earlier and maturer stages of *Tiracola* larvæ and to think that two species of caterpillars are attacking his bananas. The young caterpillar has a general body colour of greyish-green to black, but the mature larva is brown.

The full grown larva (Plate 70, figs. 7 and 8) is a khaki coloured, fat, sluggish grub, about $2\frac{1}{2}$ inches long, bearing in the majority of cases two pairs of black markings on its dorsal surface towards the posterior extremity, and a narrow, broken, yellow band on either side of the body.

The Pupa.

The pupa (Plate 71, fig. 1) is shiny mahogany brown in colour, and measures approximately 1 inch in length. It is found in the ground in a cocoon (Plate 71, fig. 2) made of soil particles cemented together.

The Moth.

The moth (Plate 71, figs. 3 and 4) is brown coloured, measuring about 2 inches across the wing expanse and exhibits a sex variation in colouration, the female moth being darker and more uniformly coloured than the male. The forewings are mottled, ranging from greyish-brown to chocolate-brown in the female, and from fawn to warm reddish-brown in the male, both sexes having a dark V-shaped marking towards the anterior margin of the wing. The hindwings are dark mole-coloured with a light fringe. The under surface of the wings is light-coloured and is faintly tinged with red.

BANANA FRUIT-EATING CATERPILLAR (*Tiracola plagiata* Walk.).

PLATE 70.

FIG. 1. Egg, $\times 20$.

FIG. 2. First instar, $\times 8$.

FIG. 3. Second instar, $\times 8$.

FIG. 4. Third instar, $\times 7$.

FIG. 5. Fourth instar, $\times 3$.

FIG. 6. Fifth instar, $\times 2$.

FIG. 7. Sixth instar, natural size.

FIG. 8. Sixth instar, natural size, lateral view

Tiracola plagiata Walk.



Fig. 1.



Fig. 2.



Fig. 5.



Fig. 6.



Fig. 7.

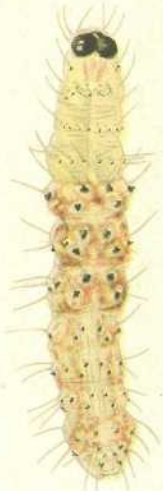


Fig. 3.

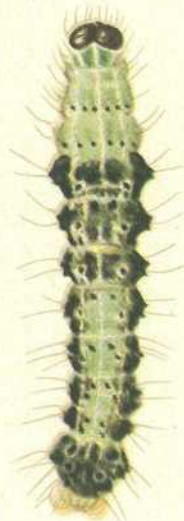


Fig. 4.



Fig. 8.

PLATE 70.—THE BANANA FRUIT-EATING CATERPILLAR (*Tiracola plagiata* Walk.).

From a Watercolour Drawing by I. W. HELMSING.

LIFE HISTORY.

Food Habits of Adult.

No opportunity has been afforded of studying the food habits of this moth in nature, but it probably feeds on the nectar of flowers as it flies about at night. In the laboratory the moths were fed on a solution of sugar in water. Moths were seen feeding greedily on the syrup during the day, particularly females about to oviposit.

Longevity of Adult.

Under laboratory conditions females showed themselves to be longer lived than males. In the case of female moths the maximum longevity was seventeen days (see Table II.), while for males the maximum period was fourteen days. The average period for females was thirteen days, while the longevity of male moths averaged eight days.

Mating.

Mating has not been observed in either the laboratory or the field. Moths of both sexes were released in small breeding-cages and were also confined in pairs in glass jars, but none of the eggs laid were fertile. In order to facilitate mating, male and female moths were released in the laboratory overnight for several days, but in all cases the eggs laid failed to develop.

Oviposition.

Oviposition takes place during the night or early morning, in the laboratory the eggs being laid closely together, occasionally superimposed one upon the other. Although inkweed leaves growing in culture solution were placed in the breeding jar, the eggs were laid indiscriminately on the leaves, string, blotting paper, the sides of the jar, and its cheese cloth top. In the field, Mr. J. A. Weddell took twenty eggs which subsequently developed into *Tiracola* larvæ, on inkweed at Harlin, May, 1927, and in all cases except one the eggs were laid singly on either the upper or lower surfaces of the leaves. In the exceptional case two eggs were found together, one being superimposed on the other.

In the oviposition records of Table II., obtained from unfertilised moths, the maximum number of eggs laid by a single moth was 1,500, while the minimum number was 37. The period elapsing between the date of emergence of the female and the date of oviposition of the first batch of eggs averaged seven days. In the majority of cases after the first batch of eggs was deposited moths laid daily until their death. The maximum period over which eggs were laid was ten days.

A single fertile moth laid 898 eggs more than the maximum number of eggs laid by an unfertilised moth. Fewer batches of eggs were laid by this moth, and the period over which oviposition extended was six days. The dates of oviposition and the number of eggs laid will be found in Table I.

Development of the Egg.

The egg is creamy coloured and opalescent, with a slight greenish tinge. The mandibles are observed about six days after oviposition as a pair of light brownish structures showing very faintly through the chorion or egg shell, usually in an eccentric position. On the seventh day the head capsule can be seen and the development of the mandibles is more pronounced, so that they can be detected with the naked eye. The prothoracic shield is now visible immediately behind the head capsule.

By this time the egg has lost its greenish tinge and has become white. About twelve hours before hatching the dark body of the larva can be seen through the chorion, giving the egg a dark grey appearance.

Emergence of Larva.

About an hour prior to emergence, the larva can be seen moving its mandibles. With these it tears away the chorion, making a semi-circular slit at the apex of the egg, the chorion lifting back like a flap, as the larva wriggling its abdomen pushes its way out. In some cases a second slit is made towards the base of the egg, which allows the body of the larva to expand, setae and part of the abdomen protruding before the head has emerged. About twenty minutes elapse between the time the shell is first ruptured until the larva finally emerges. Upon emergence the larva devours the empty egg shell.

Incubation Period.

Eggs laid in June had an incubation period of eight to nine days, the average minimum and maximum temperatures in the laboratory for this period being 61 deg. and 67 deg. respectively. The incubation period for each batch of eggs is given in Table I.

Fertility.

In the case of the fertilised female under consideration, larvæ emerged from the great majority of eggs. Table I. shows the dates of oviposition and the number of eggs laid. In batch (1) the emergence was 100 per cent., while in (2) all the larvæ emerged except six, three of which became caught in the egg shell as they were emerging and died. Larvæ emerged from all the eggs in batch (3). In batch (4) 66 per cent. of the eggs collapsed owing to the fact that culture solution was accidentally spilt on them. Of the remaining 34 per cent., 120 larvæ emerged, while twenty-one of the eggs had ruptured shells but the larvæ failed to free themselves. The eggs of batch (5) showed well-developed head capsules but practically all of them collapsed on the eighth day, possibly owing to mechanical injury.

LARVAL PERIOD.

Behaviour.

The newly emerged larva is extremely active, and having made its first meal on the egg shell does not feed for about twenty-four hours but wanders about, in the field probably migrating far from the hatching site. The larva is very sensitive and at the slightest touch rolls over and over till it reaches the edge of a leaf, dropping from it by a silken thread and swaying about in the breeze. This habit is very marked until about the end of the fourth instar. In the field it is possible that the young larvæ are dispersed by the winds as they hang in this position.

When handled the larva secretes drops of bright green fluid, which appear to be exuded from the mouth but which come from an eversible gland on the ventral surface of the prothorax.

In the early stages the larva is positively phototropic, and in the breeding jars the larvæ collected together in large numbers on the side of the jar nearest the light. This tropism is confirmed by the field observations of Mr. Weddell, who found that bananas were damaged on that side of the bunch which received the most light.

Food Habits.

Young larvæ were placed on inkweed, milk-thistle, and banana leaves. They fed readily on inkweed and thistle, but those which were placed on banana leaves all died before they had completed the first instar. Those which survived more than three days ate so little of the cuticle that it was impossible to see the feeding marks without the aid of a lens. This inability to thrive on banana leaves in the early stages indicates a possible migration in the field from such plants as inkweed to the banana plant. Mr. Weddell found that the heaviest infestations occurred when inkweed was growing in abundance beside a plantation.

The early larval stages are surface feeders and erode the cuticle of the leaf, but about the third instar and onwards they eat the whole tissue of the leaf, commencing at the edge and eating inwards, leaving only the harder tissue of the midrib. On occasions, when no other food was available, they even ate into this.

Ecdysis.

The larva feeds vigorously, increasing in size and casts its skin and head capsule six times, undergoing what is commonly termed a moult or ecdysis. A larva about to moult has a very characteristic appearance. The head capsule appears narrow in comparison with the width of the body. The prothoracic shield which is normally in contact with the vertex of the head, becomes separated from it by an orange coloured membranous area. The ocelli of the new head capsule can be seen as a group of purple spots showing through the membrane in a lateral position, while the ocelli of the old head capsule are colourless. For a day previous to ecdysis the larva remains perfectly quiescent, and does not feed until the old head capsule is pushed off. In the majority of cases the cast skin is devoured by the newly moulted larva, the discarded head capsule and the pale soft body of the larva indicating that a moult has taken place.

Duration of Larval Instars.

The average duration for each of the six larval instars is given in Table III., where it will be seen that the duration of the second and third instars is shorter than the first; the fourth is also shorter than the first but slightly longer than either the second or the third instars. The duration of the fifth instar is as long as the first, while the period of the sixth instar is the longest of all.

For any one larva the average feeding period is forty-five days. In Table III. it will be seen that the sixth instar is considered as having two well-defined periods—the active or feeding period and the prepupal period—so that the total duration of the sixth instar is obtained by adding the figures in these two columns together.

Effects of Food Plants on Colour Variation of the Larvæ.

Larvæ feeding on the same plant exhibit considerable variation in colouration and markings, while the difference in general colouration is most noticeable amongst larvæ which have been fed on different plants. Larvæ fed on cabbage were very pale translucent green, those on banana fruit yellowish brown with orange substigmatal bands, while those feeding on inkweed were khaki coloured with pale yellow substigmatal bands.

Prepupal Period.

When full grown the larva ceases feeding and the skin darkens, becoming more uniform in colour. The larva now migrates to the soil, burrowing below the surface to a depth of $1\frac{1}{2}$ to 2 inches, and commences the formation of an earthen cocoon. The soil particles are chewed up with the mandibles and are deposited in a moistened condition to form the walls of the cell in which the larva pupates. The larval skin becomes almost black in colour and the body becomes wrinkled and shortened, and approximately eight days after entering the soil the cuticle splits dorsally and the last larval skin and head are cast off and lie inside the cell with the pupa.

The duration of the prepupal period for a series of larvæ will be seen in Table III. and Table IV. This period varies from a minimum of six days to a maximum of ten days.

Pupal Period.

The average pupal period is twenty-nine days. At the end of this time the pupal case splits irregularly and the moth emerges from the soil.

The maximum pupal period is thirty-two days while the minimum is twenty-six days.

Parasitic Enemies.

A number of hymenopterous and dipterous parasites destructive to both larvæ and pupæ were bred from material collected in the field.

Two common parasitic wasps belonging to the Ichneumonidae were bred from pupæ, namely *Lissopimpla semipunctata* Kirby and *Paniscus testaceous* Grav. The adults of these parasites were also observed to be active in the field at Kilcoy and other places where *Tiracola* infestation was severe.

In the laboratory two hymenopterous larvæ were found spinning up in a breeding jar containing larvæ collected at Kilcoy. Each formed a dark-brown cocoon about 4 mm. long, which soon became very hard and wrinkled. Similar cocoons were brought in from Dayboro', where they were reported to be very numerous on the stems of weeds bordering plantations. A cocoon of the same type was also found at Amamoor on banana foliage. Later a small *Tiracola* larva collected at Harlin, which had been confined in a tube by itself, voided a hymenopterous larva which spun up in the tube, forming the characteristic hard wrinkled cocoon. After voiding the parasite the larva ceased feeding, became sickly, and died three days later. Up to the time of the completion of these notes no adults have emerged from these cocoons.*

Hymenopterous larvæ were found attached to the thorax of *Tiracola* larvæ from Kilcoy. These larvæ were bred through to the adult stage and proved to be *Euplectrus kurandaensis* Girault. The adults were released in a breeding jar containing *Tiracola* larvæ at various stages of development, and the following is a brief account of their life history.

The adult chalcid selected larvæ about the third or fourth instar on which to place the minute oval eggs, which were scattered in groups over the dorsal surface of the host. After an incubation period of four days the eggs hatched and grey coloured larvæ were found attached to

* The material subsequently dried up without yielding adults.—R.V.

the host in the region of the thorax, where they commenced feeding. When the host died the larvæ migrated to the ventral surface of the host and commenced spinning, attaching themselves to the body of the host by silken threads. Just before pupating the larvæ exuded black treacle-like globules of fluid from the anterior end, after which they became white, inactive, and the body contracted. The silken threads soon hardened, and the larvæ became concealed in shiny black cocoons. The duration of the larval period was four days. The adults emerged after a period of seven days, making a total life cycle period of fifteen days. A Tachinid fly was also reared from material collected in the field.

TECHNICAL DESCRIPTIONS.

The Egg.

(Plate 70, fig. 1.)

Average height 0.44 mm., average diameter 0.64 mm. An oblate spheroid, slightly more flattened basally than apically; semitranslucent, pearly white, iridescent, surface reticulated, having the general appearance of a golf ball.

First Larval Instar.

(Plate 70, fig. 2.)

Average length 3 mm., average breadth of head capsule 0.42 mm. Body creamy yellow, head capsule blackish. Prothoracic shield, suranal plate and tubercles mole coloured, the latter being closely approximated giving the larva a ringed appearance most marked on first three abdominal segments. Body clothed with fairly long black setæ arising from tubercles; spiracles oval with mole coloured rims; thoracic legs brown; first and second pairs of prolegs not wholly everted; prolegs bearing from 4 to 9 crochets per leg arranged in a uniordinal mesoserries. An eversible gland is present on the sternal region of the prothorax.

Second Larval Instar.

(Plate 70, fig. 3.)

Average length 7 mm., average breadth of head capsule 0.66 mm. Thorax and abdomen creamy yellow; head dark brown almost blackish; prothoracic shield, suranal plate and tubercles mole coloured, the latter bearing black setæ. First three abdominal segments thickly overlaid with burnt orange, giving an irregular banded appearance; fourth segment with narrower orange band, subsequent segments not so marked, more or less blotched with orange, decided blotch on eighth and ninth segments. Thoracic legs dark brown, first and second pairs of prolegs not wholly everted but more so than previous instar; prolegs bearing from 4 to 13 crochets per leg.

Third Larval Instar.

(Plate 70, fig. 4.)

Average length 9 mm., average breadth of head capsule 0.92 mm. Head dark brown, almost blackish; thorax creamy yellow, with mole-coloured tubercles surrounded with white blotches. Setae black, prothoracic shield and suranal plate mole-coloured. Abdominal segments yellowish green with first three segments bearing well-defined brownish bands, the tubercles on these segments being very pronounced, bands on subsequent segments paler but more marked on the eighth and ninth

abdominal segments. Dorsally one median and two lateral irregular white lines from the first thoracic to the eighth abdominal segment. Thoracic legs dark brown, first and second pairs of prolegs wholly everted; prolegs bearing from 7 to 20 crochets per leg.

Fourth Larval Instar.

(Plate 70, fig. 5.)

Average length 1.5 cm., average breadth of head capsule 1.6 mm. Head dark brown with yellowish brown vertex. Thorax and abdomen green, with prothoracic shield, suranal plate, and tubercles dark mole-coloured, the latter bearing black setae. Light greyish-green dorsal strip from the first to tenth segments, bordered dorso-laterally by darker olive green area. The light dorsal strip is broken transversely on the first three abdominal segments by prominent mole-coloured tubercles. A yellow substigmatal band on abdominal segments—most prominent on segments 4 to 6 and segments 10 and 11. Spiracles surrounded by darkened area. Eleventh segment produced backwards forming a hood, mole-coloured with posterior margin ochreous. Thoracic legs brown, prolegs greenish, bearing 14 to 22 crochets per leg.

Fifth Larval Instar.

(Plate 70, fig. 6.)

Average length 3.2 cm., average breadth of head capsule 2.5 mm. Head capsule dark brown, vertex yellowish brown, prothoracic shield mole-coloured with black anterior margin. General body colour greenish-brown or khaki; thoracic segments bearing dark median line. A light dorsal area extends from first to tenth segments, eleventh segment smoky with hind margin of hood ochreous, segments eight and nine sometimes bearing a pair of black dorsal markings. Abdominal segments with yellow substigmatal band, most prominent on segments 4 to 6 and 10 and 11. Suranal plate dark brown, tubercles small, white, bearing dark setae. Spiracles with dark brown margins, thoracic legs light brown, pygidium posteriorly margined with yellow. Prolegs bear from 28 to 36 crochets per leg.

Sixth Larval Instar.

(Plate 70, figs. 7 and 8.)

Average length 4.8 cm., average breadth of head capsule 3.95 mm. Head: Face dark brown, vertex yellowish brown, emarginate, antennæ yellow, tips of mandibles reddish brown. General body colour khaki, thoracic shield smoky black with dark anterior margin. Median smoky black line on thoracic and abdominal segments. Dorsal surface slightly lighter than lateral, lighter area intermittently flanked with yellow as far as segment 10. Segments 8 and 9 bear a pair of smoky black markings, which may be transverse, crescent-shaped, or distinctly L-shaped.

PLATE 71.

- FIG. 1. Pupa, natural size.
- FIG. 2. Pupa, in earthen cell.
- FIG. 3. Adult male, natural size.
- FIG. 4. Adult female, natural size.
- FIG. 5. Damage to immature fruit by young larvæ.
- FIG. 6. Damage to mature fruit by later-stage larvæ.

Tiracola plagiata Walk.



Fig. 1.



Fig. 3.



Fig. 4.



Fig. 2.



Fig. 5.



Fig. 6.

PLATE 71.—THE BANANA FRUIT-EATING CATERPILLAR (*Tiracola plagiata* Walk).

From a Watercolour. Drawing by I. W. HELMSING.

