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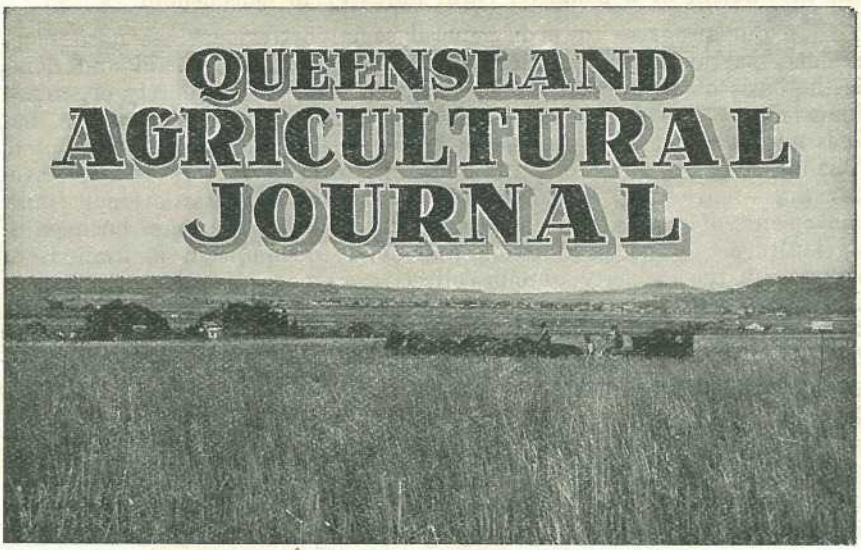

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Event and Comment.

The New Year in Agriculture.

1936 should be an extraordinarily interesting year in Queensland Agriculture. Apart from our normal cropping programmes, the success of which depends so largely on seasonal circumstances, we shall see the expansion of a policy that, it is believed, will have a definite beneficial influence on the future of agriculture in this country. We shall see new developments in agricultural research for the purpose of increasing efficiency, quality, and stability of crop production and disposal. We shall see the tackling of many perplexing problems with which primary industry is faced in this State—problems, many of them, common to agriculture the world over. The investigation of those problems—and, let us hope, their solution—calls for the co-operation of our best brains.

Research is the Agricultural Department's biggest job. It cannot help farmers to plan their production, to reduce their costs, to fight vegetable and animal diseases and pests, to produce better crops and live stock, to market their products efficiently without first studying how these things may be done. The Department has, accordingly, strengthened its scientific staffs and extended its scientific services. A new Research Bureau will commence to function early in the New Year; the Bureau of Tropical Agriculture, established recently at South Johnstone, will commence its planned field programme; the Dairy Research Laboratory, now fully staffed and equipped, will enter on

new and important phases of its work; while the Marketing Branch of the Department, which may be regarded as the foundation of a future Bureau of Agricultural Economics, will intensify its activities towards the attainment of a balanced rural industry in Queensland.

In our progress towards general social betterment we need more science, particularly in agriculture which, when all is said and done, is the basis of all our activities. Science, after all, is merely organised knowledge. The science of production is familiar to most of us, but it is not of much value unless the goods we produce can be distributed. The need arises, therefore, of studying primary factors in successful farming—marketing, consumption, interstate and international trade, movements of population, and commodity prices. The main business of agriculture is food production, and food consumption is limited, of course, by the capacity of our collective stomach. Technical progress in distribution is just as essential as the production of wealth. Standardisation and grading are not only for the purpose of protecting the consumer, but should also make it possible for farmers to get higher prices for products of better quality.

The most important and most difficult problem in marketing is in bringing about changes in our present methods, practices, and facilities in order to promote efficiency and lower selling costs. Any reorganisation of marketing methods and facilities requires very careful study in order to find a practical way of cutting out costly methods and unnecessary services. That will be one of the jobs of the economist in the coming year.

The regulation of methods and practices—for the purposes of directing rather than regimenting the producer—as provided for in our existing legislation will, presumably, be another subject for study in 1936; and it is obvious that research and educational work are necessary in order to indicate how practical improvements in marketing can be made. Improved marketing and better education can also go a long way towards increasing the consumption of certain foods. Recent surveys have shown, for instance, that in our cities there is a widespread under-consumption of milk and vegetables. To a great extent this under-consumption can be remedied by better marketing and distribution.

For the dairy farmer, the Dairy Research Laboratory should be of special value in the coming year. Dairying actually is the most complex of our rural industries, for it is not a single industry but a group of related industries of vast economic and social importance to Queensland, the only country in the world, by the way, that is dairying successfully and on a large commercial scale within the tropics. Obviously research work is of enormous value to the industry in all its branches. In the course of the year just beginning, greater attention will, no doubt, be given to the advantages of selecting breeding animals for both milk and meat production.

The increased interest now taken in our indigenous and introduced grasses by farmers as well as graziers is clear evidence of a broader appreciation of the value of grass in our rural economy—a "grass consciousness," so to speak. This is as it should be, for Queensland is remarkably rich in the number and nutritive value of its native grasses. About 450 have been classified, and a strong characteristic of many of them is their drought resistance. We are now thinking of grass in

comparison with other field crops and it is not hard to foresee that the attention given to the annual fodder crop will be extended to the permanent pasture in general agricultural practice. That that should be so is plain in the light of the fact that at least 70 per cent. of our national income is derived from our grasslands. Grass is, therefore, the most important crop in the whole range of the State's production. In our grasslands—particularly the Mitchell and Flinders grass country of the West—we have a wonderful asset and a great inheritance. Our job—and this is part of the research programme for this year—is to preserve that inheritance by preventing that asset from vanishing through any misuse or abuse of grazing lands, whether through lack of intelligent pasture management, wantoness, or sheer greed. These problems are often, unfortunately, questions of human nature rather than of economics. Grass is the best and cheapest stock food, and yet through human perversity it is the most abused. No country can make progress on worn-out pastures.

Man's maltreatment of the soil or of its natural forest and grass cover is a cause of increasingly destructive erosion by wind and water. That is another of the research jobs for the coming year, and in regard to which we have not yet realised fully the high cost of doing nothing. Studies conducted recently by the Forest Service in California produced evidence that vegetation not only obstructs and retards the run-off of surface water, but also by means of leaf litter and the action of roots keeps the top soil so porous that a large proportion of rain water percolates continuously into the soil to increase underground supplies. Litter-covered soil was found to absorb five to ten times as much water as that absorbed by bare soil. Run-off was just the reverse—ten to thirty times as great from bare soil as from litter covered soil. Generally from a hundred to a thousand times more soil was swept away from bare soil plots than was eroded from forest-covered plots and, under ordinary field conditions, it was found that heavy rain falling at an hourly rate of an inch upwards, even though of brief duration, quickly puddled the surface soil, sealed the soil pores and started a rapid process of gully erosion.

The loss of soil through wind erosion is tremendous, as every observer on the land knows. A well-authenticated case is reported from Ukraine, where 700 widely distributed measurements of a violent dust storm were taken, and they showed that a total of 15,400,000,000 tons of soil had been swept up into the air and deposited in other parts of the country as well as in Poland and Roumania. This type of soil denudation, just as in the case of sheet and gully erosion by water, is a usual consequence of unwise use of land. Nature, however, has pointed the way to recovery. The dominant influence of vegetation—whether it be windbreaks of forest trees, grass, close-growing cover crop or shrubs—as a controlling factor stands out as an impressive fact. A combination of the vegetable factor with mechanical control—terracing contour cultivation and sod banks where gully erosion is threatened—are among the most practicable means of preventing the loss of surface soil from farm lands.

The Minister's New Year Message

WITH the opening of the New Year, I look forward to another period of sustained progress. The past year has been one of expanding activity as several new undertakings of vital concern to farming and pastoral interests have been successfully launched. Chief amongst these are the establishment of a Dairy Research Laboratory and specialised nutritional and disease research in the pastoral industries.

The Department is an essential part in the life of the farming community and is always prepared to give service in the cause of farming. We have highly trained officers whose life work is the advancement of one or other of the many matters associated with farming. Our degree of usefulness, however, is measured by the degree of co-operation we succeed in obtaining from the primary producer of the State. Unless you acquaint us with your problems, we are frequently unaware of their existence.

Might I suggest, therefore, that the coming year be made outstanding on account of the number of new contacts we make and the expanding service we are able to give in consequence.

On behalf of all officers of the Department, I wish all our primary producers a good season and a series of successful operations.

Frank. W. Bulcock

Diseases of the Tomato.

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

THE tomato is subject to a number of diseases which demand special attention from the grower if a healthy crop is to be obtained. The two most important maladies in this State are Irish blight during the cooler months and Fusarium wilt in the summer. The individual diseases are first dealt with separately, followed by a summary of the precautions it is necessary to take for their control. It will be noticed that a number of the diseases of the tomato occur also on the potato. This is not surprising since the two plants are closely related botanically.

IRISH BLIGHT.

Irish blight (Plate 1) is so called since it first came under special notice in Ireland where, as a serious disease of the potato crop, it was an important cause of the Irish famine in the middle of last century. The disease is now widespread throughout the world, and attacks the tomato as well as the potato.

The first symptoms to appear are dark brown patches on the leaves or an elongated dark area on the stem. If the weather is wet these areas will assume the appearance of a wet rot and enlarge rapidly. If it is sunny, they will remain in a dry papery condition until wet weather again allows them to extend and further spots to develop. A heavy fall of dew may be sufficient to allow a temporary increase. Eventually the whole plant may become blighted and die.

Fruit infection is an even more serious proposition since tomatoes may be packed in an apparently sound condition and develop in the market later the large mottled brown area of decay which is characteristic of the disease.

Irish blight is caused by a fungus (*Phytophthora infestans*), the delicate threads of which ramify within the tissue of the plant, bringing about the death and decay of the part invaded. Under moist conditions the fungus comes to the surface and forms enormous numbers of minute spores which may be seen in mass as a white down over the lower surface of the spots. It is these spores which spread the disease. They are very delicate and need an abundance of moisture to enable them to live and germinate—so forming fresh spots. The fungus also requires a relatively cool temperature for its development, hence, if wet weather is experienced during the winter and spring, the crops growing at this time will be seriously affected. Later crops are usually free from the disease.

Control.

The disease can be controlled by spraying with Bordeaux mixture. Spraying should commence in the seed-bed, using a 2-3-40 mixture and be continued in the field with a 4-4-40 strength as soon as the plants have become established. Spray thoroughly and sufficiently often to keep the whole of the plant, both upper and lower leaf surfaces, covered. During wet weather this may have to be done every few days. When the plants are large and bushy, a copper sulphate-lime dust applied frequently under good dusting conditions may have some advantage over the wet spray, but this is not recommended for small or staked plants.

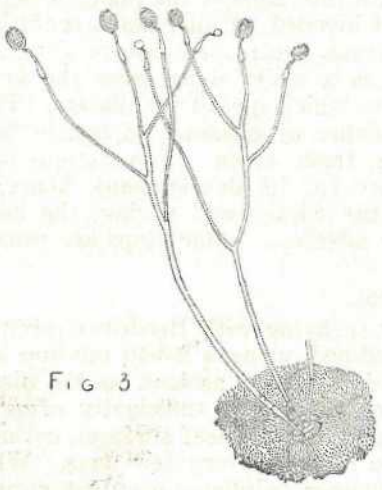


PLATE 1.

IRISH BLIGHT OF THE TOMATO.

Fig. 1, Foliage symptoms. Fig. 2, Fruit rot. Fig. 3, Fruiting stage of the causal organism (*Phytophthora infestans*), highly magnified.

Burgundy mixture may be substituted for Bordeaux if desired.

Clean up and burn the remains of all tomato plants at the end of the season.

SEPTORIA LEAF SPOT.

Small circular grey spots about $\frac{1}{8}$ inch in diameter appear scattered over the lower leaves of the plant. The centre of the spot is somewhat lighter in colour and is characterised by the presence of a number of minute black points. (Plate 2; fig. C.) These latter are the tops of minute flask-shaped spore receptacles belonging to the fungus *Septoria lycopersici*, the cause of the disease. A yellowing of the leaf takes place round the spots and gradually spreads until the leaf dries out and withers. The lower leaves are gradually killed from the bottom up, and a scalding of the fruit by the sun may result. The disease is most serious in the warmer months.

Control.

(1) Spray in the seed-bed and the field with Bordeaux mixture as recommended for Irish blight.

(2) Collect and burn all tomato refuse as soon as the crop is off.

TARGET SPOT.

The general effect of this disease on the plant is similar to Septoria leaf spot, but the spots are as a rule larger, $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, and are often marked by concentric rings. It is these markings which give the disease its name. They are formed as a result of the somewhat intermittent growth of the fungus (*Alternaria solani*) within the tissue. Affected leaves gradually turn yellow and dry out, the plant becoming defoliated from the base up. Other less common symptoms produced by this organism consist of a black spot on the fruit, usually commencing near the stalk, and a brown shrunken area at the base of seedlings which may eventually cincture the stem and cause their death.

Other species of *Alternaria* are also associated with a fruit decay following wound infection (Plate 2; fig. B). The dark spot first formed often becomes covered with a greenish black felt-like mound of mould growth of characteristic appearance.

Control.

The control of target spot is similar to that of Septoria leaf spot, and the precautions recommended for the one are satisfactory for the other.

WILTS.

There are at least four different wilt diseases affecting tomatoes in Queensland. These consist of a bacterial wilt caused by *Bacterium solanacearum*, two fungus wilts due to *Fusarium lycopersici* and *Verticillium alboatrum*, and the virus disease, spotted wilt. The lastnamed will be dealt with separately under the heading of virus diseases.

In the first three diseases mentioned the typical symptom is a drooping of the foliage from the ends of the branches, followed by the collapse of the plant in a general wilt. In the case of *Fusarium*, the actual wilting may be delayed or may even never eventuate. In this case a characteristic yellowing of the lower leaves takes place and these die progressively from the base of the plant upwards.

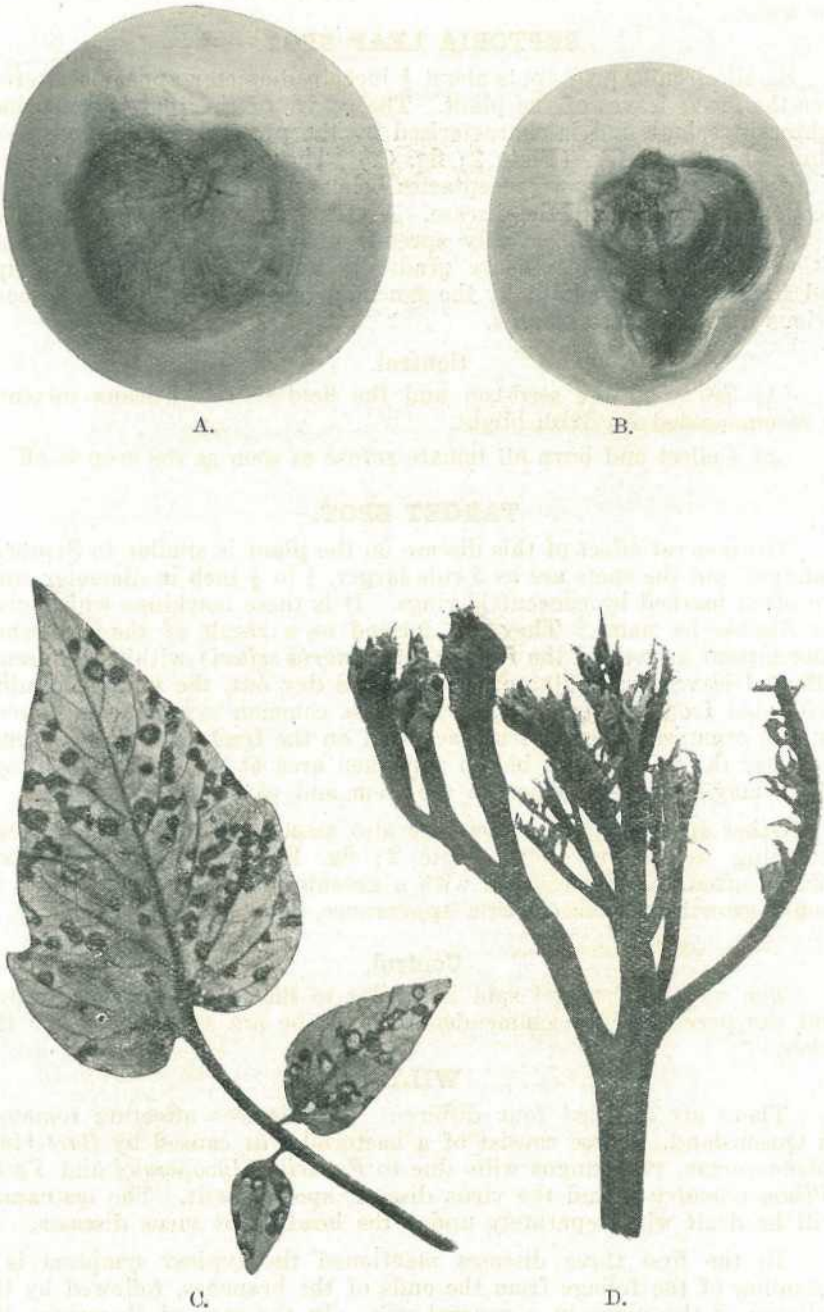


PLATE 2.—TOMATO DISEASES.

A. Blossom end rot. B. Alternaria rot following infection through a crack near the stem sear. C. Septoria leaf spot. Note the fruiting bodies showing as black points. D. Big bud.

When the base of the stem is cut across, or the bark removed, the large, woody, water-conducting vessels are seen to be discoloured brown. If a slimy bacterial ooze issues from the cut ends of these then the disease is diagnosed as bacterial wilt. Verticillium and Fusarium wilt have the same browning of the vessels in the stem but the bacterial slime is absent. It is difficult to distinguish between these two without isolating the fungus which is present. Verticillium wilt occurs during the cooler months. Fusarium wilt is by far the most common of all the wilt diseases and is most prevalent in the warmer weather.

The symptoms described above are brought about by the invasion of the vessels of the stem by one of the parasites mentioned. Its presence causes the vessels to cease their normal function of water and food conduction and turn brown. Entrance is obtained in the first place through injured roots. The fungus *Fusarium* in particular can live for many years on organic matter in the soil, and from there attack a tomato plant when one becomes available. Varieties of tomato vary in their degree of susceptibility to the attack of this organism.

Control.

(1) Remove diseased plants and destroy the remains of the crop by burning after harvesting is completed.

(2) Where possible allow at least a three-year interval between crops of tomatoes on the same land.

(3) Sterilize seed by immersion for five minutes in a solution consisting of 1 part of corrosive sublimate in 3,000 parts of water. The seed should then be rinsed well in clean water and sown as soon as possible.

(4) Use only virgin or sterilized soil for the seed-bed, which should not be made near the site of previous tomato crops.

(5) Attempt to find a resistant variety suited to the district, and if successful use this for planting on infected land. Varieties which exhibit resistance to Fusarium wilt are Bowen Buckeye, Break o' Day, Denisonia, Globe, Marglobe, Norton, Ponderosa, Pritchard. These vary in general suitability and wilt resistance in different districts, and the grower will therefore have to make his own selection.

VIRUS DISEASES.

The virus diseases of the tomato differ from those already dealt with in their mode of origin. They are brought about by the presence within the cell sap of affected plants of a minute infectious agent or virus. The virus is so minute that it cannot be distinguished even by a high powered microscope. These diseases are spread by transferring virus-infected sap from a diseased to a healthy plant. In some instances, such as with mosaic, this may be done mechanically by means of the hands or pruning knives. In other cases sucking insects such as aphids or thrips are responsible for transmitting the disease. Usually an incubation period of ten days or more follows the inoculation before the typical symptoms are evident.

At least four different virus diseases occur in Queensland. These are mosaic, spotted wilt, big bud, and streak.

Mosaic.

This disease of the tomato is identical with the disease of the same name on tobacco and potato and is intertransmissible with these hosts. Affected plants are distinguishable by a lighter green colour and slightly crinkled condition of the foliage. Closer examination shows the leaves to be mottled with indefinite light and dark green areas. The fruit are not affected, and unless the plants are infected early in life the loss from mosaic is not serious. Mosaic is extremely infectious and is readily spread by the hands, pruning knives, or aphids.

Spotted Wilt.

This disease is sometimes known as bronzy wilt from the fact that the young shoots of an infected plant develop a dark reddish-brown or bronzed appearance. This is due to a more or less close aggregation of circular brown spots of $\frac{1}{8}$ inch or so in diameter. Other symptoms are a cessation of active growth and a bending back of the leaf stalk and incurving of the blade of the leaflets. These last give a drooping appearance to the plant. The bronzed leaves wither and dry up. Fruit from affected plants occasionally have bronzed markings or a blotched yellow and green appearance of the skin.

Spotted wilt is spread by a minute insect, the black carnation thrips (*Frankliniella insularis*), while feeding. The virus is not normally carried mechanically.

Big Bud.

This disease (Plate 2; fig. D) is common in some of the more northern districts where it is sometimes known as blue top. It is characterised by either a bunched or attenuated terminal growth. In either case there is a definite swelling of the leaf and flower stalks, an enlargement and abnormal development of the floral parts and a reduction in size but increase in the number of leafy structures. A bunched and tufted type of growth with a distinct purplish colouration is the final condition. The fruit remains small and hard with thickened and irregular septa. Big bud can be transmitted by grafting a diseased on to a healthy plant. In the field it is no doubt spread by the agency of some sucking insect but which one is not yet known.

Streak.

This is the least common of the virus diseases and little is known regarding its peculiarities in this State. The characteristic feature is the development of elongated, slightly sunken, greyish-black streaks or spots up and down the stem. Black lines on the leaf and brown irregular markings over the surface of the fruit also occur.

Control.

The control of these maladies is based on the characteristic behaviour of virus diseases which has been briefly outlined above.

(1) Make the seed-bed on virgin or sterilized soil.

(2) Remove all weed growth from the vicinity for some time prior to planting, as wild hosts may be present amongst the weeds.

(3) Make frequent inspections while the plants are young and remove and burn any abnormal plants in order to avoid having them act as a source of the virus.

(4) Always wash the hands or pruning knives in soap and water after touching diseased plants.

(5) Add nicotine sulphate to the Bordeaux spray in order to keep aphids and thrips in check.

(6) Clean up and burn the remains of the crop as soon as it has ceased to be profitable and eradicate volunteer tomato and potato plants or Solanaceous weeds which are likely to carry on the disease until next season.

(7) Avoid excessive use of nitrogenous manures which appear to make the plant more susceptible to some of the virus diseases.

BLOSSOM END ROT.

In blossom end rot (Plate 2; fig. A) a light brown circular area forms at the apex or blossom end of the green developing fruit. The tissue of the discoloured region is firm and may be shrunken to form a slight depression. There is no soft rot.

This trouble is a physiological one and is not due to the presence of a parasite. It appears to be brought about when the plant is subjected to an erratic water supply, such as occurs when periods of heavy rain are followed by hot dry weather. Under these conditions the foliage may withdraw water from the fruit, causing a collapse of the cells at the apex.

The control of this disease is to some extent outside the power of the grower. However, he can help to provide an even supply of moisture throughout the growth of the crop by means of good cultivation, and, where possible, irrigation. Avoid excessive applications of nitrogenous manures. Build up the humus content of the soil where necessary.

Summary of Measures to be Included in the Cultural Programme for Controlling Tomato Diseases.

(1) Use virgin or sterilized soil for the seed-bed.

(2) Sterilize the seed in 1 in 3,000 corrosive sublimate for five minutes.

(3) Spray the seed-bed with 2.3.40 Bordeaux mixture.

(4) Spray in field with 4.4.40 Bordeaux mixture.

(5) Remove and burn plants exhibiting virus disease symptoms.

(6) Cultivate well and, if possible, irrigate.

(7) Collect and burn crop remains and keep the farm free from weed growth.

(8) Rotate tomato land with non-allied crops for as long as economically practicable.

Leaf Miner and Stem Borer of Tobacco in North Queensland.

By D. O. ATHERTON, B.Sc.Agr., Assistant Entomologist.

TOBACCO has been grown in the various States of Australia for many years, but only recently has the crop assumed an important position in the economy of the country. Several years ago the Australian Tobacco Investigation established an experiment station near Mareeba, in North Queensland, to ascertain the suitability or otherwise of the surrounding areas for the production of bright flue-cured tobacco. The State Department of Agriculture and Stock co-operated with the Australian Tobacco Investigation, and the results of the development thus initiated are evident to-day in the importance of the Cairns hinterland as a tobacco producing centre. Bright tobacco is also produced in other parts of the State, but the investigations discussed in this report have been confined to the districts north from Mackay, these including Bowen, Ayr, Herveys Range, Woodstock, and the Cairns hinterland. During the 1929 season only 489 lb. of flue-cured tobacco were produced in the areas indicated, but production increased to over 6 tons in 1930, to 56 tons in 1931, and since then it has fluctuated between 270 tons and 500 tons each season.

It is not surprising that, coincident with this enormous increase in production, there has also been a considerable increase in the attention paid to the control of insect pests associated with the crop. The leaf miner, *Phthorimaea operculella* Zell., and the stem borer, *Phthorimaea heliopa* Low., the species dealt with in this paper, are two of the most important of these, and both have caused extensive losses. The former was recognised as a serious pest of the potato in Australia in 1854, (Berthan, 1855), and in many other potato-growing countries before the beginning of the present country. As potatoes have been produced for many years in some of the northern districts to which tobacco has recently been introduced it is not surprising that the latter crop should be attacked. The second species has not been recorded from economic plants other than tobacco, and until an account of the stem borer was published in "The Queensland Agricultural Journal" (Smith, 1932) the pest had not been recorded from tobacco in the literature of this State though it was well known in some other countries.

When both species were obviously becoming serious pests of tobacco, in the North at least, they were made the subject of a major investigation by the North Queensland Entomological Field Station. Control measures were difficult to formulate and both pests therefore warranted the fullest study. Laboratory work was carried out at Cairns and Atherton, but field investigations were conducted at Mareeba. This paper discusses the problem in the light of all the information at present available.

LEAF MINER.

The leaf miner, *Phthorimaea operculella* Zell., has been recognised as a serious pest of the potato, tomato, egg plant, and tobacco for many years in various parts of the world. It was reported as a pest in Australia, not specifically but as "the potato grub," as early as

1854 (Berthan, 1855). "The moth was described in 1878* from specimens from Texas, and its destructiveness to solanaceous plants came to notice shortly afterwards. Within a decade it was reported as an agricultural pest from Algeria and the Canary Islands in Africa, and from Australia and New Zealand in Polynesia" (Fullaway, 1914). It was soon reported from Hawaii and Southern Europe. Before 1912 the leaf miner was "known as the tobacco splitworm to the tobacco planters of Florida, the Carolinas, and Virginia, in which places the amount of damage done is at times very serious" (Chittenden, 1912). One author gave a map of its distribution as known to him in the year 1917 (Graf., 1917), but since then the known distribution of the species has extended to such a degree that it is now recorded as a pest from some of its cultivated solanaceous hosts in the following regions:—Brazil, Chile, Peru, Columbia, Porto Rico, Haiti, Cuba, Mexico, United States of America, Canada, Canary Islands, Norway, Austria, France, Spain, Portugal, Algeria, Tunisia, Sicily, Malta, Cyprus, Belgian Congo, South Africa, East Africa, Mauritius, India, East Indies, Guam, Hawaii, New Caledonia, New Zealand, Tasmania, and Australia.

Various opinions have been expressed regarding the place of origin of *P. operculella*, but the bulk of evidence points to the New World as the original home of the species (De Azevedo, 1924). The fact that it was recorded from Australia as early as the middle of last century does not discredit this theory, as there was a considerable volume of traffic between North America and Australia prior to the date of its first recorded occurrence in the latter country. It was apparently well established in the Americas and Australia before appearing in pest proportions in either Europe or Africa, but any existing early records are difficult of access. Much of the artificial distribution of *P. operculella* by the agency of man took place before facilities for recording the appearance of new pests had become as effective as they are to-day; therefore, it is not surprising that information respecting the original source of the species is somewhat fragmentary. However, it is probable that the insect is native to America, not only because of the considerations outlined above, but also because both the potato and tobacco, the more favoured of the cultivated hosts, are indigenous to tropical America.

In many countries the insect appears as a pest on the following cultivated plants:—Tobacco, potato, tomato, cape gooseberry (*Physalis peruviana*), egg plant (*Solanum melongena*), and chillies (*Capsicum* spp.). It has also been recorded from the following wild plants:—In America, *Solanum carolinense, S. nigrum, S. paniculatum, S. torvum, S. verbascifolium, Datura stramonium, Physalodes physalodes,* and *Physalis* sp.; in Europe, *Solanum commersoni, S. dulcamara, S. maglia, S. miniatum, Nicotiana sylvestris, Fabiana imbricata, Hyocyamus albus,* and *Lycium europeum;* in South Africa, *Datura stramonium;* and in the East Indies, *Solanum nigrum, S. torvum, Datura stramonium, D. suaveolens,* and *Physalis angulata.* In Australia it has been recorded from several cultivated hosts including tobacco, tomato, potato, egg plant, and cape gooseberry. There are very few previous records of wild hosts in the Australian literature, but *Solanum nigrum* and *S. sodomaeum* are reported from Western Australia (Newman, 1920). During the course of the investigations at present under discussion,

* Obviously a misprint for 1873.

larvæ of the pest have been found breeding in the foliage of at least three solanaceous weeds on and around tobacco farms. These weeds have been identified as *Solanum nigrum, Datura Metel,* and *Physalis minima* var. *indica.*

Description.

The moth (Plate 3; fig. 9) is quite small, being about 6·5 mm. long and little more than 13·0 mm. across the outspread wings. A spotted or mottled dark grey is the general colour impression gained from a cursory examination. The wings are held folded over the back when at rest and this habit apposes two rows of light and dark spots one row on each forewing. Thus there appears to be a double row of dark spots running along the dorsal wing surface of the resting moth. The forewings are grey, mottled with darker spots, and there is a short fringe of hairs on the outer or apical margin. The hind wings are light grey in colour and less scaly than the forewings, and are bordered by a fringe of long fine hairs from the apex round the apical and anal margins of the wing. The head and thorax are not mottled and are a lighter grey than the forewings. The sexes are easily separated by several readily discernible constant characters, two of which are (*a*) the abdomen in the female has a more robust construction than in the male, (*b*) the male possesses a girdling tuft or "kilt" of white or light grey hairs which project back from the penultimate segment of the abdomen and cover the genitalia.

The following is a translation of the description given by Zeller:—

"The male bears on the upper side of the anal segment a large oval disk, from each side of which protudes a readily perceptible tuft of crumpled hair. The somewhat lighter female—if it is the female—has somewhat wider forewings, and the dot on the cross-vein and the one before it darker in colour, the one toward the inner margin distinctly lighter.

"Of the sizes of the smallest (species) *terella* or of the largest (species) *senectella.* Head whitish, mixed with a little ocherous, brighter on the dorsum. Ocelli I cannot perceive. Antennae gray, lighter on the undersides, with well-defined joints. Palpi whitish, second joint flattened, with noticeably channelled bristles, and having a gray efflorescence on the outer sides near the end. Third joint more than half as long as the second, awl-shaped, finely pointed, with a brown spot between the base and middle. The four front legs light gray, the outsides dusted with brown, tarsi brown, the joints with whitish ends. The hind legs pale yellow, the tibiae with small light coloured hairs, and the tarsi brownish at the joints. Abdomen yellowish dust-gray, grayish-white beneath, the last joint, in the male, as long as one-third of the abdomen, bright ocher yellow. Two elliptical, somewhat hollowed disks lying with their hollows upon one another. The lower projects somewhat from beneath the upper and is clothed on the upper side with a rich covering of somewhat loose-lying hairs, appressed above and projecting over the margin. On both sides of the base of the upper disk stands an outwardly crumpled brush of hair reaching nearly or quite to the end. In the female the anal joint is of the usual length, and is of the form of a truncated cone, the ovipositor slightly projecting. Forewings 2¼ to 2½‴ in length, smaller in the male than in the female, light gray, dusted yellowish gray, particularly towards the base, in the middle pure ocherous; along the middle fold lies a longitudinal blackish streak, enclosed at both ends with whitish dashes. Above this lie two

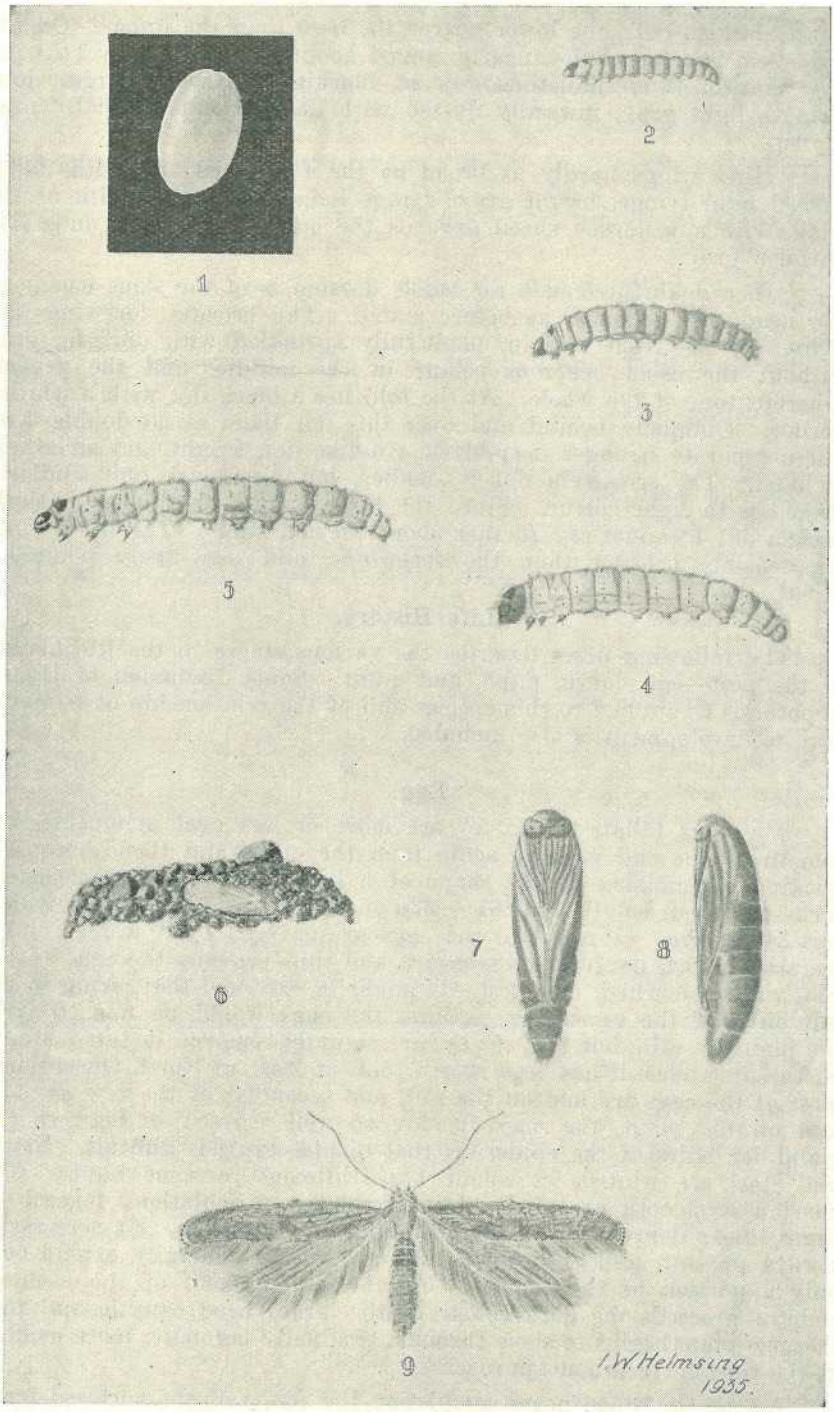


PLATE 3.

Tobacco Leaf Miner (*Phthorimaea operculella* Zell.). Fig. 1.—Egg × 35. Fig. 2.—First instar larva × 10. Fig. 3.—Second instar larva × 10. Fig. 4.—Third instar larva × 10. Fig. 5.—Fourth instar larva × 4. Fig. 6.—Earthen cocoon × 2½. Fig. 7.—Pupa, ventral view × 7. Fig. 8.—Pupa, lateral view × 7. Fig. 9.—Adult × 4.

small blackish dots, the lower nearer the base than the upper. On the cross-vein is a larger dot, nearly ringed about with light gray. At the rear margin is an indistinct row of blackish, somewhat larger dots. Fringes light gray, inwardly dusted with darker, and especially near the tip.

"Hind wings hardly as broad as the forewings and with under turned hind fringe, bright gray; fringe longer than the width of the wing, with a yellowish sheen towards the base. The entire underside uniform gray.

"In a doubtful female the whole dorsum is of the same colour as the head, the abdomen as before stated. The broader forewings are lighter at the front margin, plentifully sprinkled with uniform gray without the usual ocherous colour in the middle, and the general ocherous tone of the whole. At the fold lies a black dot with a whitish border. Obliquely behind and over this dot there is no double spot, but a separate stronger deep-black, ringlike dot, bright and strikingly inclosed. The cross-vein dot is smaller, but also black and similarly ringed with light colour. Since the hind fringes are almost entirely broken off, I cannot say further about the markings. The hind wings are sensibly broader than the forewings, and less finely pointed." (Graf, 1917.)

Life History.

The following notes describe the various stages in the life history of the pest—egg, larva, pupa, and adult. Some discussion of Dyar's hypothesis as applied to this species and of the relationship of temperature to development is also included.

Egg.

The eggs (Plate 3; fig. 1) are more or less oval in outline, but sometimes one end is more acute than the other and then there is a striking resemblance to the shape of a hen's egg. In one measured series the mean length was 481 $\pm$ 33μ and the mean width at the widest part 349 $\pm$ 16μ. When laid the eggs are covered by a water soluble secretion which hardens on exposure and thus cements the eggs to the substratum on which they rest. It might be expected that owing to the solubility of the cementing medium the eggs would be washed from the plant by rain, but few, if any, are actually removed in this manner. In the first place it has been shown that, at least in North Queensland, most of the eggs are laid on the soil, and secondly, of the few actually laid on the plant, the majority are so well pressed in between the glandular hairs of the epidermis that displacement is difficult. Newly laid eggs are whitish in colour but iridiscent in some lights. The chorion is smooth except for faint irregular reticulations formed by slight linear depressions. These reticulate markings are not necessarily always present, and even when they are visible generally extend over only a portion of the chorion. As the development of the enclosed embryo proceeds the dark colour of the larval head capsule and prothoracic plate begins to show through, gradually becoming more evident as the time for eclosion approaches.

As the egg stage nears completion the shape of the enclosed larva may be seen through the chorion and is more or less distinctly visible some time before hatching takes places. The anterior and posterior portions of the ventral surface are closely pressed together as the larva

lies folded inside the egg. For one or two hours before emerging from the egg the larva may be seen moving about within the confined space. Eventually it begins to eat its way out of the chorion through a crescent-shaped opening, usually near one end of the egg. Pieces of the chorion are bitten off and thrust outside until the hole is large enough for emergence. When eclosion has occurred the chorion is left as a colourless shell practically invisible to the naked eye, though it may be strongly iridescent in some lights.

TABLE 1.

LIFE HISTORY OF THE LEAF MINER.

Date Eggs Laid.	DAYS DURATION OF LIFE-HISTORY STAGES.									Date Moth Emerged.	Sex.
	Egg.	1st Larval Instar.	2nd Larval Instar.	3rd Larval Instar.	4th Larval Instar.	Prepupal.	Total Larval.	Pupal.	Total. All stages.		
7–7–32	11	6	5	4	6	4	25	13	49	25–8–32	♀
7–7–32	12	7	4	4	9	3	27	12	51	27–8–32	♀
18–7–32	7	6	6	6	8	2	28	14	49	5–9–32	♂
20–7–32	9	6	5	7	5	2	25	10	44	2–9–32	♀
20–7–32	9	6	5	6	5	1	23	12	44	2–9–32	♂
25–7–32	8	6	5	5	6	1	23	11	42	5–9–32	♀
25–7–32	8	6	5	6	5	1	23	12	43	6–9–32	♂
26–7–32	8	5	5	4	7	3	24	12	44	8–9–32	♂
26–7–32	8	6	4	5	6	2	23	11	42	6–9–32	♀
26–7–32	8	5	5	5	6	2	23	11	42	6–9–32	♀
26–7–32	8	5	5	5	3	4	22	12	42	6–9–32	♂
26–7–32	8	5	5	4	6	2	22	11	41	5–9–32	♀
1–8–32	9	5	4	5	3	2	19	12	40	10–9–32	♀
1–8–32	9	7	4	5	6	1	23	14	46	16–9–32	♀
1–8–32	9	6	3	4	3	2	18	13	40	10–9–32	♂
Winter Average	8·7	5·8	4·7	5·0	5·6	2·1	23·2	12·0	44·0	..	..
28–9–32	5	4	3	3	3	2	15	7	27	25–10–32	♂
28–9–32	5	5	3	3	4	2	17	8	30	28–10–32	♀
8–10–32	5	3	2	2	3	1	11	6	22	30–10–32	♀
8–10–32	5	4	2	3	3	1	13	9	27	4–11–32	♀
13–10–32	5	4	3	2	3	2	14	7	26	8–11–32	♀
30–11–32	5	3	2	3	2	1	11	8	24	24–12–32	♂
30–11–32	5	4	3	2	2	1	12	7	24	24–12–32	♂
30–11–32	5	3	3	2	4	1	13	7	25	25–12–32	♀
Spring Average	5·0	3·8	2·6	2·5	3·0	1·4	13·3	7·4	25·6	..	..

The time occupied in the egg stage (Table 1) was found to vary a great deal both with individuals and also with the time of the year. In July some eggs hatched seven days after they were laid, while in others the incubation period was as long as twelve days. The majority of winter eggs, however, were either eight or nine days incubating and twelve days was decidedly unusual. As summer approached the period of incubation decreased and in that season most of the eggs completed their development in either four or five days.

Larva.

The newly emerged larva, which is about 1·0 mm. long, is either colourless or very faintly yellowish pink except for the head capsule and dorsal shield of the prothorax, these being dark brown or black in colour. It is quite inconspicuous on the soil and among the glandular hairs which cover the surface of the tobacco leaf. Mature larvæ (Plate 3; fig. 5) attain a length of nearly 15 mm. at times, though the majority

range between 10 and 13 mm. The head capsule and prothoracic shield retain their original dark colour, but the remainder of the body changes colour slightly to either gray or yellowish pink. In potato tubers the larvæ are generally much lighter in colour than in the aerial parts of that plant or in tobacco. Owing to these differences in colour and habitat of the larvæ there was at one time some confusion in identification (Spencer and Strong, 1925), but there is now no doubt that only one species is involved.

Larvæ hatched on the plant may begin feeding immediately after emergence, eating their way through the chorion directly into the leaf. But it is more usual for some exploratory wandering to occur before leaf mining begins. Most larvæ, emerging on the ground near the plants, are, of course, forced to do some wandering before finding a suitable feeding site. The mines are initiated on almost any part of the leaf with the exception of the veins and may start at the edge of the lamina or beside a vein, or even beside the midrib. Before starting the mine proper the larva often spins a small amount of webbing from the mouth. This webbing has a silky appearance and is attached to a few of the glandular hairs on the surface of the leaf in the vicinity of the part about to be mined and serves to remove from the mouth parts of the larva the first pieces of epidermis which are uneaten. The fact that this epidermal tissue is not consumed merits consideration during the formulation of control measures. After making this observation a similar statement was discovered in an old paper written in 1913, though in this case the habit referred to concerns the larvæ of *P. operculella* on potatoes. "Observations tended to show that the larva rejected the skin and did not ingest any material until it had penetrated into the subjacent starchy tissue of the tuber." (Stoward, 1913.)

The mines are quite irregular in size and shape but the whole of the mesophyll is eaten and the epidermis of both leaf surfaces left intact. When initiating a mine and for a few days immediately thereafter, larvæ have been known to construct and use a silken frass-covered tunnel on the surface of the leaf leading away from the entrance. This is part of the very early phase and subsequently the larvæ live within the mines. The mines may pass through veins or even the midrib of the leaf and tunnels leading for a short distance along the centre of the leaf midrib have been observed. As the mines extend the frass is packed into corners of the tunnels.

The larva usually spends the whole of its prepupal life inside the original mine. Sometimes, however, three and even four mines are constructed and inhabited for a longer or shorter period by the same larva during the course of its development. The larva may be forced to leave the original mine by natural circumstances—e.g., a small leaf in which the mine is initiated may contain insufficient nourishment to carry the larva right through its development or, the miner in feeding may sever the midrib and cause the leaf to wither, thus rendering it unsuitable as food. The total area of leaf lamina destroyed by one larva varies considerably, probably depending, to some extent at least, on the age and thickness of the attacked leaf. The actual area destroyed by single larvæ in the laboratory varied from six to eight square centimetres.

Larvæ often travel from one leaf to another in the seed-bed, and this may be accomplished by joining two adjacent leaves with a silken tunnel, although migration outside the protection of tunnels is not

uncommon. In other countries it has been stated that the leaf miner rarely attacks leaves at any distance from the ground, and is therefore of little economic importance (Bondar, 1925, Jack, 1927, and Edwards, 1929), but the significance of the pest in seed-beds has been stressed by several authors (Fullaway, 1914, De Bussy, 1914, and Edwards, 1929). In North Queensland, however, as well as being a menace to plants in seed-beds, the pest may also cause considerable losses in the field. When a field is severely attacked the insect does not confine its attention to leaves near the bases of older plants, but also attacks leaves near the top. The severity of the attack and the effect of weather conditions on the plant are two factors which determine the height at which mines may be initiated. When weather conditions favour rapid growth and there is a mild attack by the pest, only the lower leaves are likely to be infested, but with weather conditions favouring slow growth and a severe attack by the pest, leaves near the tops of the plants may be attacked. Only lower leaves are attacked in moderate infestations during good growing weather, as the plants in normal growth apparently outstrip the pest. Larvæ of the leaf miner in the field do not always confine their attention to leaves, and it is not uncommon to see damage by this insect on the main stem of the plant. This damage appears as serpentime mines in the chlorophyll-bearing cortical tissue outside the vascular cylinder. The newly hatched larvæ may attack the stem directly or may invade the cortical tissue through the residual stipules after the leaf is picked. In the latter case the mesophyll of the stipule is probably destroyed before the stem is entered. The stem mines are irregular and meandering in direction, and may even completely encircle the stalk. They are discernible as narrow raised areas, seldom more than one-eighth of an inch across, contrasting with the mines made by the same species in the leaves. The latter are seldom linear after the first day or so but cover irregular patches.

During the course of their development the larvæ pass through four instars (Plate 3; figs. 2, 3, 4, and 5), but the time occupied by each instar varies greatly with the individual. Variations under winter climatic conditions were observed in some detail, and the observations (Table 1) show that the first instar occupied from five to seven days, the second from three to six days, the third from four to seven days, and the final instar from three to nine days. The means for successive instars were 5·8 days, 4·7 days, 5·0 days, and 5·6 days respectively. The prepupal period is not included in the fourth instar figures.

The head of a larva when newly hatched and for a short time immediately succeeding each ecdysis, is generally carried partly retracted within the prothorax but is protruded at will. Towards the end of each instar, however, the growth of the body is so pronounced that the head is kept permanently protruded to the full extent of the neck, and the prothoracic shield is found well back from the head capsule instead of being partly superimposed on it, as happens shortly after an ecdysis has occurred. Ecdysis occurs within the mine, the exuviæ and cast head capsule generally being left wherever the ecdysis takes place, although sometimes these cast structures are pushed into the frass heap. Probably not more than one or two square centimetres of leaf tissue is destroyed until the final instar is reached, but during this fourth instar the pest is very destructive and increases rapidly in size.

When full fed the larvæ desert the leaves and after selecting suitable sites spin cocoons of fine silk, these usually being completed within twenty-four hours of the larvæ deserting the mines. The larvæ then shrink considerably in length and become very torpid, remaining in this quiescent stage for two or three days in the winter, though less in summer, before pupating.

Dyar's Hypothesis.

Dyar in discussing the number of moults of lepidopterous larvæ contended that "the widths of the head of a larva in its successive stages follow a regular geometric progression and if, in examining the measurements of heads taken in following out a life history, any deviation from the calculated progression is shown, it is evidence that an error has been committed or that the larva has behaved in an abnormal manner" (Fisher, 1924). As the early instars of *P. operculella* are minute it is difficult to separate them by ordinary means, and therefore Dyar's hypothesis was applied to clarify the position. A number of measurements of the widths of larval head capsules was recorded, these being obtained by the use of a micrometer scale inserted in the eyepiece of a binocular microscope. As such readings would be inconveniently small if recorded as millimetres they are referred to as direct readings of the scale, e.g., "width of head capsule of first instar 7·5" indicates the width in scale divisions only. Thirty-eight of these divisions are equivalent to one millimetre—i.e., the factor 0·0263 converts scale readings to millimetres.

It was found that the head capsules from the first, second, and third instars were not distorted after ecdysis, but cast head capsules from the fourth instar were distorted a great deal. In the earlier instars the head capsule is cast entire, but in the final ecdysis there is a rupture of the capsule along the median line of the lower face and this causes the distortion. Therefore, although it is possible to follow the complete development of individual larvæ, and collect the head capsule after each ecdysis, the measurement of the final larval head capsule when taken after ecdysis is not comparable with those from earlier instars. Consequently, in the records of individual larvæ in Table 2 measurements for the final head capsule are not included. These larvæ were required for life history data, and the use of chloroform for their constraint during measurement was not considered advisable.

TABLE 2.

HEAD CAPSULE SIZES OF SUCCESSIVE INSTARS IN THE LEAF MINER.

The size increase ratio is given for each ecdysis.

(38 units = 1.0 mm.)

Instar I.	Ratio.	Instar II.	Ratio.	Instar III.
7·2	1·612	11·6	2·242	26·0*
7·5	1·733	13·0	1·692	22·0
7·5	1·733	13·0	1·731	22·5
7·5	1·733	13·0	1·731	22·5
7·7	1·636	12·6	1·746	22·0
7·7	1·753	13·5	1·689	22·8
7·8	1·603	12·5	1·760	22·0
7·8	1·564	12·2	1·803	22·0
7·8	1·744	13·6	1·706	23·2
8·0	1·500	12·0	1·750	21·0

* This larva died after moulting to the third instar.

The measurements recorded in Plate 4 (Graph 1) were made from larvæ selected at random from spirit material. From these no attempts to correlate the measurements for successive instars is possible. Obviously, however, the measurements are readily divisible into groups, though the range within the groups is somewhat wide. Each group represents an

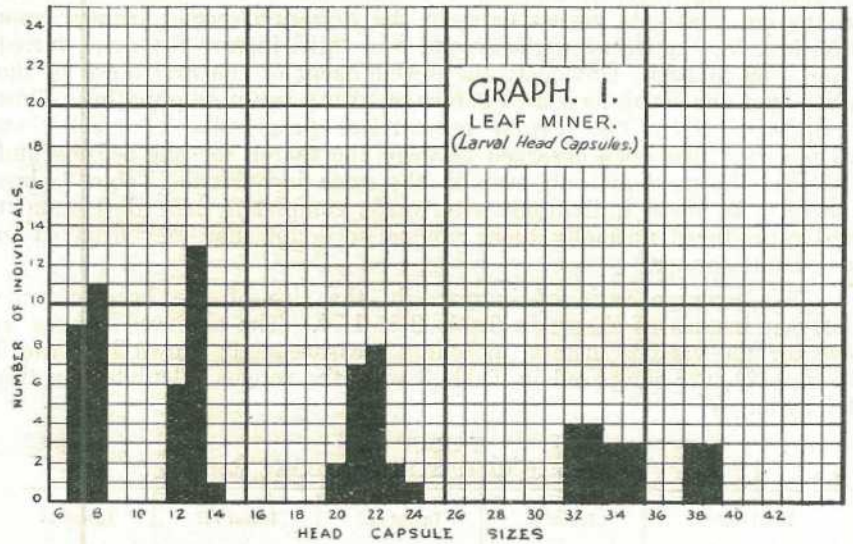


PLATE 4.

instar, and the value of the hypothesis in separating the instars is thus well illustrated. The means for the successive groups are: (1) $7{\cdot}55 \pm 0{\cdot}51$, (2) $12{\cdot}75 \pm 0{\cdot}55$, (3) $21{\cdot}65 \pm 1{\cdot}0$, and (4) $34{\cdot}9 \pm 2{\cdot}6$. This deduction of four instars was confirmed by subsequent observations. The mean ratio of increase between the successive means as given

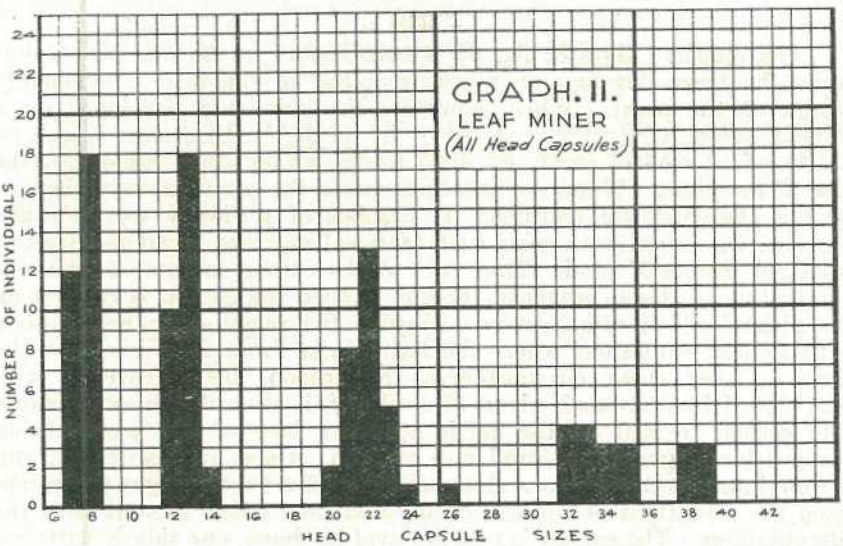


PLATE 5.

above is 1·67, but even in such a restricted series it is not constant between groups. Between the first and second it is 1·69, between the second and third it is 1·70, and between the third and fourth 1·61.

Even when individual larvæ were followed through their ecdyses (Table 2) the ratio of increase between successive instars was by no means constant. It varied between the first and second instars from 1·50 to 1·75, and between the second and third instars the ratio varied from 1·69 to 1·80. Obviously the development of the first larva in the series was abnormal, as it died before moulting again or pupating. Thus a deviation from the regular geometrical progression of more than 16 per cent. has been observed between the factor for one ecdysis and that for the previous one, even in the same individual (Table 2; last larva). As these individuals afterwards completed their development and reproduced normally there can be no doubt that they behaved in a normal manner.

The average ratio of increase in the size of the head capsule between instars as shown in Table 2 is 1·70. The observed ranges in size for the various instars, including measurements shown in Plate 5 (Graph 2), are compared in Table 3 with the ranges calculated on this 1·7 ratio.

TABLE 3.

HEAD CAPSULE SIZES OF LEAF MINER.

Head Size.	Instar I.	Instar II.	Instar III.	Instar IV.
Calculated	7·0—8·0	11·9—13·6	20·2—23·1	34·4—39·3
Observed	7·0—8·0	12·0—14·0	20·0—24·0	32·0—39·0

These experimental data show that the hypothesis was useful in determining the number of larval instars in *P. operculella*.

Pupa.

The cocoon (Plate 3; fig. 6) is constructed in various places, but when the larva develops on a mature plant in the field it commonly occurs on the plant. When, however, the larva has developed on a small plant either in the seed-bed or in the field, the cocoon occurs on a convenient clod of earth, on dead leaves, or on other rubbish at the base of the plant. Wherever it is constructed the cocoon always displays certain characteristic features. It consists of a closely woven silken framework covered with some such material as frass, small particles of earth, or grains of sand. That part of the cocoon in contact with the substratum is closely attached thereto. When the cocoon is formed on the plant itself it often occurs alongside the remains of the laminate petiolar leaf extensions where the latter arise from the surface of the stem. Under these circumstances the cocoon, being covered with particles of frass or small pieces of dead leaf, is somewhat inconspicuous. The cocoon formed on the earth near the base of the plant, being covered by fragments of sand and rubbish, is also inconspicuous, and it would appear that the covering materials afford some slight protection from the attentions of natural enemies as they blend so well with the surroundings. The cocoon is roughly oval in shape, one side is flattened and closely appressed to the substratum, and it measures 9 mm. in

length and 4 mm. in width. When constructed in the laboratory on a substratum of glass the part of the cocoon in contact with the glass was semi-transparent, and through it the outline of the pupa could be observed.

The pupa (Plate 3; figs. 7 and 8) immediately after formation is light green in colour and appears almost translucent, but it soon takes on a deeper hue and after a day or two is brown. The depth of colour increases until the pupa is very dark-brown or almost black immediately before the adult appears. Pupæ vary considerably in size, but they are seldom less than 6 mm. and not more than 9 mm. in length. Size is dependent to some extent at least on the amount of food available to the larvæ, those having the most food producing the largest pupæ. Male pupæ are usually smaller than female pupæ when developed under similar conditions. Larvæ of different sexes reared in the laboratory from the one batch of eggs and fed on the same leaves generally produced pupæ which differed slightly in size, the female being the larger. The sexes of the pupæ are readily determined on the position and size of the obsolete gonopore (Plate 6; figs. 3 and 4) situated on the ventral surface of the ninth abdominal segment.

The duration of the pupal stage varied considerably at different times of the year. The mean duration in the winter months was twelve days, varying from ten days to a fortnight, while in summer the stage was completed in about a week.

Length of Life Cycle.

The duration of the life cycle in Cairns from the time the eggs were laid till the adults emerged varied from forty to fifty-one days in winter and from twenty-two to thirty days in early summer (Table 1).

Temperature and Development.

It is a well recognised and important fact that the rate of development of the immature stages of an insect is dependent, to a large extent, on the prevailing temperatures under which the insect exists. The extent of the ravages caused by the leaf miner is therefore very largely dependent on the rapidity with which generation follows generation when temperatures are high during summer while the host crop is being produced.

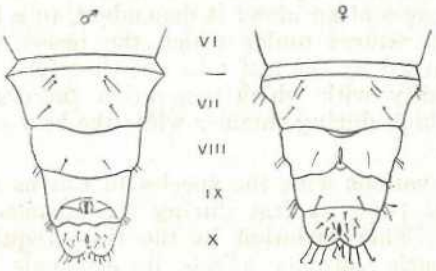
Experimental observations with the species in Cairns showed that development was almost twice as fast during the summer months as it was during winter. This variation in the time required by the developing insect to reach maturity affects its economic relationship with tobacco in two ways. The acceleration during summer when the seedlings and field crops are being grown ensures a rapid increase in the numbers of the pest at a time when it effects maximum losses. The retardation during winter when there is a greatly reduced food supply and much slower growth in its host plants enables the pest to utilise this diminished food supply advantageously and thus increases its ability to survive the winter period. A carry-over population is thus maintained through the winter and readily infests the new season's crop.

A somewhat detailed consideration of the temperature factor is included in this discussion. Obviously some means of measuring that factor is essential for the full interpretation of experimental data, and

a widely accepted method of measurement depends for its validity on the fact that all development ceases at temperatures below a certain minimum known as the threshold of development or theoretical zero of development, measurement being expressed in terms of day-degrees or effective day-degrees. A day-degree is equivalent to one degree of

1

2



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1932.

PLATE 6.

TOBACCO LEAF MINER (*Phthorimæa operculella* Zell.).

Fig. 1.—Eclosion cap on face of moth. Fig. 2.—Front view of eclosion cap. Fig. 3.—Abdominal segments of male pupa. Fig. 4.—Abdominal segments of female pupa.

temperature maintained for twenty-four hours. An effective day-degree is equivalent to one degree above the threshold of development maintained for the same period (Peterson and Hæussler, 1930). The value for the threshold of development varies with different species of insects, and in the following discussion that for *P. operculella* is taken as 52 degrees Fahrenheit (Langford and Cory, 1932). All values are in degrees Fahrenheit, and the method of computing day-degrees is that proposed by S. A. Forbes for use when only maximum and minimum thermometer readings are available (Glenn, 1918).

A daily record of effective day-degrees for six months is presented in Plate 7 (Graph 3). By using this information in conjunction with the laboratory records from Cairns (Table 1) it has been possible to compile a table showing the cumulative day-degree requirements for a short series of individuals (Table 4). This table indicates considerable variation in the day-degree requirements for the completion of any one stage by different individuals. The figures for the egg stage vary from 95 to 148 with a mean of 118, thus giving a variation of almost 45 per cent.; for the larval stage they vary from 298 to 419 with a mean of 351, a variation of 34·5 per cent.; while for the pupal stage the figures are 180 and 254 with a mean of 221, a variation of 33·5 per cent. The total effective day-degrees required for development from the day the egg is laid till the day the moth emerges varies from 606 to 766 with a mean of 690, which is a variation of 23 per cent. Thus it appears that although there is a certain amount of correlation between the accumulated day-degrees and the rate of development it is not of a very high order. However, as life history observations were made only once every

TABLE 4.

TEMPERATURE AND DEVELOPMENT OF THE LEAF MINER AT CAIRNS IN 1932.

Date Eggs Laid.	Effective Day—Degrees.				Date Moth Emerged.
	Egg.	Larva.	Pupa.	Total.	
7–7–32	131·76	335·12	212·32	679·20	25–8–32
7–7–32	147·51	363·40	206·79	717·70	27–8–32
18–7–32	94·84	399·60	231·00	725·44	5–9–32
20–7–32	116·62	363·57	194·75	674·94	2–9–32
20–7–32	116·62	329·07	229·25	674·94	2–9–32
25–7–32	112·79	339·81	217·25	669·85	5–9–32
25–7–32	112·79	339·81	236·25	688·86	6–9–32
26–7–32	110·43	328·91	217·25	656·58	5–9–32
26–7–32	110·43	328·91	326·25	675·59	6–7–32
26–7–32	110·43	348·41	216·75	675·59	6–7–32
26–7–32	110·43	348·41	216·75	675·59	6–7–32
26–7–32	110·43	367·41	236·25	714·09	8–7–32
1–8–32	113·62	297·95	253·75	665·32	10–9–32
1–8–32	113·62	316·95	234·75	665·32	10–9–32
1–8–32	113·62	397·95	250·25	761·82	16–9–32
Winter Averages	115·06	347·02	225·97	687·99	..
28–9–32	110·75	361·50	205·25	677·50	25–10–32
28–9–32	110·75	419·25	236·50	766·50	28–10–32
8–10–32	119·00	307·00	179·50	605·50	30–10–32
8–10–32	119·00	367·75	245·00	731·75	4–11–32
13–10–32	132·50	408·25	184·00	724·75	8–11–32
30–11–32	130·50	311·25	228·75	670·50	24–12–32
30–11–32	130·50	337·00	203·00	670·50	24–12–32
30–11–32	130·50	364·00	205·00	699·50	25–12–32
Spring Averages	122·94	359·50	210·88	693·31	..

twenty-four hours, an error of almost a day is possible in measuring the duration of any one instar. The probability that such errors have occurred is heightened by the fact that the percentage variation in effective day-degrees required for different individuals in any one instar and for complete development is progressively less with the increase in the number of days over which the records were accumulated. It is interesting to note that the effective day-degree figures obtained with this species in Cairns correspond fairly closely with values obtained in Maryland in North America, even though the larvæ in the latter centre were bred in potato tubers (Langford and Cory, 1932).

The number of individuals included in the Cairns records is small, and this limits the value of the results obtained. Nevertheless, they do indicate temperature as being an important factor in the variation of summer and winter developmental periods. It is also obvious that when the duration of the various stages is recorded in days only, the value of such a record is not so great as when temperature data are added.

Moth.

As the time for emergence approaches some notable changes occur in the appearance of the pupa. The length is increased by an extension of the abdominal segments, and the annular character of each segment is very clearly defined. This contrasts with the earlier appearance of the pupa when the constriction between the segments, though definite, is inconsiderable. During the last day of the pupal period the moth can be discerned through the cuticle and is apparently bathed in a liquid medium. Convulsive movements take place when emergence is imminent, and finally the cuticle is ruptured and the adult appears. Presumably emergence is aided by the bathing liquid as the moth is still wet immediately after the event. Rupture of the cuticle invariably occurs along certain well defined sutures surrounding the fronto-clypeus and vertex and also down the dorsum of the thorax. As the adult emerges from the pupal shell the eclosion cap (Plate 6, figs. 1 and 2), consisting of the fronto-clypeus and vertex, is retained on the head and by convulsive movements against one end of the cocoon the moth gains its freedom. The eclosion cap is shed within a few minutes of emergence, and after reaching a suitable resting place the moth remains still for about half an hour until the wings expand.

The number of eggs laid by individual moths varies a great deal, normally mated females in the laboratory laying from 13 to 163 eggs each, the mean of a series being 65. The greatest number of eggs laid by one female in twenty-four hours was 51. The laboratory records show that no eggs were laid between the hours of 9 a.m. and 6 p.m. The moths are usually inactive in the field during daylight but commence activity soon after dark and flight continues for two or three hours or even longer, eggs being laid during this flight period. Early in the morning, within an hour or two after sunrise, moths have been seen on the wing, but the flight is never of long duration. Data collected in a heavily-infested block of potatoes suggested that the morning activity is essentially a mating flight. Males greatly predominate in this early morning activity, being in the proportions of approximately three to five males to every female. It is unusual for moths disturbed during the day in the field to make a protracted flight, a short snappy flight of at most a few yards being common. During the earlier hours of the night much longer flights sometimes occur as the

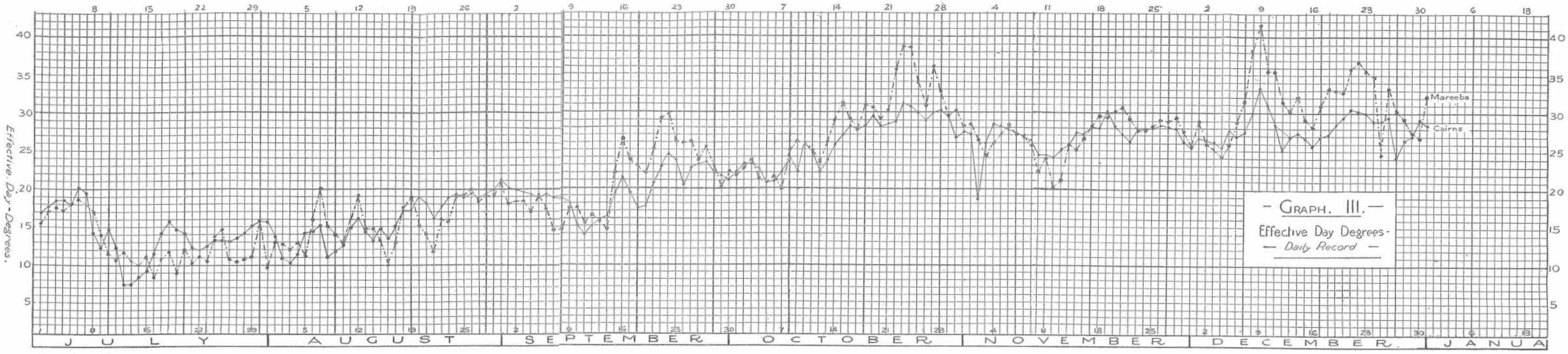
Effective Day-Degrees.
Day of the Month
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUA
Mareeba
Cairns
— GRAPH. III. —
Effective Day Degrees -
— Daily Record —

PLATE 7.

adults of both sexes have been taken at lights several chains from the field. Moths have also been reported to fly several miles, though perhaps with the aid of winds (Cockerell, 1928).

Egg laying may begin within twenty-four hours after mating or it may be delayed for several days. In one instance the moths had been mated for over three weeks before eggs were laid, but this pair had been bred in the laboratory on a very limited food supply and were exceptionally small specimens. Eggs have been laid as long as five and a-half weeks after first mating the moths, but in the whole of the laboratory material over 90 per cent. of the eggs were laid within three weeks of first mating.

From laboratory egg-laying observations there are indications that normal oviposition is dependent to some extent at least on repeated acts of coitus. One pair of moths were mated on 14th July and the male died two days later. Six fertile eggs were laid on the 20th and three on the 21st, but no more eggs appeared until the 29th when two infertile eggs were laid. On 2nd August a day-old male was introduced and on 8th August eight fertile eggs were laid, two more on the following day, and ten more on the 10th. The pair were seen copulating on the 11th and 13th and on the 13th two more fertile eggs were laid. The male died on 14th August, but fertile eggs were laid on the 15th and 16th, the female dying on the 25th. Other data suggesting a similar interpretation have also been obtained.

It has been stated that smooth surfaces are not suitable for oviposition which is only stimulated by unevenness in the surface of the host (Pickard, 1913), but laboratory observations show that this statement may not be generally applicable. Moths confined in glass vessels partly closed by calico laid eggs on both glass and cloth, 192 eggs in one series being laid on glass and 263 on calico. In another case a seedling standing in a small jar of water on a white paper-covered table was enclosed in a large glass jar and a pair of moths was liberated in the jar for twenty-four hours. The eggs laid totalled 51, 27 being on the glass, 18 on the white paper, and only 6 on the plant itself. This moth certainly did not show a preference for the rougher surface when choosing a site for oviposition. Egg laying has not been observed directly in the field, but as it almost certainly occurs in the dark this is not surprising. Eggs have been found on almost any part of the young plants in seed-beds, including both leaf surfaces and the stem. They may also be laid on larger plants, and occasionally several eggs are laid close together on the surface of a leaf in the depression adjacent to a vein, although normally eggs are laid singly. Recent work in the laboratory, however, has indicated that by far the greater proportion of the eggs are actually laid on the soil about the base of the plant. Observations made on heavily-infested seed-beds definitely supported this conclusion, and soil taken from such seed-beds yielded numerous larvæ when the associated eggs hatched. There can thus be no doubt that in this species the bulk of the eggs are laid on the soil.

Observations on the duration of adult life have necessarily been confined to moths in the laboratory, and the figures obtained are probably greater than those which would apply to moths living under field conditions. Moths in the Cairns laboratory during the late winter lived as long as two months, but others in the same season and under comparable conditions lived no more than three weeks. There seems to

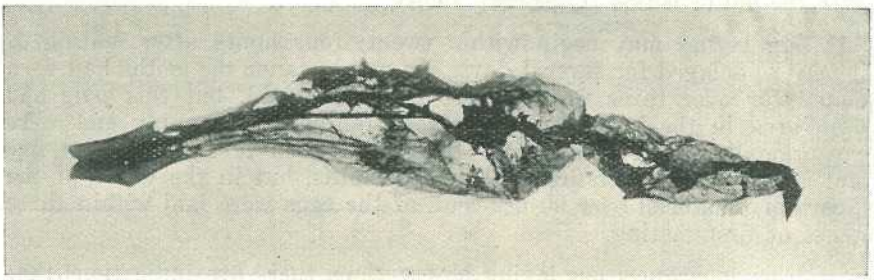

FIG. 1.