Dorsal surface of eleventh segment darker than preceding segment, posterior margin of hood ochreous. Dorsally segment 12 uniformly darker in tone than preceding segments, bearing a smoky spot anterolaterally. Segment 13 dark like preceding segment, suranal plate smoky black with short median dark line, margin of anus bordered with creamy yellow. Thoracic legs yellowish brown darker at junction of segments. Setae dark brown to blackish, tubercles small, white, surrounded by brownish blotches. Prolegs green with black markings on outside. Laterally light yellow oblique lines tilted from before backwards on segments 1 to 8. Substigmatal bands on abdominal segments, not distinct on segments 4 and 5 and 11 to 13. Prolegs bear from 30 to 40 crochets per leg.

An eversible gland is situated on the sternal region of the prothorax. When fully everted this gland reaches to the end of the maxillae and secretes a bright green fluid which appears to come from the mouth.

The larval instars described above were fed on inkweed leaves.

The Pupa.

(Plate 71, fig. 1.)

Average length 2.5 cm. Mahogany-brown colour, vertex slightly dome shaped, wing pads opaque. First pair of legs reaching to the tip of wing pads, second pair half way, and third pair almost to the tip of pads. Spiracles dark brown transverse slits. Abdominal segments 3 to 8 on the dorsal surface, and abdominal segments 5 to 7 on the ventral surface, have their anterior margins finely punctate. The posterior segment bears a cremaster of six hooks. The abdominal segments are sparsely clothed with light brown microscopic setae.

The Adult.

(Plate 71, figs. 3 and 4.)

The moth agrees with the following description taken from the Fauna of British India, "Lepidoptera," volume II., page 282, where it is described under the synonym *Arcilasisa*.

"Pale grey brown; abdomen fuscous. Forewing often much diffused with red-brown and irrorated with dark brown; an indistinct waved antemedial line, often almost obsolete; the orbicular obsolete; the reniform almost obsolete ochreous or fuscous, sometimes on a dark patch; traces of a postmedial curved series of black specks; a submarginal doubly curved ochreous line; a marginal series of black specks; hind wing fuscous; the cilia whitish."

TABLE I.—OVIPOSITION RECORDS FOR FERTILISED MOTH.

Number of Egg Batch.	Date of Oviposition.	Number of Eggs per Batch.	Total Number of Eggs.	Date of Emergence.	Incubation Period in Days.	Average Incubation Period in Days.
	1927.			1927.		
1 22 June	713	} 2,398 {	30 June	8	} 8.4
2	.. .. 23 June	241		1 July	8
3	.. .. 24 June	760		2 July	8
4	.. .. 26 June	423		5 July	9
5	.. .. 27 June	261		6 July	9

TABLE II.—OVIPOSITION RECORDS FOR UNFERTILISED MOTHS.

Number of Series.	Date of Emergence of Moth.	Period in days between Emergence and Oviposition.	Oviposition.			Date of Death of Moth.	Longevity of Moth in Days.	
			Date.	Number of Eggs.	Total Number of Eggs.			
B 1 ..	1927. 5 May	5	1927. 10 May	11	} 495	1927. 12 May	7	
			11 May	235				
			12 May	249				
B 3 ..	16 May	5	21 May	34	} 539	*	..	
			22 May	12				
			23 May	456				
			24 May	37				
L 4 ..	27 Sept.	7	4 Oct.	130	} 437	11 Oct.	14	
			8 Oct.	124				
			9 Oct.	183				
L 38 ..	26 Sept.	6	2 Oct.	47	} 692	11 Oct.	15	
			4 Oct.	125				
			5 Oct.	216				
			7 Oct.	304				
L 52 ..	29 Sept.	10	9 Oct.	17	} 823	16 Oct.	17	
			11 Oct.	13				
			12 Oct.	72				
			13 Oct.	110				
			14 Oct.	62				
			15 Oct.	343				
			16 Oct.	106				
I 9 ..	23 Sept.	8	1 Oct.	37	} 37	2 Oct.	9	
I 13 ..	24 Sept.	8	2 Oct.	50				
			3 Oct.	138	} 809	9 Oct.	15	
			5 Oct.	158				
			6 Oct.	448				
			7 Oct.	15				
I 14 ..	25 Sept.	5	30 Sept.	230	} 688	5 Oct.	10	
			1 Oct.	22				
			2 Oct.	53				
			3 Oct.	250				
I 16 ..	25 Sept.	7	4 Oct.	133	} 1,365	10 Oct.	15	
			2 Oct.	130				
			3 Oct.	17				
			5 Oct.,	833				
			6 Oct.	186				
			8 Oct.	189				
			9 Oct.	10				
I 17 ..	23 Sept.	6	29 Sept.	307	} 1,500	8 Oct.	15	
			30 Sept.	186				
			1 Oct.	192				
			2 Oct.	655				
			5 Oct.	37				
			6 Oct.	105				
			7 Oct.	10				
I 18 ..	25 Sept.	4	8 Oct.	8	} 714	8 Oct.	13	
			29 Sept.	3				
			30 Sept.	37				
			1 Oct.	65				
			2 Oct.	90				
			3 Oct.	165				
			4 Oct.	170				
			5 Oct.	140				
			6 Oct.	1				
			7 Oct.	43				
I 19 ..	26 Sept.	7	3 Oct.	69	} 701	10 Oct.	14	
			7 Oct.	428				
			9 Oct.	204				
I 23 ..	28 Sept.	8	6 Oct.	13	} 171	11 Oct.	13	
			8 Oct.	44				
			9 Oct.	114				
	Average	6.61	..	..		Average	13.08	

* Moth escaped.

TABLE III.—LIFE CYCLE STAGES (COMPLETE RECORDS).

Series Number.	Incubation Period in Days.	Duration of Larval Instars in Days.							Pupal Period in Days.	Total Life-Cycle Period in Days.
		I.	II.	III.	IV.	V.	VI.			
							Feeding Period.	Prepupal Period.		
L 1	8	8	4	5	7	8	14	8	30	92
L 6	8	8	5	5	5	9	12	7	32	91
L 13.. ..	8	7	5	6	5	9	12	9	31	92
L 21.. ..	8	8	5	5	5	9	11	10	30	91
L 22.. ..	8	8	5	5	6	9	11	10	29	91
L 26.. ..	9	7	5	4	5	8	13	6	27	84
L 30.. ..	8	7	5	5	6	8	13	9	31	92
L 38.. ..	8	8	7	6	8	6	14	9	28	94
L 42.. ..	8	8	6	7	6	9	13	9	29	95
L 50.. ..	9	14	7	6	7	6	12	6	30	97
Averages ..	8.2	8.3	5.4	5.4	6.0	8.1	12.5	8.3	29.7	91.9

The period during which the above results were obtained extended from June to September.

TABLE IV.—LIFE CYCLE STAGES (INCOMPLETE RECORDS).

Series Number.	Duration of Larval Instars in Days.							Pupa Period
	I.	II.	III.	IV.	V.	VI.		
						Feeding Period.	Prepupal Period.	
L 2	8	4	5	6	8	13	..	..
L 4 .. ..	..	..	..	..	..	..	8	28
L 5	7	5	5	6	9	14	..	..
L 14 ..	8	8	5	6	7	13	..	..
L 16 ..	8	4	5	6	9	11	..	..
L 17 ..	8	6	5	5	9	13	..	..
L 20 ..	7	5	6	5	9	14	7	..
L 25 ..	8	4	5	5	8	12	..	..
L 27 ..	7	5	5	6	7	12	6	..
L 29 ..	7	5	5	6	9	12	9	..
L 31 ..	7	7	4	7	8	14	..	..
L 35 ..	..	..	6	7	8	12	8	29
L 36 ..	8	7	7	7	8	14	..	..
L 37 ..	8	7	6	7	9	11	..	..
L 39 ..	8	7	6	6	7	13	8	..
L 40 ..	8	7	7	8	7	12	9	..
L 41 ..	8	6	4	7	8	13	8	..
L 43 ..	8	6	5	7	6	13	..	..
L 44 ..	8	8	5	7	8	12	..	..
L 47 ..	8	12	6	6	9	12	..	..
L 52 ..	..	..	..	..	..	..	9	31
L 55 ..	..	..	..	..	..	..	7	31
L 60 ..	..	..	..	..	..	..	9	30
L 61 ..	..	..	..	..	..	..	8	29
L 62 ..	..	..	..	..	..	..	7	26
L 64 ..	..	..	..	..	..	..	8	26
Averages	7.72	6.27	5.36	6.31	8.05	12.63	7.92	28.75

The period during which the above results were obtained extended from June to September.

CLIMATOLOGICAL TABLE—FEBRUARY, 1930.

SUPPLIED BY THE COMMONWEALTH OF AUSTRALIA METEOROLOGICAL BUREAU, BRISBANE.

Districts and Stations,	Atmospheric Pressure. Mean at 9 a.m.	SHADE TEMPERATURE.						RAINFALL.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
		Deg.	Deg.	Deg.		Deg.		Points.	
<i>Coastal.</i>									
Cooktown	In. 29-88	87	75	89	6	72	15	1,905	16
Herberton .. .. .	.. .. .	81	63	89	28	55	14	959	15
Rockhampton	29-96	86	70	95	15,16	65	11	439	12
Brisbane	30-06	83	68	92	15	63	13,28	181	13
<i>Darling Downs.</i>									
Dalby	30-02	86	62	99	16	54	12	123	8
Stanthorpe .. .. .	.. .. .	80	58	94	22	52	13	136	10
Toowoomba .. .. .	.. .. .	77	59	90	15	56	4,12,13,27	427	10
<i>Mid-interior.</i>									
Georgetown	29-85	90	72	95	14,16	67	12	706	10
Longreach	29-88	94	71	107	16	64	11	140	6
Mitchell	29-97	91	67	105	16	59	11,12	89	5
<i>Western.</i>									
Burketown	29-84	89	75	95	4	69	6	1,583	13
Boulla	29-83	98	73	108	16,17	66	11	367	5
Thargomindah	29-90	95	76	107	15	64	24	206	3

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF FEBRUARY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING FEBRUARY 1930 AND 1929, FOR COMPARISON

Divisions and Stations.	AVERAGE RAINFALL.		TOTAL RAINFALL.		Divisions and Stations.	AVERAGE RAINFALL.		TOTAL RAINFALL.	
	Feb.	No. of Years' Records.	Feb., 1930.	Feb., 1929.		Feb.	No. of Years' Records.	Feb., 1930.	Feb., 1929.
	In.		In.	In.		In.		In.	In.
<i>North Coast.</i>									
Atherton	10-14	29	17-25	21-07	<i>South Coast—continued :</i>				
Cairns	15-53	48	13-74	28-02	Nambour	9-59	34	5-76	12-07
Cardwell	17-10	58	17-67	15-24	Nanango	4-19	48	2-35	4-13
Cooktown	13-49	54	19-05	26-68	Rockhampton	7-99	43	4-39	36-37
Herberton	7-67	43	9-59	14-63	Woodford	8-47	43	5-11	6-14
Ingham	16-52	38	18-04	18-48	<i>Darling Downs.</i>				
Herberton	22-61	49	14-98	39-52	Dalby	2-87	60	1-23	2-80
Mossman	17-41	17	34-27	31-60	Emu Vale	2-64	34	1-22	7-75
Townsville	11-46	59	7-69	5-25	Jimbour	2-65	42	2-00	1-91
<i>Central Coast.</i>									
Ayr	9-22	43	4-12	4-15	Miles	2-80	45	1-49	3-59
Bowen	8-87	59	6-89	4-74	Stanthorpe	3-31	57	1-36	5-85
Charters Towers ..	4-51	48	3-41	4-86	Toowoomba	4-51	58	4-26	10-37
Mackay	11-57	59	5-62	12-41	Warwick	3-15	65	2-05	6-72
Proserpine	12-37	27	13-00	19-58	<i>Maranoa.</i>				
St. Lawrence	8-05	59	4-96	11-08	Roma	3-08	56	0-30	4-68
<i>South Coast.</i>									
Biggenden	4-36	31	3-54	7-72	<i>State Farms, &c.</i>				
Bundaberg	6-22	47	5-00	10-73	Bungeworgorai ..	2-53	16	0-20	3-94
Brisbane	6-25	79	1-81	6-24	Gatton College ..	3-43	31	..	5-98
Caboollture	7-46	43	3-85	6-72	Gindie	3-01	31	0-85	5-98
Childers	6-62	35	4-02	12-51	Hermitage	2-64	24	..	5-47
Crohamhurst	13-03	37	9-28	6-45	Kairi	10-02	16	8-18	15-37
Esk	5-42	43	6-57	7-91	Mackay Sugar Experiment Station	10-66	33	4-38	12-77
Gayndah	4-32	59	3-31	8-39	Warren	5-14	15	1-64	24-44
Gympie	6-66	60	3-64	10-78					
Kilkivan	5-01	51	4-27	5-37					
Maryborough	6-44	58	5-00	3-21					

GEORGE G. BOND, Divisional Meteorologist

GROWING FODDER FOR WINTER USE IN CENTRAL QUEENSLAND.

By G. B. BROOKS, Senior Instructor in Agriculture.

With our somewhat erratic rainfall in the months from June to October, the growing of fodder crops during that period is attended with some risk, consequently it is pleasing to find that farmers in increasing number are taking the precaution of raising high-yielding succulent crops in late summer for winter use. The subjoined notes by Mr. Brooks are seasonably appropriate.

THIS method of providing an assured supply of green material has been demonstrated by the Agricultural Branch of the Department for many years. The crops recommended are sudan grass and sorghum. High-yielding varieties of the latter are being bred by the Department, and demonstration areas planted out in the various dairying districts. Sudan grass should either be fed at the beginning of winter, or cut and stacked as hay. The sorghum can be allowed to stand over and be harvested as required. In localities where very low temperatures may at times be experienced, the risk of getting severely frosted (light frosts are not damaging) is obviated by storing in a trench or stack silo. Both crops are somewhat low in protein, and when used for milk production a little lucerne or cowpea hay, cotton seed, bran, &c., will be found of much benefit.

Not a Matter of Luck.

Notwithstanding the fact that our winter rains are somewhat scant and irregular, farmers are to be found in practically every district who seldom fail to raise satisfactory crops of either barley, wheat, or oats. This is not a matter of luck, as some who have failures would suggest, but is the result of conserving the moisture in the soil by early and thorough preparation. Land for winter crops should be broken up months ahead. Ploughing one week and planting the next is only courting disaster.

Providing Feed for an Extended Period.

It is most desirable that in grazing winter crops provision should be made for the supply to last over as lengthy a period as possible. To obtain this objective, a succession of sowings made, say, every three weeks would appear desirable. Unfortunately, this practice is not to be recommended, the reason being that the winter rainfall is really too irregular to permit of its being carried out with any degree of safety. Scattered rains can usually be depended upon until June, but subsequent months are invariably dry.

Varieties to Sow.

An alternative to successive sowings is the utilisation of a number of cereal varieties that will come into the useful stage at different periods from the one planting. The selection of varieties, of course, applies more to crops that are to be cut and fed rather than to those that are to be grazed off. The matter of keeping the stock off any particular portion can, however, be overcome by the erection of a skeleton fence.

In the demonstration trials carried out by the Department for a number of years in the various dairying districts, it has been found that the following varieties have given very satisfactory results. In regard to maturity, those selected are Early, Medium, and Late, and will become available in the order named:—

Skinless barley—Rate of sowing, 1 bushel per acre.

Cape barley—Rate of sowing, 1 bushel per acre.

Florence wheat—Rate of sowing, 1 bushel per acre.

Algerian, Sunrise, or Ruakura oats—Rate of sowing, 1½ bushel per acre.

In addition to Florence, a later-maturing wheat could, if desired, take the place of the oats, such as Huguenot, Warden's Hay, or Cleveland. Wheat is much more dependable than oats in a dry season, while in a wet winter oats are subject to rust. For several years rye and Canary grass were included in these trials, but owing to the indifferent results obtained were discontinued.

Field Peas a Useful Addition.

In the event of any of the crops mentioned being raised for hand-feeding purposes, both nutritive value and yield per acre can be considerably increased by mixing with them a $\frac{1}{2}$ bushel of field peas per acre. To ensure the covering of the peas, they should either be sown on a cultivated surface and lightly ploughed, or disced in. In loose or friable soil, it is a distinct advantage where the crops are to be grazed, and when a drill is not available, to disc or shallow-plough both cereals and field peas.

Time to Plant.

In order to provide feed during early winter, planting should be carried out at the earliest possible date. A good deal of risk is, however, attached to very early sowing, consequently it is advisable to allow summer conditions to pass, and the soil to cool somewhat before sowing. Should high temperatures, combined with humid conditions, follow germination, a spindly growth, failure to stool, and premature seeding will invariably result.

No actual date can, therefore, be stated, the time being dependent on climatic conditions. May, however, is generally considered a safe month to plant. In the more Western districts sowing can usually be undertaken at a somewhat earlier date than on the coast.

Crops Suitable for Pig Raising Purposes.

The Department has, by practical demonstrations, endeavoured to impress upon pig raisers the benefit accruing from the growing of root and other crops during the winter.

Although the winter rainfall is somewhat precarious, yet when due consideration has been given to the preparation of the land, a large measure of success has attended these trials.

The method adopted for the selection of crops for the dairy herd will also apply in the case of pigs—that is, to plant a range of varieties that will, from the one planting, mature over a very wide period. Planting can usually be carried out during the latter part of March or early in April. However, should the weather be hot and humid, sowing could be delayed for a week or two. Rape and Yellow Turnip are liable to aphid attack in hot weather.

The varieties mentioned will mature in the order mentioned, and should, if conditions are at all favourable, provide a feed from, say, June to December. Sow in rows 2 feet 6 inches to 3 feet apart:—

Rape—2 to 3 lb. per acre. No thinning required.

Yellow Aberdeen Turnip—2 lb. per acre. Thin to about 8 inches apart.

Field Swede Turnip—2 lb. per acre. Thin to about 8 inches apart.

Cattle Cabbage—Raise in a bed and transplant.

Sugar Beet—4 to 5 lb. per acre. Thin to about 8 inches apart.

Long Red Mangel—5 lb. per acre. Thin to about 12 inches apart.

Yellow Globe Mangel—5 lb. per acre. Thin to about 12 inches apart.