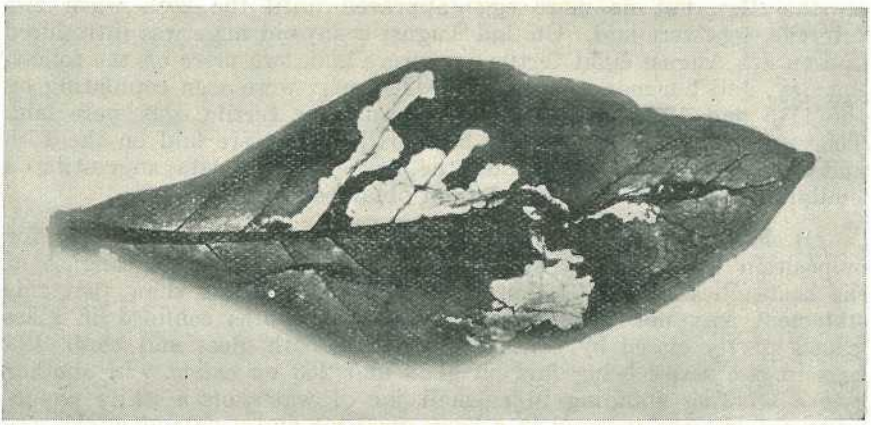

FIG. 2.

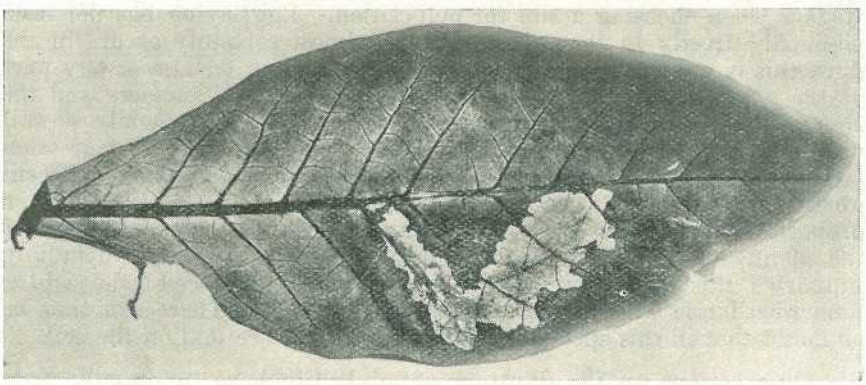

FIG. 3.

PLATE 8.—TOBACCO LEAF MINER (*Phthorimæa operculella* Zell.). Tobacco leaves mined by the Tobacco Leaf Miner.

be no significant difference in longevity between the sexes. The average age at death of late winter laboratory moths was, roughly, five and a-half weeks.

The number of generations in a year varies a great deal under the different climatic conditons of various countries, but as many as thirteen generations in eleven months have been recorded (Husian, 1926). As breeding is continuous throughout the year in North Queensland there is no clear line of demarcation between generations, and all stages are present continuously throughout the year wherever host plants are available. As the host plants include the potato and the tomato, as well as solanaceous weeds, a complete absence of hosts, even where tobacco is the primary crop, is very unlikely. Some indication of the expected number of generations each year may be deduced from the data presented in the discussion on temperature and development. The total effective day-degrees from July to December, inclusive, approaches 4,000 for both Cairns and Mareeba, and therefore 8,000 effective day-degrees annually for either centre is a justifiable assumption. Something less than 700 effective day-degrees are required for the development of the average individual (Table 4), and the preovipositional period probably requires about 50 effective day-degrees. Thus 750 effective day-degrees would be required for one generation of the pest. At this rate there must be ten or eleven generations in a district where 8,000 effective day-degrees are experienced in the year. Tobacco is available as a host in the northern districts of Queensland for at least nine months of the year, from October till June, inclusive. During this period, if it is assumed as before that 750 effective day-degrees are required for one generation, eight generations are possible, or perhaps nine. A small infestation in October, in a season which favours the pest and allows of almost unhindered reproduction, becomes quite serious by the beginning of the following year, and the effect on the crop may then be disastrous, particularly when planting out operations have been delayed by seasonal conditions.

Injury.

Outbreaks of leaf miner may be centred on seed-beds or in the field, and in both serious losses sometimes occur. The characteristic damage (Plate 8; figs. 1, 2, and 3), as one would expect from the popular name, is a mining of the leaves. Irregular areas of the mesophyll are eaten, the epidermis covering both leaf surfaces being left intact. When a damaged leaf is held up to the light the mines are apparent as translucent blotches in which the larvæ are often visible. Sometimes larger plants in the field are damaged in a different way, the larvæ constructing narrow tortuous mines in the cortext immediately under the epidermis of the main stem. These mines are apparent as meandering slightly raised areas around the stem, not much more than one-eighth of an inch wide. During severe attacks the stem may be completely encircled several times and this may check the growth although the vascular tissue is not directly attacked. When a plant not yet fully grown is affected in this manner, a mine which encircles the stem may interfere with the balance of metabolism to such an extent that growth ceases in the affected area. This results in a constriction of the stem and weakening of the vascular tissues, and such plants are sometimes blown down by high or even moderate winds. Partial or complete fracture occurs where the tissues have been weakened.

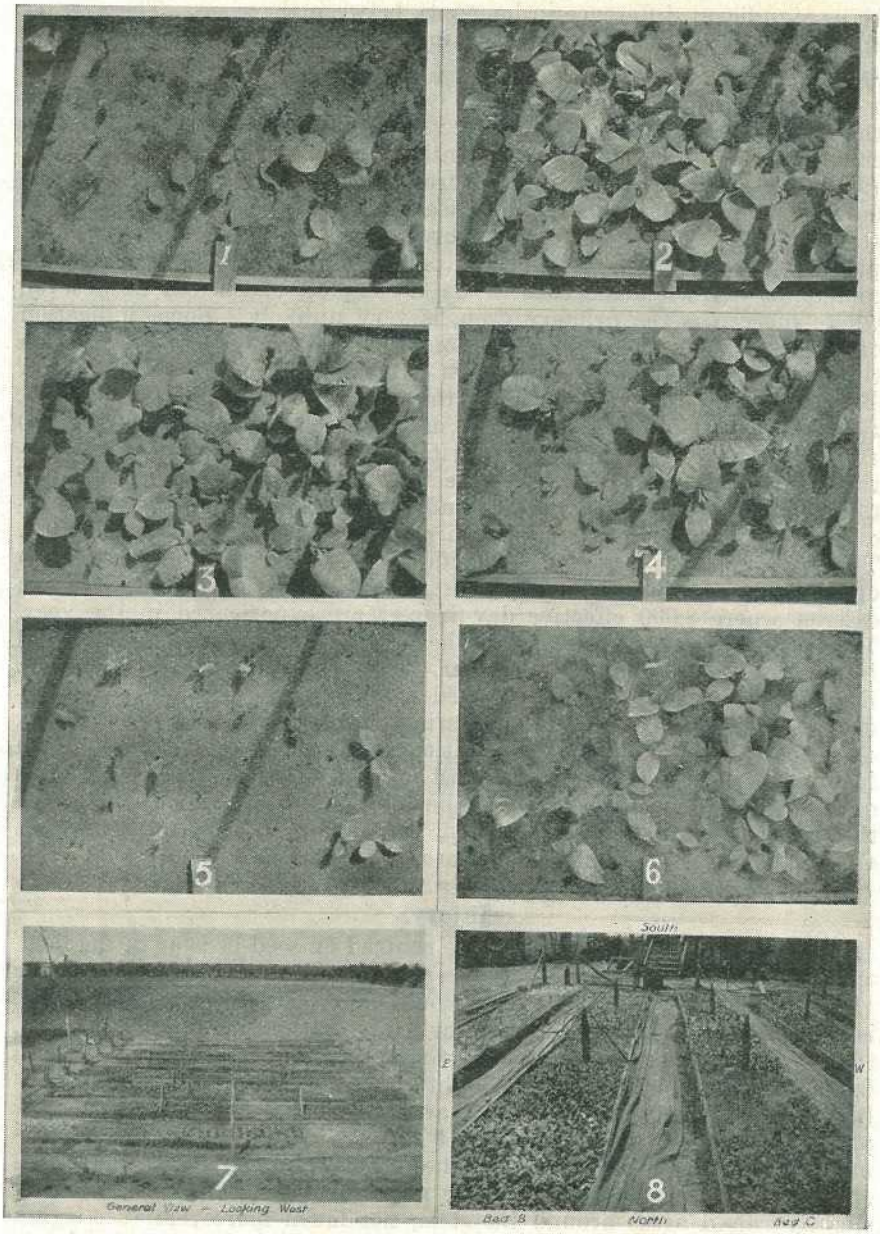

PLATE 9.

EXPERIMENTAL SEED-BEDS AT MAREEBA.

Figs. 1–6.—Seed-bed A. Plants pricked out at six weeks, then treated for three weeks. Fig. 1.—Control. Fig 2.—Dusted daily with 50 per cent. lead arsenate. Fig. 3.—Sprayed twice weekly with colloidal copper. Fig. 4.—Sprayed twice weekly with lead arsenate 1½ oz. per gallon. Fig. 5.—Sprayed twice weekly with sulphonated white oil. Fig. 6.—Same as Fig. 2. Fig. 7.—General view of experimental seed-beds looking west. Note bare patches representing c plots in seed-beds B, C, and D, compared with growth in sprayed plots. Taken when oldest plants nearly eight weeks old. Fig. 8.—Seed-beds B and C looking south, taken at seven and a-half weeks. Note definite failure of plants in c plots due to attacks of blue mould and leaf miner in Bed B, but to leaf miner alone in Bed C.

During severe infestations in the seed-beds seedlings may be completely destroyed as the larvæ consume the greater part of the chlorophyll bearing tissue of attacked plants (Plate 9). A single larva may damage more than one plant by travelling from seedling to seedling, as has been described in an earlier paragraph. A number of instances have been observed where the leaf miner has been responsible for the complete destruction of seed-beds. In most of the northern seed-beds there are usually numbers of plants attacked by this species even though they may not be completely destroyed. The check to the young plants, if infested before being transferred to the field, acts as a handicap at a time when growth should be rapid and unhampered.

When the seed-beds have been severely infested or if for any other reason there is a large population of moths present when the seedlings are transplanted, heavy losses of young plants in the field are to be expected. The seedlings seldom make very much growth until the rooting system has recovered from the injury inseparable from transplanting, and such recovery and renewed growth may not occur for one or two weeks or even longer. If attacks are initiated during this period of suspended growth the young plant has but a slender chance of recovery. For this reason planting out late in the season on farms where the leaf miner is already well established is seldom successful. An unsatisfactory and unprofitable stand may be the sole result of several replantings under such conditions.

If the onset of an infestation in the field is delayed until the period of suspended growth is past and the plants have resumed vigorous growth, the risk of total destruction by leaf miner is considerably reduced. When attacks are initiated on vigorously growing plants in the field direct losses are usually confined to the lower leaves (Bondar, 1925, and Edwards, 1929). Occasionally, however, under North Queensland conditions all the leaves on the plant, even as high as 5 feet from the ground, may be mined, and in such cases the losses are very severe.

In addition to such direct losses as have been described above, the pest also does some indirect damage, particularly in the seed-beds. It has been shown that viable spores of tobacco blue mould, *Peronospora tabacina* Adam, can be carried by the adults, and the species is therefore probably instrumental in spreading this disease (Angell, Hill, and Currie, 1930).

[TO BE CONTINUED.]

Inoculation of Cattle against Redwater and Anaplasmosis.

By JOHN LEGG, D.V.Sc., Animal Health Research Station, Oonoonba, Townsville, Queensland.

RECENT research work on the problem of tick fevers of cattle has caused us to radically alter our views in connection with these diseases. It was previously thought that only one tick-borne blood parasite was present in Queensland, but we now know that there are several. These various parasites have been recently separated from each other in different carrier animals and their individual effects on the animal have been studied. In addition, an attempt has been made to procure a vaccine which could be applied in the field as a single inoculation but which would protect against all forms of tick fever found in Queensland.

In preparing the vaccine, which it is now proposed to distribute from the Animal Health Station, Yeerongpilly, use has been made of a mild strain of anaplasm, which has recently been imported from South Africa. This strain has been combined with one of the organisms causing redwater of cattle in Queensland so that the vaccine actually contains two different blood parasites.

The Vaccine.

The vaccine is intended for use against redwater and anaplasmosis, and contains two blood parasites capable respectively of setting up these diseases. The incubation period of the two parasites is different; the redwater parasite, known as the piroplasm, produces a reaction between the seventh and fourteenth day, while the anaplasm reaction does not usually commence before the beginning of the third week and often a month or six weeks passes before it occurs. The redwater parasite used is one obtained from naturally infected Queensland cattle, while the anaplasm is a specially mild strain introduced from South Africa. This strain was imported because it was found that the anaplasm present in naturally infected cattle in Queensland was too virulent for use in the vaccine, while the South African strain produces only a mild reaction, and after recovery leaves a measure of resistance to the local anaplasm.

The vaccine should be inoculated as soon as received. It will only keep for three days, so that the sooner the injection is made the better. Any vaccine having an offensive smell should be immediately returned to the laboratory. It should not be used later than the date given on the label. Dose, 5 c.c. for animals of any size or age.

Use of the Vaccine.

Redwater and anaplasmosis are found throughout the tick-infested area of Queensland. As a rule calves bred in the tick-infested zone become infested with ticks soon after birth and infection with the blood parasites of redwater and anaplasmosis naturally follows. Since calves have a definite age resistance to these blood parasites the reaction produced is very mild. They recover quickly without having shown any ill effects, and after recovery are "immune." Continual infestation with ticks throughout the lifetime of the animal means continual reinfection by the blood parasites, and so the immunity is retained.

Cattle born and bred in areas free from ticks have not this resistance or "immunity," and hence it is necessary to vaccinate these cattle before introduction to tick-infested districts.

It should be noted also that there are many areas in Queensland, particularly in the best class of dairying country, where the continual destruction of the tick by dipping has so reduced their number that the cattle grow up without any immunity and hence are susceptible to these diseases.

Instruments Required.

A hypodermic syringe 5–10 c.c. capacity with suitable hypodermic needles.

The syringe should be taken to pieces and with the needles boiled for ten minutes. The water is then allowed to cool and the syringe fitted together, care being taken that all the parts fit properly and are in good order.

The operation is performed by injecting the appropriate dose of blood under the skin, usually behind the shoulder, care being taken to wash the area thoroughly, before injection, with a suitable disinfectant (2½ per cent. carbolic).

Where large numbers of cattle have to be inoculated a suitable apparatus consisting of rubber tubing, valves, hypodermic syringe, and needles fitted to a convenient handle can be supplied.

Precautions Following Inoculation.

As already stated there are two reactions. The first, or redwater, takes place in seven to fourteen days, the second, or anaplasm, about a month after inoculation. During the redwater reaction it is advisable to take the temperature, particularly if it is an aged imported beast. If the temperature rises above 105 degrees and/or the animal is distressed, appropriate means should be taken to control the reaction. This can be done by the use of piroblue. This drug has only recently been introduced into Australia for the treatment of redwater, although it has been in use in some of the other countries of the world for several years. The dose of piroblue recommended is 1 gram for animals of all ages. The drug is dissolved in 100 c.c. (half a breakfast cup) of clean water which has been *previously* boiled and then allowed to cool to blood heat. The solution is then injected directly into the jugular vein and should always be prepared just before it is used, although the drug kept in the dry state will remain potent for a very long period.

The anaplasm reaction usually produces a high temperature (which can be detected by the thermometer). Condition is usually lost and in severe cases there may be some anaemia, but no special treatment is required beyond proper feeding and in the case of valuable animals proper housing.

General Recommendations.

After recovery from the two reactions animals can be exposed in tick-infested country. Under ordinary circumstances they will become infected with the two forms of blood parasites which produce redwater. In addition they will become infected with the local anaplasm, but their resistance to all these parasites should be sufficient and they should not show any signs of illness. It must be recognised, however,

that the immunity is only relative. Valuable animals particularly should therefore be carefully attended to and watched for the first few weeks after being exposed to ticks and the following points require attention:—

(1) The animals should not be driven or railed over long distances, or exposed to hardships—i.e., drought conditions.

(2) Heavy tick infestation should be avoided. If the country is heavily infested frequent dipping is necessary.

(3) Bulls should not be given too much work during the first few weeks.

Special Recommendations.

In some areas, particularly the best dairying districts of Queensland, there are farms where very few ticks exist. This state of affairs is frequently due to the zeal of the owners who desire to see their animals as free from ticks as possible and who consequently dip their cattle at frequent intervals. Under such circumstances it is quite possible to find farms where ticks are very difficult to discover. Cattle bred on these farms may thus reach a stage of life where their age-resistance has been reduced or lost before actually becoming infected with the redwater or anaplasm parasites. Outbreaks of redwater and anaplasmosis are, therefore, likely to occur, and, unfortunately, some of the worst outbreaks during recent years have been among dairy stock.

Owners, therefore, are specially advised not to persist in dipping until all the ticks have been killed out. For the sake of the young stock a minimum number of ticks should always be present. If there is any doubt as to the immunity of their animals owners are advised to inoculate.

In carrying out inoculation, owners should note the following:—

(1) Young cattle under one year and in store condition are less susceptible than aged, fat animals.

(2) Pure breeds are more susceptible than cross breeds.

(3) Inoculation of pregnant cows should be avoided as they are likely to abort subsequently.

(4) Milk yield in heavy milkers will be considerably reduced during, and for some days after, the reaction.

Two Forms of Redwater Parasites.

There are two types of redwater parasites in Australia. Both these parasites are entirely independent of each other, although in outbreaks of redwater in the field, they may be associated. One of these types of blood parasites, known as the babesiella, is not susceptible to piroblue, and unfortunately appears to be very common. If piroblue is used in cases of redwater outbreaks in the field without a previous correct diagnosis being made, results are for this reason likely to be disappointing. Owners therefore are specially advised to consult their nearest Stock Inspector, who will assist and advise in taking blood smears from acute cases for their despatch to the laboratory.

It should be noted that the type of redwater parasite used in the vaccine supplied, and known as a piroplasm, gives considerable resistance to infection with the second type (the babesiella).

Issue of Piroblue.

Owners are advised to keep piroblue on hand when inoculating valuable stock with the vaccine supplied by the laboratory.

Guarantee.

Vaccine is issued only at the risk of the owner. No guarantee can be given that losses will not occur from the inoculation; neither can an assurance be given that surviving animals will be immune.

Where and When Obtainable.

Vaccine can be obtained from the Animal Health Station, Yeerongpilly, Brisbane. Order should be placed so that the blood can be despatched on specified days (every Tuesday).

CARE OF THE CREAM SEPARATOR.

The quantity of cream which is lost through worn and uncared for separators is not always realised by the dairy farmer. Seeing that the cream is the source of livelihood, every care and attention should be given to the machine, and proper adjustment made so that it will render the best service. A common cause of trouble is due to the failure to keep the separator perfectly level and securely fastened down. When installing the machine select a solid foundation and see that the bolts get a firm hold. Besides causing wear of the gearing the effect of a shaky machine is that the vibration allows of the remixing of the cream and the lighter liquid after they have been separated. The separator should be lubricated with good quality oil of the correct grade, as recommended by the suppliers of the machine. The oil in the bath should be changed occasionally. Owing to the high rotative speeds of the bowl, the gearing and spindle bearings have to be very accurately made, with fine clearances. If these clearances get much greater through wear vibration is set up, resulting in less efficient skimming.

All separators should be gone over at least once a year and all worn parts replaced. After an overhaul the user should get a test of the skim milk to see the adjustments and the cream screw setting are correct, and if the butterfat content is higher (over .03 of 1 per cent.) other adjustments should be made. If the screw is adjusted for a very rich cream there is a tendency to decrease the efficiency of the separator, and further losses through the cream sticking on the sides results. Bad skimming, whilst frequently due to the bowl out of level or wear and vibration, may be due to incorrect speed. This is important.

A lowering in speed of ten revolutions per minute below that recommended by the maker may affect the butterfat content of the skimmed milk to double the quantity. The machine should be driven evenly and smoothly. Driven by an electric motor or an oil engine of the throttle governed type, better skimming results than hand drive are obtained for the reason that the speed is maintained at its speed. The machine should be started up slowly, gradually increasing in its speed up to normal, or damage or excessive wear to gearing is occasioned. For a power drive a special friction pulley should be used to obtain this end, or if fast and loose pulleys are employed, the belt should be moved across slowly.

The milk should not be allowed to get too cold before separating. In winter its viscosity would get greater, making it harder to separate, and thus decrease the skimming efficiency of the separator. The fat separates easier at 90 degrees. Thorough washing is an important factor in efficient separation. This should be done every time the machine is used. Any collection of thick material in the cream and milk passages and bowl shell prevents complete separation. The bowl should be taken apart and all the fixtures properly cleaned immediately after each separation. Too often the farmer omits to give the separator the attention it deserves, and to watch the important points mentioned. Proper care in the running of the machine will prolong its life and reduce wear. Corrections, too, are usually quite simple, and replacements inexpensive, but in the case of a badly worn machine it is cheaper and surer to purchase a new machine. A worn-out separator is a bad proposition.

Tick Fevers of Cattle in Queensland.

By C. R. MULHEARN, B.V.Sc., Animal Health Station, Yeerongpilly.

TICK fever and redwater are the popular names applied to a number of closely related diseases of cattle caused by extremely small blood parasites. These parasites, under natural conditions, are transmitted by the cattle tick (*Boophilus microplus*). Hence the diseases only occur within the tick-infested areas.

The female cattle tick develops on one animal reaching maturity in approximately twenty-one to twenty-five days. It then drops to the ground and lays from 2,000 to 3,000 eggs. The young larval ticks which develop from the eggs remain on the ground until they get a chance to attach themselves to other cattle. If the first animal was suffering from an acute attack of tick fever or was a carrier of any of the tick fever organisms, it would infect the female tick. The tick fever blood parasites pass through the egg stage into the larval ticks of the next generation. These in turn would infect the cattle to which they become subsequently attached and, if susceptible, such animals then suffer from an attack of tick fever.

There is some evidence to suggest that at least one form of the disease may also be transmitted on occasion from animal to animal by the agency of blood sucking flies.

Economic Importance.

This group of diseases is of very great economic importance to the Queensland cattle industry. Their presence in the tick-infested country greatly handicaps the free movement of cattle from the tick-free areas into the coastal country. For economic reasons it is essential to have the principal sale yards and killing centres on the coast, and as all the coast country in Queensland is tick-infested considerable inconvenience is experienced each year when cattle are forwarded from the inland tick-free areas to the tick-infested coastal areas for sale or slaughter.

Another form of loss and inconvenience is incurred when stud cattle are introduced from clean districts into the tick area. If these cattle are forwarded direct to the holdings they very frequently develop an attack of tick fever, often with fatal results, and consequently it becomes necessary to inoculate them so that they will pass through mild reactions. After recovery such animals are highly resistant to subsequent infection by these parasites per medium of the tick.

Frequently losses occur in cattle in that area of country situated between the definitely tick-infested and definitely tick-free country. Owing to seasonal and other conditions, the cattle on such an area may not be exposed to ticks for several years, and these stock then become susceptible to these blood parasites. When they are again exposed to ticks in a favourable season there may be severe losses.

Losses are also continually occurring in cattle bred within the tick zone. This occurs particularly in areas where dry seasons cause a diminution in the number of ticks or where these parasites have been killed out by frequent dipping. The presence of these diseases in such

districts under the present conditions in Queensland render the abolition of ticks from individual areas inadvisable, for if such is carried out the cattle lose their resistance and when again exposed to ticks they may develop a severe form of the disease resulting in heavy losses. Consequently it is necessary to either regularly inoculate these cattle or to expose them continually to a certain amount of tick worry to maintain their resistance.

Susceptibility to these Diseases.

The severity of these diseases varies considerably with the age of the individual animals. Young animals possess a natural resistance to all forms, and consequently when infected they usually show only a mild attack, but this resistance gradually diminishes as the animal ages so that at one year old a severe attack may be experienced. As a general rule well-bred heavy beef cattle are more susceptible than the lighter grade animals.

Almost all young cattle when exposed to ticks pass through mild attacks of the various forms of tick fever and acquire a premunition which gives them a resistance against subsequent infections. Under normal circumstances, whilst continually exposed to tick infestation, this resistance is maintained during the life of the animal.

The condition of premunition does not give a solid immunity, but it brings about a state of balance between the animal defences and the tick fever organisms, which are continually carried in the body of the animal. If, owing to unfavourable circumstances such as sudden exposure to heavy tick infestation, starvation, overwork, or other diseases, the animal's resistance is lowered, the body defences may be unable to cope with the tick fever organisms. The latter then again assume control and the animal has a relapse to one or other or possibly all of the different forms of tick fever. This fact partly accounts for a number of the cases of tick fever which occur in cattle bred in the tick-infested areas.

If an animal is not constantly exposed to infestation by ticks the body defences gradually overcome the organisms which disappear from the animal's body. When the organisms have disappeared, the animal again becomes susceptible and will develop an attack of tick fever when re-exposed to infection.

The Causal Organisms.

For many years it was considered that tick fever in Australia was caused by a single blood parasite, but recent investigations carried out by the Council for Scientific and Industrial Research at Townsville have shown that there are at least four different parasites (1). All these blood parasites are quite independent of each other and in any tick-infested zone one, two, three, or four, or any combination of these forms may be present.

Scientifically the parasites are known as—(1) *Piroplasma bigeminum*, (2) *Babesiella argentinum*, (3) *Anaplasma marginale*, and (4) *Theileria mutans*.

All these organisms were undoubtedly introduced into Australia with the ticks many years ago.

Symptoms.

There is a marked variation in susceptibility in individual animals. Some animals pass through an attack of tick fever without showing any obvious symptoms, whilst other animals are affected with a very severe attack which may cause pronounced symptoms and even death. The symptoms also vary according to the organism causing the disease.

P. bigeminum.—This parasite is widely distributed throughout the tick-infested areas. For many years it was thought to be the only tick-transmitted blood parasite of cattle. Recent investigations have shown that it is probably not the most common cause of serious outbreaks of tick fever in the field.

Under natural conditions the incubation period is three or four weeks. When artificially produced by blood inoculation the incubation period is much shorter and is about one week.

Usually the first sign of the disease is manifested by a rise in temperature. This, however, may not be noticed unless temperatures are regularly taken with a clinical thermometer. The temperature gradually rises over a number of days until it reaches a maximum which may vary from 104° to 108°F. A sudden drop in temperature, without special drug treatment, is a bad sign, as this sudden lowering of temperature frequently precedes collapse and death.

If the affected animal is in the open it frequently leaves the rest of the mob and seeks shade when its temperature is high. It next ceases to cud and refuses to eat. The coat may appear ruffled and the ear droops. The breathing becomes rapid and jerky. If the animal is driven it may stagger and show a weakness of the hind quarters. In dairy cows the milk supply is greatly diminished. Constipation, which is present in the early stages, may be followed by diarrhœa as the disease advances. In severe cases changes are noticed in the urine which becomes a dirty reddish colour, hence the name redwater. In most fatal cases death occurs within a week of the first symptoms.

The post mortem appearances are marked by pallor of the mucous membranes due to poverty of the blood. The liver is enlarged and of a bronze colour and the gall bladder is distended with dark thick bile. The spleen is enlarged and the kidneys are often dark in colour. The bladder usually contains a quantity of dark reddish urine.

B. argentinum.—This parasite appears to be frequently responsible for outbreaks of redwater in the field.

The incubation period, symptoms, and post mortem appearances are somewhat similar to those seen in cases of tick fever due to *P. bigeminum.* However, red urine may not always be present in this form of tick fever, while jaundice is often a very marked feature. The kidneys are often enlarged and very dark in colour.

It is therefore impossible to differentiate between these two forms of tick fever without the aid of a microscope. For this reason stock owners should forward blood smears from sick cattle and smears from the cut surface of the kidney, liver, and spleen from fatal cases to the Animal Health Station for diagnostic purposes.

A. marginale.—This blood parasite is known to be widely distributed throughout the tick-infested area of Queensland. Infested cattle do not usually show high fever or great distress, but there is a gradual wasting and loss of condition. In fatal cases the animal becomes so

weak that it goes down and death follows from gradual exhaustion. Most owners do not recognise this condition as being a form of tick fever for there may be no high temperature and there is no red urine. Post mortem appearances are marked by great wasting, with pallor and often jaundice.

T. mutans.—This blood parasite is very widely distributed throughout the tick-infested area. Up to the present there has been no evidence to show that it causes any harm.

Treatment.

General treatment consists in good nursing. The animal should be rugged in cold weather and made as comfortable as possible. The appetite should be tempted at frequent intervals with freshly-cut green feed and bran mashes. A liberal supply of water in which potassium nitrate at the rate of 1 oz. to 2 gallons has been dissolved should be available at all times. If the animal is carrying a large number of ticks and it is only in the early stage of the disease it should be sprayed, but if the disease is well advanced spraying is not advisable and as many ticks as possible should be picked off.

The animal must be kept quiet and disturbed as little as possible. If driven, the fever may be aggravated and cause collapse and death.

Drug treatment has been found to be very effective for that type of tick fever caused by *P. bigeminum.* Piroblue, which was introduced by the South African authorities, and is now widely used in that country, has been found to be extremely effective in controlling this form of the disease in Australia. Supplies with directions for use can be obtained at the Animal Health Station, Yeerongpilly. The treatment consists of injecting 1 gram of piroblue dissolved in 100 cc. of water into the jugular vein.

The sick animal, even when suffering from a severe attack of the disease, usually recovers within twelve hours of treatment, in which time the temperature will fall to normal and the number of organisms in the circulation will be greatly diminished. The drug should be given before the case becomes too far advanced, for if left too long the animal may die before the drug can produce its beneficial results. Any cases showing red urine should be looked upon as severe and should be treated without delay. It must be borne in mind, however, that red urine is also a symptom of babesiellosis, the second form of redwater against which piroblue is not effective. Hence to avoid disappointment and a wrong impression of the efficacy of the drug it is always advisable, where possible, to have a correct microscopic diagnosis made before the drug is used.

Preventive Inoculation.

Preventive inoculation is most frequently carried out to give a protection to valuable stock which are being transferred from tick-free to tick-infested country. It is also used for cattle which are maintained in lightly tick-infested country to ensure that they retain their resistance against the different forms of the disease.

This inoculation consists of an injection of freshly drawn blood from a specially prepared animal into the susceptible animals.

As previously pointed out there are three organisms, viz., *P. bigeminum, B. argentinum, and A. marginale,* capable of producing a severe attack of tick fever, and the object of preventive inoculation is to give the animals as mild an attack as possible and at the same time give a resistance against these three organisms.

Recent work at Townsville has indicated that animals which have recovered from an attack of *P. bigeminum* have considerable resistance to *B. argentinum*(2). If a severe reaction follows the preventive inoculation with *P. bigeminum,* it can readily be controlled with piroblue.

The third form of tick fever, which is caused by *A. marginale,* has been found difficult to deal with in Australia, because the local parasites when inoculated into susceptible cattle produce too severe a reaction, and up to the present no suitable drug has been discovered which can influence the course of this form of tick fever. For this reason a milder form of the parasite known as *A. centrale* has been introduced from South Africa. Experiments have shown that Australian cattle tolerate this parasite well, and after recovery the great majority of them show considerable resistance to infection with *A. marginale.*

It is intended, therefore, to incorporate this South African parasite in the vaccine which will be supplied by the Animal Health Station, Yeerongpilly. Such vaccine issued in the future will therefore contain two blood parasites, viz., *P. bigeminum* and *A. centrale.* The first produces a reaction about the end of the first week, and, if too severe, can be controlled by piroblue, while the second produces a reaction which occurs about one month after inoculation and which will be found to be quite mild. This vaccine will give a protection against all forms of tick fever.

Blood Supplied for Inoculation.

Blood will be supplied from this Station for inoculation purposes. As the organisms in the drawn blood do not survive for more than a few days and as the possibility of a successful reaction diminishes as the blood becomes older, it is essential that the blood should be used as soon as possible after it is drawn. Blood which is more than three days old should not be used. In order that all blood may be supplied under the most suitable conditions cattle will only be bled and blood forwarded on certain specified days. The dose recommended for all cattle is 5 cc.

Cattle carrying the recommended organisms will be prepared as bleeders and supplied from this Station. It must be borne in mind, however, that when these specially prepared bleeders become exposed to ticks they will probably soon become infected with the other organisms which may render them dangerous for use as bleeders.

If a specially prepared bleeder is to be used over a considerable period of time on a property it must be received and maintained in a tick-free condition. Under such conditions the animal only remains infective for about three months.

The most suitable time to inoculate cattle in the tick-infested areas is in the spring or early summer—i.e., before the commencement of the wet season. Cattle which are continually exposed to ticks do not require to be inoculated, but cattle which are running on country where

ticks are comparatively rare should be inoculated each year. All clean cattle which are moving from the clean to tick-infested districts should be inoculated at least two months before they are moved.

The operation of inoculation is carried out by injecting the dose of blood into the tissues under the skin. The most suitable situation for inoculation is just behind the shoulder. The area is prepared by clipping off the hair and then washing with a reliable antiseptic solution. A 10 cubic centimetre hypodermic syringe and a few stout hypodermic needles are required. The bottle containing the blood is opened and the syringe, after sterilizing, is filled and the inoculation is carried out immediately. When a bottle of blood is opened it should be used straight away. It may be convenient to pour the blood into a clean dry cup which has been previously sterilized by boiling in water. The syringe and needles should also be sterilized both before and after the operation.

Two reactions should follow the inoculation of susceptible cattle. The first in from six to fourteen days and the second in from twenty to forty days. If, however, the inoculation is performed on cattle in the tick area the animals may not react or the reaction may be so mild that it is not noticed.

Cattle which are reacting should be treated as recommended. Cows heavy in calf should not be inoculated, for a severe reaction may bring on abortion. Cattle which have been inoculated should be kept as free of ticks as possible for six to eight weeks. After inoculated animals are exposed to ticks they should be carefully watched for about one month to ensure that they are resistant. If no attack occurs within this time the inoculation has been successful and, under normal circumstances, the animal will remain resistant.

All blood forwarded from this Station is taken from specially prepared animals, but no responsibility can be accepted by the Department for any mortality following inoculation, neither can any guarantee be given that the animals that have reacted will remain resistant to all the tick fever organisms.

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The Feather Mites of Poultry.

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

SEVERAL species of mites have been recorded as associated with the feathers of poultry. Some of these are definitely parasitic in habit and obtain their food by piercing the skin and sucking up the blood and lymph. To this group belong the Gamassid mites of the genera Dermanyssus and Liponyssus.

There is a single species of the genus Dermanyssus which normally infests poultry, namely the red mite, *D. gallinæ* Redi. The red mite is found on all classes of poultry and appears world-wide in its distribution. It occurs on its hosts only at such times as it requires food, and lays its eggs in sheltered cracks and crevices in the fowl house.

In the second genus, Liponyssus, two species are known to attack poultry—namely, the northern fowl mite, *L. silviarum* Canestrini and Fanzago, and the tropical fowl mite, *L. bursa* Berlese. Both these species are found on the birds in all stages of their life cycle, their eggs being laid on the feathers. The northern fowl mite reaches its highest development in temperate climates and is well known in Europe and North America. In warmer countries it is replaced by the tropical fowl mite which is very prevalent in such countries as the Southern United States, South Africa, South America, and Queensland.

There are other species of mites found on the feathers, which do not appear to be parasitic, but are said to live and feed on the feathers only. These are the true feather mites and belong to the family Analgesidæ. The members of this family occur on a large number of birds and do not appear absolutely restricted in their choice of host, as a single species may be found on many different birds. They may be found on or among the feathers or in the quill. Some species occur only on the flight feathers, others on the body feathers, and others again among the feathers of the head and neck. The Analgesidæ are closely related to the Sarcoptidæ or itch mites and lay their eggs usually on the barbs of the feathers. In some species there is a migratory nymphal stage. Fourteen species belonging to this family have been recorded from domestic birds.

One of the most interesting is the mite *Falculifer rostratus* Buchholz, which is found among the feathers of the pigeon. Under certain conditions the hypopial nymph penetrates into the subcutaneous tissues and has been found in large numbers in the thymus gland. Sweet (1908) has recorded this species from the pigeon in Australia (Proc. Roy. Soc., Vic., Vol. XXI., p. 523). Three further species are recorded from the pigeon *Falculifer cornutus* Trouessart, *Analges bifidus* Nitzsch, and *Pterophagus strictus* Mégnin.

Megininia cubitalis Mégnin is found among the body feathers of fowls and turkeys. Recently the writer's attention was directed to a species of mite occurring in large numbers among the body and wing feathers (excluding the flight feathers) of some Australorp pullets which are being used for nutritional experiments at this Station. For some time these birds had been addicted to the vice of feather picking. Extremely heavy infestations with this mite were observed on the majority of the birds, and it appeared as though the association had resulted in an irritation causing the birds to pick out the feathers, the areas affected being chiefly the neck, breast, rump, and back. Very few mites were observed actually on the skin, being practically confined

to the barbs of the feathers adjacent to the shaft. The species was identified as *M. cubitalis*. This, so far as can be ascertained, is the first record of the presence of a species of this genus on poultry in Australia.

A second species, *M. columbae* Buchholz, has been recorded from the pigeon, fowl, canary, and a number of other birds, and a third species, *M. velata* Mégnin, from ducks. Wickware has written of a very unusual case of scabies associated with a species of Megninia in a flock of fowls in Quebec, Canada. (Jour. Paras., Vol. VIII., 90-91.) In the affected birds a dried exudate and crusts were prominent on the combs, wattles, and face. The eyelids were glued together with the exudate and the birds could not eat. Scrapings of the crusts revealed large numbers of a mite which was determined as *M. gallinula* Buchholz. This species was first described from the spotted crake, *Ortygometra porzona,* in Europe.

The feathers of the fowl may also be infested by a species of *Pterolichus, P. obstusus* Robin, while *Microspalax chayani* Trouessart is known to be fairly common on the feathers of the turkey.

Two species of Dermoglyphus are recorded as inhabiting the quills of the feathers of the fowl, guinea fowl, and turkey, namely *D. minor* Nörmer and *D. elongatus* Mégnin.

Two very minute species of mites are found among the down and on the skin of the fowl, *Epidermoptes bilobatus* Rivolta and *Rivoltasia bifurcata* Rivolta. On occasions when the infestation with these two species of mites is heavy an intense pityriasis may be caused.

Three species belonging to the family Chyletidæ have also been recorded as being associated with the feathers of poultry. *Syringophilus bipectinatus* Heller occurs in the quills of the fowl, in which it is said to feed on the external cones of the feathers, while *S. columbae* Hirst has been found in the quills of the pigeon. The third species, *Sarcopterinus nidulans* Nitzsch, has been recorded from a number of birds, including pigeons. It lives in colonies in the follicles of the feathers and gives rise to tumours or cysts in the skin.

Another species which may be seen among the debris attached to the shafts of feathers is *Cnemidocoptes gallinae* Railliet. This mite burrows into the skin alongside the quills of the feathers, causing an itching inflammatory condition and giving rise to the disease known as "depluming itch."

LITTER RECORDS.

Four litters of pigs were officially recorded by the Department recently for stud pig breeders; a summary of results follows:—

OWNER.	BREED.	DATE OF BIRTH.	NUMBER REARED.	WEIGHT AT EIGHT WEEKS.	
				Total (lb.)	Average (lb.)
Hibberd Bros., Indooroopilly	Large White	17-8-35	10	327	32·7
M. G. Bayliss, Maleny	Large White	23-8-35	8	399·5	49·9
H. O. Rees, Maleny	Middle White	26-8-35	9	232	31·3
R. Turpin, Lowood	Wessex Saddleback	14-9-35	10	375	37·5
A. G. Stewart, Gympie	Large White	4-10-35	13	488	37·5

Grass Tetany.

By C. R. MULHEARN, B.V.Sc., Animal Health Station, Yeerongpilly.

SEVERAL cases of Grass Tetany (also known as Lactation Tetany) in dairy cows have been reported to this Station during the past year. From the histories given it would appear that this disease has been present in Southern Queensland for some years. Cases have been investigated or reported from the Downs and the South Coast dairying districts, but it is probable that under favourable circumstances the disease may appear in other parts of the State. Experience both in Queensland and in other parts of the world indicates that grass tetany may be regional, for some districts are repeatedly affected whereas adjoining districts remain comparatively free.

Cause of the Disease.

The cause of the disease is not definitely known although several theories as to its nature have been put forward. It is now generally believed, however, that the most significant change is a disturbance of the mineral (chiefly magnesium) content of the blood. As previously stated the disease is chiefly seen in dairy cows. In many respects it is closely related to milk fever and some success has been claimed for the time honoured milk fever treatment, viz., inflation of the udder, in the treatment of grass tetany.

Cases are usually seen within a month of calving when cows are in heavy milk, but they may appear at any time during the milking period and they often coincide with the periods of heat. Outbreaks are usually associated with more or less continuous feeding on some quickly growing grass, herbage, or fodder crop, hence the name—grass tetany.

The Queensland cases have followed continuous feeding on growing oats and barley, or natural pastures in which a luscious growth of clover was present. One theory suggests that the increased milk production due to the ingestion of these succulent plants has proved too great a strain on the mineral portion of the blood, which cannot be recouped at the same rate from the body reserve, with the result that there is a disturbance in its mineral balance. This may occur although the animal may not actually be suffering from a general mineral deficiency.

A second theory suggests that the cause is dietetic, and that the quickly growing crops in certain localities are deficient in the necessary minerals and are also unbalanced as regards a suitable fodder for the animals concerned. In support of this theory it can be stated that the disease may occur in beef as well as dairy cows, and it has also been occasionally reported in bullocks and calves. The disease has also been responsible for heavy mortalities in sheep in Australia.

Symptoms.

The animals in which the disease is mostly seen are in good condition and they may even be in a fat or plethoric state. Poor animals are rarely affected. A history is often given that the cows were put into a paddock of luscious quickly growing feed from a fortnight to a month before the first cases occur. The outbreak may be confined to one or two animals or a large percentage (10 to 20 per cent.) of the herd

may be affected. The number of cases depends to a large extent on the time of calving in conjunction with the access to the rich feed and also on the resistance of the individual animals. When a large number of cows calve shortly after being turned on to rich pastures in a susceptible area it is probable that several cases will occur.

The symptoms usually appear suddenly. In the most acute cases no sign of disease may be seen, but the cow may be found dead overnight in the paddock from no apparent cause. In the case of dairy cattle the symptoms sometimes occur shortly after the animal has been brought into the yard, or a short time after milking. The cow may appear normal whilst being milked, or at the worst it may be irritable and restless. A little later symptoms of tetany as evidenced by muscular spasms and twitchings may develop. The muscles of the head, neck, body, or limbs may be involved. There is usually a wild look in the eyes, which may roll about in their sockets, and the head may be held up stiffly or thrown about. The animal may walk round in circles in one direction, and twitching of the various muscles may occur. These spasms generally last about ten minutes, when the animal apparently recovers. The spasms may be repeated at frequent intervals and they generally become worse at each turn, until the animal may go down and show evidence of profuse sweating. The breathing becomes deep and rapid and the animal appears to be in great pain. Convulsions may follow during which there are usually uncontrolled leg movements. The animal then appears to become unconscious. It may succumb to this attack or it may later get up, and apart from being stiff it may go on feeding as if nothing had happened. The milk yield is usually diminished whilst the animal is showing evidence of the disease. The spasms may return after an interval of several hours if no treatment is carried out, and the animal will finally collapse and die. The disease is fairly fatal, and a large percentage of the affected animals will die if not treated at the first signs of symptoms.

Recovery or death usually takes place within a few days. The fatal cases are sometimes confused with Tympanites (blown), but there is no excessive gas formation or swelling of the left side in grass tetany.

Treatment.

It is most important that treatment should be carried out as soon as possible after symptoms are observed. Early treatment frequently leads to recovery, whereas the results of delayed treatment are often disappointing. As the disease is considered to be due to a disturbance of the mineral balance of the blood the most successful treatment aims at remedying this condition. In order to do this it is necessary to inject the requisite drugs directly into the jugular vein. The following mixture is recommended for intravenous injection:—

Magnesium chloride	½ oz.
Calcium chloride	1½ oz.
Sterile water	10 oz.

To carry out this treatment the jugular vein should be raised by means of a cord and a bleeding needle is inserted into the vein. The cord is then released and a piece of rubber tubing is attached to the needle and the mixture is either injected into the vein by means of a syringe or it is allowed to flow in by means of gravity. In carrying out this treatment it is necessary to ensure that no air is allowed to

enter the vein and the apparatus should be carefully sterilized before use. This treatment is rather difficult for the untrained person, and it requires considerable practice before it can be successfully carried out.

A more simple line of treatment consists of drenching with the following mixture:—

Epsom salts	10 oz.
Aromatic spirits of ammonia	2 oz.
Ginger	2 oz.
Molasses or treacle	½ lb.
Water	1½ pints

If the cow is given this drench at an early stage of the disease recovery frequently follows. When muscular spasms and pain are pronounced relief may be afforded by the injection of 1 oz. of chloral hydrate dissolved in 1 pint of water well into the rectum by means of a rubber tube. In addition to the above treatment the cows should be kept under observation and made as comfortable as possible. They should not be milked out, but only a little milk should be taken at each milking.

Prevention.

It is much easier and more economical to prevent grass tetany than to attempt to cure it. In some districts where conditions are favourable and where the disease is seasonal and makes its appearance about the same time each year it should be expected, and the following preventive measures should be carried out:—

(1) A lick comprised of the following medicaments should be available to the cattle at all times:—

Sterilised bone meal ..	50 per cent.
Epsom salts	5 per cent.
Coarse salt	42 per cent.
Sulphate of iron	3 per cent.

(2) Cows which are due to calve and those which have recently calved should be carefully managed, and the period of time they are allowed to feed on quickly growing crops should be restricted.

(3) Epsom salts at the rate of 8 oz. to each 30 gallons should be added to the drinking water during the season when cases are expected to occur.

MEETING TROUBLES.

Some people never stop moaning. They spend their lives talking about their woes. Without a cross or two we would never develop character. It is the way that we meet our difficulties that we prove our worth. The weakling prays for deliverance; the stoic prays for strength. A strong character has no time for an easy life and a smooth path, but for power to conquer, ability to surmount, and grace to persevere. Difficulties, hard work, setbacks of any kind are the gist, spice, and joy of life, and things that make life interesting to the strong and troublesome to the weak. Work—mental and physical activity—is life's greatest gift to the one who really loves life, and a reverse is the jewel that makes that gift worth while—priceless.—C.C., Strathfield, in "Sydney Morning Herald."

Rations for Dairy Cows.*

E. H. GURNEY, Senior Analyst.

FEEDERS of dairy stock frequently forward to the Department lists of food material available to them, desiring to know how to make balanced rations from such material. On account of this it was thought that examples of rations made up with various feeds might prove useful, some of the examples being composed of foodstuffs named in the list mentioned above.

The Agricultural Chemist, Mr. J. Brünnich, has written a pamphlet entitled "Stock Foods," in which the objects of feeding, description and analyses of various stock foods, and the making up of rations are all very fully detailed, and with this information the dairy farmer can judge how to feed to the best advantage.

Modern experience has shown that rations with somewhat lower protein content than was previously considered necessary can be successfully used.

Examples of rations computed from analyses of feed-stuffs contained in "Stock Foods" are given below, and are in accordance with the feeding standards for dairy cows published in "Feeds and Feeding Abridged," by Henry and Morrison.

Professor J. K. Murray states that this standard is referred to in lectures in the Agricultural Course at the Queensland University.

HENRY AND MORRISON FEEDING STANDARD.

—	Digestible Crude Protein.	Total Digestible Nutrients.
Dairy Cows.		
For maintenance of a 1,000-lb. cow	0·700	7·925
To allowance for maintenance add—		
For each 1 lb. of 2·5 per cent. milk ..	0·045—0·053	0·230—0·256
For each 1 lb. of 3·0 per cent. milk ..	0·047—0·057	0·257—0·286
For each 1 lb. of 3·5 per cent. milk ..	0·049—0·061	0·284—0·316
For each 1 lb. of 4·0 per cent. milk ..	0·054—0·065	0·311—0·346
For each 1 lb. of 4·5 per cent. milk ..	0·057—0·069	0·338—0·376
For each 1 lb. of 5·0 per cent. milk ..	0·060—0·073	0·362—0·402
For each 1 lb. of 5·5 per cent. milk ..	0·064—0·077	0·385—0·428
For each 1 lb. of 6·0 per cent. milk ..	0·067—0·081	0·409—0·454
For each 1 lb. of 6·5 per cent. milk ..	0·072—0·085	0·434—0·482
For each 1 lb. of 7·0 per cent. milk ..	0·074—0·089	0·454—0·505

Then upon this standard a 1,000-lb. cow, yielding 25 lb. of milk of 3·5 per cent. fat, would require from a minimum amount of digestible crude protein $0{\cdot}049 \times 25 = 1{\cdot}225 + 0{\cdot}7 = 1{\cdot}925$ lb. to a maximum amount $0{\cdot}061 \times 25 = 1{\cdot}527 + 0{\cdot}7 = 2{\cdot}225$ lb.; and this cow would require from a minimum amount of total digestible nutrients $0{\cdot}284 \times 25 = 7{\cdot}1 + 7{\cdot}925 = 15{\cdot}025$ lb. to a maximum amount $0{\cdot}316 \times 25 = 7{\cdot}900 + 7{\cdot}925 = 15{\cdot}825$ lb.

* Published originally in the "Queensland Agricultural Journal" for December, 1931, and reprinted in response to a general request.—Ed. Q.A.J.

Again, a 1,000-lb. cow, yielding 25 lb. of milk of 4·0 per cent. fat, would require from 2·05 lb. to 2·325 lb. digestible crude protein, and from 15·7 lb. to 17·57 lb. total digestible nutrients,

The term "nutritive ratio" means that amount of digestible protein that exists in a feed compared with the amount of non-nitrogenous digestible nutrients in that feed. As fat is capable of producing more heat when digested than the other nutrients, the fat content in the following rations has been multiplied by 2·3 and the product added to the amount of digestible carbohydrate and fibre—this total divided by the digestible protein gives the "nutritive ratio" of the ration. Thus in No. 1 ration there is one part of digestible protein to six parts of other digestible nutrients.

When considering rations for animals it must be understood that other factors, beside the digestible crude protein and total digestive nutrients supplied to the animal, must be taken into account, such as succulence, palatability, and variety of feeds.

Proteins are very complex bodies, and different proteins yield different substances when digested, and a number of these different substances have to be supplied by the food for satisfactory nutrition. Therefore there is less chance of feeding an unbalanced protein content by using several feedstuffs than by using only one or two.

Rations are useful guides in feeding, but it must be noted that the analyses of the feedstuffs from which they are computed are averages only—that is to say, the composition of the feedstuffs varies according to soil and climate wherein grown, and particularly to the age of growth when harvested.

The legumes, such as lucerne, cowpea, clover, &c., are characterised by the high amount of phosphorus and lime (particularly lime) they contain. Therefore, when animals graze on grass pastures growing upon soils deficient in phosphoric acid and lime, the inclusion of a legume in a ration is of particular value to these animals supplying both protein and mineral matter. Bran is also relatively rich in phosphorus.

There is in very many cases a deficiency of phosphoric acid in the pasturage grazed by dairy stock. When such deficiency occurs the rations should be supplemented by the addition of from 2 to 4 oz. of a mixture of finely ground Nauru phosphate and salt. The mixture is in the proportion of two parts by weight of finely ground steamed bonemeal or calphos* or finely ground Nauru phosphate to one part by weight of salt.

Another consideration is the cost of a particular ration—whether it pays, when it is compared with the price obtained from the milk produced. But care should be taken that blame for unprofitable feeding is not placed upon the ration, when the fault is due to the cow. Some cows are capable of producing a large amount of milk, other cows are only capable of yielding a small amount of milk, even when supplied with ample well-balanced feed; such poor producers do not pay, and should be culled out from the herd.

* Calphos is a bone preparation obtainable at the Brisbane Abattoir.

RATIONS PER 1,000-LB. COW YIELDING 25 LB. MILK.

—	Dry Matter.	Digestible Nutrients.				Total Digestible Nutrients.	Nutritive Ratio.
		Crude Protein.	Fat.	Carbo-hydrates.	Fibre.		
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	
1—							
40 lb. Green Sorghum ..	8·0	0·48	0·08	2·32	1·36		
60 lb. Mixed Pasture (average)	12·0	0·53	0·12	3·48	3·01		
8 lb. Lucerne Chaff ..	7·4	1·24	0·05	2·22	0·67		
	27·4	2·25	0·25	8·02	5·04	15·5	1 ÷ 6·0
2—							
65 lb. Green Sorghum ..	13·0	0·78	0·13	3·76	2·14		
7 lb. Lucerne Chaff ..	6·4	1·08	0·04	1·95	0·58		
7 lb. Maize Meal	6·0	0·35	0·21	4·20	0·07		
	25·4	2·21	0·38	9·91	2·79	15·3	1 ÷ 6·1
3—							
45 lb. Green Sorghum ..	9·0	0·54	0·09	2·61	1·49		
13 lb. Wheat Chaff	11·3	0·27	0·12	3·39	2·04		
3 lb. Bran	2·6	0·37	0·05	1·21	0·10		
2¾ lb. Cotton Seed Meal (decorticated)	2·5	0·96	0·17	0·54	0·06		
2 lb. Molasses	1·5	0·02	..	1·15	..		
	27·9	2·16	0·43	8·90	3·69	15·2	1 ÷ 6·2
4—							
50 lb. Green Sorghum ..	10·0	0·60	0·10	2·90	1·70		
40 lb. Green Cowpea ..	8·8	0·64	0·12	2·92	1·14		
3 lb. Bran	2·6	0·37	0·05	1·21	0·10		
1¾ lb. Cotton Seed Meal (decorticated)	1·6	0·61	0·11	0·34	0·03		
4 lb. Molasses	3·0	0·04	..	2·29	..		
	26·0	2·26	0·38	9·66	2·97	15·3	1 ÷ 5·5
5—							
42 lb. Sorghum Silage ..	10·7	0·38	0·08	3·06	2·06		
9 lb. Lucerne Chaff ..	8·3	1·39	0·06	2·49	0·75		
7 lb. Maize Meal	6·0	0·35	0·21	4·20	0·07		
	25·0	2·12	0·35	9·75	2·88	15·1	1 ÷ 6·3
6—							
35 lb. Sorghum Silage ..	8·9	0·31	0·07	2·55	1·71		
5 lb. Lucerne Chaff ..	4·6	0·77	0·03	1·38	0·42		
6 lb. Wheat Chaff	5·3	0·12	0·05	1·56	0·96		
2 lb. Linseed Oil Meal ..	1·8	0·44	0·15	0·63	0·09		
3 lb. Pollard	2·7	0·41	0·09	1·62	0·06		
3 lb. Rice Meal	2·7	0·20	0·28	1·50	0·06		
	26·0	2·25	0·67	9·24	3·30	15·5	1 ÷ 6·2

RATIONS PER 1,000-LB. COW YIELDING 25 LB. MILK—*continued.*

—	Dry Matter.	Digestible Nutrients.				Total Digestible Nutrients.	Nutritive Ratio.
		Crude Protein.	Fat.	Carbo-hydrates.	Fibre.		
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	
7—							
65 lb. Green Maize	11·7	0·65	0·19	3·90	2·01		
8 lb. Lucerne Chaff ..	7·4	1·24	0·05	2·22	0·67		
7 lb. Maize Meal	6·0	0·35	0·21	4·20	0·07		
	25·1	2·24	0·45	10·32	2·75	15·7	1 ÷ 6·3
8—							
54 lb. Green Maize	9·7	0·54	0·16	3·24	1·67		
10 lb. Wheat Chaff	8·7	0·21	0·09	2·61	1·57		
3 lb. Maize Meal	2·6	0·15	0·09	1·80	0·03		
3 lb. Bran	2·6	0·37	0·05	1·21	0·10		
2¾ lb. Cotton Seed Meal (decorticated)	2·5	0·96	0·17	0·54	0·06		
	26·1	2·23	0·56	9·40	3·43	5·6	1 ÷ 6·3
9—							
30 lb. Maize Silage	9·0	0·30	0·09	3·21	1·56		
5 lb. Good Bush Hay ..	4·6	0·14	0·03	1·20	1·13		
4 lb. Cowpea Chaff ..	3·6	0·45	0·07	0·76	0·54		
5 lb. Maize Meal	4·4	0·25	0·15	3·00	0·05		
3 lb. Cocoanut Cake ..	2·6	0·40	0·21	1·19	0·20		
1 lb. Blood Meal	0·9	0·67	0·01	0·05	..		
	25·1	2·21	0·56	9·41	3·48	15·6	1 ÷ 6·4
10—							
35 lb. Maize Silage	10·5	0·35	0·10	3·75	1·82		
8 lb. Lucerne Chaff ..	7·4	1·24	0·05	2·22	0·67		
7 lb. Barley Meal	6·2	0·65	0·06	4·27	0·21		
	24·1	2·24	0·21	10·24	2·70	15·4	1 ÷ 6·0
11—							
80 lb. Green Paspalum ..	20·0	1·20	0·16	5·60	4·96		
6 lb. Lucerne Chaff ..	5·5	0·93	0·04	1·67	0·50		
	25·5	2·13	0·20	7·27	5·46	15·0	1 ÷ 1·6
12—							
67 lb. Green Paspalum ..	16·5	1·00	0·13	4·69	4·15		
3 lb. Maize Meal	2·6	0·15	0·09	1·80	0·03		
3 lb. Bran	2·6	0·37	0·05	1·21	0·10		
2 lb. Cotton Seed Meal (decorticated)	1·8	0·70	0·13	0·39	0·04		
	23·5	2·22	0·40	8·09	4·32	15·0	1 ÷ 6·0
13—							
100 lb. Sudan Grass	22·0	1·50	0·10	7·50	3·80		
4½ lb. Lucerne Chaff ..	4·1	0·70	0·03	1·25	0·37		
	26·1	2·20	0·13	8·75	4·17	15·3	1 ÷ 6·0

RATIONS PER 1,000-LB. COW YIELDING 25 LB. MILK—*continued.*

	Dry Matter.	Digestible Nutrients.				Total Digestible Nutrients.	Nutritive Ratio.
		Crude Protein.	Fat.	Carbo-hydrates.	Fibre.		
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	
14—							
100 lb. Sudan Grass	22·0	1·50	0·10	7·50	3·80		
3 lb. Bran	2·6	0·37	0·05	1·21	0·10		
1 lb. Cotton Seed Meal (decorticated)	0·9	0·35	0·07	0·19	0·02		
	25·5	2·22	0·22	8·90	3·92	15·3	1 ÷ 6·0
15—							
50 lb. Sudan Grass	11·0	0·75	0·05	3·75	1·90		
8 lb. Wheat Chaff	7·0	0·16	0·07	2·09	1·29		
4 lb. Lucerne Chaff ..	3·7	0·62	0·02	1·11	0·33		
3 lb. Maize Meal	2·6	0·15	0·09	1·80	0·03		
2 lb. Linseed Oil Meal ..	1·8	0·44	0·15	0·63	0·09		
	26·1	2·12	0·38	9·38	3·64	15·5	1 ÷ 6·5
16—							
20 lb. Green Oats	4·6	0·28	0·08	1·30	0·98		
8 lb. Lucerne Chaff ..	7·4	1·24	0·05	2·22	0·67		
10 lb. Wheat Chaff	8·8	0·21	0·09	2·61	1·61		
3 lb. Cocoanut Cake ..	2·6	0·40	0·22	1·19	0·20		
3 lb. Molasses	2·3	0·03	..	1·72	..		
	25·7	2·16	0·45	9·04	3·46	15·1	1 ÷ 6·3
17—							
25 lb. Green Barley	5·2	0·45	0·10	1·50	1·07		
13 lb. Wheat Chaff	11·4	0·27	0·11	3·40	2·10		
6 lb. Lucerne Chaff ..	5·5	0·93	0·04	1·67	0·50		
2 lb. Linseed Oil Meal ..	1·8	0·44	0·15	0·63	0·09		
3 lb. Molasses	2·3	0·03	..	1·72	..		
	26·2	2·12	0·40	8·92	3·76	15·2	1 ÷ 6·4
18—							
60 lb. Sugar-cane Tops ..	16·8	1·02	0·18	5·64	3·90		
10 lb. Cowpea Chaff ..	9·2	1·12	0·19	1·90	1·35		
	26·0	2·12	0·37	7·54	5·25	15·3	1 ÷ 6·4
19—							
50 lb. Sugar-cane Tops ..	14·0	0·85	0·15	4·70	3·25		
30 lb. Green Cowpea ..	6·6	0·48	0·09	2·19	0·84		
5 lb. Lucerne Chaff ..	4·6	0·77	0·04	1·38	0·42		
	25·2	2·10	0·28	8·27	4·51	15·2	1 ÷ 6·3
20—							
35 lb. Elephant Grass ..	7·0	0·32	0·07	2·03	1·75		
35 lb. Imphee	7·0	0·42	0·07	2·03	1·15		
8 lb. Lucerne Chaff ..	7·4	1·24	0·05	2·22	0·67		
5 lb. Maize Meal	4·4	0·25	0·15	3·00	0·05		
	25·8	2·23	0·34	9·28	3·62	15·5	1 ÷ 6·1

RATIONS PER 1,000 LB. COW YIELDING 25 LB. MILK—*continued.*

	Dry Matter.	DIGESTIBLE NUTRIENTS.				Total Digestible Nutrients.	Nutritive Ratio.
		Crude Protein.	Fat.	Carbo-hydrates.	Fibre.		
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	
21—							
35 lb. Elephant Grass ..	7·0	0·32	0·07	2·03	1·75		
35 lb. Imphee	7·0	0·42	0·07	2·03	1·15		
10 lb. Pumpkins	1·7	0·15	0·06	0·80	0·16		
7 lb. Lucerne Chaff ..	6·4	1·08	0·04	1·95	0·58		
5 lb. Maize Meal	4·4	0·25	0·15	3·00	0·05		
	26·5	2·22	0·39	9·81	3·69	16·1	1 ÷ 6·4
22—							
65 lb. Mixed Pasture (average)	13·0	0·57	0·13	3·77	3·26		
9 lb. Lucerne Chaff ..	8·3	1·39	0·05	2·50	0·75		
5 lb. Maize Meal	4·4	0·25	0·15	3·00	0·05		
	25·7	2·21	0·33	9·27	4·06	15·8	1 ÷ 6·3
23—							
15 lb. Poor Bush Hay ..	14·0	0·21	0·08	2·77	3·03		
10 lb. Pumpkins	1·7	0·15	0·06	0·80	0·16		
5 lb. Lucerne Chaff ..	4·6	0·77	0·03	1·38	0·42		
7 lb. Maize Meal	6·1	0·35	0·21	4·20	0·07		
1 lb. Blood Meal	0·8	0·66	0·02	0·06	..		
	27·2	2·14	0·40	9·21	3·68	15·4	1 ÷ 6·4
24—							
65 lb. Prairie Grass	15·1	1·95	0·26	4·29	2·75		
5 lb. Wheat Chaff	4·4	0·10	0·04	1·30	0·80		
5 lb. Maize Meal	4·4	0·25	0·15	3·00	0·05		
1 lb. Molasses	0·7	0·01	..	0·57	..		
	24·6	2·31	0·45	9·16	3·60	15·5	1 ÷ 5·9

It has been mentioned before that better results are obtained from rations composed of a variety of feed ingredients than from a ration made up with only one or two feedstuffs.

A very convenient method is to have on hand a quantity of the concentrates already mixed, and then to feed a certain quantity of this mixture with the roughage that is being used, increasing the quantity of the mixture used until it is noticed that no further increased milk production is obtained. An example of this procedure has been published in the "Live Stock Bulletin" under the heading of "4-2-1" plan; this meaning that a concentrate mixture is made of four parts maize meal, two parts ground oats, and one part linseed meal. The abovementioned paper recommends the following:—3 lb. of silage and 1 lb. of legume hay for every 100 lb. of the animal's body weight, and to gradually increase the amount given of the concentrate mixture until the cow is getting 1 lb. for every 5 lb. of milk produced. Thus a 1,000-lb. cow, yielding 25 lb. of milk, would be given a ration of 30 lb. maize

silage, 10 lb. lucerne hay, and 5 lb. of the concentrate mixture—containing 2·26 lb. digestible crude protein and 13·6 lb. total digestible nutrients. This ration has the amount of digestible crude protein required by the Henry and Morrison standard, but has a somewhat lower amount of total digestible nutrients. Other concentrates can be used in this convenient manner.

For instance, a concentrate mixture could be prepared by mixing eight parts maize meal, one part bran, and one part cotton seed meal. This mixture would have the following composition:—

—	Dry Matter.	Digestible.			
		Crude Protein.	Fat.	Carbo-hydrates.	Fibre.
	Lb.	Lb.	Lb.	Lb.	Lb.
1 lb. Concentrate Mixture	0·87	0·088	0·032	0·539	0·014
5 lb. Concentrate Mixture	4·3	0·44	0·16	2·69	0·07

If 4 lb. maize silage and 1 lb. lucerne chaff be used for every 100 lb. live weight, and 1 lb. of the above concentrate mixture for every 5 lb. of milk produced, the following will be the ration for a 1,000 lb. cow yielding 25 lb. of milk:—

—	Dry Matter.	Digestible.				Total Digestible Nutrients.	Nutritive Ratio.
		Crude Protein.	Fat.	Carbo-hydrates.	Fibre.		
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	
40 lb. Maize Silage	12·0	0·40	0·12	4·27	2·08		
10 lb. Lucerne Chaff	9·2	1·55	0·07	2·77	0·84		
5 lb. Concentrate Mixture ..	4·3	0·44	0·16	2·69	0·07		
	25·5	2·39	0·35	9·73	2·99	15·5	1 ÷ 5·6

The amount of digestible crude protein is a little higher in this ration than is required by the standard.

The following extracts from the "Agricultural Gazette" of New South Wales, December, 1927, are given as an illustration of what complete feeding, when combined with high milk-producing power, can accomplish:—

"On 15th October, 1927, Wagga Gladys, the seven-year old Jersey cow of the Hawkesbury Agricultural College herd, completed 365 days' official test for a yield of 20,835 lb. milk, with an average test of 5·52

per cent. and 1,149,385 lb. butter fat, which is equivalent to 1,384·8 lb. commercial butter. This is an official world's record for both milk and butter fat production for the Jersey breed. It was achieved on twice-a-day milking, whereas all the great records in other countries have been made on three and four milkings a day. Wagga Gladys calved on 9th November, 1926, and on the day of her last periodical test she yielded 53·5 lb. milk and 3·694 lb. butter fat in twenty-four hours."

The following is extracted from the "Agricultural Gazette" of New South Wales, October, 1927, and shows the ration fed to Wagga Gladys, together with the record of her 273 days' performance:—

"On her present lactations as a seven-year-old, which is still in progress, she has produced for the first nine-months period 15,951 lb. milk, of 5·3 per cent. test, 839,814 lb. butter fat, being equal to 1,011·8 lb. commercial butter. . . . On the hypothesis that feeding must be linked with breeding to secure high production, an indication of the ration fed to Wagga Gladys may be given.

"*Concentrates.*—The following mixture was fed daily at the rate of 1 lb. to every 3½ lb. milk produced:—300 lb. maize meal, 200 lb. bran, 100 lb. crushed oats, 50 lb. linseed meal. During March and April the mixture was altered by the substitution of 25 lb. cotton seed meal for 25 lb. of the linseed meal.

"*Bulk Ration.*—The daily bulk ration consisted of:—25 lb. maize silage, 10 lb. lucerne chaff (of poor quality during May), 3 lb. bran, and 1½ lb. linseed meal. During March and April half the linseed meal was replaced by an equal amount of cotton seed meal. During the latter half of the month of March the silage was replaced by an equal amount of green corn stalks chaffed.

"*Grazing.*—The pastures were very poor, except after the Easter rain. In December, Wagga Gladys was grazed on a poor stand of green lucerne for two days prior to test. In January, she was grazed on green lucerne for two hours daily for a week previous to test. In February, March, and April, she was grazed on green lucerne for two hours daily, and in May and June for one hour daily. In July, green oats were given for a week previous to the test; Gladys and the whole herd went off in butter fat yield this month, and the green oats were blamed. In August, she was grazed on green lucerne for two hours daily."

It will be interesting to compare the abovementioned cow's milk production and her feeding with the standard used in computing the examples of rations previously given. The weight of Wagga Gladys is not known, and though it may not be 1,000 lb. live weight, this figure will be used for the sake of comparison.

The cow produced 15,951 lb. milk in 273 days—that is, 58·4 lb. of milk per day, of 5·3 per cent. fat. Using the minimum requirements of the standard, the cow should receive 4·32 lb. digestible crude protein and 29·7 total digestible nutrients.

The cow produced on an average 58·4 lb. of milk per day, and it is stated that for every 3½ lb. of milk produced 1 lb. of the mixed con-

centrate was given; therefore, 16·6 lb. mixed concentrate was fed daily. The following is the total ration fed:—

	Dry Matter.	Digestible Nutrients.				Total Digestible Nutrients	Nutritive Ratio.
		Crude Protein.	Fat.	Carbo-hydrates.	Fibre.		
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	
Bulk Ration—							
25 lb. Maize Ensilage ..	7·5	0·25	0·07	2·67	1·30		
10 lb. Lucerne Chaff ..	9·2	1·55	0·07	2·77	0·84		
3 lb. Bran	2·6	0·37	0·05	1·21	0·10		
1·5 lb. Linseed Meal ..	1·3	0·33	0·11	0·47	0·06		
16·6 lb. Mixed Concentrate	14·6	1·50	0·52	8·20	0·37		
	35·2	4·00	0·82	15·32	2·67	22·8	1 ÷ 4·9
Allowing 10 lb. Green Lucerne for one hour's grazing ..	2·4	0·32	0·04	0·63	0·29		
	37·6	4·32	0·86	15·95	2·96	24·0	1 ÷ 4·8
Or—							
Allowing 20 lb. Green Lucerne for two hours' grazing ..	4·8	0·64	0·08	1·26	0·58		
	40·0	4·64	0·90	16·58	3·25	25·4	1 ÷ 4·7

It will be seen that the digestible crude protein, 4·32 lb., agrees with that required by the standard, and that the amount of total digestible nutrients of this ration is somewhat lower.

WATER ELEVATOR.

This device, reprinted from "The Canegrowers' Weekly" (Mackay), should be of interest to farmers with a creek frontage:—

A length of No. 8 fencing wire is stretched from a post at the top of the bank to a stake driven into the creek bed, in such a position that the lower end of the wire will be completely under water. A bucket is suspended from the wire by means of a pulley and snap hoop. A weight must be attached to the side of the bucket in order to sink it. The bucket is operated by a rope, either with the hand or with a small windlass.

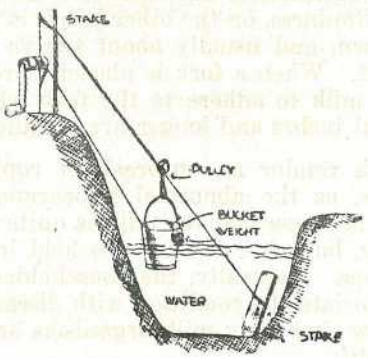

PLATE 10.

Ropiness in Cream.

By E. B. RICE, Dairy Research Laboratory.