Rape and turnips should be sown at a shallow depth. The latter will give best results if planted on a slight hill. Mangels occasionally give an indifferent germination through not obtaining sufficient moisture. Either rolling or pressing the soil around the seed after sowing is an advantage. Should the soil be dry, soaking the seed prior to sowing will hasten germination. Mangels and Sugar Beet can be transplanted when about the thickness of a lead pencil, choosing dull, moist weather for this operation. Owing to the heavy yields usually obtained, Mangels will repay transplanting, utilising the thinnings. When the Scottish Delegation visited Gatton College, they unfortunately could not visit the farm on account of the heavy rains. The writer procured a dray load of Mangels for their inspection, every root weighing over 56 lb.

Field Carrots, Thousand Headed Kale, and Silver Beet are useful additions to the crops mentioned. The latter, being aphid-resistant, will provide green material during early summer, when it is not possible to grow Rape; 5 lb. of seed are required per acre. This plant is often used for culinary purposes when other vegetables are scarce.

RURAL LIFE IN OTHER LANDS.—XI.

By the EDITOR.*

BYWAYS IN BELGIUM.

IN our last talk we were discussing some minor aspects of social life in Belgium. We showed, or rather suggested, that no people have become so subjective to social and economic experiments as the Belgians, and that, whereas in other countries man has been more or less influenced—even to the extent of transportation—by his environment, in Belgium man has transformed and conquered Nature.

A Land with a Long History.

It is a mistake to regard Belgium as a modern political creation dating only from the thirties of last century. As a matter of fact, it is one of the oldest of European nationalities. Bruges, for instance, with its charming vignettes and vistas, its network of waterways that down through the ages have continued to carry the commerce of a continent, and its quaint architecture—particularly of its churches and municipal buildings—Bruges, that delights every visitor from newer and younger lands, was the Venice of Northern Europe when London was still a village. For many centuries, we are told, the Belgian people produced a common and original culture, and knocking around that country one saw many evidences of this. That culture has been municipal, not feudal; democratic, not aristocratic. In the past Belgium was mainly a federation of self-governing cities, and its municipal monuments, its town halls, its guild halls, its belfries, its church buildings, and other architectural adornments are typical of its cultural development and symbolical of its national life.

It is an interesting theme, the development of a social life of a people and its culture, but time will not allow me to follow too long that very fascinating by-path.

Physical Features.

Belgium has only forty miles of coastline, and, like Holland, much of its land surface is below sea-level. The work of reclamation in one form or another is still going on. So low-lying is much of the country that water was employed to good effect as one of the main lines of defence during the great war. The opening of dykes and the flooding of part of the country in 1914 checked, it will be remembered, especially by those Australians who fought in Flanders, substantially the invaders' advance.

The climate is something like that of the south of England, though, in my experience, much more sunless. Days of unbroken sunshine average only about twelve a year—not much good to a Southport surfer!—and generally it is cloudy and rainy. It is colder than England in winter, when if one does see the sun it appears as a pale, cheese-coloured disc, with just enough power to illuminate its own impotence.

Belgium has great mineral wealth—iron, zinc, and coal. Additional mining fields have been discovered in recent years, and as a result the bleak moorlands of the Campine, on the Dutch border, have become a thriving industrial area.

The country is equally rich in agricultural resources and every variety of produce is grown, yet all the same, like Holland, the agricultural wealth of Belgium has been created mainly by unremitting human toil.

Much of the plain of Flanders was once a desolate waste, a seemingly boundless expanse of unproductive land. Other sections around Antwerp and elsewhere formed part of a large marsh—boggy, water-logged country.

In passing, may I say that, however one may admire the industry of the European peasant as manifested in an extraordinary variety of ways, one still thinks that in a new country like Queensland what is required—and I think it is what we already have—is not a peasantry more or less overburdened, but an intelligent and technically trained yeomanry to whom primary production offers reasonable security and some financial prospects.

A Country of Workers.

Belgium is a country of farmers and artisans. Half the population live by agriculture—grain-growing, dairying, cattle-breeding, horticulture, and so forth. And the other half live by secondary industry, which is highly organised. Technical education both in the arts of field and factory is highly developed, and in the

* In a radio address from 4QG.

Workers' University at Charleroi I saw one of the most complete plants for technical instruction in full operation, with students enrolled to the full strength of the establishment.

Living Standards.

There, as in Holland, are no large landowners, and 500 acres of country is considered as an exceptionally big estate. The density of the population has created keen competition in every calling, and viewed from our standpoint wages and salaries are in consequence very low. Living standards are, however, being raised steadily through organised industry, and a powerful, ever-extending co-operative movement.

Transport.

Transport facilities are wonderfully well organised in Belgium. Brussels, the capital, is only thirty minutes journey from Louvain and Malines; it is only an hour from Antwerp and Ghent; about two and a-half hours from Ostend on the coast, and from Liege in the other direction near the German border. It is less than five hours from Paris. The road system is excellent, and everyone seems to own a bicycle. There is a close network of railways; and as feeders to the main arterial lines there are many light lines which help to keep the population well distributed. These light railways have assisted very materially in checking the exodus from the country to the cities, and have been a beneficial factor in the continuance of village life by the factory worker. One day I travelled seventy miles by an electric tramway connecting various towns and villages—starting at a place called Lobbes and passing through Binche where the British cavalry made a first contact with the invading forces in 1914, and going on to Mons, thence to La Louviere, and returning by another route to Charleroi, the whole distance being travelled in ordinary electric trams which ply between town and town and village and village.

A Centre of Commerce.

Being at the cross-roads on well-beaten international routes, Belgium is naturally a great commercial country, enjoying, in addition to its external trading enterprises, a prosperous home market. The Belgian village market to which produce is brought from the surrounding farms and sold in the open squares, and which Australian Diggers found so quaint, is one of the picturesque survivals of the middle ages and presents one of the interesting social aspects of Belgian life.

Fortunes Down a Drain Pipe.

Anyone who has had an opportunity of studying agricultural development in the old country—I mean Great Britain—will remember the fortunes that have gone, so to speak, down a drain pipe. Fortunes have been buried in deep drains and other works which our conservative forefathers considered essential to the task of reclaiming the soil. The consequence is that most people there look sideways at any reclamation project. But science has not stood still since their day, and the progressive farmer knows very well that the costly processes of old have been replaced with others much cheaper as well as more effective. Let us go to Esbeek, in Belgium, to see what can be done in the way of land reclamation with modern appliances and, incidentally, get some idea of what land settlement means in the older countries, where every arable acre and every perch of grassland is brought under tribute to man's energy and to meet man's necessity.

From Antwerp to Turnhout.

Let us start, say, from Antwerp on the light railway to a place called Turnhout. On either side of the line we see a variety of growing crops, and at the same time catch glimpses of inland sand dunes and waving heather. Leaving the railway we take a car as far as it will go, and then get out and travel on foot. Having got to that stage we have a fair idea of the country. The Campine, the country we are looking at, stretches from Antwerp into Holland, and contains the poorest land in Belgium. Standing in the middle of it we see all round a great, flat, hungry-looking plain covered with heather and presenting a picture of hopeless barrenness.

Out of the Wilderness—A Lesson in Reclaiming Waste Lands.

Out of a wilderness such as this was created the rich and beautifully wooded estate of Esbeek. The feat was not accomplished by some multi-millionaire with money to burn, nor by a paternal Government. It was done by a Dutch insurance company. That an insurance company chose such an investment for its funds was at first glance surprising, but a close observation showed its sense of values and of a satisfactory security.

Both Belgians and Dutch are tackling the job of reclaiming waste land, employing modern engineering plant—tractors and so forth—as a purely routine business matter. Very little has been written and less said about it. Instead of talking they act, and let their work supply the convincing rhetoric and its own propaganda.

The first furrow in the reclamation scheme was opened in 1901, and the whole project completed long since, and the country which was once a barren waste brought into full and payable production. Esbeek is now what is called a model agricultural and forest farm. At the time of our visit what had been formerly a sour, sandy waste was waving with wheat and rye. A herd of pedigree cattle was grazing on rich pastures as contentedly as Shorthorns on an English park or Illawarras on Queensland dairy lands. The homestead and farm buildings were on a substantial scale, and surrounded by plantations of pine trees that had been planted eighteen years before. They looked at least a century old. Orchard lands were a beautiful feature of the farm layout, and the fruit trees laden with a bountiful harvest reminded one vividly of the apple lands on the road to Rouen, down in Normandy.

The whole of this estate was wrested from utter waste in the short term of eighteen years, and the success of this and other reclamation projects has aroused interest in English counties where similar conditions exist.

A Queensland Example.

In Queensland in other forms of reclamation—the reclamation of an extraordinarily rich volcanic land from the jungle and the winning of our rich blacksoil river flats—we can present many examples of success in developing unproductive lands along every stage from the primitive to the practical, from rich promise to ripe fulfilment. But we have not as yet had to confront the problem that farmers have to face in overpeopled Europe where every acre must have its productive value, and where every plant constituent taken from the soil must be returned in full and ample measure.

It would be idle, of course, to institute comparisons, and it has not been intended, for the conditions of agriculture in the old world are in many important points so entirely dissimilar from those of Australia; and let me say this: that we in Queensland have reason to regard with some satisfaction the position we have reached in the world's industrial economy. In field practice and scientific direction we have some achievements to our credit. Queensland wheat to-day, the varieties evolved by our plant breeders—Scotter, Quodling, and others—at the Roma Experiment Station, for instance, has created a world's record for weight of grain per bushel. The work of our sugar experiment stations and that of our sugar scientists is evident in record sugar tonnages. We are dairying successfully and extensively on tropical lands, and so far as I know no other country is doing that. On every agricultural and pastoral problem we are bringing trained brains to bear on its solution. We are bringing science and technical efficiency into the paddock wherever they can be applied. We are organising agriculture under farmers' control, in every present practicable direction. And all this is to the good, but, of course, we can always learn something more about our own job; and where they apply or relate to our own particular interest, lessons from the older lands—from Britain, Denmark, Holland, Belgium, and elsewhere—will not be ignored by us.

FUR-BEARING RABBITS.

In view of the many inquiries made by persons who have been attracted by suggested possibilities in the farming of fur-bearing rabbits, the Minister of Agriculture and Stock (Mr. Harry F. Walker) announced recently that, in the absence of official information as to marketing facilities overseas, and in order to give intending investors in the industry an opportunity to ascertain the state of the market, he had arranged for a cable to the Agent-General in London, with a request to supply this information. In reply, the Agent-General has informed him to the effect that supplies of Angora rabbit wool far exceed the demand, and the average price of first-grade wool is about £1 3s. per lb. The market for Chinchilla rabbit pelts is also much depressed, as present prices for best winter only reach 5s., but average about 2s., with heavy stocks on hand.

As a result of this information the Minister suggests that caution should be exercised in the establishment of this industry, and that market possibilities should be closely studied if, as is probable, heavy supplies of rabbit fur are made available in Australia.

DENMARK'S DAIRYING INDUSTRY.

The following information on features of the Danish dairying industry has been supplied by Mr. F. Wigan, Commonwealth Dairy Officer, London, who recently visited Denmark:—

Herd Testing.

The testing of cows for production is a strong feature in Denmark, and there are no less than 1,250 Herd Testing Associations, with 40,000 members, and helped by this the production of the cows has been actually doubled. The average cost per year of testing amounts to about 2s. 8d. per cow to the farmers, who transport the tester from farm to farm, and provide him with board and lodging. There are also over 1,000 Bull Clubs or associations, which, like the Herd Testing Associations, are practically all co-operative.

Careful breeding, culling, and selection, together with systematic testing of the cows, has enabled the Danes to secure a high average butter production per head, but one can see that they have realised that sufficient and scientific feeding is the basic essential for success; for, notwithstanding the production of large quantities of food on the farms, they have not hesitated to spend money on imported fertilisers to increase fodder yield, but they also import annually the large quantities of feeding stuffs I have previously referred to. Dairying depends primarily on economic and plentiful food supply, and the Danes, realising it, have shown the way to the world in developing it. This and their wonderful co-operative systems is, I think, the chief lesson for an Australian dairy farmer who visits Denmark.

Factories.

There are about 1,600 factories, or, as they term them, creameries in Denmark, 94 per cent. of which are co-operative, each receiving milk daily from 600 to 2,000 cows, averaging about 1,000 cows to the factory. I was able to visit the older type of factory and the most modern factories in both Jutland and Zealand districts. The factories are mostly of uniform plan, the milk being received on a small platform, and then passed on into a large central room of the factory where almost everything in its manufacture into butter takes place. After weighing, the milk is passed into a flash pasteuriser in which it is heated to about 130 deg. Fahr., from whence it is run into separators (usually two or three of these) and skimmed. From the separator the cream is pumped into a second flash pasteuriser where it is heated to about 195 deg. Fahr. It then passes over ordinary pipe coolers, leaving them at about 45 deg. Fahr., to enter the cream-holding vat, which in some instances is of the aluminium jacketed type without atemperators, and is situated in another room called the cream room. These cream tanks are usually fitted with an hydraulic lifting apparatus, so that by a few turns of the handle the whole cream vat is raised to a sufficient height to enable the cream to run into the churns. The cream tank is also on a small turntable, thereby enabling it to be turned in any direction necessary when emptying it. The skim milk is also pasteurised by law to a minimum of 180 deg. Fahr. before it runs into a skim milk tank, from which the farmers are returned their portion of skim milk to the farms.

In the smaller factories the churns of the long barrel type or simplex type are situated in the general manufacturing room with the separators, pasteurisers, and coolers, but I noticed the more modern ones have a separate room for the churning and the packing of the butter. The churning methods appear to be approximating ours more closely, showing a finer grain and less free moisture than it used to, and as far as I could learn the average moisture content was not much above 14½ per cent.

The factories I inspected were very clean, and had tiled walls and floors, whilst the utensils had every evidence of being well scrubbed and kept in good condition. The churns especially were given full attention with the scrubbing-brush and small quantities of washing soda and chalk used in the washing water.

Most of the factories use the gerber test for butter fat, and 85 per cent. of them the methylene blue test to detect the poor quality milk. The milk is paid for according to butterfat test, plus the results of the methylene blue test for quality, and in this way the factory manager has a full knowledge of his good suppliers, and the careless farmer is penalised for his unsatisfactory work.

All cream in Denmark for butter-making is ripened with a starter added to it in the cream vat after pasteurising and cooling. The percentage of starter used varies a little, ranging from about 2½ per cent. to 4 per cent. The cream with this added starter is well stirred and remains in the vat overnight at a temperature of about 65 deg. Fahr. until churning time in the morning. From the few starters I

saw in Denmark, and from my examinations of Danish butter generally, I have concluded that their starters must be irregular, or develop irregularly, resulting in variation in flavours and keeping quality in their butter, and from this experience I am more than ever convinced that it would be dangerous for Australia to export butter from Australia made from cream to which a starter has been added after the pasteurising of the cream.

Starters.

My interviews with Professors Orla Jensen and Knudsen at their respective laboratories enabled me to get the latest information in connection with the preparation of a suitable starter for butter-making, as Professor Orla Jensen commenced investigations concerning the bacteriology of starters some years ago, and his work has been carried on where he left it by Professor Knudsen up to the present time, whilst Professor Orla Jensen's investigations on clean milk recently have added bearing on the matter. These Professors have arrived at the opinion that certain foreign substances in milk have decided influence on the behaviour of the germ life present. For instance, when autolysed yeast phosphates and citrate of sodium have been added to pure milk, creating what is termed buffer action, a greater germ activity is noticed. They find that the chief organisms of a suitable starter consist of streptococcus cremoris and the aroma-producing bacteria which have been named *bactococcus cremoris*, which have the capacity for growing well in symbiosis. Split products produced in the milk by the streptococci organisms produce conditions suitable for rapid growth of the *bactococci* and the formation of acidity by them.

Investigators have not yet discovered any certain two or three organisms which are alone responsible for the desirable flavour of butter if propagated in an absolutely pure milk, and it may be that certain protein-attacking organisms assist and are essential for the best results.

The starters used at the butter factories are mostly those of the powder or tablet form placed on the market under Hansen Standard Starter or the Flora Danica Brand. From these commercial starters the factory manager prepares his liquid starter by adding some of the commercial starter to a small quantity of previously sterilised skim milk—i.e., milk which has been standing in boiling water for about one hour. This process is carried on until sufficient starter is developed of suitable activity for use in the cream, 1 to $\frac{1}{4}$ per cent, of starter being used for the mother starter from day to day, whilst the cream receives somewhere about 4 per cent. starter.

I do not propose to enlarge on starters in this report, but I feel sure that with the more frequent daily deliveries of cream to the factories in Australia, the necessity of thoroughly understanding and using starters will become imperative if we wish to excel in quality with our butter.

Grading Station.

I was very anxious to visit the grading station in Copenhagen and see how the work is carried out there, consequently I arrived in Copenhagen to be there on a Monday, which is the day of each week when grading is carried out. On a given day once a week certain factories receive a telegram instructing them to send one cask of that day's manufacture immediately to the Copenhagen grading station, where it is placed in store and held at a temperature of about 60 deg. Fahr. for a fortnight. At the end of that time the casks that are a fortnight old are placed in three separate rooms for the judges to examine. The day I was there there were about 170 casks ready for judging, placed in three separate rooms, with about 50 odd casks in each room. There are nine judges to do the work, consisting of six exporters, two factory managers, and one Government expert. They are split into three groups of three, each group having two exporters, with the Government expert in one group and a factory manager in each of the other two. All the judges examine all the butters—group No. 1, say, judging in room A, whilst group No. 2 judges in room B, and group No. 3 in room C. When they have finished in these rooms they just pass on, group No. 1 going to room B, and so on, until they have all judged every cask of butter. The number of points used in judging are 15 only, and no butter ever gets 15 points. All butters scoring 10 points and upwards entitle their factories to continue using the Lur Brand for export, and the 10 points are arrived at by the average points of the nine judges for that cask. Where any great variation in points takes place, such as I saw in one instance from 8 to 13, the whole of the nine judges go and examine this butter together and arrive at a final decision for it. Very few remarks are made on the judging slips, and these only when the butter is inferior in quality. The points awarded to butter that day for

the worst butter averaged 5.8 and for the best 11.7. I was able to examine these butters, and a number of others, and compare their opinions with ours. Their highest scored butters had mild acidity and they appear to be realising the bad effect of extra high acidity on the quality of butter, for I noticed their remarks in defects against butter included the word "acidity." Although some of the terms on the grading slip were the same as we use, such as "oily," "cheesy," "unclean," "free moisture," and "acidity," I was struck with the number of butters showing low points where no explanation of the defects was set against them. Some of the best butters I saw were unsalted, and amongst the defects were overlooked flavour, unclean, cheesy, metallic, free moisture, greasiness, and streaky colour, but for the most part the butters were of good quality, and a very high percentage of them passed for the Lur Brand.

Amongst conditions for the use of the Lur Brand is that the nett weight and date of production must be marked on the Lur branded staves of the casks or on the ends of boxes, and the date of manufacture must also be stamped on the control labels placed on the butter. Many factories pay a bonus for quality, and take the Lur Brand grading 10 points as a basis—i.e., if a factory has an average grade of 11.7 that factory receives 1.7 more than the one grading 10 or standard only.

The weights of all casks of butter are checked and the butter analysed for moisture.

All factory markings on the casks and the butter are covered up so that none of the judges are aware of the identity of the butter, and they know the butters only by the numbers on the drums which are slipped over the casks. In discussing their method of grading with me, Mr. Sorensen said he was greatly impressed with the system of grading the butter at the port of export by officials, such as is done in Australia, and only because it is quite impracticable in Denmark has he not attempted to introduce it there, the reason being that the butter is exported from many centres, in strong contrast to the one or two ports of export in each State in Australia.

In this butter judging a fine system of recognising factories consistently producing high-quality butter has been instituted—i.e., a diploma is awarded to all factories who have maintained not less than Lur Brand quality without one failure during three consecutive years of grading, whilst if this record is continued for seven years a diploma of honour is issued, and a greatly coveted honour of a gold medal is given to the factory that keeps up this standard for a period of ten years without default. It was very interesting to see a list of the factories who had obtained these honours and, in the case of the gold medallists, the photograph of the manager of the factory obtaining same was hung in the meeting room of the judges at the grading station, totalling in all twenty-one gold medallists in a forty years period.

If the quality of the butter from any one factory is inferior, and continues so for two or three occasions, the manager is advised to call in the Government Dairy Expert for the district, and some little time is allowed for him to remedy the faults in the butter. If it still continues to be unsatisfactory the police are notified, and they remove all Lur Brand staves and control slips from the factory, and that factory cannot export butter until the quality of the butter is improved and they are again accepted for the Lur Brand.

Five Government dairy instructors, who are situated in various districts, as they are in Australia, are employed in supervising and helping factory managers where the quality of the butter is found to be unsatisfactory.

Government Experimental Dairy Farm.

I visited this dairy, which is situated at Hillerod, some little distance north of Copenhagen, and was pleased to meet there the manager, Mr. A. Hansen, whom I had met during the World's Dairy Congress in London, during a visit to Tooley street, where I discussed our and other countries' butters with a number of the Danish delegates to the World's Dairy Congress.

This experimental dairy is run like an ordinary factory, and receives about 3,000 gallons of milk daily from 190 odd farms, representing about 1,200 cows. The plan and lay-out of the factory is similar to the modern up-to-date factories I visited in Jutland and Zealand, and besides the manufacture of a considerable amount of butter, cheese, chiefly of Gouda and Gruyere types, is manufactured. The method of pasteurisation here is the flash system, using a temperature of about 195 deg. Fahr., and I believe that this system is practically universal throughout Denmark, and wherever I discussed pasteurisation the opinion was emphatic that the flash system was much preferable to the holding system for cream for butter making. There is, however, considerable research work going on at present with low temperature holding system pasteurisation for fresh milk for household use, in which Professor Orla Jensen is taking part, and there is a strong feeling that this is the better

system for that purpose in Denmark. The atomising system of pasteurisation, about which I will furnish a report later, was fully tried out at this factory. The plant had been dismantled and removed at the time of my visit. I hope shortly to receive the full report of its trial at this station from the agents who are having it prepared in English.

I saw here also a test of recent origin, the Hoyberg single liquid method for determining the butter-fat content in milk, to be used in place of the Gerber or Babcock tests, which had been tried out, and a full report made of its value as compared with the Gerber test at this factory. I am forwarding a report of the manager of the results of these investigations, in the form of a booklet, in which, on pages 40-41, appears a summary in English.

The management of this factory is in close touch with other Government scientists in dairying, and it is here that the practical test is applied to investigate modern methods of manufacture or science in bacteriology or chemistry of dairying, as well as new inventions of dairy machinery. It was at this factory that I was able to see milk inoculated with various starter organisms, amongst them being *betacoccus*, which does not produce acid when growing in pure milk by itself. It needs no stretch of imagination to realise the great importance of such an institution to the dairying industry in Denmark, and the difficulties under which experts and scientists in Australia must labour without one. One cannot too strongly urge Australia to establish at least one of these research stations.

Agricultural Education.

The need for facilities for educating the young people of Denmark in agricultural matters is met, firstly by the establishment of what are termed High Schools, where students of between eighteen and twenty-five years of age attend short courses mostly on agricultural subjects, and secondly, by the Agricultural Schools, providing higher agricultural education, principally for graduates from the High Schools. There are nineteen Agricultural Schools, with a yearly attendance of about 2,400 pupils. These schools are privately owned, but are subsidised by the Government, which also provides a number of scholarships yearly. These schools can be attended only by those who have been employed in butter factory work for a period of four years.

A full scientific training in dairying is obtainable at the Royal Veterinary and Agricultural College, at Copenhagen, which is a Government institution, the course at which occupies from two to three years, and it is at this college that quite a number of the scientists and advisers in Danish agriculture have graduated.

Agricultural Co-operation in Denmark.

Denmark is perhaps the greatest example of successful co-operation, especially in the dairying industry, of any country in the world, and it is principally through this system of getting together for mutual self help amongst the producers, and especially the small producers in Denmark, that the dairy industry has become so successful.

It was with a view to standardising dairy production that small peasants in Western Jutland formed the first co-operative creamery and dairy society in the year 1882, and from this beginning the co-operative system has grown until there are now 1,400 local dairy societies on a strictly co-operative basis, uniting under this heading nearly 200,000 farmers, or 90 per cent. of the industry. The chief principles of their co-operative system are as follow:—

- (a) The members bind themselves for a certain period, usually ten years to deliver to the society all milk produced in excess of that used in their homes.
- (b) All members are jointly and severally liable.
- (c) The profits are divided in proportion to the amount of milk delivered.
- (d) Membership is open to all milk producers.
- (e) Each member has but one vote.
- (f) The general assembly is the supreme authority in the society's affairs.

The average society has about 150 members, representing approximately 900 cows. The co-operative idea after a while amongst producers was found so beneficial that its development soon included in its assisting powers many farm activities and requirements, such as herd testing associations, bull clubs, horse-breeding societies, cattle export societies, the purchase of feeding stuffs, manure supply, coal supply, farm seeds, and wholesale societies covering most of the requisites of farm and factory, until later co-operative banking institutions were included, and the export and selling of the butter was finally largely brought under the co-operative system.

BUTTER MAKING FOR HOME CONSUMPTION.

In the parts of this State where dairying is in general practice, it has become the custom to forward the cream raised on the farm to a butter factory, where the cream is received, treated, and manufactured into butter. To those supplying cream in this way to the factory, the process of manufacture of small quantities of butter on the farm is generally well understood. However, there is a number of persons scattered throughout the State who milk one or more cows, and have neither the desire nor the opportunity to tender the cream from the milk to a butter factory, but on the other hand, they are anxious to make butter from the cream. Frequently, advice upon the procedure to be followed in so doing is sought from this office, and it is with the object of meeting inquiries of this nature that the subsequent simple particulars are supplied relative to the production of milk and cream, and the manufacture of the latter product into butter. The more important matters for observation will be referred to in their natural sequence.

Primarily it must be understood that the flavour of butter is influenced by— (a) the class of food to which the cows have access, (b) the degree of cleanliness practised in the handling of the milk and cream, and the skill exercised in the manufacture of the butter.

Many varieties of weeds and some useful fodders are capable of conveying objectionable flavours or taints to milk, and, in turn, the tainted flavour is noticeable in the cream, and ultimately the flavour of the butter is affected.

The tainting influence of fodders is minimised by feeding same to cows directly after milking, but not immediately preceding same.

Thorough cleanliness is necessary to prevent contamination of the milk or cream. The cow-bail and place where the cow is milked must have an impervious floor, and be kept in a clean and sweet condition. The udder, teats, and flanks of the cow should be washed and wiped prior to milking. The hands of the person who intends to carry out the milking should be cleansed similarly.

The milk should never be exposed to an impure atmosphere.

Strain the milk without delay after it is drawn from the cow by running it through a very fine-mesh gauze or, preferably, through a strainer fitted with a wad of sterilised cotton.

The milk should next be passed through a separator, or set in dishes to allow it to cream, the separator proving by far the more satisfactory means of obtaining the cream. If setting of the milk in dishes has to be resorted to, it will be found that shallow dishes, which provide a comparatively large surface for the cream to gather upon, are more satisfactory than deeper vessels with a limited surface.

Generally the milk is allowed to sour, or even coagulate, before the cream is skimmed off, but no more cream can possibly rise to the surface after the milk has thickened. The layer of cream is removed with the aid of a utensil termed a "skimmer," the customary makeshift being a tablespoon. The objective should be to collect as much cream as possible, but to avoid gathering any of the milk with it.

The cream is best placed in an enamel vessel and should be kept as cool as possible. It must not be brought into contact with a tainted atmosphere, for the cream readily absorbs odours from such a source.

It is advisable not to mix the cream obtained by individual skimmings, or separations of the milk, until some hours before churning time, when the whole of the cream available for churning should be placed in one receptacle, and allowed to ripen uniformly. Always avoid the mixing together of hot and cool cream.

A certain amount of lactic acid should be permitted to develop on the cream before churning, and this usually requires from thirty-six to forty-eight hours, according to the care taken and the temperature at which the milk and cream are held. Holding either milk or cream at comparatively high temperatures expedites the development of the acidity.

Generally natural temperatures in Queensland, particularly during the warmer season of the year, are too high to give satisfactory results in the churning of cream, and to remedy this difficulty, artificial cooling of the cream by the aid of an ice-chest is advantageous. The water used for butter-washing purposes may be placed in a vessel and similarly cooled in the ice-chest. A more primitive means of cooling the cream is to stand the vessel containing it in water drawn from an underground well or spring; another method is to make a canvas jacket to cover the vessel holding the cream, and to arrange that the edges of the canvas covering reach a supply of water, which is drawn up by capillary attraction, and acts on the same principle as the cooling of water in a water-bag.

Usually good results in churning are obtainable by having the cream at a temperature of 56 degrees to 58 degrees Fahr. during the cooler months of the year, and reducing the temperature of the cream preparatory to churning several degrees lower throughout the warmer season.

In butter-making there are certain requisites and appliances that must be provided, even in cases where primitive methods are practised. Firstly, an ample supply of both hot and cold water must be available. The cold water is necessary for the purpose of washing the butter, and the hot water is required for use in cleansing and scalding the dairy utensils.

The water may be drawn from either a tank or well supply, provided it is wholesome. What is known as "hard" water from a well supply may be employed for washing the butter, so long as this condition of the water is caused by the presence of salt or limited percentages of other mineral matter, not injurious to health. Water containing decayed vegetable matter should not be used for washing butter.

To recover the cream from the milk, either milk setting-pans or a separator is required. The setting of milk in pans to allow the cream to rise is not to be viewed as a satisfactory or economical method of recovering cream from milk. In the first place, there is the risk that the surface of the milk will catch a deal of fine dust particles from the atmosphere while awaiting for the cream to rise; another disadvantage is, that a large percentage of the butter-fat content of the milk is not recoverable by this method. A small-sized separator provides by far the more advantageous means of recovering the butter-fat from milk. Separators of a wide range in skimming capacity are procurable, and one should be secured of a capacity in agreement with the complement of milk to be treated.

A churn is necessary. There are many types of churns that have been designed to meet the requirements of those who desire to churn, for their own use, small quantities of cream. Generally, all are capable of churning satisfactorily. For convenience, the churn should be simple in construction, durable, and so designed as to be readily cleansed.

Two butter pats for use in working and salting the butter should be provided.

Hand power butter-workers are procurable on the market, but such appliances (while admittedly most serviceable) are more suited to cases wherein the operations of the butter-maker are carried on in a comparatively large scale. In instances where it is intended to manufacture sufficient butter to satisfy the requirements of a family, the two pats are to be made to perform successfully the working and patting of the butter. This process can be carried out in a clean shallow dish if so desired.

A dairy thermometer is a most useful article, and should be included in the equipment of the dairy; and by its aid the temperatures of cream or water may be determined from time to time.

Churning is simply a mechanical process for bringing together the butter-fat globules in the cream in order to make them coalesce or unite. Preparatory to the churning of cream, the utensils used in connection with the process should be dipped in scalding water and then rinsed in clean cold water.

The whole of the cream from the various skimmings or separations of the milk (that should have been cooled and mixed in a container for some hours prior to churning time) is placed in the churn and the churn is put into operation.

If the churn is of a design that allows the operator to view the cream while churning, it will be noticed that, after some little time under the churning process, the cream will assume a paste-like consistency and possess a smooth texture. At a later stage the cream will appear to increase in density, and subsequently the texture will appear gritty. This gritty appearance of the texture of the cream is occasioned by the union of the fat globules, and indicates that the churning is nearing completion. Care should be taken at this stage that no cream is allowed to remain stationary on the sides of the churn, and any cream attached thereto should be removed and brought under the influence of the "paddles" of the churn with the main bulk of the cream. Otherwise a portion of the cream will remain unchurned, and be carried away and lost with the butter-milk.

As soon as the cream "breaks," it is advisable to add a small quantity of cold water to flush the sides and paddles of the churn, using about half a pint of water to each quart of cream in the churn. Carry on with the churning process until the globules gather in particles about the size of a grain of wheat. Now stop the churning and allow the butter to float upon the butter-milk, which should then be drawn off. In the case where the temperature of the cream is higher than

it should be for correct churning, the butter-fat fails to assume a granular appearance, but gathers rather in the form of a mass of soft fat. However, this does not call for any change in the procedure in so far as the draining off of the butter-milk is concerned. When this is done, add wash water to the churn, and wash the butter, working the butter with the pats in order to eliminate the butter-milk as thoroughly as possible. The temperature of the wash water should be several degrees below that specified for the cream. It is well to remember that the incorporation of an excessive amount of butter-milk in the butter will result in the keeping properties of the latter being prejudicially affected.

In some cases a second washing of the butter is advantageous, but this is dependent upon the degree of success attained in removing the butter-milk in the first washing. After the washing of the butter has been effected, add fine salt to the butter in the proportion of from three-eighths to half an ounce of salt to each pound of butter.

Work the butter steadily with the pats, taking care not to injure the grain of the butter more than is necessary in expelling the excess of moisture. The working also mixes and incorporates the added salt with the butter.

If the churning of the cream has been carried out efficiently and correct temperatures observed and the butter properly washed, the moisture showing in beads on the finished article will be in the form of a crystal clear brine.

The butter is now ready for use, but as it is capable of absorbing odours given off by other strong flavoured foodstuffs, it should be stored away beyond attack from such influences in clean surroundings and kept as cool as possible.

CONTAGIOUS PNEUMONIA IN PIGS.

COMMON PREDISPOSING CAUSES.

“All coughing pigs should be regarded with suspicion. Healthy pigs do not cough frequently, and the fact that pigowners have formed the opinion, expressed in many districts, that it is normal for pigs to cough is an indication of the extent of the infection with contagious pneumonia.”

This passage is extracted from a pamphlet issued by the New South Wales Department of Agriculture, concerning a condition of particular importance now that the cooler period of the year is approaching. Contagious swine pneumonia is an infectious disease which is characterised by inflammation of the lungs and the membranes lining the chest cavity and covering the lungs. The casual organism may frequently be present in small lesions in the lungs of apparently healthy pigs, and no harm appears to be caused by its presence there until the animal is subjected to unfavourable conditions which lower the body vitality and resistance to disease. These unfavourable conditions are associated with faulty management, and include:—

1. Damp low-lying situations for piggeries and yards.*
2. Inadequate shelter and consequent exposure to inclement weather.
3. Damp cold floorings in sties.
4. Inadequate diet.

In addition it must be remembered, states the pamphlet referred to, that the condition when established is definitely infectious, and the introduction of an infected pig into a piggery is sufficient to cause a widespread loss from pneumonia.

The symptoms shown vary according to the form of the disease, which may be acute, sub-acute, or chronic. Diagnosis is not easily made in an isolated case, but presents no difficulty if a number of pigs are affected. Rapid breathing, coughing, discharges from the eyes and nose in the live pigs, and characteristic findings in the chest on post-mortem examination indicate that contagious pneumonia is the cause of sickness or death. The disease with which it is most likely to be confused in New South Wales is swine fever, since this is also an infectious disease in which the lungs may be involved. Swine fever, however, is a much more serious disease. Both are scheduled under the Stock Diseases Act, and must therefore be reported to the District Stock Inspector, who will take the necessary steps to see that a correct diagnosis is made.

Treatment of sick animals with medicaments is not advised. Pigs slightly affected make a rapid recovery. Where pigs are more severely effected, it is not profitable to try and cure them. Many die, and those that do make a recovery are generally stunted, unthrifty, and slow to fatten. From an economic point of view it is better to destroy them at once.

BALLANITIS IN SHEEP.

Replying to a correspondent, Mr. J. A. Rudd, L.V.Se., of the Veterinary Staff, had this to say of a common ailment in sheep:—The wethers are suffering from Ballanitis or big pizzle, which is the common term wrongly applied to the prepuce, which is the covering externally of the penis and which in large measure protects this important organ from traumatic injury, and which is chiefly affected primarily, but ultimately, in sympathy or by direct contact, a certain amount of inflammatory oedema appears on the penis itself. The question naturally arises: What is the cause? And many and various theories have been propounded from time to time by laymen who are at times accepted as keen observers who know all about sheep. There is no doubt, however, that the one and only cause beyond all doubt is the persistent shearing away, especially since the advent of the machine shears, of the hairs which grow on the prepuce for one special purpose, and that is to drain the urine away and thereby prevent it spreading on the surrounding skin. The spread of the urine causes fissures or cracks to form around the prepuce. This is termed by some as "scalding." These fissures in time become contaminated with filth, dust, and flies, and the irritation compels the sheep to rub on any projections in the paddock such as low stumps or even on the ground, with the result that the condition becomes rapidly worse and spreads.