DURING a recent visit to the Laidley Butter Factory for the purpose of carrying out certain scientific investigations, the attention of the writer was drawn to a can of ropy cream on the platform. It was pointed out that, in spite of all efforts on the part of the farmer concerned to combat the trouble, intermittent outbreaks of ropiness occurred.

An inspection of the farm supplying the cream was made, and samples from various sources which were suspected of harbouring the particular casual organism were collected. Upon arrival back at the factory preliminary work was commenced which was followed up upon return to the Dairy Research Laboratory. Finally a bacterium, which reproduced the ropy or slimy condition when inoculated into fresh and sterilized milk and cream, was isolated. The source of this organism on the farm was the water from a tank adjacent to the milking shed. Cultural and other laboratory tests demonstrated that the organism was *Bacterium viscosum*, a common cause of ropiness in dairy products in many countries.

It may be mentioned that a large and deep dam is situated on the property, and attention was focussed on this as being the most probable source of the trouble, it being thought that the udders and other parts of the bodies of the animals were contaminated while they were wading in the dam. However, attempts to isolate the bacterium from this water yielded negative results. This case goes to show very clearly how the origin of a defect which may mean considerable monetary loss to the farmer may lie in the least suspected quarter.

For the information of farmers who may at times be faced with the ropy milk problem, a brief description of the defect, the responsible organisms, the methods by which they may gain access to the milk, and means for their eradication are given below.

General.

Ropiness in milk or cream must first of all not be confused with gargety or mammitis milk. All practical farmers are aware that the latter condition is present immediately the milk is withdrawn from the udder of the affected animal. The condition observed in mammitis milk arises from the disintegration of the tissues of the udder as a result of bacterial infection. Ropiness, on the other hand, is never observed when the milk is first drawn, and usually about twelve hours elapse before the defect is apparent. When a fork is placed in ropy milk the viscous condition causes the milk to adhere to the fork when it is withdrawn, so that threads several inches and longer are obtained (see photograph).

To the city milk vendor an outbreak of ropiness may result in severe monetary loss, as the abnormal appearance renders the milk unsaleable. It often happens that the milk is quite normal when palced in the customer's jug, but after it has been held in the home for some hours ropiness develops. Naturally, the householder becomes suspicious and is inclined to associate the condition with disease. In reality, there is no evidence to show that ropy milk organisms are in any way detrimental to human health.

Peculiarly, in contrast with most microbial defects, ropiness is often encountered in dairies where all operations are conducted with scrupulous care. The milk, too, is often sweet to the taste on account of the normal souring being retarded.

Various Ropy Organisms.

The organisms mainly responsible for ropiness are—

1. *Bacterium viscosum.*—This bacterium which grows well at ordinary temperatures is usually overgrown by the rapid development of the common milk souring germ, *Streptococcus lactis.* Where low temperatures prevail, in the vicinity of 50°F., the growth of *S. lactis* is greatly retarded, but *B. viscosum,* which is able to grow faster at this temperature, is able to gain control of the fermentation. When cultivated in milk a gummy capsule surrounds the cell, which causes the viscid or ropy condition. *B. viscosum* was the organism responsible for the Laidley outbreak.

2. *Escherischia-Aerobacter Group.*—These organisms grow best at blood heat (98·6°F.). Their natural habitat is the intestinal canal of man and animals, on fodder and grains, and in the soil. Again ropiness is attributed to capsules formed by the cells.

3. An organism known as *Micrococcus freudenrichii* has been reported in Europe as being the cause of ropiness. It is frequently found in milk.

4. *Streptococcus lactis,* var. *Hollandicus.*—This organism is more particularly concerned with ropiness in cheese starters. The conditions result from the cells growing together in long chains.

Occurrence.

Under the usual conditions in the dairy the ropy bacteria are overgrown by the common milk souring bacterium, *S. lactis.* When conditions do obtain which allow them to gain control of the fermentation, it is only by persistent effort and attention to detail in all farm practices that they can be eliminated.

The experience of overseas observers points to ropiness being of more frequent occurrence in the winter months on account of *Bacterium viscosum,* perhaps the most common causal agent, being able to thrive at temperatures which are too low for other species to proliferate. From information gleaned during the course of many conversations with farmers at field days, which have been held recently under the Dairy Cattle Improvement Act, there is reason to believe that in this State the defect assumes more serious proportions in the warmer months of the year. This is also borne out by the number of samples which are arriving in the laboratory now that summer conditions have set in. The *Escherischia-Aerobacter* group, which grow better at higher temperatures, are frequently isolated from samples of ropy milk and cream, in which they occur in large numbers when responsible for the ropy condition.

The ropy milk organisms are common inhabitants of swamps, bogholes, or other places where stagnant water is lying. Through the animals wading into such places the udder, flanks, and other parts of the body become infested, and later in the milking process the bacteria are dislodged and fall into the milking pail. Water which is suspected of harbouring these organisms should never be used for washing-up purposes without previous boiling. Boiling will completely destroy the

organisms. Once established in the dairy they are often able to be isolated from the dust on the floors of the bails and walls themselves. A thorough cleaning up of the stables is the first step in the campaign of elimination. Disinfection may be resorted to, either using a limewash or chlorine solution. Chlorine solutions in appropriate dilutions can be made up from the concentrated commercial preparations which are obtainable from stores in all dairying districts, and the directions on the package should be closely followed.

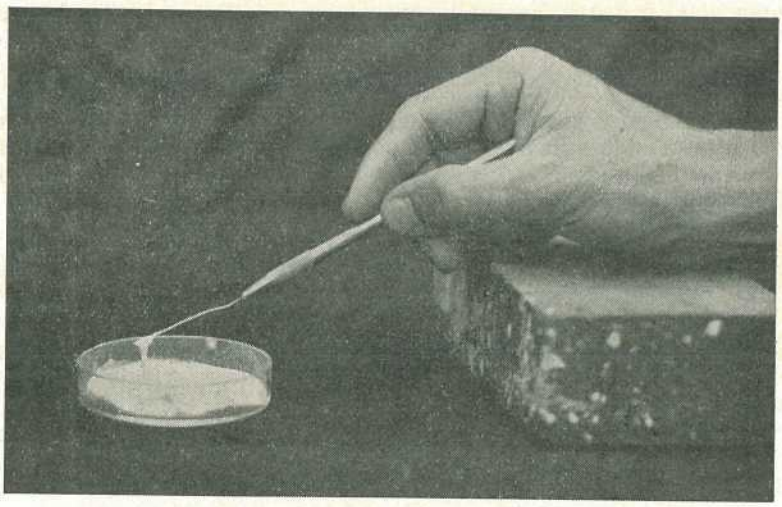

PLATE 11.
ROPY MILK.
Showing Ropiness produced by *B. viscosum* after inoculation into sterile milk.

Control of Ropiness.

Before remedial measures which will be of permanent benefit can be applied, it is first essential to ascertain the source of the organisms, otherwise only temporary relief is the most that can be expected from any steps taken towards control of the defect.

The factors which may be regarded as being of most significance in outbreaks of ropiness, in their order of importance, are—

(1) Improperly sterilized utensils.
(2) The use of impure washing-up water.
(3) Dust falling from the body of the animal into the pail during milking. The organisms adhering to the dust particles may come from the animals wading in contaminated water or from dust in the stables.

In the extermination of the infestation attention should be given to the following:—

(1) Keep the hands perfectly clean during milking.
(2) Scald and thoroughly dry all utensils.
(3) Before milking wipe the udders and flanks with a clean cloth which has been moistened with dilute Condy's fluid or chlorine solution.
(4) Boil all water used for washing-up purposes.
(5) Maintain bails and dairy buildings in as clean a condition as possible. Disinfection or limewashing may be advisable.

Butter—Over-Run Explained.

By G. B. GALLWEY, A.F.I.A., A.A.A., A.A.I.S., Inspector of Accounts, Dairy Produce Acts.

OVER-RUN is a subject that the supplier of cream to a butter factory should understand and know what it is and how it comes about.

It is peculiar to the dairying industry, for the dairy farmer is paid for more butter than is actually in the cream which he supplies. The reason for this is that during the process of churning the butter maker, in addition to consolidating the butter fat in the cream supplied by the farmer, adds moisture and salt to it, which correspondingly increases the weight of the resultant butter, as compared with the butter fat in the cream when received at the factory.

Over-run is defined as being the excess of the quantity of butter actually manufactured over the quantity of the commercial butter content of all cream, received at a butter factory, as estimated from the chart approved. In other words, it is the quantity of butter in excess of that estimated prior to actual manufacture. Therefore, in order to find the over-run it is necessary to ascertain the difference between the quantity of commercial butter as estimated by the chart and the quantity of commercial butter obtained from such cream. This is ascertained from a specially prepared chart which is so calculated as to show at a glance the quantity of commercial butter which should be made from any given weight of cream testing between 29 per cent. and 50 per cent. butter fat.

The basis on which the chart is moulded is to assume that the average moisture content of butter will be 14 per cent. plus the addition of salt. As both these constituents are bound to vary in the actual butter when made, it is obvious that the only method which will assure to the farmer a full return for the actual butter made from his cream is a system which provides that he shall have credited to him any additional commercial butter which the factory has produced, over and above that which has been credited to him in accordance with the quantity calculated by means of the chart.

The factors which affect the estimated quantity of butter manufactured are governed largely by the exactness or otherwise of the factory hands performing the duties of weighing, sampling, testing, and recording of the cream on its arrival at the factory. It can be set down definitely that when cream arrives at a factory it has a certain weight, and that it contains a certain percentage of butter fat. It is the duty of the factory staff to weigh and test this cream correctly and to record the result accurately.

Control of Over-run.

The correctness of all scales at a butter factory is an important factor in the controlling of over-run. It must be remembered that scales at a factory are subject to inspection by the Weights and Measures Department and the farmer's scales are not so checked. It is part of the routine duty in a factory, before commencing operations each day, to check and adjust the scales with a standard weight. Weights are important because they are the first items in estimating the manufacture and can raise or lower the over-run, as the case may

be. The reason is that, if the weights are entered as higher than the actual quantity received, they increase the estimated manufacture and decrease the difference between it and the actual manufacture. On the other hand, if the weights are lowered the estimated butter is correspondingly less and the difference between it and that actually manufactured is increased.

The testing of the cream for its butterfat content is a factor equally important as that of weighing. Care should be taken to see that all glassware used in this connection has been approved by the Department of Agriculture and Stock. All glassware passed by the Agricultural Chemist is marked indelibly with the D/A stamp. In testing the cream care should be taken to see that the samples are taken correctly and treated prior to and during testing. The reading of the tests is important, for they operate in the same way as the weights. Reading the test above its correct percentage means that the estimated butter is increased and the over-run decreased; while reading the test below its correct percentage means that the estimated butter is decreased and the over-run increased.

Both these factors, weights and tests, can operate independently or together. For example, the weights may be raised or lowered and the test read correctly; or the test raised or lowered; or both weight and test may be recorded above or below the correct figure. Every change, whatever it is, will affect the over-run either one way or the other. Another aspect which has a considerable bearing on over-run is the generally accepted factory practice to weigh to the nearest pound and to read the test to the nearest percentage mark.

In ordinary circumstances, it is claimed that this give and take system works sufficiently accurately and equitably for factory practice. Still there are possibilities that a set of circumstances may operate under this system which may affect the over-run appreciably, but on the law of averages such occasions would be very rare. Therefore, provided that the system is carefully followed, the farmer need have no fear on this score, particularly as such a practice saves the factory from working in fractions, and as the farmer owns the factory, this system is indirectly a saving to the farmer. In any case, these factors do not affect the ultimate quantity of butter acually made, but merely influence the estimated quantity of butter obtainable, and this either raises or lowers the over-run, the value of which is eventually paid to the farmer.

Another aspect of platform operations which may affect over-run is the loss of cream, which occurs after weighing. In such circumstances, it should be obvious that the quantity of butter estimated will not be realised because of the fact that, since weighing, a portion of the butter-fat has been lost, and is therefore not available for churning. Careless handling in this regard may even bring about an under-run. Here, as in the case of fat loss in buttermilk, is emphasised the need for care in respect of these particular operations.

The Influence of Factory Processes.

The next step in considering over-run is the actual manufacture and the factors involved are the process of churning, the composition of the butter and the loss of butter.

The first of these is principally of a technical nature and occurs through loss of butter-fat in the butter milk, which is influenced by the size of the grain and churning temperature. Other reasons can be given for this loss, and these include:—

1. Some types of machinery used are liable to increase the normal loss of butter-fat; and
2. The temperature of the cream, the capacity of the churn, and the condition of the equipment.

These can be overcome only by practical work and experience, and the buttermaker learns the best temperature at which to churn and the quantity of cream to place in the churn to control this loss. However, it must be remembered that even these factors vary in different districts.

The composition of the butter is an important factor in the manufacture of the product and the over-run. There is a maximum and minimum range of moisture within which the buttermaker must work, and this is the legal standard of 16 per cent. and the chart standard of 14 per cent.

No butter can be exported or sold within Australia which contains more than 16 per cent. of moisture, and the buttermaker must, therefore, not exceed this quantity. With the fine control which can now be exercised by the buttermaker over the manufacturing process, the legal standard of 16 per cent. can be exceeded appreciably and the over-run correspondingly increased. However, such an action on the part of a factory is unfair to the consumer, besides being a breach of the law. Salt has only a minor influence and assists to make the over-run.

How Butter Loss Occurs.

Loss of butter occurs through the machines used in cutting butter into pats and packing into boxes. There must always be some loss on the patting machines, but where care is exercised this is not a very important factor. The greatest loss takes place in packing bulk butter at the factory.

The Commonwealth Government requires every box of butter exported to contain 56 lb. 2 oz., and such butter is always taken into the manufacture figures of a factory at 56 lb.; therefore, all butter packed in excess of 56 lb. 2 oz. is a direct loss and reduces the over-run, an important phase of factory management.

In packing bulk butter for local sale a factory is only required to pack 56 lb., and any butter over that weight is therefore a direct loss and reduces the over-run. Moreover, payment is only made for 56 lb. of butter and the purchaser gets something for nothing, although in reality, if he gives full weight to his customer, he cannot hope to get 56 pats of 1 lb. from 56 lb. supplied to him in bulk.

An examination of the factors involved leads to the consideration of what the over-run paid by a factory should be. As pointed out previously, the method employed in registering weights and tests may be expected to cause slight variations. Salt also is infinitesimal, and these three items might be set down as yielding approximately 1 per cent.; while moisture, if kept within the legal margin, should at most add another 2 per cent., giving in all a maximum of 3 per cent., which might be regarded as the standard over-run of an efficiently run factory.

No supplier can expect to get the full value of the weight and test of the cream and a high percentage of over-run, nor can the factory pay him a high percentage. if the operations are carried out on a practical and equitable basis.

It should then be obvious that if all the operations at the factory are faithfully carried out, the over-run should be kept at a fairly uniform figure.

High over-run is evidence of either lax methods at the factory, or that the factory has manufactured a butter which does not comply with the legal standards set down by the Dairy Produce Acts.

Summary.

To summarise the position over-run depends on the following factors:—

Efficient and correct weighing and testing of cream;

No avoidable loss of cream;

Correct churning methods;

Composition of the butter being within the legal standards; and

No undue loss of butter through careless handling or weighing.

DAIRY INDUSTRY POSSIBILITIES.

Thus an editorial in the Brisbane "Telegraph":

"It is the plain duty of Queenslanders engaged in primary production to make the very best of their opportunities, not only for their own personal benefit but also in justification of the national assistance which in one way and another is extended to so many branches of production. This generality applies with special force to the dairying industry, which owes so much to the people of Australia in consenting to stabilised prices, and which in this State, and, we fear, in large part of the rest of Australia, is conducted with a minimum of regard for scientific aids and methods. Recent remarks in these columns on the subject of the relative neglect of herd-testing in Queensland have received valuable endorsement from the Minister for Agriculture, Mr. Bulcock, and with his reputation for thoroughness one is encouraged to hope that he will pass on from words to definite action towards the further stirring of the dairy farmers to a better appreciation of their responsibilities.

"Official returns have made it obvious that the generality of herds are of anything but a satisfactory character, with the consequence that the average butter-fat yield is far below the legitimate expectation as based on actual results where systematic herd-testing for the culling of poor-quality beasts is practised. Unfortunately, the testing in this State is confined to a few herds, and those probably among the best, for it is the most enterprising farmers who are anxious to submit their herds to the test, but even the records so obtained disclose a substantial yield below the modest average set up by the Department of Agriculture as easily attainable. As a matter of cold figures it should be possible to get a return of 50 more lb. of butter-fat per beast than is now recorded in Queensland, and that figure multiplied by the approximate number of dairy cows in milk—730,000—would give the dairy farmers an improvement worth more than one and three-quarter million pounds sterling per annum, assuming butter-fat to be worth 1s. a lb.

"At present the farmers are deliberately throwing away that material advantage by retaining beasts which are uneconomic. Many of them are not worth their keep, and others could be brought into better productiveness by attention to pasturages which periodical testing of the cows would show to be necessary and expedient. The prodigality of Nature in this favoured State has been partly to blame for the indifference shown towards measures of betterment which other countries and States have more wisely adopted. The neglect of those measures here is a folly reflecting not alone on the farmers but upon the whole community which is bolstering an industry that could be, and ought to be, worked more profitably and efficiently. Consistent campaigning by the Department of Agriculture should have an appreciable effect in awakening a largely increased number of dairy farmers to the clear duty which rests upon them to maintain a higher standard of production."

THE ENDLESS WIRE SYSTEM FOR BANANA PLANTATIONS.

The use of the endless wire system for transporting bunches of bananas from the plantation to the packing shed means a saving of much time and hard work for the banana-grower. The use of the system need not necessarily be confined to banana plantations; any hillside orchardist will find it a great convenience.

Briefly, the idea of the system is to despatch the fruit from a central point in the plantation on carriers which run on carrier wires to the packing shed. The carriers are attached to an endless wire running round grooved wheels at each end of the system. The carriers are placed in such a way that as one is sent to the packing shed with its bunches the second carrier is returned uphill for its load.

The system is not difficult to instal. One of the chief things is to see that the structure is strongly built. A steep grade does not necessarily make the system impracticable, as the provision of a braking system serves to check the speed of the carriers.

First a central part of the plantation must be selected as a despatching point. This should be conveniently situated so that bunches from surrounding parts of the plantation can be easily carried to it. From this site select a position at the bottom of the plantation for a receiving station. A suitable place is usually found on the top of a small rise, as this will give the wires greater height so that the bunches will not brush against the plants whilst they are in transit. This receiving terminal should also be suitable for the building of a packing shed in order to save unnecessary handling of the fruit, and it should therefore have easy access to a roadway. Difficulty may be experienced on some slopes in obtaining sufficient height for the wires. In such cases, a staging can be built at the despatching point and the terminal for the wires made higher up the hill, somewhat as shown (Plate 12).

Construction of the System.

Reference to Plate 13 will explain the building of the system. The main posts marked "A" at both top and bottom terminals must be solid and about 12 feet long. They require to be firmly fixed in the ground, at least 4 feet deep and preferably 5 feet, and should be well braced. In Plate 13 the posts at the despatching end are shown anchored to a convenient stump for additional strength. The distance between the posts at each terminal may be about 6 or 8 feet.

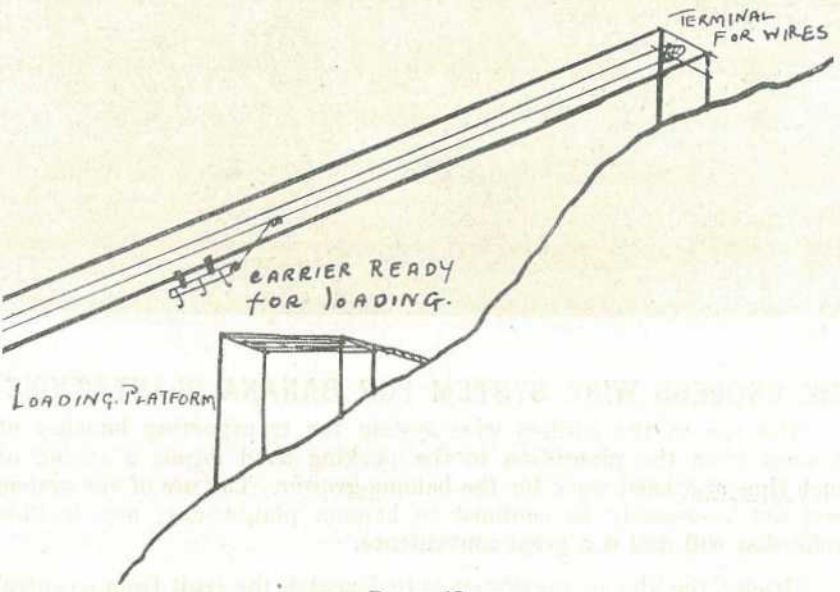

PLATE 12.

About 6 inches from the top bore inch diameter holes through each of the posts for the carrier wires ("B"). The holes in the posts at the top end should be inclined downhill and those through the bottom posts inclined uphill so that the wires when strained will not kink at the entrance to the holes. A straight pull also makes it easier to strain the wires, which should be drawn as tightly as possible. To do this, tie the wires firmly round the posts at the sending end, and at the receiving terminal wind the slack of the wires round good strong rollers ("C"). If wooden rollers are used, they should be made of tough cross-grained timber, 4 inches in diameter, clear of sap. Straight-grained timber is liable to split and is not capable of carrying the load. Iron levers $\frac{3}{4}$ inch to 1 inch diameter ("D") passed through holes bored at right angles to one another in the ends of the rollers will give a good purchase and enable the wires to be tightly strained. For the carrier wires, heavy 10 by 12 gauge oval steel wire is sold specially for the purpose. This wire has a breaking strain of 2,140 lb. and is suitable for all ordinary distances up to approximately 600 yards. Some systems in use are a mile long, but heavier wires are required for these.

For the endless wire ("K") 12 by 14 gauge steel wire is generally used. This runs round grooved wheels fixed at each terminal.

Posts marked "E" are sunk and well braced at the receiving terminal. If a good anchorage such as a stump is not available at the

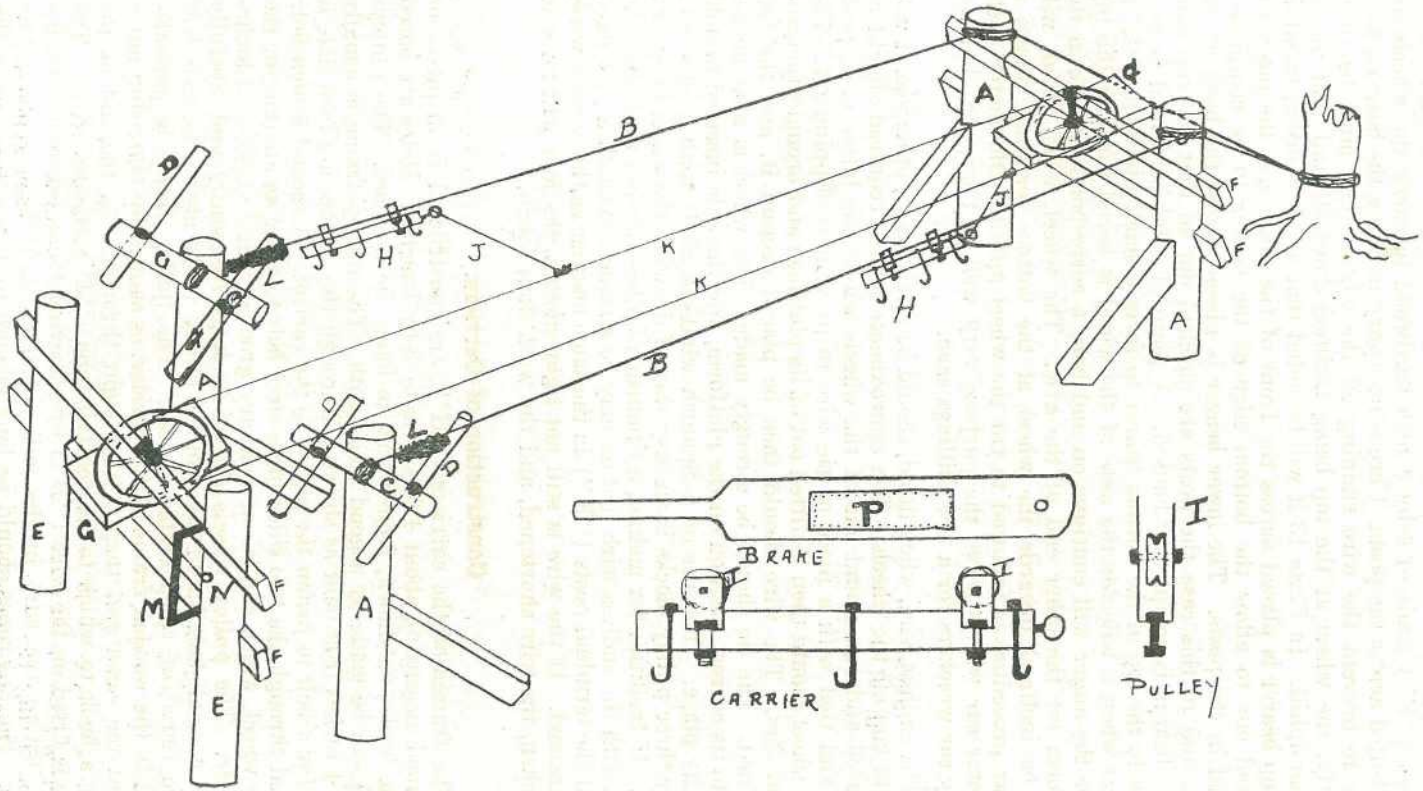

PLATE 13.
Plan of an Endless Wiring System for Bananas.

despatching end, similar posts should be erected there also. Cross bearers ("F") made of 4 by 3 inch hardwood to carry the wheels are then bolted across the posts. Care is necessary in fixing the bearers, as in order to prevent the wire running off the wheels they must be tilted slightly, the wheel at the top being inclined downhill and that at the bottom uphill. In Plate 13 it will be noted that at the sending terminal the top bearer is placed across the front of the posts and the posts are checked out to allow the bottom edge of the bearer to be completely housed in the posts. The lower bearer is placed across the back of the posts, and in this case the posts are checked out so that the top edge of the bearer is completely housed. A piece of solid hardwood is next bolted to the top of the bottom bearer to form a small platform ("G"), so that when a hole for the axle of the wheel is bored through the top bearer the auger will continue on and bore a corresponding hole in the platform for the other end of the axle. The wheel, when fitted, will then be inclined towards the wheel at the bottom terminal, where a similar procedure is followed to tilt the wheel uphill. Old motor cycle or motor car wheels serve the purpose very well and may be obtained at any car wreckers for a few shillings each.

The endless wire, when fitted, should be fairly tight, otherwise it will tend to run off the wheels. The approximate length required should be measured and run round one of the wheels whilst the latter is in position, and tied with a piece of tie wire to prevent it slipping off. The other wheel should then be lifted out of its platform and brought forward several feet. The wire should then be placed around it, and the two ends tied. The tie should be strongly made. The wheel is next drawn back to its correct position on the platform, and the axle inserted to hold it in its place. The use of a Spanish windlass made with a rope and two or three pulley blocks is an easy way of drawing the wheel back into place. If facilities for making a Spanish windlass are not available, the wheel with the endless wire tied on may be strained through a post fixed behind the terminal posts ("E") in the same manner as the carrier wires are strained. If the wire is still not tight enough, the join will have to be broken, the wire shortened, and the work done again.

Construction of Carriers.

The frames of the carriers ("H") are constructed from pieces of hardwood measuring about 4 feet long by 3 by 1 inches. Holes are bored for the hooks, as shown, from which to hang the bunches. The pulleys ("I") can be made by a good blacksmith. The pulley frame is usually $1\frac{1}{2}$ by $\frac{1}{4}$ inches iron bent as shown. Through the bottom a $\frac{3}{8}$-inch hole is bored for a bolt to fasten the pulley to the carrier. A second $\frac{3}{8}$-inch hole is bored through the two sides for a steel bolt to serve as an axle for the pulley wheel, which can be an ordinary grooved wheel of about 2 inches diameter. The pulley wheels should be kept frequently and liberally oiled. A small hole bored through the pulley wheel above the axle bolt will be found of considerable benefit. The pulley frame is partially housed in the wooden frame of the carrier, as shown, by mortising out a piece of the wood and then bolting right through. At the end of the carrier a hook to which to tie the tail rope ("J") is screwed in. The carrier is fitted on the wire ("B") by removing the axles for the pulley wheels, fitting the wire in the pulley frames, and then replacing the wheels. The tail ropes should be long enough to allow for a sag in the carrier wires when carrying a load, and they should be firmly fastened

with the wire to the endless wire to prevent it slipping. Also, if one tail rope is tied to the join in the endless wire, the latter will not be required to run round the wheels, and the tie will therefore not cause any obstruction. It is also a good idea to fit a swivel in the tail rope, near where it is tied to the endless wire, to prevent the tail rope from twisting round it. At the bottom terminal of each of the carrier wires, a piece of wood ("L") about 2 feet long wired on will act as a stop to hold the carrier when it arrives with its bunches, and prevent it from bumping the posts and bruising the fruit.

The Brake.

The brake is made from a piece of solid hardwood fashioned with a handle like an elongated cricket bat. It should be loosely fastened with a long bolt to one of the bottom posts at the point "N." For extra strength a piece of iron ("M") may be bolted through the post to form a D, through which the brake is inserted. The brake should be only loosely bolted, as it must be capable of being moved forwards and backwards, according as it is pressed against the wheel to check its speed or released to allow the wheel to spin faster. A piece of leather ("P") tacked to the face of the brake where it comes into contact with the wheel will increase its efficiency and reduce friction.

SOME TROPICAL FRUITS.

5. THE JACK FRUIT.

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

KNOWN botanically as *Artocarpus integrifolia* or *A. integra,* the Jack fruit is a close relative of the Bread fruit, the subject of last month's article. Whilst the Bread fruit is strictly tropical in its requirements, however, the Jack fruit is much less exacting and will grow under conditions which would be fatal to the Bread fruit.

The tree is a large and handsome one reaching a height of 50 to 70 feet. Foliage is dense, the leaves being deep green, leathery and glossy. Its fruit are probably the largest known, and individual specimens have been reported to weigh up to 1 cwt. This is probably somewhat of an exaggeration however; a closer estimate would be 40 to 50 lb. Even at this weight the fruit is a large one.

The tree is a native of the mountainous districts of India and the Malayan archipelago, but it is now widely distributed throughout the tropical regions of the globe. It is fairly plentiful in North Queensland, chiefly in old gardens, and is often to be found as one of the few surviving trees in abandoned gardens over-run with lantana. Even under such trying conditions the trees are usually healthy and fruitful.

The Jack fruit is usually raised from seed which, when planted fresh from the fruit, germinate readily. The trees make rapid growth, a height of about 20 feet being reached within five or six years. The first crop of fruit is produced at about five years old. At this age the fruit is produced on fairly long thick stalks growing from spurs on the main branches. As the trees become older the fruit are produced directly from the main branches and later from the trunk. On very

old trees the fruit is reported to form on the roots, its presence being discovered by the cracking of the soil above it. This cropping habit has not yet been observed in Queensland, possible because our trees have not reached sufficient age. Fruit borne on the roots is reported to be of finer flavour than that borne on the branches.

The fruit is oblong to oval in shape, sometimes up to 2 feet in length, although 12 to 18 inches is the usual size. The skin is covered with short, hard-pointed studs. In colour it is pale green in young fruit, changing to yellow and finally to brownish yellow as it ripens. The flesh is divided into numerous small segments, each consisting of a seed surrounded with pulp which possesses a strong pungent odour. Those accustomed to it regard the pulp as possessing a very fine flavour, but the strong smell deters most people, and many who overcome the odour find the flavour too spicy. Besides being used fresh the fruit is preserved and dried. The seed may be used as well as the flesh. These are either boiled, or roasted like chestnuts. The season of ripening of the fruit extends over several months during the summer and autumn.

Although no propagation work has been done, several distinct races are known and recognised. The most clearly defined are a firm fruited race and a soft skinned one. In Asiatic countries the former of these is the most favourably regarded. In Queensland, trees of three types of foliage have come under the notice of the writer, one with long narrow leaves, another with broad oval leaves of a darker green, and a third with lobed leaves. Fruit of the first two named have been observed, but up to the present not those of the third. The first has a larger fruit more fleshy and juicy than the second, which possesses more seeds and drier flesh.

For best results the Jack fruit should be grown on rich deep soil, and should receive abundant moisture. Good drainage is necessary, however. Very little cultural attention is needed once the trees are well established. They withstand fairly cool weather without injury, but should be grown in situations free from frost. Trees grown in cool climates, however, are said to produce fruit of inferior quality.

THE FRUIT INDUSTRY IN THE NORTH.

The Director of Fruit Culture (Mr. H. Barnes) has made available a summary of the report of the Instructor in Fruit Packing (Mr. J. H. Gregory) on a recent visit to North Queensland Fruitgrowing Districts.

THE districts visited were—Ambrose, Yarwun, Targinni (tomatoes and papaws); Rockhampton Centres, Yeppoon, Tanby, Byfield, Bondoola (citrus, pineapples, tomatoes, and papaws); Gracemere (pineapples); Nankin (citrus); Bowen (mangoes, pineapples, and tomatoes); Townsville and Magnetic Island (pineapples, mangoes, papaws, and citrus).

All these district were suffering severely from the prolonged dry spell, the conditions becoming worse the farther north one went.

The first district visited was the Yarwun-Ambrose-Targinni area, where a demonstration of packing was held at Machine Creek, Ambrose, on the property of Mr. Anderson. Local growers who attended showed

much interest. Advantage was also taken by the Head Teacher of the local school of an invitation extended to him to bring along the whole school of about forty pupils. Unfortunately, the dry weather made it difficult to obtain sufficient fruit for a large demonstration. Papaw growers were visited and the inadvisability of marketing green papaws and tomatoes stressed.

At Rockhampton the C.O.D. section was visited and inspections made, Mr. S. McCullough, Manager of the Section, being very helpful. An examination of the retail fruit shops showed that the best fruits displayed were oranges and apples. Tomatoes on the C.O.D. section and in the shops suffered from immaturity, quite large percentages of waste from this cause being apparent.

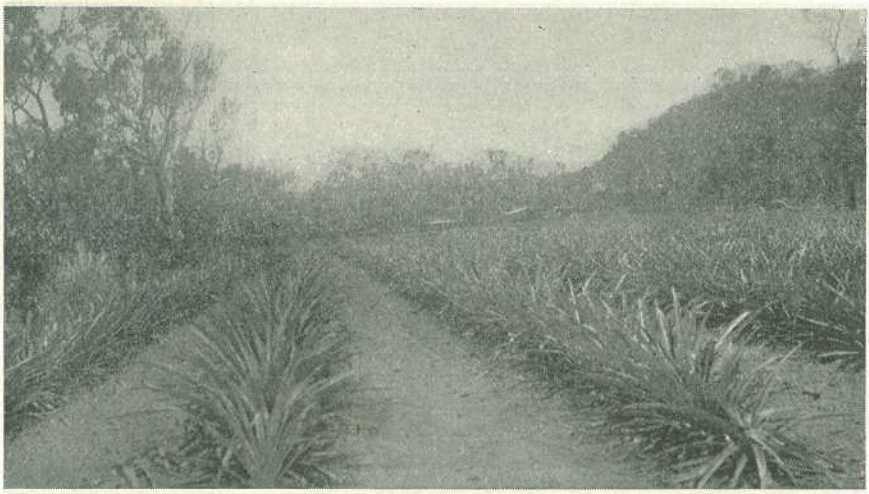

PLATE 14.

Pineapple plantation, Horseshoe Bay, Magnetic Island, North Queensland.