Prevention is by far the best method, and lies in the direction of explaining to those who shear the sheep the result of their bad work. Every sheep (wether) should be examined after he is shorn and this particular part dressed with zinc ointment (1—8) if the drainage hairs have been removed. I have also noticed that in some instances the whole prepuce has been cut clean away and the pizzle exposed. These sheep should also be dressed and carefully tended for a day or two before being returned to the flock.

Once the sheep is affected, the best practice is to shear the wool away all around the affected part and up towards the scrotum, cleanse this thoroughly with common household soap and water containing 1 dessertspoonful of phenyle to 1 gallon of water, taking care to remove all debris or decaying skin and tissue. Make a start with the scissors made for the purpose and run straight up to the limit or a very little beyond where the pus is seen to burrow. Having done this, cleanse the wound once again with the solution as recommended or, better still, with a solution made up with 1 teaspoonful of salt to 1 pint of water, adding 1 tablespoonful of phenyle to every gallon of salt solution.

The main object of using the phenyle is to keep flies away, the smell being sufficient for the purpose. If the wethers are turned out into a good grass paddock and brought in after three days and dressed once again this is generally found sufficient to effect a cure.

They should not be turned out into a dirty, dusty yard after being cleansed, but straight out over the fence and into a grass paddock. If they are caught in a yard they should be cleansed outside. An improvised hurdle yard away from the home-stead is by far the better place for making a success of this treatment.

I do not think that there is anything lacking in the soil, but a good deal is lacking in care of the sheep during shearing. Big tallies are useless if sheep are cut about and exposed to injuries which are avoidable. If it is thought the soil is the cause of the affection, or is an aid in this direction, a sample of the soil should be sent down to the Agricultural Chemist for analysis and report.

A good method of discovering affected sheep in a mob is to start them ringing, when the pressure of the mob will cause the affected animals to seek relief by working their way painfully towards the circumference of the ringing mob.

A USEFUL JOURNAL.

In renewing his subscription a Willow Tree farmer writes (8th February, 1930):—

"I find the Journal most useful and a great help."

On the same date a Kandanga farmer also writes:—

"We have every Journal since 1924, and should not have liked to miss one. We always look forward to receiving each copy, and have had a lot of useful information from every one of them."

DISEASES IN PLANTS ACT.**NEW REGULATIONS PROCLAIMED.**

All Proclamations and Regulations under the Diseases in Plants Acts have now been rescinded and new Proclamations and Regulations issued in lieu thereof. The first Proclamation states that the Act of 1929 shall come into operation on the 27th February, 1930. Other Proclamations deal with the declaration of certain pests and diseases under the Act, the defining of certain fruit districts, the prohibition of the removal of banana plants without a permit, the introduction of grapes (fruit) from New South Wales and Victoria, the prohibition of the introduction of Codlin Moth or Fruit Fly into the Stanthorpe fruit district, the introduction or removal of plants affected with symptoms denotive of Crown Gall or Hairy Root, the introduction into Queensland of wheat for seed purposes, the declaration of sugar-cane quarantine districts and conditions of interchange of sugar-cane plants.

An Order in Council has also been drafted whereby it is compulsory that the owner or occupier of a banana orchard used for the purpose of obtaining a monetary return therefrom, shall, on or before the 31st March in each year, make application to have his orchard registered. The sum of 5s. shall be charged for such registration, and the money so obtained shall be placed to the credit of the Banana Industry Fund.

The Regulations state that no trees or plants or portions thereof, other than fruit and vegetables, shall be introduced into Queensland at any place other than the places of entry, such places of entry being Brisbane, Cairns, Rockhampton, Bowen, Townsville, Wallangarra, and such other places as may be appointed by the Minister. On its arrival at its destination, every tree or plant introduced into Queensland, and every cover, wrapper, and container thereof shall be taken into a place of quarantine for examination, inspection, treatment, or destruction. A Regulation has been made prohibiting the exporting or importing of potatoes, unless they are accompanied by a certificate declaring such potatoes to be free from specified diseases.

All cases, crates, bags, &c., containing fruit, vegetables, or plants imported into Queensland must be legibly marked, showing the grower's or exporter's name and address, all letters or figures to be not less than half an inch in length.

Any fruit which is found on inspection to be slightly diseased may be used by fruit preservers for manufacturing purposes only.

Regulations have been included which deal with the fumigation of fruit for export purposes, and directions are given for such fumigating.

Every nursery must be registered, and the fees payable will be:—

In cases where the area actually devoted to the raising of plants does not exceed $\frac{1}{2}$ acre, 10s.

Where the area does not exceed 1 acre, 15s.

Where the area exceeds 1 acre, an extra 5s. for each additional acre or part thereof.

No person shall be allowed to remove any tree, plant, vegetable, or fruit thereof from the district of Bowen until it has been passed by an inspector. In that district the occupier or owner of land whereon cucurbitaceous plants are being grown shall once in every three days gather and collect all diseased fruits and destroy same by boiling or as otherwise ordered by the inspector.

All grape vines which are affected with the disease of Downy Mildew must be sprayed with Bordeaux or Burgundy mixture. No person shall allow fruit, whether diseased or not, to lie on the ground. The Regulations lay down certain rules to be followed in certain areas where Codlin Moth is present.

Persons discovering the presence of Bunchy Top of bananas in any banana plants on their land must at once notify the Department of Agriculture and Stock.

Instructions are given as to the spraying of potato and tomato plants, and the times for such spraying are set out in the Regulations.

The occupier of any land on which wheat affected with Flag Smut is growing shall burn all stubble of the wheat plants immediately after harvesting the grain.

QUEENSLAND SHOW DATES, 1930.

Dalby: 8th and 9th April.	Bundaberg: 12th to 14th June.
Nanango: 10th and 11th April.	Lowood: 13th and 14th June.
Oakey: 11th April.	Miriam Vale: 16th and 17th June.
Kingaroy: 15th and 16th April.	Gladstone: 18th and 19th June.
Sydney Royal: 15th to 26th April.	Mount Larcom: 20th and 21st June.
Miles: 16th April.	Rockhampton: 25th to 28th June.
Chinchilla: 22nd and 23rd April.	Pine Rivers: 27th and 28th June.
Kalbar: 26th April.	Mackay: 1st to 3rd July.
Charleville: 30th April and 1st May.	Kilcoy: 3rd and 4th July.
Beaudesert: 30th April to 3rd May.	Gatton: 8th and 10th July.
Wondai: 1st and 2nd May.	Woodford: 10th and 11th July.
Wowan: 1st and 2nd May.	Townsville: 8th to 10th July.
Goombungee: 2nd May.	Cleveland: 12th July.
Taroom: 5th to 7th May.	Barcardine: 15th and 16th July.
Mitchell: 7th and 8th May.	Charters Towers: 16th and 17th July.
Mundubbera: 7th and 8th May.	Caloolture: 17th and 18th July.
Boonah: 7th and 8th May.	Rosewood: 18th and 19th July.
Murgen: 8th to 10th May.	Ithaca: 19th July.
Blackall: 13th to 15th May.	Laidley: 23rd and 24th July.
Roma: 13th and 14th May.	Nambour: 23rd and 24th July.
Goomeri: 14th and 15th May.	Esk: 25th and 26th July.
Gaydah: 14th and 15th May.	Ayr: 25th and 26th July.
Wallumbilla: 20th and 21st May.	Maleny: 30th and 31st July.
Ipswich: 20th to 23rd May.	Royal National: 11th to 16th August.
Springsure: 21st and 22nd May.	Crow's Nest: 27th and 28th August.
Kilkivan: 21st and 22nd May.	Imbil: 3rd and 4th September.
Biggenden: 22nd and 23rd May.	Malanda: 5th and 6th September.
Maryborough: 27th to 30th May.	Gympie: 10th and 11th September.
Emerald: 28th and 29th May.	Redcliffe: 12th and 13th September.
Toogoolawah: 30th and 31st May.	Beenleigh: 19th and 20th September.
Marburg: 3rd June.	Rocklea: 27th September.
Childers: 3rd and 4th June.	Kenilworth: 27th September.
Gin Gin: 5th to 7th June.	

THE WORLD'S COTTON SITUATION.

Warnings of the danger to America of twenty years of almost steady deterioration of the average quality of its cotton crop, as contrasted with the efforts of other lands to improve staple grades as well as to enlarge production, are sounded by Professor John A. Todd, of Liverpool, England, in an analysis of "The World's Cotton Situation," announced recently by the Association of Cotton Textile Merchants of New York.

Weevil damage in the United States has affected quality as seriously as quantity. Due to it this country has turned to heavy-yielding cottons of early maturity, with the "Half-and-Half" variety commanding a market of sorts in domestic and Continental mills at the expense of America's better cottons. On such cotton recent short Indian crops have accounted for good prices thus far, which will be reduced on a bumper crop in India, with India and other countries able to grow more cheaply these grades that are entirely out of place in America.

Analysing the world crop according to staple, Professor Todd finds that in the fine 1½-inch to 2-inch staple, America has had no substantial part since the failure of the Sea Island crop due to the weevil. The Pima crop has recovered from the slump of 1920 to only about 25,000 bales, against 100,000 in 1930. Egypt accounts for this division with one-third of its crop of Sakel quality and with steadily increasing supplies of such grades in the Sudan. In 1¼-inch staple there has been a marked increase in Upper Egyptian cotton, lowering the price of this and East African and Peruvian growths.

In the great American middle grade, the largest new development is in India, where 1,500,000 to 2,000,000 bales per year are now of 1-inch staple. The Argentine crop has shown a marked increase in quality and has proved desirable in Lancashire in the place of good Texas cotton. Promising conditions for this grade exist in South and West Africa, Australia, Mesopotamia, and the Southern Sudan. In short staples India and Korea have developed, with transportation improving future possibilities in the entire sub-tropical belt.

Answers to Correspondents.

BOTANY.

The following answers have been selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.:—

Gympie District Plants Identified.

B. (Gympie)—

1. *Smitax australis*, a species of Supple Jack or Wire Vine, not known to be poisonous.
 2. *Pteridium aquilinum*, the Common Bracken Fern. The common Bracken is known to cause harm to stock, but only when they eat it in any quantity. It is not likely under the present circumstances that stock would eat enough of it to cause any trouble.
 3. No specimen received bearing this number.
 4. *Asclepias curassavica*, the Milky Cotton Bush or Wild Oleander, generally regarded as poisonous, but rarely eaten by stock in sufficient quantity to cause harm.
 5. *Stephania hernandifolia*, the Tape Vine or String Vine, poisonous to stock.
 6. *Desmodium* sp., a species of Tick Trefoil. These are generally regarded as useful plants in the average mixed native pasture.
 7. *Lantana Camara*, the Common Lantana, when eaten in any quantity causes the disease in stock known as Pink Nose, but apparently large quantities would have to be consumed before trouble arises.
 8. *Richardsonia scabra*, Mexican Clover. This plant is a native of tropical America and the southern United States. In the latter country it has been boomed as a fodder, but it is not in any way related to the true clovers, and our experience here is that stock rarely touch it.
 9. *Lespedeza cuneata*, a native legume generally regarded as a useful fodder.
 10. Same as No. 9.
 11. No specimen was received bearing this number.
 12. Fungus, impossible to determine from the specimen sent, as when it reached us it was represented more or less by a stain on the paper. Very few fungi are poisonous.
 13. *Erechthites valerianifolia*, the Federal Weed or Commonwealth Weed, not poisonous.
- One specimen was received without a number. It was *Erigeron linifolius*, generally known as Rag Weed. It is not poisonous.
- The specimen of decayed wood you sent we cannot determine from the material, but if anything can be done with it later on will let you know. We do not think this likely to be the cause of the trouble to which you refer.
- The collection is very typical of plants growing on North Coast Line farms. If any is the cause of the trouble, we are inclined to suspect No. 5, the Tape or String Vine, *Stephania hernandifolia*.

Rattle-pods. *Glycine tabacina*.

R.C. (Ubobo, via Gladstone)—

- No. 1 is *Crotalaria trifoliastrum*, the Small Rattle-pod. The *Crotalaria*s or Rattle-pods are a genus of plants of which several are known to be poisonous. The one you send has come under suspicion once or twice though nothing very definite has been proved about it. In view, however, of the dangerous character of members of the genus it is as well to eradicate it from the paddocks to which the stock have access.
- No. 2 is a small leguminous vine, *Glycine tabacina*, very common in the mixed native pastures of coastal Queensland and generally regarded as a very useful fodder. Though fairly common we have not heard a common name applied to it.

Poisonous Weeds.

A.A. (Pialba)—

- No. 1 is *Trema aspera*, the Peach-leaf Poison Bush or Wild Prach. This plant at times develops a prussic-acid-yielding glucoside in much the same way as in young Sorghum, Soudan Grass, &c., and if eaten in any quantity at this time may cause trouble. What controls the formation of the poison in the plant is impossible to say; sometimes it is present, sometimes absent. This plant is exceedingly common in coastal Queensland, and stock often eat large quantities of it without ill effects following.
- No. 2 is *Gomphocarpus fruticosus*, the Cape Cotton or Balloon Cotton. This plant often comes up very thickly on scrub farms to the exclusion of other undergrowth. It belongs to a dangerous family of plants and is generally regarded as poisonous to stock. Stock, however, rarely eat it in sufficient quantities to cause trouble.
- No. 3 is *Solanum stelligerum*, the Devil's Needles or Needle Bush. All our species of *Solanum* may be looked on with suspicion, as they contain a poisonous principle, particularly the green berries, but losses of stock from eating these plants, common as scrub undergrowth in coastal Queensland, are very rare.
- No. 4 is *Asclepias curassavica*, the Milky Cotton Bush or Wild Oleander, a very common weed in Queensland belonging to the same family as the Cape Cotton (No. 2). It, however, is rarely eaten in sufficient quantities to cause harm.

The plants you send are common ones of secondary growth in scrub country in coastal Queensland, and to a less extent on the better-class forest country. Losses of stock commonly occur on country where these plants are growing in abundance, and it is as well to clear them out if possible. The stomach contents have been handed over to the Agricultural Chemist for report.

Bull-head Grass.

INQUIRER (Allora)—

Your specimen of Bull-head Grass is *Cenchrus carolinianus*, the American Burr Grass or Sand Burr Grass, a native of the United States, and regarded there as a bad weed. This is the first time apparently it has made its appearance in Queensland. Unfortunately, its burrs, which contain the seed, are readily carried about by all classes of stock, and thus the plant is distributed.

Giant Couch.

D.A.L. (Mackay)—

Your specimen is *Panicum muticum* or Para Grass, commonly known in Queensland by its botanical name or sometimes as Giant Couch. It is one of the best grasses we possess for dairying and general stock-raising purposes along the coastal belt of North Queensland. The percentage of fertility in the seed is very low and hence propagation is generally effected by means of root cuttings or by division.

***Rhynchosia minima*.**

R.H.F. (Bowenville)—

Your specimen is *Rhynchosia minima*, a creeping legume very common in the Downs country. It is not known to have become a pest, but is generally looked on as a useful plant in general mixed native pasture. Though the plant is moderately common we have not heard a common name applied to it.

Australian Eryngo.

D.C. (Dalveen)—

Your specimen is the Australian Eryngo (*Eryngium expansum*), a moderately common weed in Queensland, most abundant in the Stanthorpe area. Though a heavy seeder it does not seem to make itself a pest to the extent one would suppose, and as it has no particular value it should be destroyed where seen.

White Oak, or "Wheel of Fire."

A.T. (Mudgeeraba)—

Your specimens represent *Stenocarpus sinuatus*, the Wheel of Fire or White Oak, one of the handsomest of our native flowering trees. Propagation is by means of seeds, but growth in the early stages of the tree is rather slow. The tree belongs to the Silky Oak family, Proteaceæ, and possesses a whitish wood with a Silky Oak grain, rather pleasing to people fond of timber of the Silky Oak type, though not too highly figured.

Chinese Goosberry. Arjun Tree.

INQUIRER (Brisbane)—

Your specimen is *Averrhoa carambola*, the Carambola or Chinese Gooseberry, a small tree, native of tropical America, widely cultivated. In India the fruits are said to be candied and made into pickles; also used as most things are in that country in curries. It is not common here, and is only grown as a curiosity, and the fruits do not seem to be used.

The dried fruit from the Maryborough Gardens is *Terminalia arjuna*, the Arjun Tree, a native of India and regarded as a valuable timber tree there.

Plants from Pittsworth Identified.

INQUIRER (Pittsworth)—

No. 1 is *Gaura parviflora*, the small-flowered Gaura, a plant of the Evening Primrose family, a native of the southern United States—Texas, Missouri, New Mexico, &c. We have only received it once before from any Queensland locality, and that was Charters Towers. It has the possibility of becoming a weed pest, but not to the same extent as the Wild Mint, another importation to your district from the United States.

No. 2 is *Bassia Birclii*, the Galvanised Burr.

No. 3 is *Bassia quinquecuspis*. This is the plant now most commonly known in Queensland as "Bindy-eye"—a name, however, in very general use for many burr plants.

Cockspur Thistle.

J.J. (Redbank Creek, Esk)—

Your specimen is the Cockspur Thistle or Saucy Jack (*Centaurea meitensis*), a native of the Mediterranean region, now common in most warm countries. In Queensland it is abundant on the Darling Downs, and is still more abundant in the Southern States. It is one of the worst weed pests we possess, and if possible should be eradicated on its appearance in fresh localities. Eradication should be done prior to seeding.

A Widely Distributed Grass (*Chrysopogon Gryllus*).

N. (Warra)—

The grass is *Chrysopogon Gryllus*, a species widely distributed in Queensland and also occurring in New South Wales, but though it has a wide distribution we have never seen it abundant in any one locality. It is generally regarded as a useful pasture grass, and is said to improve a good deal in cultivation. In spite of its utility and general spread we have not heard a common name given to it.

Rattle-pod (*Crotalaria incana*).

E.A. (Nerang)—

Your specimen is *Crotalaria incana*, a species of Rattle-pod. It has several times been suspected of poisoning stock in Queensland, and though nothing definite is known about this particular species, as several members of the genus *Crotalaria* have definitely been proved poisonous to stock both here and abroad, it is as well to look on the plant with suspicion and cut it out from paddocks in which stock are grazing.

Wild Cherry (*Vitex acuminata*).

J.E.E. (Mundubbera)—

Your specimen is *Vitex acuminata*, a small tree very common in the drier scrubs of Queensland, and commonly known as Wild Cherry, though this name is applied more appropriately to some other native plants. The pretty red fruits are not edible, having a nauseating taste though they are not known to be poisonous.

PIG RAISING.

(Selected from the outward mail of the Senior Instructor in Pig Raising, Mr. E. J. Shelton, H.D.A.)

Points in Pig Management.

W.Z. (Numinbah, Nerang)—

We regret that you have had trouble among your pigs, and have been compelled to destroy the boar. Under the circumstances, we suggest your erecting entirely new sties and providing a good pig paddock on a fresh site, and keep all new purchases away from the other pigs on the farm, for only in this way are you likely to get rid of infection and carry the new stock without undue risk.

The provision of a really good pig paddock of from one-half to one or more acres in extent would be well worth while and would not only be economically sound, but would permit of the development of healthy stock under conditions favourable to early and profitable development. Your storekeeper would quote you for suitable wire netting, and simple shelter sheds would be quite satisfactory without the necessity for more expensive sties.

The growth and use on the farm of as much of the food supply as is possible is advised, and until you are quite certain (by tuberculin test) that there is no risk of infection through skim milk, we recommend that the milk should be always scalded and cooled down before feeding the pigs.

Tuberculosis is a dangerous disease and it is quite impossible to state there is no risk of infection from unclean sties, &c.

DAIRYING.

Selected from the outgoing mail of the Supervisor in Dairying, Mr. Chas. McGrath.

Points in Dairy Cattle Breeding.

A.E.T. (Byrnestown)—

Generally it is not advisable to breed back a sire to his own progeny, which is inbreeding of stock. This practice of inbreeding has been practised by breeders skilled in the selection and mating of stock. It must be kept in mind that while desirable characteristics may be intensified, undesirable features may also be increased. In line breeding, as in inbreeding, the matter of constitution has an important bearing. It is advisable for other than skilled breeders to restrict themselves to line breeding.

I am forwarding to you, under separate cover, a copy of the "Agricultural Journal" for December, 1928, on page 592 of which you will note an article dealing with the selection and breeding of stock, with which is a table illustrating the principle of line breeding.

If you like this issue of the Journal, kindly bring it under the notice of a neighbour who is not already a subscriber. To the man on the land it is free. All that he is asked to do is to complete the Order Form on another page and send it to the Under Secretary, Department of Agriculture and Stock, together with a shilling postal note, or its value in postage stamps, to cover postage for twelve months.

General Notes.

The Dairy Produce Act—Its Application Extended.

An Order in Council has now been passed under "*The Dairy Produce Act of 1920*" bringing that Act into force in the areas of the following local authorities:—
 Cities: The cities of Townsville and Charters Towers. Town: The town of Bowen.
 Shires: The shires of Johnstone, Cardwell, Hinchinbrook, Thuringowa, Dalrymple, Ravenswood, Ayr, Wangaratta, Proserpine, Mirani, Sarina, Broadsound, Livingstone, Douglas, and Eidsvoll.

Staff Changes and Appointments.

The Officer in Charge of Police at Charters Towers has been appointed an Acting Inspector of Stock, as from 15th February, 1930.

The appointment of Mr. J. H. Gregory as an Instructor in Fruit Packing, Department of Agriculture and Stock, has been confirmed as from 1st August, 1929.

Mr. H. St. J. Pratt, Instructor in Fruit Culture, Stanthorpe, has been appointed also an Inspector of Stock, as from 15th February.

Mr. C. A. Joseph, of Diamond Valley, Mooloolah, has been appointed an Honorary Inspector under the Diseases in Plants Act.

Mr. S. W. Buhot, District Inspector of Stock, Toowoomba, has been appointed Government Representative on the Darling Downs Dingo Board.

The Officer in Charge of Police at Fossilbrook, North Queensland, has been appointed an Acting Inspector of Stock.

Sugar Industry—An Amended Regulation.

An amendment to Regulation 147 under and for the purposes of "*The Primary Producers' Organisation and Marketing Acts, 1926 to 1928*," has been made. The old Regulation 147 read as follows:—

"147. At the election in March, 1927, each Mill Suppliers' Committee, District Executive, and the Queensland Cane Growers' Council shall be elected for a period of three years, namely, for the period to the 31st March, 1930."

Regulation 147, as above, has now been rescinded, and the following has been approved in lieu thereof:—

"147. At the election in March, 1930, each Mill Suppliers' Committee, District Executive, and the Queensland Cane Growers' Council shall be elected for a period of three years, namely, for the period to the 31st March, 1933."

The Banana Industry Protection Act.

A Proclamation has been issued proclaiming the date of commencement of "*The Banana Industry Protection Act of 1929*" as the 27th February, 1930, and forty-six regulations have been made under the Act, and which are summarised thusly:—Regulations 1 to 22 deal with the transaction of business at Board meetings; 23 and 24 deal with a quorum. One representative of the Government and one representative of the growers shall form a quorum; 25, growers' representatives shall hold office for two years; 26 deals with fees. Growers' representatives shall be paid one guinea per day for each sitting or day occupied in the Board's business, plus travelling expenses at public service rates; 27, up to the 31st August the growers' representatives shall be nominated by the Committee of Direction. Their term shall cease on the 31st August, 1930; 28 to 44 deal with the election of growers' representatives, who shall hold office from the 1st September, 1930; 40, rolls of registered banana-growers entitled to vote shall be subject to the approval of the Minister; 45, all general records shall be kept in the Office of the Department of Agriculture and Stock; 46, all agreements shall be signed by the chairman or deputy chairman and be countersigned by the secretary.

The following appointments have been made to the Banana Industry Protection Board:—

Mr. G. Williams (Director of Fruit Culture), Mr. R. Veitch (Chief Government Entomologist), Government representatives;

Mr. K. R. Hack, Nerang, and Mr. A. E. Maher, Cooroy, growers' representatives;

and Mr. Williams has been appointed Chairman of the Board.

Canada Adopts Meat Grading.

An organisation for the grading and branding of beef produced in Canada has been put in operation. Two grades of beef are to be marked at the outset; "Choice," which will bear a red brand, and "Good," which will have a blue brand. The brands will be so applied that a portion of the marking will be present on any retail cut, so that the smallest consumer will be able to buy a graded product.

A recent report states that the new policy carries out the recommendations of the Joint Beef Committee, which was appointed by the National Beef Conference which was held in 1928.

Honey Board Nominations.

The following nominations have been received at the Department of Agriculture and Stock in connection with the election of four growers' representatives on the Honey Board:—

Brown, Alexander Roy (Park Ridge),
 Campbell, John Duncan Colin (Hillview, Beaudesert),
 Edwards, Charles William (Greenbank, via Kingston),
 Fagg, Henry Edgar (South Killarney),
 Schutt, John (Holstein Park, Perthton),
 Spry, Augustus Frederick (Clayfield, Brisbane),
 Tanner, Owen Norman (Samford),
 Woodrow, Robert Victor (Woodford).

New Zealand Pig Products—Satisfactory Experiments.

The following interesting report on experiments recently carried out in England by New Zealand producers to manufacture good quality bacon from frozen pigs shipped from the Dominion has been received from Mr. R. H. Heywood, Commonwealth Veterinary Officer attached to the High Commissioner's Office, London:—

An experiment of considerable interest to pig producers in New Zealand and consumers in Great Britain was recently organised in London by the New Zealand Meat Board and the New Zealand Department of Scientific and Industrial Research, both of which organisations are giving every assistance in the establishment of a pig industry in New Zealand. The object of the experiment was to demonstrate that it is possible to manufacture good-quality bacon from frozen pigs from the Dominion. This is well known to a few, but it is desired to bring home to the whole body of interested producers and consumers, by actual demonstration, that bacon of a certain quality can be produced when efficiently cured. The experiment was undertaken by a prominent firm of curers, to whom the thanks of those who organised the experiment are due.

The frozen carcasses were manufactured into Wiltshire sides by standard methods of cure. The finished sides were judged by a panel of judges from the London Provision Exchange, whose report is briefly as follows:—

The general conformation and proportion of sides were good and the colour and mildness of the bacon were excellent. The total points awarded for three types of cure were 81, 76, and 82 out of a total of 100, the first being a tank cure and the two latter dry salt cured.

These results are regarded as being extremely satisfactory.

A comprehensive series of cooking tests were kindly undertaken by the chief and staff of the King's College of Household and Social Science. Comparative cuts and joints of the three New Zealand bacons, best English and Danish, were cooked in five different ways and were submitted for opinions to a number of judges who were unaware of the origin of the samples. The final opinion of the college experts and others was that the New Zealand samples were at least as good as English and better than Danish in flavour, tenderness, and appearance. Another point of importance to the housewife was that all New Zealand samples lost less weight in cooking.

The promising results obtained from this experiment are of unusual interest in view of the publication of the Imperial Economic Committee's report on pigs and pig products, in which emphasis is laid on the potential importance of New Zealand as a source of pork and bacon. The fact that bacon of quality demonstrated by this experiment can be made from frozen pork is, to say the least, encouraging to those who organised the experiment, which should act as a stimulus to those endeavouring to substitute Empire products for foreign imports. It is of interest to note that bacon from New Zealand pork has been cured and marketed by several British curers for some years past.

They All Advertise.

The hen is not supposed to have much common sense or tact, yet every time she lays an egg she cackles for the fact. A rooster hasn't got a lot of intellect to show, but none the less most roosters have enough good sense to crow. The busy little bees they buzz, bulls bellow and cows moo, the watch dogs bark, the ganders quack and doves and pigeons coo. The peacock spreads his tail and squawks, pigs squeal and robins sing, and serpents know enough to hiss before they sting. But man, the greatest masterpiece that nature could devise, will often stop and hesitate, before he'll advertise.

Pig Returns—Can any other Reader beat this.

Mr. W. H. Nugent, of Milford, Boonah, writes:—"With reference to your paragraph in General Notes, February "Queensland Agricultural Journal," you ask if any reader can beat Mr. Skinner's returns for pigs, equalling £3 per dairy cow. My dairy herd consists of twenty milch cows, and I keep three to four breeding sows, also a purebred Duroc-Jersey boar. For 1928, my pig returns amounted to £110 8s. 3d., and for 1929 £100. Maize purchased to feed pigs during the two years cost £10. Skim milk, pumpkins, maize, sorghum, &c., grown on the farm made up the rest of the feed. The average return for pigs for the two years equal £5 per cow. Some of the pigs were sold as baconers and some as stores. I do not keep my pigs penned up; they have a free run in grassed paddocks fenced with seven barbed wires."

Improvement of Dairy Herds in U.S.A.

Some food for thought for Queensland dairymen:—The Secretary for Agriculture, U.S.A., recently stated that if the 22,000,000 dairy cows now in the United States were as efficient as the cows in the herd improvement associations, the same amount of milk produced by the above number of cows would be produced by 14,000,000 cows. The annual average of milk production of the association cows was 60 per cent. more efficient than the average cows. The average annual milk production from the 22,000,000 cows is only 4,600 lb., as against 7,417 lb. from cows in dairy herd improvement associations.

Here, it is stated, is a field for development to which the U.S.A. dairymen are fully awake, but which has enormous possibilities, as immense savings in feed and labour could be effected if the dairy industry had 14,000,000 cows sufficiently efficient to produce the present milk supply.

Although America produced in 1928 some 60,000,000 tons of milk, her net imports amounted to approximately 1 per cent. of her domestic requirements.

The Poisonous Plants of Queensland.

Running through the "Queenslander" for the last three months has been a valuable series of articles on the poisonous plants of Queensland. All the known and suspected poisonous species are being dealt with in this series, which is well illustrated, and all readers of this journal would be well advised to follow these articles regularly.

At the present time the known and suspected poisonous plants of the Natural Order Solanaceae are being dealt with. This order includes the potato and tomato, but most of the species are mere weeds and a large number are poisonous. A few of the plants are reputed to be useful in medicine.

Among the poisonous species of this family found in Queensland are the Apple of Sodom, Devil's Apple, Buffalo Burr, Wild Black Currant, Poison Berry or Cestrum, Stramonium or Thorn Apple, Purple Thorn Apple, Hairy Thorn Apple, Native Thorn Apple, Wild Tobacco, and Native Tobacco. Cases frequently come under the notice of the Government Botanist of stock being poisoned by eating the plants, and the descriptions given in the "Queenslander" should be very helpful to graziers and other readers. Sometimes a preparation made from a poisonous plant has a use in medicine, and where this is so reference is made to it in the articles referred to.

Botanical names are always given, mostly for check purposes, but otherwise the use unduly of technical terms is avoided, the articles being written in a style that can be followed easily by the average reader. In collecting his material the writer of the articles has consulted many publications, but the main source of information is the "Queensland Agricultural Journal," in which references to poisonous plants have appeared from time to time for over thirty years. Much assistance has also been given to him by the Government Botanist, Mr. C. T. White, F.L.S.

The "Queenslander," by giving attention and encouragement to this phase of scientific investigation, is performing a valuable service for the rural producer.

Canada's Increasing Trade.

According to an official report from Canada, in twenty years the Dominion's trade has multiplied eight times and Canada now leads all other nations in favourable trade balance per head of population. Her exports now amount to 133 per capita, which is one-third greater than Great Britain, and nearly four times that of the United States. It is also stated that Canada is making relatively faster economic progress than the United States.

Citrus Levy Extended.

Regulations have been issued under the Fruit Marketing Organisation Acts extending the Citrus Levy Regulations until the 28th February, 1931. These regulations were originally issued in February, 1926, and the new schedule just issued provides for the payment of a levy on the basis of the quantity of citrus fruit sold by a grower. It shall be at the rate of 1½d. a bushel case and ¾d. per half-bushel case, and 5s. per ton in the case of fruit used for fruit preserving. The levy shall be collected by means of levy stamps, which are obtainable from the head office of the Committee of Direction, Turbot street, and which shall be affixed to account sales or credit notes, or any other documents giving evidence of the sale of citrus fruits.

The levy is really a reduction of what formerly operated, in so far as the former levy was operative at 2d. per bushel case, and 1d. per half-bushel case, and 8s. a ton on fruit for preserving purposes.

Of the sums raised by the levy, an amount equal to 1d. per bushel case, and ½d. per half-bushel case, and 5s. per ton on citrus fruit sold for preserving purposes shall be expended only in the interests of the citrus fruit section of the fruitgrowing industry of Queensland, and the balance only upon advertising in the interests of the growers concerned.

Dairying Problems.

A recent deputation from the Queensland Co-operative Dairy Companies' Association to the Minister of Agriculture and Stock, Mr. Harry F. Walker, dealt with many questions, including the likelihood of the Buffalo Fly invading Southern Queensland; the uniform grading of butter; mammitis in dairy cattle and its prevention; the necessity of a bacteriologist being allowed to visit factories and also to do work at the laboratory; and the payment of subsidy, by various companies, on the railage and cartage of cream to the factories.

Mr. Walker pointed out that the Buffalo Fly was still being watched carefully by the officers of the Department of Agriculture, and the latest report proved that it had not come any further south than twelve months ago. He stated that the Department has got in touch with the Commonwealth Government on this matter, and the Commonwealth has convened a conference to be held in Brisbane on the 1st April, and invitations have been issued to representatives of owners of stock in the restricted area of Queensland and in Northern Australia adjacent to the border; representatives of the stock interests in Queensland and Northern Australia; representatives of the Department of Agriculture and Stock, Queensland, and of the Department of Home Affairs; with the Director, Division of Veterinary Hygiene of the Commonwealth Department of Health, as Chairman. Mr. Walker assured all present that the Department would be quite firm in carrying out the restrictions now imposed to prevent the fly coming any further south.

The question of grading dairy produce for local sales was brought up, and it was suggested by the deputation that the words "First," "Second," and "Third" be used in lieu of other markings which are used by some companies to-day. With regard to this question Mr. Walker promised to have further investigations made after consultation with other officers of the Department.

With regard to mammitis in dairy cattle, Mr. Walker pointed out that this matter was being attended to by Major Cory and Mr. Pound, who have conducted extensive investigations and are still continuing their investigations with the idea of finding some permanent preventive.

The request for a bacteriologist was acceded to, provided the request was general, and that the factories in return help the Department as much as possible by sending down to the laboratory whenever practicable samples of cream which requires attention.

Mr. Walker appealed to the members of the Butter Association to support Mr. Deacon (Minister for Lands) in his desire to see Queensland wood is used for butter boxes in lieu of any imported timber. Recent experiments, he said, had proved beyond doubt that Bunya and Hoop Pine were the best timbers to use and were less liable to impart wood taint to dairy products.

The Gospel of Good Farming.

Discussing the high standard of wheatgrowing practice of farmers who entered their crops in the championship field wheat competition in the northern area of New South Wales, the manager of Glen Innes Experiment Farm, who acted as judge, comments:—"The wheat position in the north is very bright. In past years the statement has been voiced that one good crop was enough to delay the advancement of scientific agriculture for a decade, because on these highly fertile soils it was possible to produce high-yielding crops in good seasons, quite irrespective of the cultural practice followed. Be that as it may, the gospel of good farming has now been accepted by the men that matter, and it is unthinkable that northern agriculture can do anything but progress. There seems now to be a complete understanding of the great fundamental fact that good farming is essential to good crops."

Increase Meat Sales—Attractive Joints.

The interest being shown by the meat industry in the wrapping and packaging of frosted and unfrosted fresh cuts is bringing to light some interesting subjects for speculation (says the "National Provisioner," Chicago, Ill., America).

Among these is the question of whether or not wrapping and packaging will increase meat consumption and enable the meat packer to get a larger profit from each carcass sold.

The general opinion seems to be that they will tend to increase meat sales. This is based primarily on the fact that when processed meats—such as sliced bacon, for example—were packaged, consumption of them increased.

When fresh meats are put up in a convenient form—with the added value of brand and grade identification—meat merchandisers believe the same factors that influenced the increased consumption of packaged processed meats and other packaged goods will apply.

More Popular Cuts.—But there is another angle to this subject that is only now beginning to be appreciated in connection with wrapping and packaging. This is the matter of getting out of each carcass more cuts for which a large popular demand can be built. This would mean, of course, a greater demand from each carcass.