At Bowen growers were, owing to the lack of rain, in a difficult position. The tomato crop was nearing completion for this year. The first consignment of mangoes was harvested on the day of my arrival. The mangoes were shedding heavily, and there is every prospect of only a light crop being marketed.

The country around Townsville is perhaps the driest I have ever seen. In the company of Mr. Todd, local Fruit Inspector, I visited the fruit agents and gave a demonstration of packing at the Townsville Fruit Exchange. The pack of the fruit from the north beyond Townsville was poor, and agents stated that it was more satisfactory to handle Southern fruit than that from North Queensland. Packing instruction appears to be very necessary for growers north of Townsville.

The fruit shops, which mostly appear to be owned by Chinese, were displaying fruit of somewhat better quality than those in Bowen, Rockhampton, or Yeppoon, though there appeared to me to be a tendency to overcharge for the tropical fruits, mangoes, common variety, being 1½d. each, better class 2½d. each, small papaws 9d., granadillas 1s. 3d. for small fruit.

Fruitgrowing on Magnetic Island is confined to two areas, Horseshoe Bay and Nellie Bay (Mandalay). Pineapples, mangoes, papaws, and small quantities of citrus are the fruits at present grown. The output of pines from the Horseshoe Bay area is approximately 15,000 cases, 10,000 cases of which are marketed on distant markets. The largest shipment sent last season consisting of 1,500 cases. The shipping service is confined to one boat a week, departing on Tuesdays at 3.45 p.m., making it necessary for all fruit to be loaded within three hours. Loading is done by the growers from the small jetty with the assistance of a small trolley on rails which runs a length of about 600 feet over the sandhills on the foreshore. I am informed that a road across the sandhills to the jetty is contemplated. This road should be of assistance.

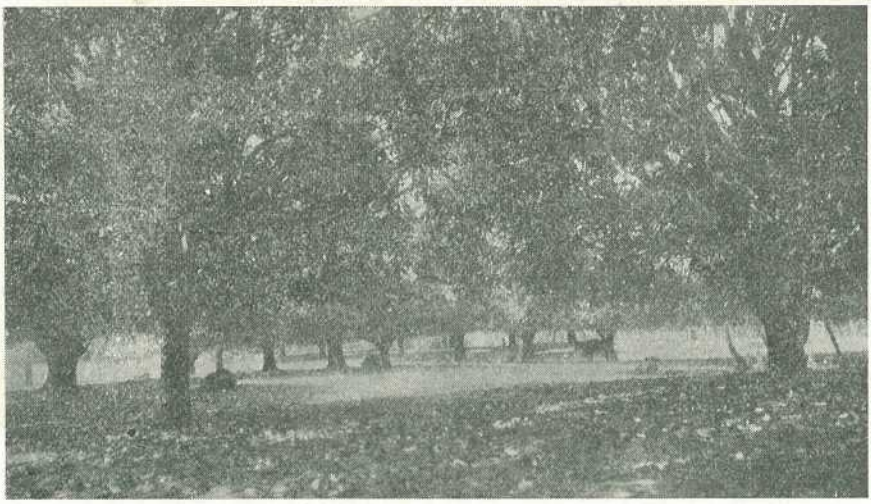

PLATE 15.
A mango plantation, Nellie Bay, Magnetic Island, North Queensland.

Both rough and smooth leaf pines are grown. Considerable difficulty is experienced in keeping the smooth leaf pines small enough for the popular sizes on the market. The present practice is to grow roughs and to replant with smooths in an effort to keep the fruit small. Interest is being evinced in the use of artificial fertilizers. Demonstrations of various packs were given, although the fullest advantage could not be taken when demonstrating owing to a shortage of fruit, the harvesting season being somewhat late, due possibly to the long period of dry weather experienced this spring. The rainfall this season is said to be the lightest in the experience of most of the growers.

Investigation showed that it was quite often the practice to harvest and pack the fruit in the field without attempting any method of cooling before packing. Often the fruit for the South was packed without padding material being used to protect it. The necessity for cooling and using satisfactory packing materials was stressed. After packing the fruit is carted and stacked on the jetty or at the head of the jetty tramway, being exposed to the summer heat for, in some cases, as long as two days, fruit being placed there on Sunday for loading on Tuesday. From this it can be seen that there is a great risk of damage to the

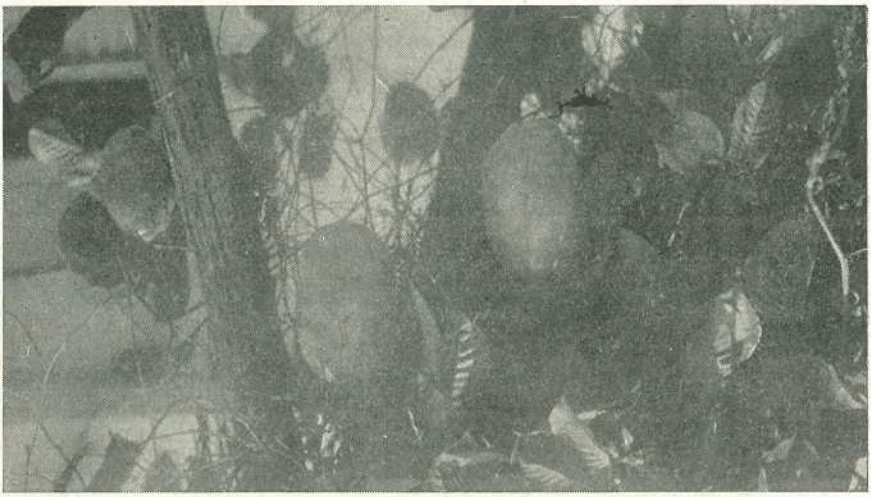

PLATE 16.
Granadillas, Nellie Bay, Magnetic Island, North Queensland.

fruit. Two days of excessive summer heat would be as detrimental to it as six days of transit in the boat. Further, the heating of the fruit before it is stowed causes a retention of heat in the hold. It is strongly recommended that a shed be placed at the jetty. Unless this is done all the benefits of the best packing possible will be minimised, as the heating of the fruit will cause excessive shrinkage and ripening in transit to distant markets. There is still plenty of room for an extension of the industry at Horseshoe Bay. The soil, which is of a loose granite nature, is easily worked.

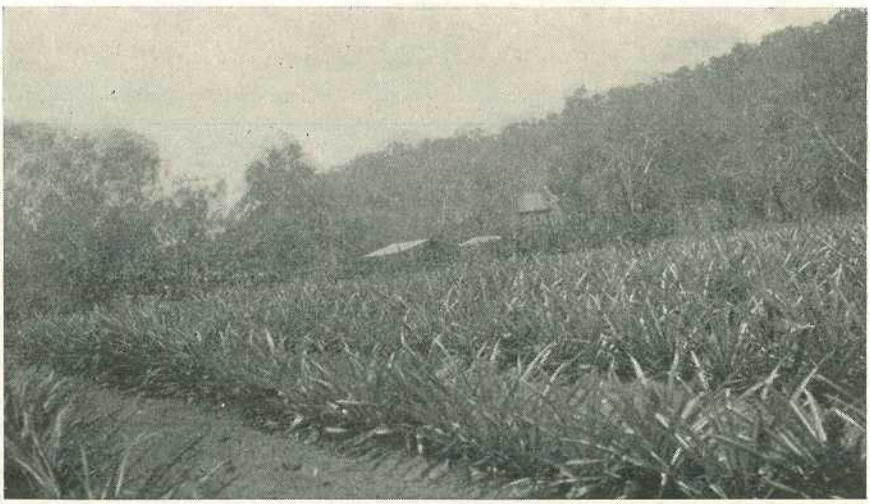

PLATE 17.
Pineapples, Horseshoe Bay, Magnetic Island, North Queensland.

Papaws are apparently a profitable crop. The quality of the fruit this season was to some extent affected by the prevailing dry weather, some fruit showing a type of granulation in the flesh and a lack of juice. Notwithstanding this, the flavour of the fruit was excellent. Retail prices were 9d. for fruit running twenty to the case.

The crop of mangoes was suffering greatly from dry weather and the fruit was dropping everywhere. No large fruit was seen. Growers were interested in the prospects of distant Southern markets and many keen inquiries were made about market prospects and packing.

Some excellent specimens of granadillas were seen on different parts of the island. There should be no reason why with careful packing this type of fruit should not be sent to Brisbane markets where a ready sale awaits it.

In summing up, one cannot but be impressed by the eagerness of the growers visited to increase their knowledge. The request was repeatedly made for a further visit in May, June, or July next season to enable citrus and winter crops of pineapples to be dealt with.

Fruit and Vegetable Country Distribution Scheme.

Among the people met with during my visit to northern districts was a resident who came from a district nearly 200 miles from Townsville. This resident had procured fruit under the Fruit and Vegetable Distribution Scheme initiated by the Minister for Agriculture. In answer to questions as to the benefits and shortcomings he expressed the following opinion:—

The scheme was of great assistance. Vegetables were all good, citrus fruit from Palmwoods was of quite fair quality, deciduous fruits and grapes direct from Stanthorpe and pineapples from Magnetic Island were excellent.

EXPIRED SUBSCRIPTIONS.

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

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

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

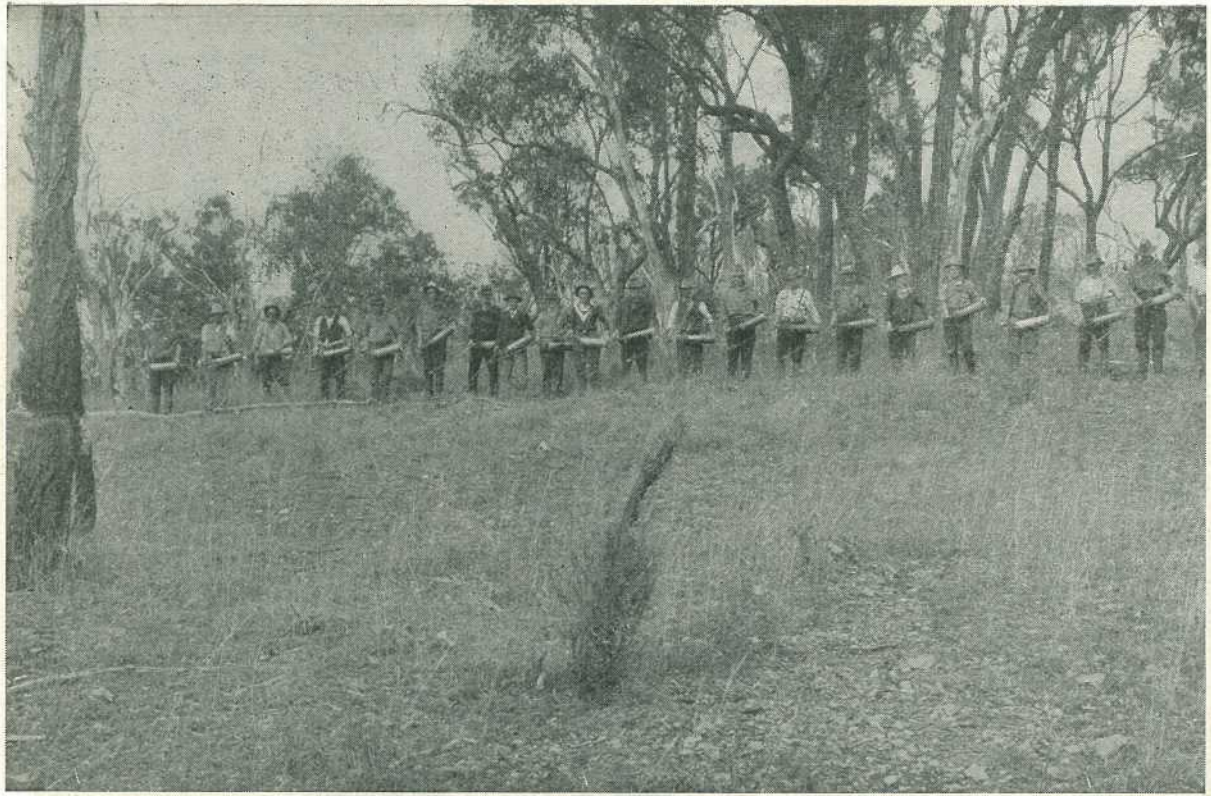

PLATE 18.
CAMPAIGN AGAINST PEAR PEST.
Employees of the Prickly-pear Commission are equipped with Atomizers for the Poisoning of Tiger Pear.

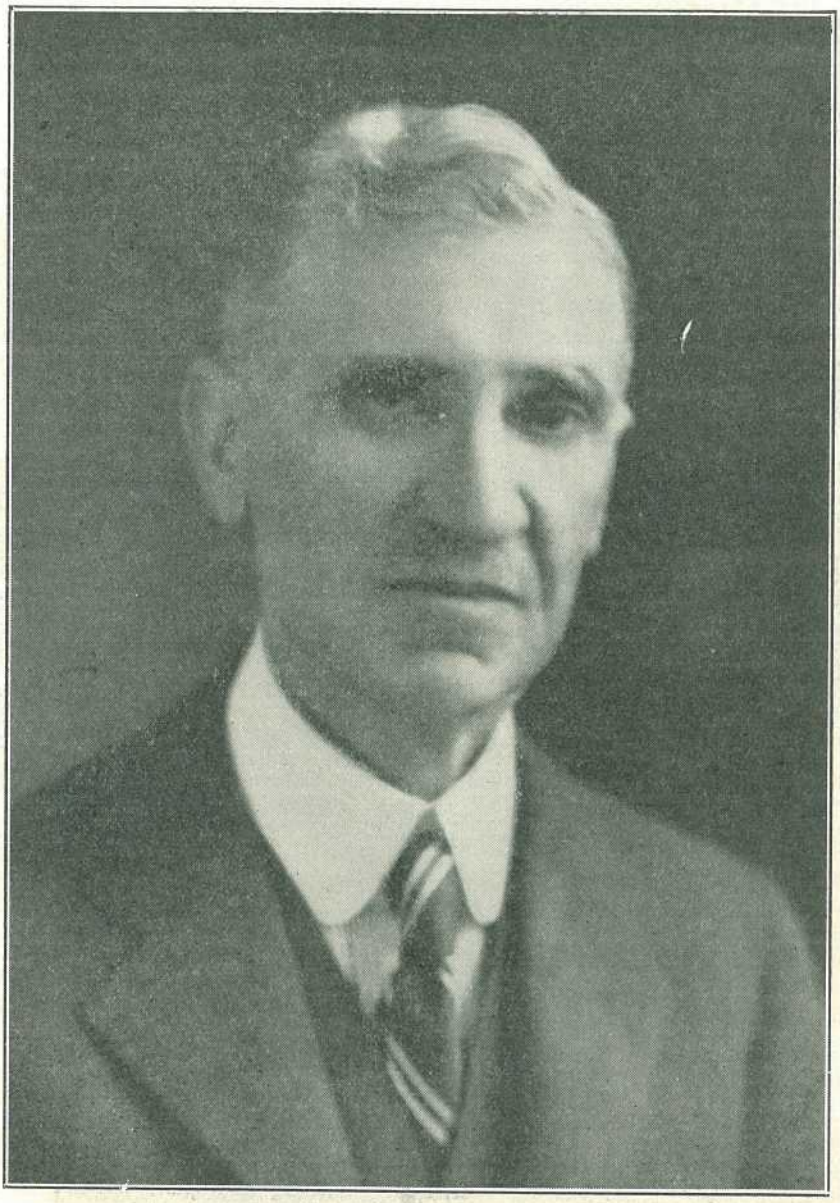

PLATE 19.
Mr. J. D. STORY, I.S.O., Public Service Commissioner.

[*Block by courtesy of "The State Service."*

PUBLIC SERVICE COMMISSIONER.

PREMIER'S TRIBUTE.

Subjoined is an interesting excerpt from "Hansard" containing a fine tribute to the Public Service Commissioner, Mr. J. D. Story, I.S.O., by the Premier, Hon. W. Forgan Smith, LL.D.:—

"The Leader of the Opposition and the member who has just resumed his seat did well to speak as they have done concerning the Public Service Commissioner. There is no doubt at all that Mr. Story and his staff are very valuable servants to the Government, and, through the Government, to the people. Mr. Story is a man of extraordinary mental power. In addition, he is able to concentrate on a vast amount of work. Like the Leader of the Opposition, I have often suggested to Mr. Story that he should not work so intensely. No one could be more assiduous in his duties than he is, and his efforts on behalf of the State have been very valuable indeed. When he was Under Secretary for Public Instruction he did a very great deal to build up the educational system in Queensland, and many generations of people in this State have enjoyed the advantage of the system which he was responsible for instituting. Mr. Story is much more than a Public Service Commissioner. If he confined himself to the duties of a Public Service Commissioner alone he would have a much easier time than he has, but he does special work for the Government in making investigations and reports that have been invaluable in many ways. In addition to that, he looks after the Government's interests on the Senate of the University, his association with which has been of tremendous benefit to that institution. . . . . Mr. Story's services are valuable, and we cannot afford to lose him, and I appreciate the fact that honourable members generally on both sides of the Committee realise the value of having a public servant like him. The term 'public servant,' used in its fullest sense, is the term that properly describes this officer."

THE relief rains received from 4th to 7th December throughout the southern agricultural areas were of considerable benefit to dairymen, many of whom had been obliged to revert to hand feeding. The scattered storms subsequently received in the coastal areas south of Mackay and on the Downs have assisted to revive pastures and summer growing crops. The rains were generally too late to be of assistance to early sown maize, the greater portion of which was therefore utilised for fodder purposes. The year 1935 will be recorded as one of the hardest experienced by both farmer and grazier, as the rainfall has been considerably under average throughout the State.

Wheat.

Harvesting was generally completed under favourable conditions, resulting in a high quality product, only a small proportion being classified as feed. Deliveries have exceeded expectations, being in the vicinity of 3,000,000 bushels, amply demonstrating the remarkable recuperative powers of the wheat plant and its ability to utilise the limited supplies of available soil moisture. Some excellent individual yields have been recorded by many progressive growers, who have lost no time in gathering the crop and commencing ploughing operations in preparation for the 1936 sowing. It is reported that Mr. F. W. von Pein harvested 6,300 bags (averaging 12½ bags per acre) in five days utilising five tractor drawn header-harvesters. This is typical of the methods in vogue in the Pittsworth and Dalby districts where extensive individual areas are the rule. The season recently experienced clearly indicates the great advantages gained by the early ploughing and preparation of the soil resulting in increased moisture conservation, as a result of which farmers are frequently able to make successful seasonal sowings, despite the absence of adequate May and June rains. The flour tax is to be continued until 30th June next, and in the absence of any change in marketing conditions, the first advance payment to growers has already been posted.

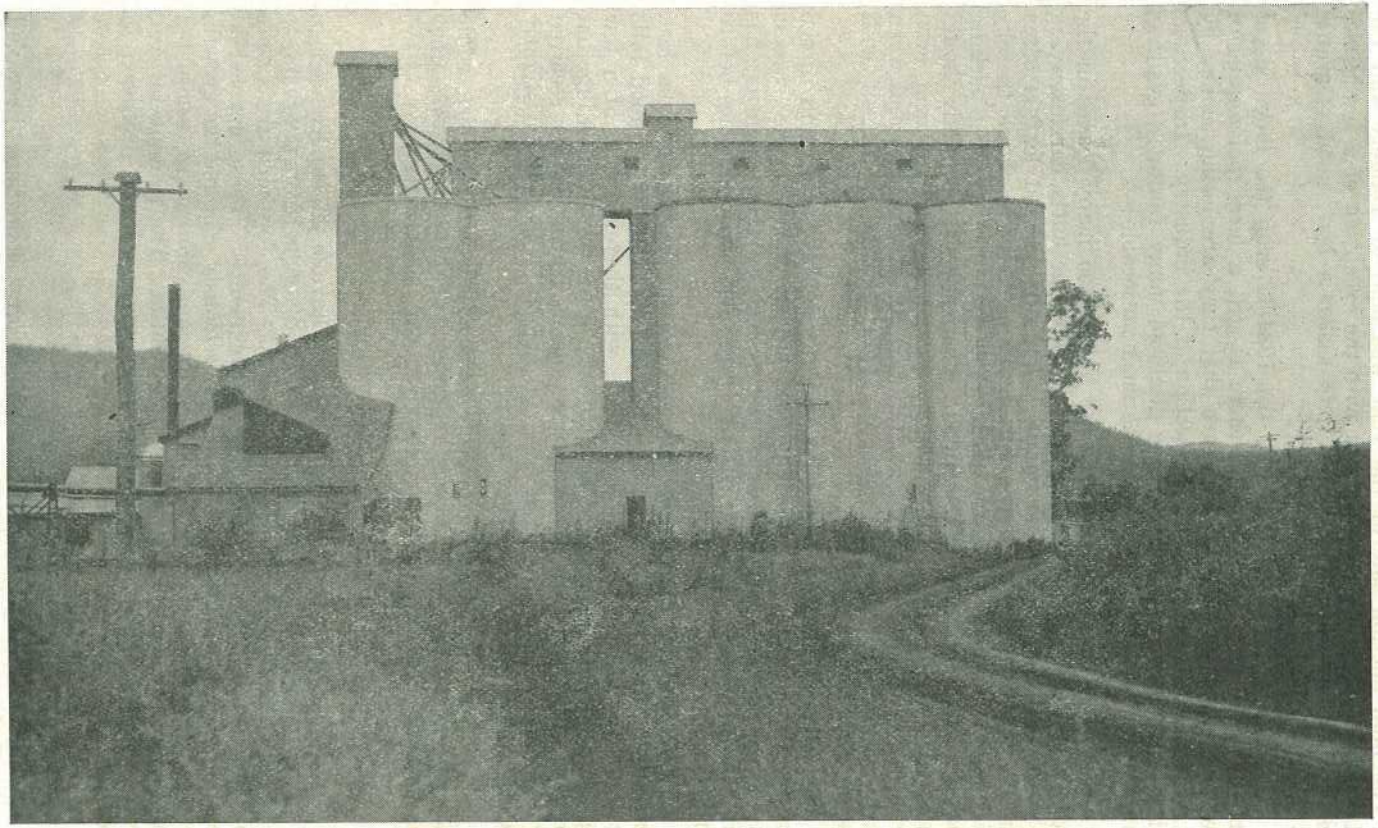

PLATE 20.
Maize Silos, Atherton.

Tobacco.

The final auction sale of the year was held by Dalgety and Co. on the 28th November, and although with the exception of a few choice lines the lots submitted comprised late season's leaf, good clearance was effected.

In reviewing the marketing of the 1934-35 crop too much stress cannot be laid upon the fact that there is still a large percentage of growers who are evidently not aware that they are losing money by not paying strict attention to this section of the industry. Inspections during the past series of sales have disclosed many faults in grading, amongst which the following were the most noticeable:—

Varying length of the leaf in the hands, too many leaves in the hands, different quality leaf used for wrapping the butts, careless tying and tying too deep down the hands. Correctly graded leaf is often found to be baled irregularly resulting in a mixed package thereby prejudicing the sale of the better quality leaf offered. Incorrect packing of bales is another fault to be avoided. The butts of the hands should be packed towards the top and the bottom of the bale in neat even layers and not across the package. Bales are handled on end and when packed crosswise the leaf is liable to suffer damage in transit with subsequent loss in value.

The current season's operations are now in full swing and in the Texas-Inglewood district planting out is completed. The success achieved in Mackay-Sarina district last season by later planting has so influenced growers that very little planting out will take place before February.

The Bowen and Townsville districts are still suffering from lack of rainfall. Conditions in those areas are so bad that, unless good falls of rain are experienced at an early date, with the exception of a few irrigated areas, no tobacco will be planted. It is worth recording that from the 1st July until the middle of December, Townsville has received only fifteen points of rain. Mareeba and Dimbulah have fared slightly better, but rain is now urgently required.

Mould has caused severe damage to seed-beds at Mareeba, while it is apparent on the lower leaves of crops at Texas. However, other areas have experienced little trouble from this scourge.

Sugar.

Conditions favourable for crop growth have been experienced in the areas from Tully North, but all cane districts from Ingham to Mackay are urgently in need of heavy rains. The Southern areas were favoured with beneficial rains early in the month. These arrived in time to revive the crop which had been seriously checked in growth. The mills have, with the exception of Tully and Mourilyan, completed their harvest, with generally satisfactory results. The present forecast shows that approximately 608,000 tons of sugar will be produced in Queensland for the 1935 season.

Cotton.

During the early part of the month dry conditions prevailed throughout the cotton belt, until the 4th, when between that date and the 9th, and again on the 15th and 16th, very useful precipitations were

recorded over most of the cotton areas, with the exception of the Callide. In this district rainfalls of less than an inch were generally recorded. This will only give temporary relief, more being required, especially for new scrub burnt areas.

This should result in a good development of growth, together with a setting of squares, and in the early planted cotton the development of bolls, and will allow of some late planting of cotton being effected.

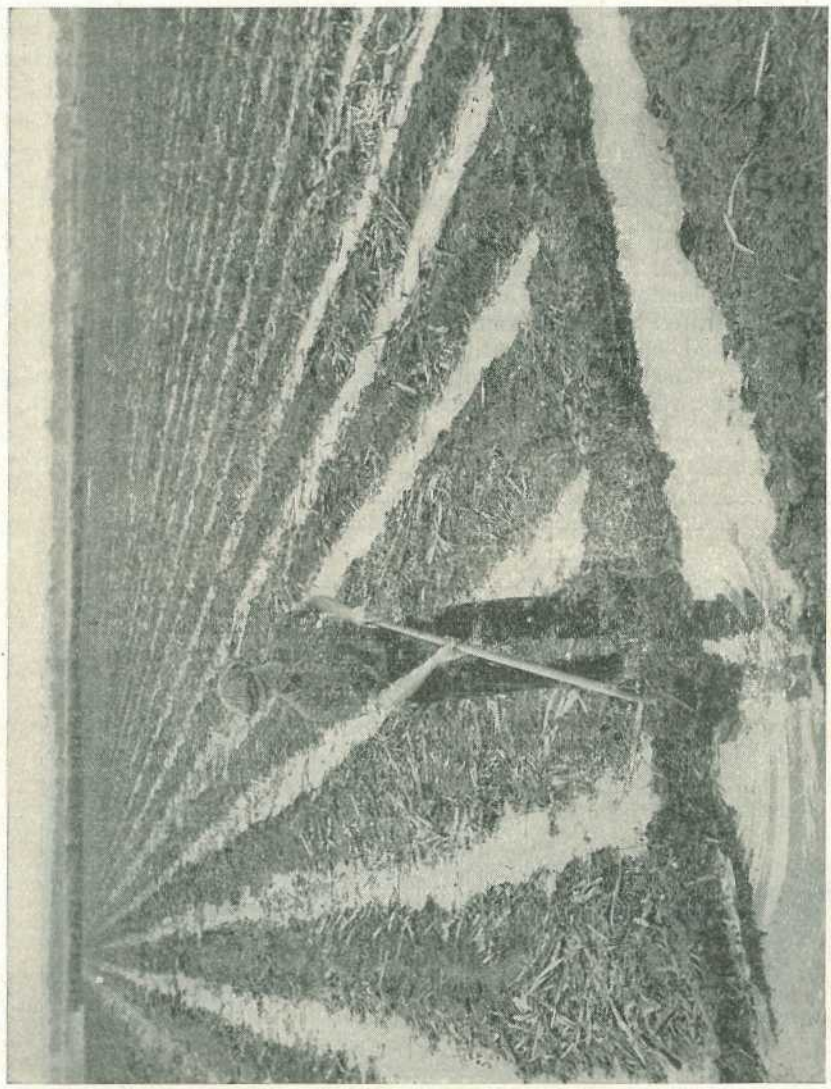

PLATE 21.
An irrigated cane field, Burdekin Delta, North Queensland.
[Photo. by courtesy of "The Telegraph," Brisbane.

Owing to the generally dry conditions prevailing after germination an excellent deep rooting system has been established, which should enable the plants to withstand, to a much greater extent, any future hot dry spells which may occur.

Insect pests, other than those attacking cotton in the seedling stage, have not been severe. One of the boll worms has been responsible in some fields for a certain amount of terminal loss.

General.

Early sown sudan grass and sorghum crops have responded to the December rains and will provide good feed, illustrating their ability to withstand a prolonged dry spell. With the exception of some favoured southern coastal areas, the early potato crop was generally a failure. However, the main planting in January and February is usually more productive, owing to the more reliable nature of the autumn rains. At the time of writing extremely dry conditions still prevail in the Townsville district where serious stock losses have occurred, and the residents are faced with a shortage of water supplies. Naturally only those farmers having irrigation facilities are able to carry on with the seasonal establishment of tobacco and other crops.

During the year 1934-35 Great Britain absorbed 56.26 per cent. of Australia's total exports. Apart from the United Kingdom, Australia's best customer was Japan, followed by Belgium, France, New Zealand, United States of America, China, and Germany. British countries supplied 59.90 per cent. of Australia's imports during a similar period. The United States of America, Japan, and the Netherlands East Indies, respectively secured the bulk of the remaining trade.

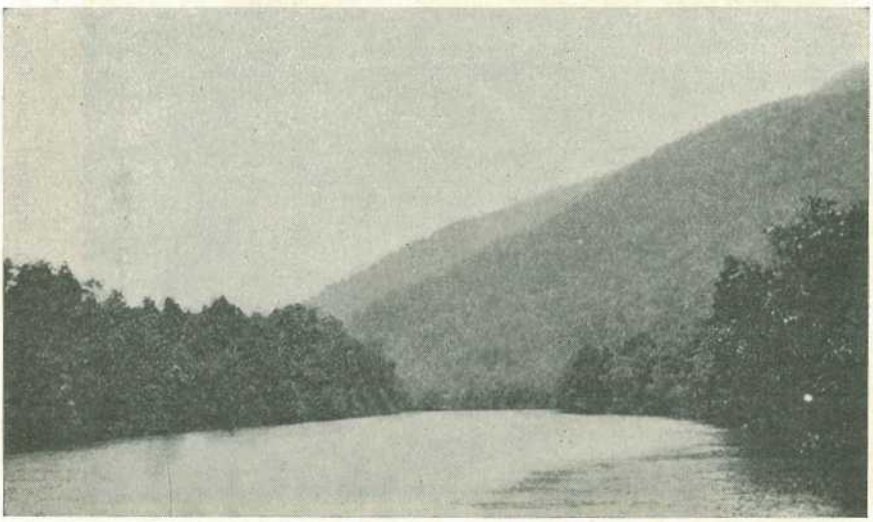

PLATE 22.
A view on the Russell River showing the Graham Range.

PLATE 23.
Cascades, near Cairns, North Queensland.

AGRICULTURAL RESEARCH.

APPOINTMENT OF PROFESSOR GODDARD.

Professor E. J. Goddard, Dean of the Faculty of Agriculture within the University of Queensland, and Professor of Biology, has joined the Department of Agriculture and Stock for twelve months to take charge of a scheme for the reorganisation, extension, and co-ordination of research activities relating to agricultural and veterinary science. The Senate of the University has made Professor Goddard available for the work and the Government has approved his appointment as from the beginning of January. Professor Goddard will retain his association with the University, and this connection will offer special advantages in facilitating co-ordination of researches and in the directing of students in their training for special branches of agricultural science.

PLATE 24.

Professor E. J. GODDARD, D.Sc., Dean of the Faculty of Agriculture within the University of Queensland.

The Minister for Agriculture and Stock (Mr. Frank W. Bulcock) in announcing the appointment of Professor Goddard stated that although the initial term was twelve months, extensions might be made from time to time. Two years ago a conference of Ministers of Agriculture had agreed that research should be undertaken into the nature of the problems confronting each State, instead of each State continuing to work on various important and unimportant problems. The idea was that there should be co-ordination between the agricultural research services of Australia. One of Professor Goddard's primary duties would be to investigate the incidence of researches and try to eliminate overlapping. Few eminent technicians were available in agriculture and, therefore, their services must be used to the best advantage. The need for co-ordination is realised when attention is drawn to the various factors that may operate in an agricultural problem. We must utilise in that connection all the available man power represented in the Department and other institutions such as the University. The position is made more evident still when we view the possibilities of co-operation with the activities of the Commonwealth Council of Scientific and Industrial Research and the other Australian States.

Agricultural research was so far advanced to-day that definite planning was necessary. Professor Goddard, with the heads of the scientific branches and the Minister himself, would try to map out a comprehensive programme extending over a number of years. The agricultural possibilities of North Queensland would call for special consideration. The Bureau of Tropical Agriculture was being established at South Johnstone, and it would be possible to lay down a considered programme so that new avenues of agriculture might be economically exploited.

Experimental work was of major importance, and by the co-ordination of the department's activities, sustained research would be possible. Professor Goddard's advent to the department would afford much closer union between the educational and official sides. He hoped the professor would find time to interest himself in the careers of the younger men. Not the least important of his duties would be to determine the amount of training the department might be prepared to make available for various junior officers.

As part of the scheme a new research branch has been created in the Department of Agriculture. The Minister, in announcing this fact recently, said the branch must become one of the most important under his control. Three outstanding officers had been appointed, and additional appointments would be made from time to time. Mr. R. E. Soutter, wheat breeder, had become agricultural research officer in wheat and maize; Mr. L. F. Mandelson, who had recently been studying abroad, had been appointed research pathologist; and Mr. Atherton, entomologist stationed at Atherton, had also been seconded for special work. The branch would deal with the practical application of research work, and every facility would be provided for it.

Professor Goddard is a graduate of the University of Sydney where he obtained the degrees of Bachelor of Arts and Doctor of Science. After graduating he served on the staff of the Department of Biology, Sydney University, for a number of years, and in 1907 was appointed Macleay Research Fellow of the Linnean Society of New South Wales. He vacated the fellowship in 1910 on his appointment to a Professorship at the University of Stellenbosch, South Africa. He relinquished that post at the end of 1922 on his appointment to the Professorship of Biology at the University of Queensland. He has been associated with numerous and varied biological researches during the past thirty years, and has given special attention to agricultural problems since coming to Queensland. He has been closely associated with the creation of the Faculties of Agriculture and of Veterinary Science at the University of Queensland. As a member of the Commonwealth Council for Scientific and Industrial Research he is in close touch with the research activities of that organisation.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of Australian Illawarra Shorthorn Society, Jersey Cattle Society, Friesian Cattle Society, production charts for which were compiled during the month of October, 1935 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Hillvale Linda	J. H. Weber, Peak Crossing	9,986·95	367·173	Charms Pride of Oakvale
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Stamford Lady	Mr. L. Coonan, Indooroopilly	9,176·05	363·325	Stamford Brilliant
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Sunnyside Honey 8th	P. Moore, Wooroolin	10,929·15	413·483	Bruce of Avonel
College Granny 3rd	Queensland Agricultural High School and College, Gatton	8,939·21	378·295	Fussy's Kitchener of Hillview
FRIESIAN.				
UNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Ryfield Argus Echo	F. C. Noller, Kumbia	9,382·35	322·939	St. Athans Argus
JERSEY.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Ellerdale Mabel 3rd	J. and R. Williams, Crawford	7,199·25	442·224	Golden Noble of Ellerdale
Langside Quip	G. W. Young, Ivnerlaw	5,832·7	398·193	Masterpiece Yeribee of Brucevale
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Langside Prim	G. W. Young, Inverlaw	6,066·85	313·793	Masterpiece Yeribee of Brucevale
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Langside Dainty	G. W. Young, Inverlaw	5,863·25	306·353	Masterpiece Yeribee of Brucevale
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Glenview Mavoureen	G. Harley, Ch lders	5,233·5	287·01	Glenview Goldfinder
College Rosaleen	Queensland Agricultural High School and College, Gatton	4,777·08	283·272	Burnside Defender
College Peggy 2nd	Queensland Agricultural High School and College, Gatton	4,054·03	247·88	College Chieftain
Glenview Pretty Maid	W. S. Kirby, Byrnestown	4,217·66	236·964	Glenview Goldfinder
Balmoral Golden Belle	H. B. Roberts, Maleny	3,785·2	231·335	Carlyle Sovereign

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

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

On Tuesday and Thursday of each week, as from the 7th January, 1936, a ten-minutes' talk, commencing at 7.5 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for January, February, and March, 1936:—

SCHEDULE OF LECTURES

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

Tuesday, 7th January, 1936.—"The Fertilizers Act of 1935," by Mr. R. A. Taylor, Inspector and Examiner, Fertilizers Branch.