One of the difficulties the packer has always had to contend with in the marketing of beef—and to a lesser extent with veal and lamb—is the growing tendency of the consumer to demand small steaks, chops, and the other better cuts. The trend toward apartment life, smaller families, the growing demands on the housewife's time, and the simplification of household tasks are some of the factors that have brought about this situation.

The live stock producer has met this demand by producing smaller animals of better quality. The packer might carry the process a step farther by redesigning carcass cutting methods so as to get from each animal more yield of cuts in greatest demand by consumers. In doing this there are chances to serve the small consumer.

Such a plan would involve more boning out than is now done. It would mean the preparation for broiling and frying purposes of cuts now boiled, roasted, and stewed.

Skewering, tying, pounding, larding, and slicing would make out of many of the boiling and roasting pieces nutritious, economical, and attractive cuts for a pan or broiler.

Goods Advertise Themselves.—Many of these cuts would approach the more expensive cuts in tastiness and attractiveness. They could be so designed that, when sliced, each slice would be sufficient for one serving. They would be economical in that they would contain no bones and they could be made popular.

In addition there would be a merchandising advantage for the packer who showed ingenuity in preparing well-flavoured, attractive cuts.

The consumer is not particularly interested in what part of a carcass a piece of meat comes from; but she does want meats of good quality that will be attractive when served, and that can be prepared for the table easily and quickly.

The packer who puts out new cuts in attractive wrappings and packages will have a new field of merchandising open to him. He can give his products distinctive names, and with the right kind of advertising, induce customers to ask for his products by these names. If he does this he will build a business that will be distinctively his own, because it will be based on consumer demand.

U.S.A. Commercial and Intelligence Service.

According to Mr. A. S. Hillyer, Chief of the Commercial Intelligence Division of the U.S.A. Department of Commerce, approximately 1,000 trade men in 385 foreign countries furnish him with material for his commercial and intelligence reports. The Division concerns itself with furnishing trade lists and credit references in connection with foreign trade opportunities and affects contracts with foreign buyers visiting the United States.

Why Silage Keeps.

When corn is placed in the silo, that near the surface where it is exposed to the air becomes hot. This has led to a somewhat general belief that the whole mass of silage becomes hot. However, such is not the case, according to experiments by the Bureau of Dairy Industry, United States of America Department of Agriculture. Thermometers buried at various places in the silage showed a maximum temperature of 100 deg. Fahr., which would be termed only lukewarm. Usually the silage reached its maximum temperature in ten days or less, after which it gradually cooled. It is evident, the Bureau says, that the formation of heat is insufficient to cause sterilisation, and thus aid in the preservation of silage. Rather, the silage keeps because of the exclusion of air and the action of the acids.

Defrosting of Beef.

Mr. R. H. Heywood, Commonwealth Veterinary Officer, London, has advised the Department of Markets and Transport that a representative of one of the London meat firms recently stated at a meeting of the British Association of Refrigeration that his firm had been able to sell more frozen meat in three months since it had been defrosted than in the whole of the previous year, and that although on a particular day his firm was unable to make 3s. 6d. per stone for frozen cow hind-quarters, on the following day after defrosting these sold readily at 4s. 3½d.

The following notes regarding the defrosting process were handed to Mr. Heywood by the representative above referred to:—

For a trader to achieve success it is necessary to do two things: He must produce the article in which he deals in such a way as will make it desirable to his customers, and the article itself must be of such a nature as will fulfil the requirements for which it is intended.

Now, Australian beef in the past has not met these requirements; to be brought to England on economic conditions, it must be hard frozen. Beef, when cut up into joints has an unfortunate way of appearing wet from the too quick thawing of the flesh, and further, when cooked, owing to the best part of the meat having been carried away in the sweat during the thawing, it eats dry and tasteless and thus gets a bad name.

The new method of defrosting alters all this; it stops what is called the weeping, thus goodness is retained in the meat; the meat itself becomes easier to cook and when cooked retains both quality and flavour, while cooked and uncooked, presents a pleasing appearance.

The trade in the defrosted Australian meat at first met with poor results, but after being persevered with for a few weeks, sales increased to twelve to fifteen times the quantity of the first venture. Further, the traders found that it suited their customers, and now elect this defrosted in preference to the similar quality of chilled meat. But the depots for defrosting are limited and are practically used to their full powers, but owing to the opposition defrosted meat is meeting in various bodies it will require to have the defrosting process supported from influential quarters to supply sufficient encouragement to extend the machinery for defrosting. At present, frozen meat when cut into joints, loses a large proportion of weight and most of its goodness. When defrosted it still loses weight, rather less than half of meat not defrosted, but keeps all its goodness and flavour, so that quality for quality, defrosted meat is every whit equal to chilled meat in all respects.

The point of difference is that Australian is Empire meat and the money paid for it remains in England in the form of wages, &c., for manufactured goods, while the money paid for chilled meat goes to America, and leaves England for good and all. So that if Australian frozen meat can be made equal to chilled meat for table purposes—and it can be in defrosting—then it is all to the advantage of the Empire that its sale should receive the necessary encouragement from the powers that be, and remember there is no question of increased price; if defrosted meat came into its own what change of price there might be would be in favour of the purchaser.

Disinfectants in the Dairy—Limitations.

Discussing a recent survey of the conditions existing in butter factories in a North Coast district, an officer of the Biological Branch of the New South Wales Department of Agriculture points out that undue reliance is often placed on preparations which, although they are effective germicides and have a definite value in the factory and on the farm, are entirely unable to take the place of boiling water, and are in no way to be regarded as grease or casein removers. The following paragraphs from a dairying pamphlet of the Department show just what the effective cleaning of dairy utensils involves.

A Most Important Operation.—The cleaning of dairy utensils, if somewhat irksome, is not particularly difficult, the dairy farmer is reminded. From the point of view of cream quality, it is one of the most important operations on the farm, yet sometimes it does not receive the attention it warrants. This is due largely to the fact that the bacteriological aspect is not properly understood. Owing to our climatic conditions which are so suitable for bacterial growth, improperly washed dairy utensils result in a large amount of contamination of the cream supply, with a likelihood of inferior cream. The object of cleaning dairy utensils and separator parts is not only to remove the milk or cream adhering thereto but also to kill all bacterial growth thereon. The removing of the residue of milk or cream is not difficult, and is best done with the aid of proper brushes and warm water to which a small amount of washing-soda has been added. It is important that all particles of milk or cream should be removed. Rags should not be used in the wash-up.

The next procedure is to kill the bacteria adhering to the utensils. There are two common methods of killing bacteria—one is by the use of germicides or disinfectants, and the other is by the use of heat in form of boiling water or steam. Disinfectants cannot be safely used for treating dairy utensils except in special cases, and the boiling water treatment is the general method adopted. This is very effective when properly carried out.

Hot Water Supply.—The question of an effective boiling water supply on the farm has been rendered more difficult of late years on highly improved properties by reason of the shortage of wood. This has not yet reached an acute stage generally, and where it has steps can be taken to overcome it. Older dairying countries have had the same problem to face and have adopted modern water heaters—electric heaters (where cheap power has been available) and other methods. We have hardly reached that stage, but consideration might be given on certain farms to the installation of bricked-in coppers (where not already done) as an economical means of heating water and for cleansing dairy utensils. The ordinary chip bath heater is a convenient method of using up cobs, waste paper, &c., but care must be exercised to see that the water is heated sufficiently. To effectively treat the utensils, the water must be close to boiling point. Warm water is of very little value, and water which has been heated some distance from the dairy and is left to stand at the wash-up bench for five or ten minutes after being removed from the fire quickly cools off to well below boiling point.

The most effective method is to place the separator parts and the smaller dairy utensils, after properly washing, in the vessel used for heating water (be it a copper, kerosene tin, or whatever is used), while still on the fire, making sure that the water comes to the boil. After five minutes, remove utensils and hang up or stand in a clean atmosphere. They will dry thoroughly in a few minutes without recourse to rags, and will be in perfect condition for the next milking. Set-in coppers are very useful for this purpose, and are not only economical as to the wood supply, but are effective in wet weather.

Chief Cause of Inferior Cream.—It is safe to say that the small percentage of inferior cream now delivered to factories would be almost eliminated if the above methods of treating dairy utensils were carried out and attention given to a few other details. By far the greater portion of this small amount of inferior cream is brought about by the utensils not being properly cared for.

It is, of course, necessary to treat the utensils as outlined *twice daily*—i.e., after each milking. Where the milking has been carried out in such a way so as to reduce bacterial contamination to a minimum, and where the separator parts and other utensils have been correctly treated as suggested, other things being equal, the cream coming from the separator will be in a sound condition from a bacteriological point of view and will not be heavily contaminated. This being so, there is every likelihood of it remaining in a "choice" condition until it is delivered to the factory, though certain additional precautions may be taken to assure of this being done.—A. and P. Notes, N.S.W. Dept. of Agric.

The Home and the Garden.

OUR BABIES.

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

THE TEETHING DELUSION.

A delusion may be merely foolish, but harmless. Old superstitions that do no harm may be safely left to die of themselves, as knowledge grows. Certainly they die very slowly; but that is no reason why we should be impatient. But when a delusion causes an immense amount of suffering to small babies, when it is an important cause of much sickness and many deaths then it is our duty to expose it without mercy. We can hold no truce with baby-slaughter.

How often do we see babies suffering from loose motions due to over-feeding or unsuitable feeding, or half starved from insufficient food, or food they cannot digest, or feverish from some infection, whether a simple "cold" or something more serious, whose mothers comfort themselves with the silly belief that it is "just his teeth"! It would almost seem that "teething" is the one cause of all the complaints from which babies may suffer! Surely this is a very absurd belief. It may be very comforting to the mother (for a time), but it is often very disastrous for the baby.

Let us Know the Truth.

Let us understand the exact truth. A baby's teeth do not come into existence when they come into sight. Baby's first tooth was not formed the night before the day you noticed it. All his first set of teeth were formed long before birth; he has a full set under his gums the day he was born. He cuts his teeth at intervals up to two years of age. Therefore all babies are teething from birth up to that age, and most babies are healthy all the time, if properly cared for. As for cutting his teeth, in most cases all that happens is that you look into his mouth, and there is a tooth visible, which the day before was covered by the gum.

Healthy Babies Cut their Teeth Easily.

Teething is never a cause of serious disease. Multitudes of little lives have been lost, because mothers have put their faith in "teething," and their hope in the disappearance of disease with the appearance of teeth. Sound, healthy babies cut their teeth quite easily. They may want to bite things, and they may dribble. These are quite healthy symptoms, though they may be messy. Very rarely the baby may be fractious for a day or two, perhaps there may be some discomfort in his swollen gums, and there may be some want of appetite. If you then force or entice him to take more food than he really wants he may have loose motions, but that is your fault. Delicate nervous babies are more likely to have these symptoms, but frequently they have none of them. The symptoms never require anything more than a little common-sense management.

Common Ailments Caused by Mistakes.

Of course a baby may be seriously ill about the time he is cutting his teeth, but there is always a reason for it. The teething is just a coincidence. When a baby is seriously ill, his teeth trouble him very often. You can see that they are uncomfortable, perhaps even aching. This does not mean that his sickness is caused by his teeth, as is so often thought. It means that his sickness has caused the aching of his tooth. Cutting his teeth will not improve his sickness; but get rid of his sickness, and his teeth will be all right,

Nearly all the common ailments of babyhood are caused by mistakes in feeding or management or by some infection. Your first effort, when baby is upset, should be to find out the cause. Never put it down to "teething." If you are puzzled, seek advice from your doctor or the Baby Clinic. Do not listen to old bodies who tell you "it is nothing but his teeth."

KITCHEN GARDEN.

Onions which have been planted in seed beds may now be transplanted. The ground should long since have been thoroughly cleansed, pulverised, and should be rolled previous to transplanting. Onions may still be sown in the open on clean and well-prepared ground. In favourable weather plant out cabbages, lettuce, leeks, beetroot, endive, &c. Sowings may also be made of all these as well as of peas, broad beans, kohlrabi, radishes, spinach, turnips, parsnips, and carrots, and, where sufficiently large, thinned out. Dig and prepare beds for asparagus, using plenty of well-rotted farmyard manure.

FLOWER GARDEN.

Planting and transplanting may be carried out simultaneously during this month in showery weather; the plants will thus be fully established before the early frosts set in. Camellias and gardenias may be safely transplanted, also such soft-wooded plants as verbenas, petunias, penstemons, heliotrope, &c. Cut back and prune all trees and shrubs ready for digging. Dahlia bulbs should be taken up and placed in a shady situation out of doors. Plant bulbs, such as anemones, ranunculus, snowflakes, freesias, ixias, watsonias, iris, narcissus, daffodils, &c. Tulips will not suit the Queensland climate, but hyacinths may be tried, although success is doubtful. All shades and screens may now be removed to enable the plants to get the full benefit of the air. Fork in the mulching, and keep the walks free from weeds. Clip hedges and edgings.

MARKET GARDENING.

(Continued).

ROTATION.

Plants belonging to the same natural order should not be allowed to succeed each other on the same section of land. Some crops are a good preparation for others, as, for instance, onions after celery or carrots after beans.

Rotation assists in checking the devastations of insects and fungi to which a crop may be subject. Deep-rooted crops enrich the top soil for the benefit of shallow-rooted varieties which may follow.

Different crops require plant foods in varying proportions; hence a rotation is more economical of manure.

A definite system of rotation affords better opportunities for cleaning the ground.

Crops which occupy the ground for several years should be succeeded by others of shorter duration.

Rotations allow of a better distribution of labour during the year. Plants cultivated for their roots or bulbs should not be succeeded by others grown for a like purpose.

Rotations may extend from three to eight years, according to the size of the garden, the quality of the soil, the products required, the manures available, &c.

THE COMPOST HEAP.

Although composting is essential, it should be avoided as much as possible, for decomposition cannot be controlled without some loss of plant food. It also requires a large additional expenditure of labour in the extra handling.

In the management of compost heaps, the gardener should see that leaching and fire-fanging are controlled, and that the finest texture is secured. To accomplish these ends, it is customary to stack in rather compact, flat heaps not less than 4 ft. deep, and covering as much area as may be necessary. The heaps are so deep that there can be no leaching if they are built with perpendicular sides. They must be watered with a hose often, and freely enough to prevent fire-fanging. To improve the texture, the heaps are turned from one to three times at convenient intervals. About six months are required to secure the proper decomposition.

MANURES AND FERTILISERS.

The great advantages gained by using *improved methods of cultivation*, in combination with the *application of artificial fertilisers*, in order to increase the productiveness of the soil, are becoming gradually more recognised. It is quite self-evident that the best profits will result if small areas are made to produce heavy crops of high quality. This is achieved by "*intensive cultivation*," as practised in other countries; but our farmers, on account of land being comparatively cheap, hardly realise what such cultivation means.

Even the richest of soil will gradually become impoverished by continuous cropping; the crops not only become lighter and of poorer quality, but are more susceptible to disease. The *plant foods* which are removed by the growing crops *must again be returned* to the soil in one form or another. With judicious application of artificial fertilisers, combined with thorough cultivation and, if possible, with rotation of crops, the fertility of the soil can not only be maintained, but is frequently considerably increased.

No artificial fertiliser will be of any value if it does not supply in *adequate proportion*, all the *necessary plant foods* required by the crops and what are wanting also in the soil. Excess of one plant food cannot make up for the absence or deficiency of another. In this respect, grave mistakes have frequently been made, and much money squandered in applying manures which only supply a part of the necessary plant foods and, perhaps, one which was not wanted at all. How often in practice have large amounts of bonemeal been applied to land, with a negligible result, because potash or nitrogen was wanting more than the phosphoric acid.

Artificial fertilisers will not be of any value to land unless it is in *good tilth*, is *well drained*, and contains a sufficient amount of *humus and moisture*.

Situation, class of soil, climatic conditions, and rainfall are determining factors in the selection of crops for certain districts.

The importance of *humus* in the soil is frequently quite overlooked by many farmers and fruitgrowers. Unfortunately, a large number of our soils are deficient in the amount of humus they contain, and the customary methods of cultivation and climatic conditions have a tendency to continually lower the amount. A reduction of the humus content of a soil lowers its capacity to absorb and retain moisture and adversely alters its mechanical condition.

The amount of humus may be increased by the addition of bulky amounts of vegetable matter, dead leaves, straw, cornstalks, and more particularly by *stable manure*. Small amounts of stable manure, used in addition to artificial fertilisers, have a very beneficial action, and increase the value of the artificial fertiliser, by increasing bacterial activity in the soil.

Stable manure is, however, generally very scarce, and the most economical way to supply to the soil the necessary humus, is by the practice of growing and ploughing in of *green manure crops*. As a rule, vigorous-growing leguminous crops—like cow-peas, field peas, manurifius beans, &c.—are to be preferred; but excellent results are frequently obtained with rape and mustard. The crop has to be chosen according to locality and season.

By growing crops in a *proper rotation*, and applying the manures required for each crop, soil fertility will be maintained.

In many soils the want of *lime* is apparent, and is frequently shown by strong *acid reaction of soil* and subsoil. Many plants are very susceptible to soil acidity; and application of artificial fertilisers, and more particularly such with an acid reaction, is frequently an absolute waste of money, unless the acidity is corrected by a previous application of lime in one form or another. Only in the case of heavy, clayey soils the use of *quick lime* or *air-slaked lime* is to be recommended; for lighter soils *carbonate of lime*, in the form of limestone screenings, or pulverised limestone, and also *sulphate of lime* or gypsum, are to be preferred, and all have to be applied as a topdressing. Particularly after ploughing in heavy crops of green manure, many soils develop a high acidity, and may require liming.

As a rule, soils under cultivation for some years will require *complete fertilisers*, which contain sufficient amounts of nitrogen, potash, and phosphoric acid, in order to obtain good crops and maintain the fertility of the soil.

The plant foods which are generally supplied by artificial fertilisers are:—

Nitrogen, Potash, and Phosphoric Acid; and, as they may be used in various forms, a few remarks on these points are necessary. It must be also borne in mind that the plants can only absorb, by the aid of the roots, such *mineral plant foods* which are actually in solution; and, therefore, *sufficient moisture* must be present in the soil, and the plant foods in the manure should be in a fairly *soluble form*. It is always best to use artificial fertilisers in the most concentrated form, in order to save freight and handling. The *composition of all artificial fertilisers* on the market is published from time to time in the *Queensland Agricultural Journal*.