Thursday, 9th January, 1936.—"The Dairy Produce Acts Amendment Act of 1935," by Mr. G. B. Gallwey, Inspector of Accounts, Dairy Branch.

Tuesday, 14th January, 1936.—"The Wheat and Wheat Products Act of 1935," by Mr. L. Cain, Marketing Branch.

Thursday, 16th January, 1936.—"The Farmers' Assistance (Debts Adjustment) Act of 1935," by Mr. A. Gray, Agricultural Bank.

Tuesday, 21st January, 1936.—"Farm Training for Boys," by Mr. J. A. Kerr.

Thursday, 23rd January, 1936.—"The Value of Silage," by Mr. H. W. Ball, Assistant Experimentalist.

Tuesday, 28th January, 1936.—"Summertime Troubles with Cream," by Mr. O. St. J. Kent, Dairy Research Laboratory.

Thursday, 30th January, 1936.—"The Value of Late Cultivation of the Cotton Crop," by Mr. W. G. Wells, Director of Cotton Culture.

Tuesday, 4th February, 1936.—"Microbes in the Dairy," by Mr. E. B. Rice, Dairy Research Laboratory.

Thursday, 6th February, 1936.—"Some Factors in the Control of Worm Parasites," by Dr. F. H. S. Roberts, M.Sc., Entomologist.

Tuesday, 11th February, 1936.—"Fodder Trees," by Mr. C. T. White, Government Botanist.

Thursday, 13th February, 1936.—"Forwarding Cotton to the Ginnery," by Mr. W. G. Wells, Director of Cotton Culture.

Tuesday, 18th February, 1936.—"The Stock Foods Acts Amendment Act of 1935," by Mr. F. B. Coleman, Officer in Charge, Stock Foods Investigation Branch.

Thursday, 20th February, 1936.—"The Primary Producers' Organisation and Marketing Acts Amendment Act of 1935," by Mr. L. Cain, Marketing Branch.

Tuesday, 25th February, 1936.—"The Agricultural Bank and Rural Assistance Board," by Mr. A. Gray, Agricultural Bank.

Thursday, 27th February, 1936.—"Types of Barns and Methods of Curing Employed in South Africa," by Mr. R. A. Tarrant, Instructor in Agriculture.

Tuesday, 3rd March, 1936.—"The Tobacco Disease Situation in Queensland and in America," by Mr. L. F. Mandelson, B.Sc.Agr., Assistant Plant Pathologist.

Thursday, 5th March, 1936.—"The High Cost of Doing Nothing," by Mr. J. F. F. Reid, Editor of Publications.

Tuesday, 10th March, 1936.—"The Life History of the Honey Bee," by Mr. Henry Hacker, F.R.E.S., Entomologist.

Thursday, 12th March, 1936.—"The Pineapple Industry," by Mr. H. Barnes, Director of Fruit Culture.

Tuesday, 17th March, 1936.—"Observations on Western Pastures," by Mr. S. L. Everist, Assistant to Botanist.

Thursday, 19th March, 1936.—"The Composition of Milk and Cream," by Mr. L. A. Burgess, Dairy Research Laboratory.

Tuesday, 24th March, 1936.—"Agriculture in Other Countries," by Mr. J. F. F. Reid, Editor of Publications.

Thursday, 26th March, 1936.—"Spraying Deciduous Fruits for Disease Control," by Mr. R. B. Morwood, M.Sc., Assistant Plant Pathologist.

Tuesday, 31st March, 1936.—"Keeping Pigs Healthy," by Mr. L. A. Downey, Instructor in Pig Raising.

MR. HOOPER'S IMPENDING RETIREMENT.

TRIBUTES IN PARLIAMENT.

In the course of the discussion on the Departmental Estimates in the State Parliament, members on both sides of the Chamber referred to the impending retirement of Mr. S. S. Hooper, Accountant of the Department of Agriculture and Stock, and paid high tributes to his zeal and capacity as a senior officer of the public service. Notable among the speakers was Mr. W. J. Copley, M.L.A., formerly an officer of Mr. Hooper's branch, and following is the "Hansard" report of his remarks:—

"I take this opportunity to pay a tribute to a man who this year will retire under the public service regulations. He will be a great loss to the public service. I refer to the accountant of the department, Mr. Hooper.

PLATE 25.
Mr. S. S. HOOPER, Accountant of the Department of Agriculture and Stock.

Mr. Hooper, who was transferred from the Commonwealth service, was first appointed to the department forty-three or forty-four years ago. For more than forty years he has each year attended the sittings of Parliament and assisted the Minister to pilot his Estimates through Committee. This is a record that is not surpassed by any other accountant in the State, and is one that will bear comparison with a similar officer in any other State. Both the present Minister and an ex-Minister, the honourable member for Cooroora, told me they regarded Mr. Hooper—the Premier and the Public Service Commissioner also support their opinions—as a most valuable officer. I desire to pay a tribute to him for his services to the State. The account section began with Mr. Hooper himself, but the staff has increased to twelve to fifteen officers under Mr. Hooper's control. He has trained some very valuable officers for the public service, and some of his former subordinates now occupy important positions in our civic life. The Minister informs me—and I believe this is also a record—that for about ten years—with one exception—it has never been necessary for the department to incur unforeseen expenditure. That is a compliment to the officer who framed the Estimates of the department. I also understand from the Minister that Mr. Hooper has never failed him in his public duties. . . . . Mr. Hooper will leave the public service this year with the full knowledge that he enjoys the confidence of all those with whom he has come in contact. He enjoys the confidence of the Minister and his fellow-officers. He has a very fine record, and he leaves an excellent organisation for his successor.''

TRIBUTE BY THE MINISTER.

Replying to the general discussion on the work of his department, the Minister, Hon. Frank Bulcock, referred to Mr. Hooper's approaching retirement in the following terms:—

''I should not like to resume my seat without paying a personal tribute to the accountant of my department, Mr. Hooper. He has prepared the departmental Estimates for forty-one years, and, unfortunately, these Estimates will be his last. Mr. Hooper commenced work as a clerical assistant in the public service in 1886, and became accountant of the Department of Agriculture in 1894. He has framed Estimates for the last forty-one years, and his method has been used as a pattern by the various other Government departments. He has been more than an officer to the fifteen Ministers under whom he has worked. Mr. Hooper is that rare type of individual, who is not only the Minister's accountant, but also his guide and friend. He has very largely contributed, by his skilful financial administration, to the success of the department. He is respected by everybody with whom he comes in contact, and during the war period he acted as chief clerk in the absence of the present Assistant Under Secretary (Mr. R. Wilson), who was then chief clerk. Every officer in the department is grieved by the thought that Mr. Hooper is leaving. I am particularly sorry, because there is not a more honest, zealous, or conscientious friend in the department than Mr. Hooper has been to me and my predecessors. I hope that he enjoys a period of good health after he leaves the department, but there are personal circumstances that cause him to desire to be relieved of the work he is doing. I desire to pay a tribute on the floor of this Chamber to an officer who has done yeoman service for his State, and I feel that when he leaves the department will be the poorer for his absence.''

Answers to Correspondents.

BOTANY.

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

Rough or Wild Poppy.

S.G.W. (Mulgeldie)—

Your specimen represents the rough poppy or wild poppy (*Papaver hybridum*). We have no particular notes about the toxic property of this particular poppy, but most poppies have similar properties. The ordinary field poppy of Europe contains two alkaloids, morphine and rheadine. The plants are poisonous, both in the green state and when dried and made into hay. Feeding tests in Europe indicate that "the symptoms are excitement, shown by continual movement, by pawing of the soil or litter. The complaint is not usually fatal, but when death does occur respiration becomes slower, and after a few convulsive movements death occurs owing to asphyxia." Another authority gives stupidity, retention of urine, colic, with sickness and diarrhœa, convulsions, and epileptic symptoms, so probably your neighbour's claims that it made the cow temporarily insane are correct.

Mat Grass

A.C. (Woodford)—

The specimen is the broad-leaf form of mat grass or carpet grass (*Axonopus compressus*). As you know, much trouble has been caused by the spread of this grass in coastal Queensland. If it invades the paspalum pastures, particularly those which are heavily stocked, it very much lessens their carrying capacity. For second-class country, however, we think the grass has some definite use. Of the two forms, broad-leaf and narrow-leaf, we think the broad-leaf is somewhat the better.

"Everlasting" Emu Grass. A Variety of Darling Pea.

H.L.E.S. (Harlin)—

The specimens forward with your letter of the 6th instant have been determined as follows:—

The plant with the yellow flowers is *Helichrysum apiculatum*, the small "everlasting." This plant is very common in many of the pastures of Queensland. It is not known to possess any poisonous or harmful properties, but we have heard that the furry seed-heads cause impaction.

The plant of trailing habit with spikes of blue flowers and the leaves arranged in 5-7, radiating out from the top somewhat like the foot of a bird, is *Psoralea tenax*, emu grass, a common plant in many parts of Queensland, and generally regarded as excellent fodder. We have, at times, seen it eaten by stock, and on other occasions have received some from pastoralists with the report that it was being eaten by stock when it was both young and dry, and that, being drought-resistant, it was providing wonderful nourishment during a lean time. We regard the plant as especially valuable, and it is not known to possess any poisonous or harmful properties.

The plant with spikes of rather showy flowers and leaves composed of numerous small leaflets arranged on a slender rachis is *Swainsona galegifolia*, a variety of the Darling pea. The effects of the Darling pea are well known. It affects the nerve endings and sends animals stupid. It has been shown by feeding tests that the poisonous principle of the Darling pea is a cumulative one, and that it takes from six to eight weeks for the symptoms to appear. Most of the trouble has been with sheep, but it is very rarely eaten in quantity, particularly the variety you send, which is a fairly common one in forest country in Queensland a few miles inland from the coast.

We do not think any of these plants would cause any trouble, and if you have had losses we think the trouble must be looked for elsewhere.

Cluster Clover. Burr Trefoil.

J.E.A. (Biggenden)—

Your specimen represents the cluster clover (*Trifolium glomeratum*). We think this is one of the best of the annual clovers to grow under Queensland conditions. It seems to have been much on the increase in recent years, although it is found generally in a few isolated patches in cultivation paddocks and here and there in the pastures, but only where the ground has been disturbed. Stock are very fond of it, and seed is obtainable through ordinary commercial channels. It should be sown preferably in the early winter, when it provides a good deal of fodder during spring, dying off at the approach of hot weather about the middle of November.

The other plant you describe is probably the burr trefoil (*Medicago denticulata*), one of the best of our annual trefoils grown in Queensland. Even when the plant is dead the burrs are edible and quite nourishing. A drawback is that the burrs cause some trouble in the belly wool of sheep, but we think its good qualities outweigh the bad.

Stagger Weed.

M.A. (Calvert)—

The specimen represents the Stagger Weed (*Stachys arvensis*). It is commonly called "mint weed," but is not to be confused with the "wild mint" that attracted some attention some time ago on the Darling Downs. It only affects stock when they are worked or excited in some way; ordinary resting stock seem to eat the plant with impunity. If you are making chaff of the lucerne crop, it would be as well to retain it for feeding to dairy cattle and resting stock, and not to working horses.

Bat's Wing Coral Tree.

"Sap" (Townsville)—

It is rather difficult to determine specimens from the leaves only, but the one you send is very distinctive, and we feel sure it represents the Bat's Wing Coral Tree (*Erythrina vespertilio*). This is fairly common in Queensland, and it is commonly called cork wood, a name given to many other trees besides this. It grows to a medium-sized tree, and has very pretty red or salmon-red flowers. It is well worth growing as an ornamental tree.

Fossils from the West.

INQUIRER (Quilpie)—

The Director of the Queensland Museum, Mr. H. A. Longman, writes:—I have to acknowledge the receipt of your valued donation as undernoted and to express to you our appreciation of your kindly interest, and our sincere thanks.

Fragment of lower jaw of a large extinct marsupial; *Nototherium* sp. This fragment, which is from the right-hand side, contains remains of very worn molar teeth. It represents an aged individual. This marsupial was about as large as a bullock. In general shape it resembled a wombat, but its teeth are more like those of a kangaroo. A fragment of a rib, probably from the same animal, is also present.

Another fragment is a phalangeal bone from the foot of a giant extinct kangaroo.

We have only one previous record of these large marsupials from your district, although such remains are not uncommon in Condamine deposits on the Darling Downs.

WHAT THE YELLOW WRAPPER MEANS.

If your Journal is enclosed in a yellow wrapper, it is an indication that your subscription has expired.

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General Notes.

Staff Changes and Appointments.

Mr. L. F. Andersen, Senior Herd Tester, and Mr. L. W. B. Verney, Inspector under the Dairy Produce Acts, have been appointed Dairy Instructors, Department of Agriculture and Stock. Mr. Verney will be attached to Gladstone.

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

The Officers in Charge of Police at Wallumbilla, Yeulba, Jackson, and Miles, have been appointed also Inspectors under the Brands Acts.

Mr. R. H. Heaslop, Chatsworth road, Greenslopes, and Mr. A. H. Clayton, Point Lookout, Stradbroke Island, have been appointed Honorary Rangers under the Animals and Birds Acts.

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

Constable J. B. Chambers, Calen, has been appointed also an Inspector under the Slaughtering Act.

Mr. H. T. Green, Manager of "Thornhill," the property of Messrs. Thos. Borthwick and Sons (Australasia), Ltd., near Lowmead, has been appointed an Honorary Ranger under the Animals and Birds Acts in connection with this property, which was recently declared a sanctuary.

Mr. G. W. Turner, Stafford street, East Brisbane (a qualified candidate for appointment), has been appointed Inspector under the Dairy Produce Acts, the Diseases in Stock Acts, and the Slaughtering Acts, Department of Agriculture and Stock.

Mr. C. H. P. Defries, Inspector under the Dairy Produce Acts, the Slaughtering Act, and the Diseases in Stock Acts, has been appointed Acting Instructor in Agriculture, Department of Agriculture and Stock.

The headquarters of Mr. D. A. Logan, District Inspector of Stock, will be changed from Mareeba to Atherton.

Mr. J. Wyvill, Stock, Slaughtering, and Dairy Inspector, will be transferred from Nanango to Kingaroy, and Mr. T. Douglas, Stock, Slaughtering, and Dairy Inspector, from Kingaroy to Rockhampton.

Messrs. C. J. McKeon, Director of Tropical Agriculture, L. G. Miles, Plant Breeder, W. J. Cartmill, Analyst, and C. E. Whitehead, Cadet, Department of Agriculture and Stock, will be attached to the Bureau of Tropical Agriculture, South Johnstone.

Mr. A. McDowall, a qualified candidate from the examination for appointment to inspectorial positions, has been appointed Inspector under the Stock, Slaughtering, and Dairy Produce Acts, Department of Agriculture and Stock.

Mr. H. M. Northcott, Caretaker of the Stuart River Dip, via Tingoora, has been appointed an Honorary Inspector under the Diseases in Stock Acts, vice J. Northcott, deceased.

Dr. R. P. Rundle, of Proston, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

The following appointments have been made in the Department of Agriculture and Stock:—

Mr. A. F. Bell, M.Sc., Sugar-cane Pathologist, to be Assistant Director, Bureau of Sugar Experiment Stations;

Mr. C. R. von Stieglitz, Analyst, Agricultural Chemical Laboratory, to be Chemist, Bureau of Sugar Experiment Stations;

Mr. N. J. R. Barke, Chemist in Charge, Sugar Experiment Station, Meringa, to be Manager, Sugar Experiment Station, Meringa;

Mr. N. J. King, Assistant to Analysts, Bureau of Sugar Experiment Stations, to be Soils Survey Officer, Bureau of Sugar Experiment Stations;

Mr. J. H. Simmonds, M.Sc., Plant Pathologist, to be Senior Pathologist, Science Branch;

Mr. R. B. Morwood, M.Sc., Assistant Pathologist, to be Pathologist, Science Branch;

Messrs. J. A. Weddell and W. A. T. Summerville, M.Sc., Assistant Entomologists, to be Entomologists, Science Branch;

Mr. R. E. Soutter, Wheat Breeder, to be Agricultural Research Officer (Wheat and Maize);

Mr. L. F. Mandelson, B.Sc. (Agric.), Assistant Pathologist, to be Pathologist; and

Mr. H. K. Lewcock, B.Sc. (Agric.), Assistant Pathologist, to be Pathologist.

Butter Board.

In a special "Government Gazette" of the 15th November an Order in Council amending the constitution of the Queensland Butter Board has been issued.

This order provides for an election of six growers' representatives as members of the Butter Board. The election will be held on the 21st December, and a grower has been defined as any company, association, firm, or person who, during the year ended 30th June, 1935, manufactured not less than twenty-six tons of butter. This means that the butter manufacturers will elect the representatives. The basis of allocating the votes is as follows:—

(*a*) At least 26 tons, 1 vote;

(*b*) Over 26 tons, but not exceeding 100 tons, 2 votes;

(*c*) Over 100 tons, then in addition to the two votes in respect of the first 100 tons so manufactured, one vote in respect of every 100 tons or part thereof in excess of the first 100 tons.

The roll of growers shall be prepared from the records of the Department of Agriculture and Stock.

The rules for the election are laid down, and nominations close with the Returning Officer on the 28th November, 1935.

The Board is empowered to license persons who manufacture or trade in butter, and the conditions of such licenses are outlined, as well as the powers of the Board in this connection.

The order also authorises the Board, from a date to be later fixed, to control intrastate trade and commerce in butter throughout Queensland.

A method of equalisation which can be adopted by the Board, if it is found necessary, is also embodied in the order.

Maximum Numbers of Birds which May be Killed in One Day.

An Order in Council has been issued in pursuance of the provisions of the Animals and Birds Acts prescribing the maximum numbers of birds which any one person may take or kill or have in possession in one day during an open season, namely:—Twenty wild ducks, twenty-five quail, and two scrub turkeys. Previously, similar provisions applied to wild geese, pigeons, plain turkeys, and plovers, but these birds are now totally protected.

Butter Board.

The result of the voting in connection with the election of six growers' representatives on the Queensland Butter Board was as follows:—

	Votes.
William James Sloan (Malanda)	561
Robert Morris Hill (Bororen)	543
James McRobert (Maryborough)	501
Thomas Flood Plunkett (Beaudesert)	473
Adolph Gustav Muller (Fassifern Valley, Kalbar) ..	418
James Purcell (Toowoomba)	403
Frank Augustus Cushon (Wyreema)	301
Ernest John Cannell (Toogoolawah)	147
James Edward Nussey (Warwick)	145

Rescission of Cheese Board Regulations.

Regulations under the Primary Producers' Organisation and Marketing Acts, relative to licenses to trade in cheese, which were issued in February, 1927, have been rescinded, as this matter is fully covered in the Order in Council dealing with certain amendments of the Cheese Board constitution which was issued last month.

Cotton Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts amending the Order in Council constituting the Cotton Board. The amendment provides that, in connection with referenda or elections in connection with the Cotton Board, a person shall vote for the district in which his cotton has been grown, but in no case shall a person be eligible for or exercise more than one vote, even though he has grown cotton in more than one district. Furthermore, where a person has grown cotton in more than one district he shall vote for the district in which he has the greatest area of cotton.

Commodity Board Vacancies.

A regulation has been issued under the Primary Producers' Organisation and Marketing Acts which empowers the Minister, in the event of a vacancy on a Board arising from the death, retirement, or resignation of any member thereof, to appoint some person to fill the vacancy, or direct that an election be held, in which case the election shall be held in manner provided in the regulations for the conduct of elections and the Minister shall appoint the person elected to fill the vacancy. The member so appointed shall hold office only until the time of the next general election for members of the Board.

Lake Clarendon Animals and Birds Sanctuary.

An Order in Council has been issued under the Animals and Birds Acts revoking an Order issued in March, 1900, which declared Lake Clarendon and a strip of land ten chains wide around the border of the lake to be a sanctuary for the protection of native animals and birds. The Order issued to-day declares the Lake Clarendon Pasturage and Recreation Reserve, together with an area contained in portion 12v adjoining the reserve, to comprise the sanctuary. Mr. J. M. Fitzpatrick, of Lake Mount, Lake Clarendon, via Gatton, has been appointed an Honorary Ranger for the sanctuary.

Wild Life Protection at Lowmead.

The property of Messrs. Thomas Borthwick and Sons (Australasia), Ltd., "Thornhill," near Lowmead, has been declared a sanctuary under the Animals and Birds Acts. It will be unlawful for any person to take or kill any native animal or bird on this property.

Extension of Commodity Boards.

Orders in Council giving notice of intention to extend the operations of the Butter and Cheese Boards for a period of three years from the 1st January, 1936, to the 31st December, 1938, have been issued in pursuance of the provisions of the Primary Producers' Organisation and Marketing Acts. Petitions for polls on the question of whether or not these Boards shall be continued for the period stated may be lodged with the Department of Agriculture and Stock on or before the 23rd December next.

Orders in Council have also been issued under the abovementioned Acts extending the operations of the Northern Pig and Cotton Boards, the former for the period from 1st January, 1936, to 31st December, 1940, and the latter from 1st January, 1937, to 31st December, 1941.

Roads to be Stock Routes.

Orders in Council have been issued under the Diseases in Stock Acts, declaring the Rewan Holding Road, in the Springsure Land Agent's District, and the road through Roxborough Downs and Glenormiston Holdings, near Boulia, to be stock routes for the use of travelling stock.

Sugar-cane Assessment at Mackay.

An Order in Council has been issued under the Regulation of Sugar Cane Prices Acts, which provides that the assessment which the Minister may levy on sugar-cane received at the Farleigh and Marian Mills as from the 17th May last, shall be 1¾d. per ton. An Order in Council fixing the assessment on all mills except Kalamia, Pioneer, and Inkerman Mills, at 1¼d. per ton, and at the three mills beforementioned at 2¼d. per ton, was issued on the 17th May, 1935, and the increased rate of assessment for Farleigh and Marian Mills will be made retrospective from that date. The increase is consequential upon the necessity for a survey of the Farleigh and Marian areas following an extension of the lands under cane and cultivation.

Maturity Standards for Pineapples, Papaws, and Grapes.

The Fruit and Vegetable Grading and Packing Regulations, issued under "*The Fruit and Vegetables Act of* 1927" have been amended in regard to an alteration of the maturity standards for pineapples and papaws, and for the introduction of a maturity standard for grapes.

The present standard for pineapples provides that mature fruit must contain a total sugar content of not less than twelve per centum. This has been amended to read "a total sugar content of the juice of not less than twelve per centum." The papaw maturity standard has been raised in an effort to prevent the sending of inferior fruit to the local and Southern markets.

A maturity standard for grapes has been framed with a view of preventing the practice of a few growers who send green berries on to the market very early in the season, and thereby kill the demand for later supplies. The standard introduced is similar to that in operation in New South Wales.

Stanthorpe Fruit and Vegetable Levy.

A regulation has been issued under the Fruit Marketing Organisation Acts empowering the Committee of Direction of Fruit Marketing to make a levy on all fruit and vegetable growers growing fruit and/or vegetables for market in the Granite Belt area for a period of twelve months from the 21st December, 1935.

The levy shall be applicable to all growers, as above, who send their fruit or vegetables either by rail or road in any one lot, with a minimum of ½ cwt. and upwards, and the amount of the levy shall be 3s. 4d. per ton, and a proportionate part thereof for each portion of a ton despatched in such lots.

The sums raised by the levy shall be utilised, firstly, in payment of expenses attached to its collection, and, secondly, the balance shall form part of the general funds for administrative purposes, and shall be credited to the Deciduous Sectional Group Committee.

Up to the present the only growers in the Stanthorpe district who contribute to the support of the C.O.D. organisation are those who consign fruit to Brisbane, Rockhampton, and Sydney by the special C.O.D. fruit trains. Growers who send their fruit to markets outside the cities named, whether by ordinary train or motor lorry, contribute nothing to administrative costs, though they receive all benefits apart from those of the special trains. All growers will now contribute towards administrative costs. The levy does not include any expenses incurred by the running of the fruit trains, such as loading and receiving, these items being charged only to those growers receiving this service.

Dairy Products Stabilisation Board.

An Order in Council has been issued under the Dairy Products Stabilisation Act further extending the Queensland Dairy Products Stabilisation Board until 31st January, 1936. Mr. J. Purcell (Toowoomba) has been appointed Chairman until such date.

Carriage of Bananas.

A regulation has been issued under the Fruit Marketing Organisation Acts revoking a regulation dated the 15th December, 1928, and relating to the protection of bananas in transit from growers' plantations to the rail head for forwarding to market. It is specified therein that any cart, wagon, or other vehicle used for the transport of bananas shall be specially constructed for the purpose and so fitted as to protect the fruit from rain and sun, such protection to allow a minimum air-space of 12 inches above the top layer of fruit or cases, or be provided with a dust-proof and weather-proof covering, such as a tarpaulin or similar contrivance, which covering should likewise allow a minimum air-space of 12 inches above the top layer of fruit or cases. The covering must be kept securely fastened, and opened only when necessary to add further loads of bananas en route, or on arrival at the place of unloading.

Canegrowers' Executive.

The regulation under the Primary Producers' Organisation and Marketing Acts covering the qualifications and disqualifications of persons for election as members of a District Canegrowers' Executive has been amended to provide that a paid officer of a district executive shall be disqualified from being elected to and from continuing to be a member of any executive.

Cheese Board.

An Order in Council issued under the Primary Producers' Organisation and Marketing Acts has received the approval of the Executive Council to-day, and will be published in a special "Government Gazette" dated the 22nd November.

The Order provides for an election of three growers' representatives as members of the Cheese Board. The election will be held on the 23rd December, and a grower has been defined as any company, association, firm, or person who, during the year ended 30th June, 1935, manufactured not less than 26 tons of cheese. This means that the cheese manufacturers will elect the representatives. The basis of allocating the votes is as follows:—

(*a*) At least 26 tons—one vote;

(*b*) Over 26 tons, but not exceeding 100 tons—two votes;

(*c*) Over 100 tons, then in addition to the two votes in respect of the first 100 tons so manufactured, one vote in respect of every 100 tons or part thereof in excess of the first 100 tons.

The roll of growers shall be prepared from the records of the Department of Agriculture and Stock.

The rules for the election are laid down, and nominations close with the Returning Officer on the 7th December, 1935.

The Board is empowered to license persons who manufacture or trade in cheese, and the conditions of such licenses are outlined, as well as the powers of the Board in this connection.

Protection of Wild Life.

The Minister for Agriculture and Stock (Mr. Frank W. Bulcock) has announced that an Order in Council has been issued revising the periods of protection for native fauna throughout the State. Total protection has in the past been afforded to a number of our native birds, and in the case of others partial protection has applied.

The Order in Council now provides that the Burdekin Duck, Doves, Eastern Curlew, Golden Plover, Native Goose, Honey Parrots, all other species of Parrots (except Quarrion, Budgerigar, King, and Rosella), Native Pigeons, Plain Turkeys, Plover, Rail, and True Coot, which have hitherto been protected for seven months annually, are now included in the list of totally protected birds.

Provision is also made that wading birds, in respect of which the protective period has extended from the 1st September to the 31st December, shall now be protected from the 1st October in each year to the 30th April in the following year. The protective periods for Duck and Quail will in future be fixed annually by Order in Council.

The revision of these periods of protection has been supported by various associations and public bodies who are directly interested in the propagation of our native animals and birds. In addition to the necessity for the cultivation of a public spirit in the protection of our national fauna, it is now essential that every effort should be directed towards propagating and protecting those insectivorous birds which are of considerable value to the State from an economic point of view. This has been emphasised only recently in Northern Queensland, where measures to protect insectivorous birds are widely advocated and are in process of adoption.

In addition to protection afforded to native birds under the Order in Council recently issued, it is proposed to establish further bird sanctuaries in sugar-growing districts and on the Atherton Tableland, where insect pests are a menace to the agricultural industry.

Amended Dairy Legislation Now in Force.

The Minister for Agriculture and Stock, Mr. Frank W. Bulcock, has announced that under an amendment of the Dairy Produce Acts assented to on the 5th December no supplier of milk or cream could divert the whole or portion of his supply of that commodity from the factory which he was supplying without giving twenty-eight days' notice to the factory manager of his intention to do so. Further, a supplier of milk to a cheese factory must have his dairy premises in compliance with the requirements of the Act for the supply of cream before he could supply a butter factory. It was incumbent on the owner of a factory to notify the Department of Agriculture and Stock each month of the suppliers who cease or commence to supply dairy produce during the month preceding that in which the notification was furnished.

Farmers' Assistance (Debts Adjustment) Act.

A Proclamation has been issued under "*The Farmers' Assistance (Debts Adjustment) Act of* 1935" extending the time for the receipt of applications for assistance under such Act at the Agricultural Bank until the 31st March, 1936.

Papaw Levy.

The Papaw Levy Regulation which was issued on the 23rd December, 1933, for a period of twelve months and extended until the 31st December, 1935, has been again extended for another year from the 1st January, 1936.

Committee of Direction of Fruit Marketing.

Executive approval has been given to the issue of an Order in Council and regulations dealing with the matter of the extension of the provisions of the Fruit Marketing Organisation Acts for a period of five years from 1st January, 1935. Notice is given of intention to extend the Acts, and a poll on the question may be demanded by a requisition of 500 fruitgrowers. This must reach the Department not later than 12 noon on 31st January, 1936.

For the purpose of the requisition and ballot a fruitgrower is any person who at any time since 30th June, 1934, has been a member of a Local Producers' Association in a fruitgrowing district approved by the Committee of Direction and who has had not less than 1 acre of land wholly occupied with fruit trees or fruit plants which are cultivated for the purpose of supplying fruit to market. It will also include any person (not a member of a Local Producers' Association) who at any time since 30th June, 1934, has not had less than 1 acre of land wholly occupied with fruit trees or fruit plants which are cultivated for the purpose of supplying fruit to market, and who makes application before 31st January, 1936, to the Under Secretary for Agriculture, Brisbane, asking to be considered as a registered fruitgrower. In this application he should state the number of acres of each kind of fruit he has growing. It will not be necessary for a member of a Local Producers' Association to make application.

In the event of a petition being received the question that will be submitted to fruitgrowers is:—

> "Are you in favour of the continuance of the operations of the Fruit Marketing Organisation Acts for a further period of five years as from 1st January, 1935?"

The ballot, if any, will then be arranged for, and if one-half of the votes are in favour of the continuance the provisions of the Acts shall cease to be operative. If, however, no requisition is received, or if one is received and there is a majority vote, then the Acts shall continue for a further period of five years.

Rhodes Grass for Burnt-out Country.

Reports have been received of the effect of the recent bush fires in the Tara district by the Minister for Agriculture (Mr. Frank W. Bulcock). These indicate that an extensive area of ringbarked scrub country had been burnt out, and that both old and recently ringbarked country was affected by the fires.

It is generally recognised that if a fire passes through ringbarked brigalow country before the trees are absolutely dead there is always a danger of a prolific crop of suckers springing up from the root system, which retains its vitality for some time after the trees appear to be dead. One method of coping with young brigalow suckers adopted by selectors whose country is protected by dog-proof netting is to stock it with sheep, but the obvious thing to do under the present circumstances is to promptly sow Rhodes grass on the burnt-off scrub country as soon as possible. Given suitable growing conditions the grass will make rapid growth during the warm weather; the development of the suckers will be materially checked, and stocking can soon be resorted to.

Last year special provision was made under the Agricultural Bank Acts for the purchase of grass seed, also for the purchase of stock, and should any of the settlers on this recently burnt-off country require financial assistance—for instance to enable them to buy seed—prompt application should be made to the General Manager of the Bank or to the nearest Bank Inspector.

It is to be expected, also, that some of the new settlers will be concerned about supplies of fodder, and should any of them find it necessary to apply for seed or quick-growing summer fodder crops, such as White Panicum, Japanese Millet, Sudan grass, &c., for sowing right on top of the ashes of the burnt-off country, every consideration will be given to any applications which may be submitted to the Bank.

VALEDICTORY.

Mr. J. P. ORR.

PLATE 26.

Under the age limit provisions of the Public Service Act, Mr. James P. Orr, Registrar of Co-operative Associations, has retired from the Department of Agriculture and Stock, in which he served for fifty-two years.

Mr. Orr entered the Queensland Public Service on 1st February, 1883, commencing as a junior clerk in the Office of the Chief Inspector of Stock. Since then he has served with distinction in a number of responsible positions under fourteen Ministers.

As a very young man Mr. Orr's proficiency was recognised by his appointment to the secretaryship of the Stock Board, and in that capacity he later became associated very closely with the general progress of the Stock Branch. When the tick invasion was at its height he was made Secretary of the Board of Stock Commissioners appointed to inquire into methods of checking and mitigating the effects of that menace to the cattle industry, and the alignment of quarantine areas. He was concerned on the administrative side also with other important investigations into animal pest and pathological problems. Among other important posts held by Mr. Orr in the course of his long and honourable official career were those of Chief Clerk in the Stock Branch and Deputy Registrar of Brands, Deputy Chief Inspector of Stock, and Chief Clerk of the Department of Agriculture and Stock. At the time of his retirement Mr. Orr was Registrar of Co-operative Associations, with which he combined the office of Departmental Librarian. To those who served under him he was ever the guide, philosopher, and friend.

In sporting circles it may be said without exaggeration that Mr. Orr's name is a household word. His is a familiar and popular figure on the cricket field to many thousands of enthusiasts. He was one of the original trinity that formed the Queensland Umpires' Association, and as a member of that body umpired many international (including Tests), interstate, intertown, and final premiership matches. He also interested himself keenly in Rugby Union football; he was Vice-President of and delegate for the South Brisbane Electoral Club on the old Rugby Union Committee, on which he sat for about eight years. In his younger days he was very prominent also in musical and dramatic circles.

At a valedictory gathering of his fellow officers presided over by the Minister, Hon. Frank W. Bulcock, a very fine tribute was paid to Mr. Orr's work and worth during his official career, and cordial appreciation of his high personal qualities, as expressed by the Minister, found unanimous approval. Mr. Orr carries with him into his well-earned retirement from Departmental life the high esteem and warm regard not only of his colleagues, but also of a host of friends outside the Public Service.

Rural Topics.

Feed and Weed.

No excuse is offered for repeatedly referring to this matter of feeding the dairy cow, because I know from personal experience that there is no other matter that is of such vital importance to the dairy farmer, whose motto should be "feed and weed."

It is to be hoped that those who, hitherto, have been careless in the matter of providing supplementary food, and more than willing to listen to the advocates of the "scrap the plough" and "the pastures are sufficient" doctrines, will benefit by the severe lesson they are now having, and recognise once for all that those occasional lean times are as certain as death itself, and will continue to make a periodical appearance.

A cow is simply an engine for manufacturing milk, and, like the steam engine, must be supplied in the first place with sufficient fuel or fodder to move her body from place to place. This fuel or fodder is called a maintenance ration, but if we would have the cow become a profitable producer of milk throughout the season, she must be supplied with a great deal more fodder or fuel than is included in the maintenance ration, otherwise she would remain just as unprofitable as the engine that has only sufficient fuel fed to it to move its own machinery. Such an engine would be a dead loss to the owner. If it means a loss to the farmer to supply only a maintenance ration to his herd, the loss from supplying less than a maintenance ration is obvious.

Dairy farmers rightly interest themselves in the improvement of dairying methods, improving the dairying capacity of the herd by breeding and culling, improving the pastures by top-dressing and subdivision, improving the quality of the milk and cream by more careful handling and by better methods of manufacturing them into butter and cheese, improving the method of advertising and selling the produce, &c., &c.; but what does it all amount to if the fountain head of all, which is the cow, has occasionally to exist on very scanty rations or even die of starvation?