Nitrogen is one of the most important and, at the same time, most expensive ingredients of artificial fertilisers.

Nitrogen promotes and stimulates the growth of leaves and stem, but rather retards, on account of a more luxuriant growth, the development of buds and flowers. The leaves generally show a deep-green colour, and the whole plant becomes more vigorous after application of a nitrogenous manure. In the form of *nitrates* it is most active and most readily available to plant life, and is generally applied in the form of *nitrate of soda*, or *Chili saltpetre*, which contains from 15½ to 16 per cent. of nitrogen. Saltpetre is, however, very soluble and, unless directly used up by the plant, may be readily leached out and lost in the drainage water. At the present day it is being replaced by the artificial product *nitrate of lime*, which is just as active and available, but not so easily leached out, and has a much better action on the soil on account of the large amount of lime it contains. Both fertilisers, and more particularly the nitrate of lime, absorb moisture from the air, are not suitable to mix with other fertilisers, and are also bad to handle. They are generally applied as top-dressings in repeated small amounts at the time when the crop is ready to utilise them.

Dried blood contains from 12 to 13 per cent. of nitrogen in a fairly available form, and many crops seem to benefit particularly by this nitrogenous manure, which, however, is rather scarce and not easily obtainable. Blood may be mixed with other fertilisers, and can be applied some time before planting.

Sulphate of ammonia contains about 20½ per cent. of nitrogen in a very soluble form, which, although being so soluble, is not easily leached from the soil, and becomes gradually changed into the active form of nitrate by the action of bacteria. It can be mixed with other artificial fertilisers, except those which contain free lime.

Other sources of nitrogen are fish manure, cotton-seed meal, oil cakes, meatworks manure, &c.

An *excessive application* of nitrogenous manure may act sometimes in a detrimental manner by producing a too luxuriant growth of foliage and tops, and reducing the yield of grain, fruit, or tubers. Such bad effects are counteracted by the addition of fertilisers containing potash and phosphoric acid.

Potash is an important constituent of all plants, and is found most abundantly in the young leaves and twigs, as it is intimately connected with the production of starch and sugar in the leaves and the subsequent transference of these bodies to fruit, tubers, &c.

Many of our soils are rather deficient in potash, and the mineral plant food is, therefore, of particular importance to farmers.

Sulphate of potash, or potassium sulphate, is the most concentrated form in which potassium is used as a fertiliser, as the salt contains about 50 per cent. of potash, in a very soluble and readily available form. This salt is easily handled, and can be mixed with all fertilisers, and can be applied at any time.

In the case of a few crops, for instance for bananas and potatoes, other commercial forms of potash manure—viz., *muriate of potash*, which contains from 50 to 60 per cent. of potash, and kaimit, which contains an average of 12½ per cent. of potash—can be used with advantage instead of sulphate of potash.

Wood ashes—particularly the ash of lantana, tobacco leaves and stalks, coffee berry pulp—contain a fairly large amount of potash. The ashes of our native timbers contain as a rule only small amounts of potash.

Phosphoric acid is the third important constituent of artificial fertilisers, and found therein in the form of its salts, called *phosphates*. Phosphoric acid appears

necessary to the general nutrition of all plants, and hastens their maturity. No plant could produce seeds without a sufficient supply of phosphoric acid. It also aids in the assimilation of other compounds, and aids in the production and transport of the nitrogenous compounds in plant cells.

Practically the majority of our soils are deficient in phosphoric acid, and more particularly the red volcanic soils are deficient in the readily available soluble form of phosphates, although the total amount present may be fairly high.

Phosphoric acid in the form of *Phosphate of Lime* is the principal constituent of the bones and teeth of animals; and bones, in one form or another, therefore, form the chief supply of phosphoric acid in artificial fertilisers.

Superphosphates, obtained by treating either bones phosphates or mineral phosphates with strong sulphuric acid, contain from 17 to 19 per cent. of water soluble phosphoric acid, and in a special form of concentrated superphosphates up to 40 per cent.

When applied to the soil, the water soluble form of phosphoric acid will gradually change into a less soluble form, and this change is fairly rapid in our red soils rich in iron.

For soils inclined to be acid, superphosphates are not so suitable, and the phosphoric acid is generally supplied in form of *basic slag*, or *Thomas's phosphate*, which contains the phosphoric acid in a form insoluble in water, but readily soluble in weak organic acids like citric acid.

Thomas's phosphate is at the present day being replaced by the artificial fertiliser *basic superphosphate*, which contains about 18 per cent. of citrate soluble phosphoric acid, and is therefore an excellent substitute for superphosphates in soils where the superphosphate would change into soluble phosphates.

For most of our crops, and particularly those grown on red volcanic soil, the use of *crushed rock phosphate*, like Holbourne Island phosphate, will be found very suitable, supplying not only phosphoric acid in citrate soluble form, but also lime.

Bonemeal, or *bonedust*, contains from 20 to 25 per cent. of phosphoric acid in form of lime phosphate insoluble in water or weak acids, which, therefore, becomes available very slowly. Bonemeal generally contains from 3 to 5 per cent. of nitrogen, which makes this manure more valuable.

When studying the *requirements of fertilisers* of any crop, the nature of the soil has to be taken carefully into account. There may be a sufficiency of total plant foods, as disclosed by the ordinary agricultural chemical analysis of the soil, but they may be in a *very unavailable* form. Again, small quantities of plant foods, which may be quite sufficient for the crop in a light, friable, sandy soil which promotes a prolific root growth, may be quite insufficient in a heavy, clayey soil.

As a general rule, it is much better to divide the total amount of fertiliser necessary for the crop into *two or more dressings* during the growth of the crop.

Most *farm crops* and particularly *vegetables*, which are, as a rule, gross feeders, will benefit by two or more dressings of artificial fertilisers.

For the application of artificial fertilisers calm and cool days should be selected, and the application made, if possible, just before or after rain.

Heavy applications of chemical manures should never come into direct contact with the roots of plants, but *should be well mixed with the soil*.

TABLE OF EQUIVALENT QUANTITIES OF MANURES.

Per Acre.	Approximate Quantity per Perch.	Approximate Quantity per Square Yard.	Per Acre.	Approximate Quantity per Perch.	Approximate Quantity per Square Yard.
1 ton ..	14 lb.	7½ oz.	2 cwt. ..	1¼ lb.	..
10 cwt. ..	7 lb.	3½ oz.	112 lb.—1 cwt.	11¼ oz.	..
5 cwt. ..	3½ lb.	1¾ oz.	84 lb. ..	8½ oz.	..
4 cwt. ..	2¾ lb.	..	56 lb. ..	5½ oz.	..
3 cwt. ..	2 lb.	..	28 lb.	3 oz.	..

1 Teaspoonful = about ½ oz.

Farm Notes for May.

FIELD.—May is usually a busy month with the farmer—more particularly the wheatgrower with whom the final preparation of his land prior to sowing is the one important operation. Late maturing varieties should be in the ground by the middle of the month at the latest.

Clover land, intended primarily for feeding off, should be sown not later than the end of April.

The necessity of pickling all wheat intended for sowing purposes is again emphasised; and for general purposes, combined with economy in cost of material, the bluestone and lime solution holds its own. To those who desire an easier but somewhat more costly method of treatment, carbonate of copper at the rate of 1 oz. to the bushel and used in a dry form is suggested.

Potatoes, which in many districts are still somewhat backward, should have by this time received their final cultivation and hilling-up.

The sowing of prairie grass on scrub areas may be continued, but should be finished this month. This is an excellent winter grass, and does well in many parts of Southern Queensland.

Root crops, sowings of which were made during April, should now receive special attention in the matter of thinning out and keeping the soil surface well tilled to prevent undue evaporation of moisture.

Every effort should be made to secure sufficient supplies of fodder for stock during the winter, conserved either in the form of silage or hay.

Cotton crops are now fast approaching the final stages of harvesting. All consignments to the ginners should be legibly branded with the owner's initials. In this matter the consignor is usually most careless, causing much delay and trouble in identifying parcels, which are frequently received minus the address labels.

Orchard Notes for May.

THE COASTAL DISTRICTS.

In these notes for the past two months the attention of citrus-growers has been called to the extreme importance of their taking every possible care in gathering, handling, packing, and marketing, as the heavy losses that frequently occur in Southern shipments can only be prevented by so treating the fruit that it is not bruised or otherwise injured. It has been pointed out that no citrus fruit in which the skin is perfect and free from injury of any kind can become speckled or blue-mouldy, as the fungus causing the trouble cannot obtain an entry into any fruit in which the skin is intact. Growers are, therefore, again warned of the risk they run by sending blemished fruit South, and are urged to exercise the greatest care in the handling of their fruit. No sounder advice has been given in these notes than that dealing with the gathering, handling, grading, packing, and marketing, not only of citrus, but of all other classes of fruit.

It is equally important to know how to dispose of fruit to the best advantage as it is to know how to grow it. To say the least, it is very bad business to go to the expense of planting and caring for an orchard until it becomes productive and then neglect to take the necessary care in the marketing of the resultant crop. Main crop lemons should be cut and cured now, instead of being allowed to remain on the tree to develop thick skins and coarseness. As soon as the fruit shows the first signs of colour or is large enough to cure down to about from $2\frac{1}{4}$ to $2\frac{1}{2}$ in. in diameter, it should be picked, care being taken to handle it very gently, as the secret of successfully curing and keeping this fruit is to see that the skin is not injured in the slightest, as even very slight injuries induce decay or specking. All citrus fruits must be sweated for at least seven days before being sent to the Southern States, as this permits of the majority of specky or fly-infested fruits being rejected. Citrus trees may be planted during this month, provided the land has been properly prepared and is in a fit state to receive them; if not, it is better to delay the planting till the land is right.

In planting, always see that the ground immediately below the base of the tree is well broken up, so that the main roots can penetrate deeply into the soil and not run on the surface. If this is done and the trees are planted so that the roots are given a downward tendency, and all roots tending to grow on or near the surface are removed, the tree will have a much better hold of the soil and, owing to the absence of purely surface roots, the land can be kept well and deeply cultivated, and be thus

able to retain an adequate supply of moisture in dry periods. Do not forget to prune well back when planting, or to cut away all broken roots.

All orchards, pineapple and banana plantations should be kept clean and free from all weed growth, and the soil should be well worked so as to retain moisture.

Custard apples will be coming forward in quantity, and the greatest care should be taken to see that they are properly graded and packed for the Southern markets, only one layer of one sized fruit being packed in the special cases provided for this fruit—cases which permit of the packing of fruit ranging from 4 to 6 in. diameter in a single layer.

Slowly acting manures—such as meatworks manure—may be applied to orchards and vineyards during the month; and lime can be applied where necessary. Land intended for planting with pineapples or bananas during the coming spring can be got ready now, as, in the case of pineapples, it is a good plan to allow the land to lie fallow and sweeten for some time before planting; and, in the case of bananas, scrub fallen now gets a good chance of drying thoroughly before it is fired in spring, a good burn being thus secured.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Clean up all orchards and vineyards, destroy all weeds and rubbish likely to harbour fruit pests of any kind, and keep the surface of the soil well stirred, so as to give birds and predaceous insects every chance to destroy any fruit fly pupæ which may be harbouring in the soil. If this is done, many pests that would otherwise find shelter and thus be able to live through the winter will be exposed to both natural enemies and cold.

Further, it is a good plan to clean up the land before pruning takes place as, if delayed till the pruning has been finished, the land is apt to dry out in a droughty season.

Pruning can be started on such varieties as have shed their leaves towards the end of the month, as it is a good plan to get this work through as early in the season as possible, instead of putting it off until spring. Early-pruned trees develop their buds better than those pruned late in the season. These remarks refer to trees—*not vines*, as the later vines are pruned in the season, the better in the Granite Belt district, as late-pruned vines stand a better chance to escape injury by late spring frosts.

All worthless, badly diseased, or worn-out trees that are no longer profitable, and which are not worth working over, should be taken out now and burnt, as they are only a menace and a harbour for pests.

Land intended for planting should be got ready as soon as possible, as, if ploughed up roughly and allowed to remain exposed to the winter frosts, it will become sweetened and the trees planted in it will come away much better than if set out in raw land. In any case the land must be properly prepared, for once the trees are planted it is a difficult matter to get the whole of the land as well worked as is possible prior to planting.

Slowly acting manure—such as ground island phosphates or basic phosphates—may be applied to orchards and vineyards. They are not easily washed out of the soil, and will become slowly available and thus ready for use of the trees or vines during their spring growth. Lime may also be applied where necessary.

This is a good time to attend to any drains—surface, cut-off, or underground. The two former should be cleaned out, and in the case of the latter all outlets should be examined to see that they are quite clear and that there is a good getaway for the drainage water. New drains may also be put in where required.

In the warmer parts citrus fruits will be ready for marketing, and lemons ready for cutting and curing. The same advice that has been given with respect to coast-grown fruit applies equally to that grown inland; and growers will find that careful handling of the fruit will pay them well. Lemons grown inland are, as a rule, of superior quality to those grown on the coast, but are apt to become too large if left too long on the trees, so it is advisable to cut and cure them as soon as they are ready. If this is done and they are properly handled, they may be kept for months, and will be equal to any that are imported.

If the weather is very dry, citrus trees may require an irrigation, but, unless the trees are showing signs of distress, it is better to depend on the cultivation of the soil to retain the necessary moisture, as the application of water now is apt to cause the fruit to become soft and puffy, so that it will not keep or carry well.

Land intended for new orchards should be got ready at once, as it is advisable to plant fairly early in the season in order that the trees may become established before the weather again becomes hot and dry. If the ground is dry at the time of planting, set the trees in the usual manner and cover the roots with a little soil; then give them a good soaking; and, when the water has soaked into the soil, fill the hole with dry soil. This is much better than surface watering.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

Date.	April, 1930.		May, 1930.		MOONRISE.	
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
1	6.5	5.46	6.21	5.17	a.m. 7.34	a.m. 8.33
2	6.5	5.45	6.21	5.17	8.33	9.36
3	6.6	5.44	6.22	5.16	9.38	10.40
4	6.6	5.43	6.22	5.16	10.41	11.41
5	6.7	5.42	6.23	5.15	11.45 p.m.	12.35
6	6.7	5.41	6.23	5.14	12.47	1.21
7	6.8	5.40	6.24	5.14	1.45	1.57
8	6.8	5.39	6.25	5.13	2.37	2.32
9	6.9	5.38	6.25	5.13	3.21	3.6
10	6.10	5.37	6.26	5.12	3.58	3.38
11	6.10	5.36	6.27	5.11	4.43	4.10
12	6.11	5.34	6.27	5.11	5.7	4.45
13	6.11	5.33	6.28	5.10	5.39	5.23
14	6.12	5.32	6.28	5.10	6.14	6.9
15	6.12	5.31	6.29	5.9	6.50	6.58
16	6.13	5.30	6.30	5.8	7.30	7.50
17	6.13	5.29	6.30	5.8	8.17	8.44
18	6.14	5.28	6.31	5.7	9.7	9.39
19	6.14	5.27	6.31	5.7	9.59	10.35
20	6.15	5.26	6.32	5.6	10.56	11.31
21	6.15	5.26	6.33	5.6	11.51	...
22	6.16	5.25	6.33	5.5	...	12.11
23	6.16	5.24	6.34	5.5	a.m. 12.45	1.18
24	6.17	5.23	6.35	5.4	1.39	2.12
25	6.17	5.22	6.35	5.4	2.34	3.8
26	6.18	5.21	6.36	5.3	3.29	4.6
27	6.18	5.21	6.36	5.3	4.25	5.8
28	6.19	5.20	6.37	5.2	5.23	6.16
29	6.19	5.19	6.38	5.2	6.23	7.22
30	6.20	5.18	6.38	5.1	7.26	8.29
31	...	...	5.39	5.1	...	9.32

Phases of the Moon, Occultations, &c.

6 April	☾	First Quarter	9 24 p.m.
13 "	☾	Full Moon	3 48 p.m.
21 "	☾	Last Quarter	8 8 a.m.
29 "	●	New Moon	5 8 a.m.

Perigee, 9th April, at 9.12 p.m.
Apogee, 21st April, at 10.54 p.m.

On the 9th at 10 p.m. Neptune will be 4 degrees south of the Moon, but will be much more difficult to see than Jupiter.

On 13th April at 4 o'clock in the afternoon the Moon will be undergoing a partial eclipse in the shadow of the Earth, when far below our horizon in Queensland. A fortnight later an extraordinary eclipse of the Sun will take place which will also be invisible in Queensland. It will be seen as a total eclipse at San Francisco and across Southern Canada.

The conjunction of Saturn and the Moon on the 19th will take place when both are far below the horizon.

Mercury and Venus will be technically in conjunction on the 22nd, but not favourably situated for observation.

The Moon will be passing from the west to the east of Mars on the 25th at 7 a.m. when invisible.

Mercury will reach its greatest distance, 20 degrees east of the Sun, on the 27th, it will then be at a sufficient height above the western horizon at sunset to afford opportunities for seeing it somewhat later; Venus, however, will be higher up and brighter.

The Southern Cross will be at its greatest height and on the Meridian at Warwick half an hour after midnight on 21st March. It will then be at a height of 58 degrees above the southern horizon (at Warwick). On the 1st April it will reach this position 40 minutes earlier. Four minutes must be added for each degree west of Warwick, or subtracted for Brisbane or any other place on the same Meridian, 153 degrees east of Greenwich. Subtract four minutes for each day after the 21st of March.

6 May	☾	First Quarter	2 53 a.m.
13 "	☾	Full Moon	3 29 a.m.
21 "	☾	Last Quarter	2 21 a.m.
28 "	●	New Moon	3 36 p.m.

Perigee, 5th May, at 4.48 a.m.
Apogee, 19th May, at 5.54 p.m.
Perigee, 31st May, at 3.36 p.m.

At 4 o'clock in the morning of the 7th the Moon will be passing Neptune, four degrees away on its northern side.

On the 12th Mars will be passing from west to east of Uranus, at apparently the distance of only one diameter of the Moon. A telescope or binoculars will be necessary to see the larger and much more distant planet Uranus. They will be well above the eastern horizon about an hour before sunrise.

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 Ingleswood, add 4 minutes to the times given above for Warwick; at Goodiwindi, 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.

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