Too often the provision of ample food is looked upon as a trouble and unnecessary expense; but surely the experience of the present time and of similar times in the past should convince every farmer that the cheapest way to feed the herd is to provide enough food to keep the cows in good condition the year round.

It is not suggested that all dairy farmers are equally guilty in this connection. Many handle their herds capably, and provide liberally for them, being fully convinced that it is the only safe road to success.—Primrose McConnell, in "The New Zealand Farmer."

To Keep Weevils Out of Stored Skins.

When skins are to be stored for some time, especially in the summer months, it is advisable, as soon as possible after they have cooled off, to paint the pelts with some solution to keep away weevils and other pests, which do considerable damage by eating into them, thus reducing their value. Once the weevils get into the skin it is a difficult matter to remove them, and the longer they remain the more damage they do. Care must be taken to paint the pelt thoroughly, as unless this is done the weevils get in at the points and in small pockets and soon riddle the whole piece.

Cheap and effective mixtures for this purpose are made up as follows:—

1. Arsenic, 4 oz.; soda crystals, 8 oz.; water, 1 gallon. Boil all together until dissolved, and when cool apply with a soft brush.
2. Arsenic, ½ lb.; soda, ½ lb.; water, 1 gallon. Boil for half an hour.
3. Arsenate of soda, 1 lb.; water, 4 gallons. Boil together.
4. Soda ash, 5 lb.; Barbadoes aloes, ¼ lb.; water, 4 gallons. Boil together, and when the mixture rises pour in 1 gallon of cold water. One part of this stock solution to five parts of water would be the proportion to use when required.

All of these mixtures are highly poisonous, and must be legibly branded as such. When not in use, keep under lock and key.

These mixtures are also used for painting dry hides and all descriptions of marsupial skins. Paint the pelts with the solution, using an ordinary whitewash brush. Be careful to see that the pelts are thoroughly dry before bundling, as wet skins soon go mouldy and depreciate in value.

"Intensive" Dairy Farming.

Mr. E. J. Hayes, who dairies at Nesward, Taree, North Coast of New South Wales, has demonstrated the remarkable production qualities of well-bred Jerseys on small areas. At Nesward, on 33¾ acres, Mr. Hayes grazes 17 cows, which last year produced 5,693 lb. of butter (actual factory returns), an average of 335 lb. of butter a cow, and 167 lb. of butter an acre. In addition, he grew all the fodder required for the upkeep of the herd, obtained £70 revenue from pigs and calves, £50 from pumpkins and other vegetables, and £52 from eggs and poultry. These figures he expects to greatly increase when stall feeding can be carried out.

At present there is an excellent stand of 5 acres of lucerne, 1 acre of peas, 1 acre of saccaline, 1 acre of orchard, 5 acres of maize, and 1 acre of pumpkins. Hawkesbury College blood forms the basis of the herd.

New Grazing Methods.

Mr. Max Henry (Chief Veterinary Surgeon of the Department of Agriculture, New South Wales) stated in an interview recently that the steady deterioration of natural pastures under conditions of continuous grazing without renovation was making it more necessary for graziers to grow crops to feed in dry seasons as conserved fodder.

Stock which approached winter in strong condition, it had been found, would live through on an extraordinary low diet and be in a position to respond quickly to the spring growth. On the other hand cattle that entered winter in an under-nourished condition had suffered heavy mortality, not merely through semi-starvation during periods of extreme dryness, but because when the rain did come and promote a flush of feed the tone of the digestive system was so low that they could not avail themselves of the food offering, and the tendency to scour provided the finishing touch.

In the eastern half of New South Wales there were few properties on which something could not be done to put together a store of feed to be used as a regular ration for the stock to augment the grazing.

The bogey of expense, he said, was too often raised with regard to supplementary feeding, and yet in many cases once the food was stored the expense of utilising it was practically nil. There was no expense in giving stock free access to a haystack or trailing maize for sheep. Feeding stalls for cattle need be of the simplest design, and could be constructed by the farmer himself. Feed boxes or bags slung between battens were very cheap. The only real expenditure involved was that concerned in the production of the fodder, and it would not take the value of many animals, particularly cows, to recoup that outlay.

It was extraordinary what a small quantity of supplementary food was necessary, providing it was available early enough. In one case under his notice the supply of five bags of maize per 1,000 sheep each week, increased to ten bags a few weeks later not only stopped mortality, but resulted in an amazing improvement in the appearance of the fleece. On the same property, which was heavily top-dressed, it was the practice to build meadow haystacks regularly in the paddocks. These were available to the stock, and when the grazing was good they were scarcely touched, but as the pastures became depleted the stacks were more and more used until they were finally eaten to the ground. This provision was only possible when the property was reasonably subdivided, and without subdivision of paddocks no system of supplementary feeding would be really successful.

A Biblical Rebuke—When Wheat Realised 15s. a Bushel.

A story told to Rev. James Hassall, who repeats it in his book, "In Old Australia," is worth re-telling. The story concerned an old pioneer, of Goulburn, New South Wales. In the mid-forties of last century, when wheat was abundant, and was selling at 18d. a bushel, he purchased all he could procure at the price, and stored it in huge silos, which he was the first to erect in the Goulburn district. Three years later there was a drought, and he was offered 15s. a bushel for his wheat, but declined to sell at less than £1 a bushel. The same evening, when reading his Bible, he saw in Proverbs xi., 26, "He that witholdeth corn, the people shall curse; but blessing shall be upon the head of him that selleth it." The old farmer took the admonition seriously, felt remorse, and at once drove into Goulburn and sold all his wheat at 15s. a bushel. It was carted to the mills at once, but before the flour was sold from this wheat two ships with cargoes of wheat arrived in Sydney from New York, and the market price fell to 6s. a bushel. One would be sure that the dealer in wheat became a keen student of the Bible after that, and never forgot how nearly he missed the market.

Bracken Control.

Because of its ability to spread rapidly over the ground by means of running stems or stolons, kikuyu grass can be a valuable ally to the grazier in the coastal areas where bracken fern has become dominant.

Fern country on which it is intended to grow kikuyu should be worked and ploughed prior to planting in the spring, or, if the soil be of an open, free nature, the fern fronds should be cut in the early spring, burnt, and the grass roots hoed in. On large areas drills 3 feet apart should be struck out with a single furrow plough, and kikuyu roots or cuttings dropped every 3 feet and covered with a light furrow or by running a harrow along the drills in the direction in which they run.

Under favourable weather conditions the kikuyu grass makes headway as soon as, or before the fern, and by the following spring a mat of grass will have gradually choked out the fern, assisted by the cattle, which tramp down the bracken while feeding on the grass. The grass should be allowed to become well established before being fed off, as the stock may tear up the runners if not well rooted.

To ensure a better balance of feed 4 lb. of white clover an acre should be broadcast over the area during the autumn of the early period of establishment of the kikuyu and lightly harrowed in. Top-dress with 2½ to 2 cwt. of superphosphate an acre in the autumn each year. Planting on land that may subsequently be required for cultivation is not recommended, as once established the kikuyu is difficult to eradicate.

Kikuyu provides excellent feed and, though mainly a summer grower, it withstands dry weather better, remains green longer, and provides a greater bulk of feed during the winter months than does paspalum.

The grass grows rapidly, and the roots sent out from each joint anchor the grass firmly in the ground, at the same time forming a dense turf that will stand the tramping of heavy stock well. Its ability to bind the surface of the soil also makes it of value in preventing soil erosion on creek banks and hillsides.—"The Australasian."

Keep Farm Stock Healthy.

Serious losses occur among stock, particularly young stock, from both infectious and non-infectious complaints through lack of attention to the principles of good hygiene. There is too often a tendency on the part of the farmer and stockowner to regard veterinary science as only capable of coming to his aid when stock are already sick, forgetting that the most valuable part of veterinary advice is that dealing with prevention, and that it is along these lines that the future development of the science will be most marked.

This attitude of the farmer is due to the fact that throughout the earlier years of Australian colonisation and settlement stock practically looked after themselves, and the question of good or bad hygiene never had to be considered. But to-day, in the settled parts of the country—particularly in dairying districts, on pig farms, in irrigation areas, in poultry-farming areas, and wherever stock are under more or less confined and artificial conditions—the question of good hygiene becomes one of the first importance. The prevailing opinion among farmers appears to be that good hygiene is a kind of fad—bred by Science out of Laboratory—but of no kind of use to the man making a living out of stock. Nothing could be further from the truth, though it is admittedly difficult to say at what precise moment the observance of good hygiene puts a "fiver" in a banking account.

It is also argued that because stock thrived in the old days under such-and-such conditions they must do all right now. To hold such opinions a man must have forgotten many things; such things as the actual changes which have taken place in conditions, the greater economic value of the individual animal, the totally different position as regards disease, and the fact that as this country progresses these changes in every way will become more and more marked. It is wiser to look ahead to what we have to do than to look back on what our grandfathers did; and it is of far more value to the farmer to understand what good hygiene means than to possess any number of isolated and more or less correct ideas as to the treatment of sick stock.

The treatment of sick stock is of value at long intervals—good hygiene is of value at all times. Even in parts of the State where stock are running freely in wide areas, certain aspects of the question are of considerable importance. By good hygiene is meant the correct application of those systems of stabling, housing, grazing, sheltering, grooming, clipping, clothing, feeding, and watering which are most conducive to the good health and economic efficiency of the animals.—" A. and P. Notes," New South Wales Department of Agriculture.

Lucerne Invaluable—A Pastoralist's Opinion.

In the opinion of Colonel H. F. White, of Bald Blair station, in New England (New South Wales), lucerne is the most valuable of all leguminous pastures, the hardiest herbage plant known, and has the widest range of adaptability to grazing conditions in Australia. The cultivation of lucerne he believes will be the ultimate solution of the wheat men's difficulties, enabling them to reduce their areas under wheat and to profitably replace them with grazing pastures for the production of mutton and beef.

The idea that lucerne only thrived in soil through which its roots could penetrate to water was a mistaken one, he said. At Bald Blair, he had a seven-year-old stand of lucerne sown in conjunction with phalaris, growing on soil that was not a foot deep, and had an underlying bed of impervious rock. This season following one of the driest winters ever experienced in New England, the lucerne was showing more growth than any other pasture plant on the property, and was as vigorous to-day as could be desired.

To have the best balanced pasture it was necessary, he believed, to establish legumes with the grasses, and he had found lucerne the king of the legume family, and a valuable ally that further improved the pastures by crowding out the weeds. At Bald Blair he had had splendid results from lucerne sown with phalaris. Providing it was kept short during the summer it would stand grazing through the winter, and would be the first plant to respond in the early spring, when it would provide a crop for hay.

It had been found possible to grow lucerne successfully on the extreme west of the wheat belt in the north-west of New South Wales, where a grazier was to-day cultivating it along the lines of the dry farmers in California. The seed was sown in rows from 3 to 4 feet apart at the rate of 1 lb. to the acre. The soil was well worked between the rows, thus forming a surface mulch that minimised evaporation, and at the same time permitted the maximum absorption of slight showers and heavy dews. Along these lines, he believed that lucerne could be cultivated in the lowest rainfall districts.

Dry Mash for Pigs.

In a series of interesting experiments in the feeding of pigs, conducted in Queensland recently at the Animal Health Station, Yeerongpilly, the young pigs from seven up to twenty-four weeks of age were fed entirely on dry meal with the addition of clean drinking water, fed in a trough separate from the self-feeders containing the meal. Green food was used as it became available, paspalum grass and a mixture of green lucerne and grass being used as a mid-day snack.

The meal mixture was composed of—

Maize meal	40 per cent.
Wheaten pollard	40 per cent.
Meat meal	10 per cent.
Lucerne chaff	10 per cent.

A mineral supplement was added at the rate of 2 lb. per 100 lb. of meal, this mineral mixture being composed of calphos (a bone meal mixture) 75 per cent., common salt (fine) 25 per cent., plus powdered sulphate of iron, 2 oz. to each 100 lb. of mineral mixture.

In a previous experiment it was shown that there is relatively little difference in food value between maize meal, wheat meal, and barley meal, and it is assumed that for the purpose of feeding, wheaten meal or barley meal could replace the maize meal in such feeding.

More recently still the meal mixture has been altered, and that now being fed is made up from:—

Maize meal	80 parts
Protein meal	12 parts
Lucerne chaff	8 parts

A mineral mixture composed of ground limestone 2 parts, calphos (bone meal) 2 parts, and fine salt 1 part is added in the ratio of 2 lb. of this mineral supplement to each 100 lb. of meal, with drinking and green food as in the former trials.

It is proposed later to use pumpkins in lieu of lucerne chaff, as the latter is not always available, and in some districts is difficult to procure.

The Pig's Temperature, Respiration, and Pulse.

The temperature of the pig's body is normally 102.6°F. It varies from this to a degree or so higher, and is higher than normal in very young animals. The temperature is taken with a clinical thermometer, and to obtain correct normal temperature the animal should be normal, for its bodily heat rises after a meal or after vigorous exercise, and is, of course, higher at the time the sow is approaching or passing through her farrowing period. It is higher during humid weather and when fully fed than under the reverse conditions.

The temperature of the pig is taken by means of a clinical thermometer inserted into the back pasaage (the anus) and held there for not less than sixty seconds, and for preference a longer period if the animal is quiet and readily handled.

Care should be taken to "set" the thermometer before use—that is, to see that the mercury is sufficiently below the line of normal temperature of the animal's body. Care in handling is emphasised so that the results may be looked to as correct. Some experience is needed in reading a clinical thermometer, as the column of mercury is not always readily seen.

The normal respirations of the pig are about fifteen respirations per minute. The breathing is short and jerky in cases of inflammation of the lungs, but is normally undisturbed.

The normal pulse is about seventy-five beats per minute, the pulse being taken on the inside of the foreleg. The respirations of the pig are, of course, observed by closely watching the animal when it is in normal condition, not overheated or excited after a chase.

Temperature, respiration, pulse, and gait or movement are all important in the diagnosis of disease, and it should be the aim of the pig-raiser to become conversant with each. Pigs are friendly disposed, and can be trained to obey, but they should at all times be treated firmly, be well fed, managed, and cared for.—E. J. SHELTON, Senior Instructor in Pig Raising.

Productive Jerseys—Posy V.'s Australian Record.

Continuing the remarkable production performances of 273 days, which were reported last July, the Hawkesbury College Jersey cows Richmond Posy 5th and Richmond Laurel 5th have just completed the full 365 days' period, during which each produced more than 1,000 lb. butter-fat.

The figures for Richmond Posy 5th are 19,365 lb. milk, average test 6.67 per cent., equal to 1,292 lb. fat, or 1,556 lb. commercial butter. This performance constitutes an Australian record for the Jersey breed, and has been beaten on only one occasion, that being by the Canadian cow, Brampton Basilua.

The world's record for butter-fat production was first claimed by an Australian cow in 1927, when Wagga Gladys, stationed at Hawkesbury College, produced 20,835 lb. milk, equal to 1,149 lb. fat. This figure was later lowered by the New Zealand cow, Woodland's Felicie, which produced 1,220 lb. fat. In May, 1932, Wagga Gladys regained the honours for Australia with a total of 22,847 lb. milk, equal to 1,259 lb. fat. These figures were lowered in 1933 by the Canadian cow, Brampton Basilua, with the total of 19,012 lb. milk, equal to 1,313 lb. fat.

Richmond Posy 5th was born on 1st September, 1927, and to date has been submitted to five lactation tests of 365 days' duration, as follows:—

Age.	Milk.	Commercial Fat.	Commercial Butter.
	lb.	lb.	lb.
As a junior 2-year-old	10,772	636	766
As a senior 3-year-old	18,025	1,081	1,303
As a senior 4-year-old	15,865	946	1,140
As a mature cow	15,385	871	1,050
As a mature cow	19,365	1,292	1,556
Total production over five lactations	79,412	4,826	5,815

Richmond Posy 5th has now produced in excess of 830 lb. fat (equal to 1,000 lb. commercial butter) on four separate occasions. The total number of occasions on which cows of all breeds in New South Wales have exceeded this figure is fifty-five, and of these thirty-five are credited to Jerseys, twenty-five of which have been achieved at the College.

Richmond Laurel 5th as a junior four-year-old finished up with a total of 16,320 lb. milk, equal to 1,049 lb. butter-fat. The Australian record for this age over 365 days' milking is 1,067 lb. fat, a performance which was credited to May Queen of Richmond in 1930.—"The Hawkesbury Agricultural College Journal."

"Feed the Best—Cull the Rest."

Subjoined is a leading article under the above caption taken from "The Telegraph," Brisbane, of 20th November.

"Despite the facilities offered by the Government, through the Department of Agriculture and Stock, for testing dairy cows, and despite the widening of this form of assistance, dairy farmers have been making an inadequate response. The report of the Department shows that in 1934-35 the number of cows submitted to the simple but effective means of ascertaining their value as yielders of wealth was considerably smaller than in the previous year. Altogether 24,434 cows were submitted and tested, and, as the Director observes, 'Although this service is free, the small percentage of dairy farmers who take advantage of it is remarkable.' We entirely agree. The number tested equals only about 3 per cent. of the total number of dairy cows in milking in the State. In such circumstances it is impossible to know whether these are representative of the herds as a whole, though the assumption is warranted that they are not, since they belong to the more enterprising of the dairymen, and the general average may be below that of the tested animals. However, these gave a mean return of 154 lb. of butter-fat, which is too low. The Senior Herd Tester states in his report, more than once, that it should be the aim of the dairy farmers to set a standard of 'at least' 200 lb. of butter-fat per cow, and he adds that 'unfortunately, the returns year by year do not indicate any definite improvement.'

"This melancholy generalisation rules out the influence of climate on the statistics of a single year, and proves that only a very minor percentage of the people engaged in dairying as a livelihood have been persuaded to realise the importance to themselves of testing and culling their stock. The tabulated results of what testing there was shows that more than half the cows gave an average of less than 150 lb. of butter-fat, including 13 per cent. below 100 lb. The apathy of the producers in this matter is difficult to understand, for it is palpably stupid and expensive to keep in the milking herds animals which are unworthy of their place. The Senior Herd Tester compares the outputs of two herds that were tested within a few miles of one another. One of eighteen cows yielded more butter-fat than the other of thirty-eight cows, and the officer points out that in addition to having to provide feed of some kind for the extra twenty cows, the owner of the poor herd must also employ at least one more hand to assist with the milking. He also remarks, evidently making an attempt to provoke the farmers into an intelligent interest in their job, that the records give ample evidence that the progressive farmer who makes regular tests 'is steadily showing an increase in production per cow year by year.'

"Plainly enough, there is a too great preponderance of 'passengers' in the Queensland dairy herds—animals which are not contributing to the banking accounts of their owners and should give place to better ones. The standard mentioned by the officer of at least 200 lb. of butter-fat per annum may be mildly described as moderate; it is, indeed, a low standard which would be laughed to scorn in some of the other principal dairying countries and in some of the Australian States—Victoria, at all events. Yet the yield here, so far as has been ascertained by the testing process, is but three-quarters of the 200 lb. standard, which the Herd Tester says could be attained 'without much trouble' if only 'owners would look on dairying as a business proposition—feed the best and cull the rest.' The officer's remarks warrant a further quotation: 'The market price for our produce is not likely to increase materially for some time to come, and if our dairy farmers are going to remain in business it is necessary for them to raise the average production per cow. Unfortunately, the producer has no say in the world market prices, but he can improve his income considerably by increasing the average production of his herd.'

"To this we may add that the dairy people certainly do influence the domestic market. The consuming public pays a considerable toll so that the surplus butter may be profitably sold abroad. In this respect dairying is one of the 'sheltered' industries. It therefore owes to the public the duty of efficiency. One of the stoutest claims on behalf of the sugar agreement is the high state of efficiency on the canefields and in the mills, and nothing is left undone to justify the claim. Were the butter producers of this State challenged by the consumers they would be unable to support their case as a deserving one in face of the neglect of the herds, the apathy towards testing and culling, the indifference displayed as to the quality of the animals employed in what is, notwithstanding these grave defects, a great and a growing pursuit. We make the suggestion that the energetic Minister for

Agriculture and the officers of his Department should make a special effort to stir up the dairy farmers, encourage them to look upon their industry as a business proposition, and urge them to study their own pockets by weeding out the cows that are not worth their keep and replacing them with the best stock they can obtain or afford. That is common sense and practical economy."

Improving the Dairy Yield—Facts must be faced.

In the course of a recent Press interview, the Minister for Agriculture and Stock, Mr. Frank W. Bulcock, made the following observations on the dairy industry:—

"While the sugar-grower contributes some £5 for sugar organisation, the dairy farmer contributes scarcely as many shillings, and any effort to promote efficiency by scientific herd-testing is often regarded in a very jaundiced way.

Economic Losses.

"The dairy industry cannot succeed unless it is determined to cut out avoidable economic loss. These losses may be stated under two headings: (1) Loss due to pathological causes; and (2) loss due to the very charitable practice of entertaining bovine boarders.

"The Department of Agriculture and Stock offers a service in respect of both these difficulties. We have as the headquarters of the organisation on the pathological side the Animal Health Station at Yeerongpilly, and here are research workers and routine men dealing with pathological problems and their remedies. An extensive field staff is maintained in order to keep a close co-operation between the farmer and the Department.

No Charge for Testing.

"The second factor is the unprofitable cow. Queensland is the only State in the Commonwealth that is not making a specific charge for the service of testing, and it does not refuse to test any herd providing that the applicant agrees to the conditions of the test. When we have had the opportunity of testing a herd over a number of years an improvement has taken place.

"As 'The Telegraph' truly remarks, the more progressive farmer associates himself with departmental practice.

"One often hears the argument that we cannot obtain butter-fat equal to other countries owing to our climate. But can we increase the commercial butter-fat yield per cow within the State?

"All our records show that this can be achieved once we get the co-operation of the dairy farmer.

Progress Achieved.

"In order to enlist the sympathy of the dairy farmer we have during the past two years held classes for dairy farmers at the Department and at Yeerongpilly, the department making a contribution towards the payment of fares and maintenance while in Brisbane.

"This scheme, which has been an unqualified success, has undoubtedly brought the farmer in better relationship with the Department. The scheme would be pursued in conjunction with field days, when officers of the Department meet farmers on their own localities and endeavour to emphasise the necessity for action so far as economic loss is concerned.

"Many factories in Queensland have associated themselves with this movement, and many factories at my request are prepared to conduct tests of supplies, and this organisation is designed to make it easier to eliminate the cow that does not pay its way.

Hopeful Sign.

"The most hopeful sign at present is the growing appreciation of the work of the Department amongst the primary producers generally. I think it is safe to assume that a big body of farmers realise that problems that they individually cannot tackle may be effectively assailed by co-operative activity, which means the activity of the Department."

Artificial Silk Production.

The latest available returns from countries officially recording the manufacture of artificial silk are, in tons produced in a year:—United States, 93,000; Japan, 44,000; United Kingdom, 38,000; Italy, 37,000; Germany, 30,000; France, 25,000.

Action of Acids on Cement.

Observation of the effect of lactic and other acids on the cement mixture in concrete pig troughs, on concrete floors, &c., indicates that unless some acid-proofing mixture is applied at the time the work is being carried out the acids in pig food will, in due course, cause the cement to dissolve, and the bed of the troughs, floors, and other cement surfaces to crack and crumble. Some measure of protection against the action of such acids is afforded by coating the concrete troughs, floors, and drains with a solution of silicate of soda. To prepare the mixture add 1 gallon of quartzite silicate of soda to every 4 gallons of water required, and just as the concrete or finishing coat is beginning to set apply the solution by brushing or spraying, according to the manufacturer's instructions. Just as much should be put on as can be absorbed, for if too much is used the concrete will remain permanently damp. Three coats are required, at intervals as directed by manufacturers. The material referred to may be purchased from hardware stores or may be ordered from wholesale houses dealing in paints, lime, &c. The cost is somewhere about 5s. per gallon tin, 1 gallon being sufficient to cover quite a large area. If care is taken to apply this acid and waterproofing mixture good results may be expected.—E. J. SHELTON, Senior Instructor in Pig Raising.

Prize-winning Pig from New Zealand.

The successful utilisation of the New Zealand and Canadian strains of Large White pigs in Queensland has induced Mr. J. A. Heading, of Highfields Stud, Murgon, to import from New Zealand the sow Grinton Sunbeam. This breeder's previous experience with New Zealand pigs of Canadian strain has been most satisfactory, his first importation, Pine Terrace Pear, having been champion at the Brisbane Show for the last two years. Several of the progeny of this animal have also won many prizes.

Grinton Sunbeam is bred from Canadian stock, and was mated to a New Zealand boar of Canadian strain. Her progeny should be a valuable addition to Queensland studs, which are founded either on English or on Canadian strains. In New Zealand Grinton Sunbeam won seven first prizes, two of which were won as a baconer, indicating that she is of a desirable trade type. Her sire, Kismet Character, was a prize winner, and her dam, Grinton Mistress IV., won several first prizes, and reared a litter of ten pigs, averaging 40 lb. each when eight weeks old. Sunbeam apparently inherits her dam's breeding capacity, for on her first litter, last March, she produced fourteen pigs.

Points for the Maizegrower.

Cultivation of the growing maize crop is essential for two main reasons—firstly, for the destruction of weeds, and secondly, for the conservation of soil moisture. Harrowing the young crops is the first necessity, as it destroys young weed growth, particularly in the rows, aerates, warms, and mulches the soil, and gives the young plants a quick start. As the crop grows it should be inter-row cultivated wherever weeds appear, or the soil becomes crusted, but such cultivations should cease when the crop reaches the tasselling period.

The depth of cultivation is very important. Cultivation of the established plants must not be deep. No harm is done if deep cultivation is practised in the early stages of growth, provided it is not too close to the plants, but from when the plants are 18 to 20 inches high only shallow cultivation should be given, as, the plant being a surface feeder, the roots extend across the rows and within 3 or 4 inches of the surface.

The disadvantages of hilling outweigh the advantages, and as a general practice it cannot be recommended. A light hilling may sometimes be necessary to smother weed growth or as an aid to drainage on low-lying lands, but the damage done to roots, the possibility of "gullying" on slopes, and the greater surface exposed for evaporation are all against the practice, while the support given to the stalks by hilling is not so important as is usually thought. Throwing a big hill with the plough is still often practised, but cannot be too strongly condemned.

It is not necessary to remove the suckers from growing maize crops. This practice, adopted by many farmers with the idea of increasing yield and incidentally providing a little fodder for stock, actually decreases the yield, as proved in an experiment conducted at Grafton Experiment Farm over a period of four years.

When Did the Foxes Come?

Referring to a recent paragraph on this subject, Mr. T.P.A., of Belgrave (V.), says that the first fox he ever saw was on the Wooloomanata Estate, Lara (V.), in 1878. It was on the boundary of that property and the Brisbane Ranges Estate. Foxes in those days were said to be escapees from the Werribee Park Estate, which was owned by Messrs. Andrew and Thomas Chirnside. They, it was said, had imported the foxes for hunting. They kept a pack of beagles, and gave many runs across country.—ALEC. H. CHISHOLM, in "The Australasian."

British Beef Statistics.

According to Mr. H. Burton, who writes from Stott Park, Ulverston, Lancashire, whose remarks are published in "The Australasian," the meat markets of Great Britain have absorbed an average of 721,000 tons annually of beef and veal, including cattle imported on the hoof, during the last seven years, in addition to an average of 609,000 tons of home-grown supplies. In Great Britain there are approximately 8,700,000 head of cattle, and the annual slaughterings amount to 2,800,000 head, which produce about 600,000 tons. The annual consumption of beef and veal in Great Britain is 65 lb. per capita, compared with a per capita consumption of 57 lb. in Canada, 107 lb. in Australia, 160 lb. in New Zealand, and 203 lb. in Argentina. The exports of cattle from Ireland average about 700,000 head, and chilled beef and frozen beef and veal exports from South America average more than 500,000 tons. The slaughterings in South America average approximately 6,000,000 head yearly, while the slaughterings of cattle and calves in Canada are about 1,700,000 head, in New Zealand 1,500,000 head, and in Australia about 2,200,000 head.

Belt-driven Machinery.

Mr. G. F. Young, of Apollo Bay (Victoria), in a letter to "The Australasian," gives the following interesting experiences with farm machinery:—The percentage of power absorbed by the belt transmitting the energy from the engine to the pump, chaffcutter, saw, or other machine is a factor often ignored on the farm. This loss of power is, of course, money wasted, and though unavoidable, it need not be aggravated. We all know of high-speed tools and appliances driven by belts that take only a fraction more horse-power while in use, but the gear driving them eats up far more fuel and oil than the work being accomplished. Let me illustrate by describing two instances on my own farm where, by getting away from the books and doing things an engineer would not approve of, I saved myself some cash outlay and economised on kerosene.

We have a 2-h.p. English Crossley oil engine. To use it to drive a circular saw that should have a 10-h.p. engine seems on the face of it impossible. But we did just that quite successfully. By substituting petrol for kerosene with the little necessary valve adjustment, screwing down the governor spring and so speeding up from 400 to 500 revs. (no risk with a good English job), we develop, say, 4 h.p. By using a nice, thin, pliable leather belt 3 inches wide instead of 6 inches, as advised by the maker of the saw bench, we can cut up our firewood comfortably. That is, we do not waste more power than absolutely necessary driving a heavy belt at high speed round two small pulleys. The belt may not last as long, and an engineer will tell you it is being pulled to pieces, but we have only an hour's work a week for the saw, and so far the belt, after eight years' work, is apparently as good as new. And we have saved a lot of kerosene and cash outlay on a bigger engine.

Another job this same engine does is to drive a small pump. Here we had to invert the plan just mentioned. We use a 6-inch belt where a 3-inch, or even a 1-inch would do the work better. This may seem contradictory, but it is not so. Several factors enter into the problem of driving this pump. Firstly, it is only 10 feet away from the line shaft, secondly, it makes only twenty-five strokes a minute, and lastly, we only want it for emergency work a few hours a week in January and February. The 6-inch pulley drives on to a 30-inch pulley to reduce speed, and, being so close, the belt must be tight to avoid slip. So we must use a wide belt to give all the gripping surface possible.

Any practical man will see the advice involved in these two instances of the "misuse" of belting. Both were special cases, but similar problems exist on most farms and stations. Belting, for many drives, still remains the best medium to transmit power. There are belts on the market that have a long life, but as a gift they may be dearer than leather. They absorb more energy in driving. As I am interested in keeping the demand for hides up, I may be prejudiced when I say, "There's nothing like leather."

Lucerne Area Increasing.

Figures prepared by officers of the Condobolin (New South Wales) Experiment Farm supply striking evidence of widespread appreciation of the value of lucerne for grazing purposes. The figures show that within a radius of 30 miles of Condobolin 6,790 acres of lucerne had been established, without taking into consideration the areas grown under irrigation.

Previous to 1932 the area sown to lucerne in this district was only 412 acres. During 1932 the area was increased by 150 acres, 900 acres were added in 1933, 3,350 in 1934, and 1,978 acres so far in 1935. But for the exceptionally dry autumn and early winter, the area planted this year would have been considerably greater.

Commenting on these figurues, the State Agrostologist (Mr. J. N. Whittet) attributed the increase in the area, which is one of the relatively dry parts of the State, to the department's demonstration of light seedings at the rate of 2 lb. to the acre. He stated that the "dry" farming methods adopted on the Condobolin Experiment Farm had attracted the keen interest of graziers of the district, and he believed that largely increased acreages of grazing lucerne would be put down in the near future.

Mr. Whittet added that lucerne was now established on thirty-eight holdings within a 30-miles radius of Condobolin. The areas ranged in size from 10 to 1,300 acres; two properties had 900 acres each, while others had 640, 400 (two), 270, 260, and 210 acres, respectively. One grazier, who had established 900 acres since 1932, had announced his intention of sowing 1,000 acres each year until he had attained an objective of 5,000 acres.

Light seedings in the autumn on well-prepared fallows, Mr. Whittet believed, were the secret of success in establishing grazing lucerne stands in the low rainfall districts.

Value of Sown Pastures.

Throughout Northern New South Wales, and New England in particular, the value of sown pastures was strikingly demonstrated this season, following what is considered by many graziers to have been the worst winter on record. Stock on natural grazing suffered heavy mortality from the lack of nutrition in the native grasses, and many graziers were compelled to adopt supplementary feeding in order to keep their stock alive.

The Assistant Agrostologist of the New South Wales Department of Agriculture, after a tour of the New England districts, said that on properties where sown pastures were available stock came through the winter in good condition. Although the sown paddocks made little growth during the exceptionally dry season, some palatable green feed was always available, which combined with hay cut from the summer crops enabled the stock to maintain condition. Graziers with large areas of such grasses as *Phlaris tuberosa*, perennial rye, cocksfoot, and clovers were emphatic as to their value under the extremely unfavourable conditions.

At Wallamumbi, in the Armidale district, Mr. P. A. Wright had treated about 1,000 acres of country, and, in addition to sown paddocks, had had considerable success in improving the native pastures by broadcasting subterranean clover at the rate of 2 lb. per acre with 1 cwt. of superphosphate. Hay made from the sown areas had been of great value during the winter. On a sown area of 50 acres which had been divided into two paddocks, and which was supplemented by 22 acres of ordinary grazing, sixty-one head of cattle and an average of one sheep to the acre were carried in good health and vigour from the end of April to the second week in October.

Mr. L. P. Dutton, of Urandangie, Guyra, had proved that the straw of *Phlaris*, after the seed had been threshed out, was a valuable adjunct to pastures during winter. Stocks were given access to the stacks of straw in the paddocks, which they thoroughly relished.

Mr. Moodie considered that lucerne should receive much more attention from New England graziers. A pasture mixture admirably adapted to New England conditions, and which was an excellent grazing and hay proposition, consisted of 4 lb. of *Phlaris*, 2 lb. of lucerne, and 2 lb. of English trefoil (*Medicago lupulina*). At Bald Blair, Mr. H. F. White had found that it produced excellent grazing at all periods of the year, and that the hay was of highly nutritious quality. The mixture should be sown on well-drained soils.

This season it had been possible to compare the Burbank selection strain of *Phlaris tuberosa* with the ordinary commercial strain under extensive grazing conditions. It was generally conceded that the Burbank strain was much superior to the ordinary strain.

Saving Our Wild Life.

Thus Alec. H. Chisholm, the well-known ornithologist and nature writer, in "The Australasian":—

Publication of "Australian Wild Life," the second annual journal of the Wild Life Preservation Society of Australia, shows that this society is doing excellent work in safeguarding the fauna and flora of the Commonwealth. The journal includes articles on Australian nature books, native plants of New South Wales, and (by Walter B. Griffin) "Occupational Conservation," but most of the space is devoted to the society's annual report. This shows a fine record of public service, ranging from attempts to re-establish the koala in its native state to an account of the efforts being made to restrain people from caging wild birds that are not adapted to confinement.

Personally, I am very glad that the society is fighting so stoutly the cause of the caged bird. Doubtless birds that are kept in large aviaries, where they have space to use their wings and facilities for breeding, may be moderately content, but it seems to me that there is something wrong with the mentality of people who pen wild birds in small cages.

For this and kindred reasons I commend the work of the Wild Life Preservation Society to all who esteem the birds and mammals of Australia. The annual subscription is 5s. for men and 2s. 6d. for women, and the honorary secretary is Mr. David Stead, Science House, Gloucester street, Sydney.

Soil Erosion.

Two conditions are necessary before soil erosion can commence, says Mr. H. H. Cornell (as reported in "The Australasian") who has investigated soil erosion problems in South Africa. First there must be unabsorbed water, that is, run-off water. Secondly, the run-off water must move at a certain speed. These conditions are controlled by the following factors:—The texture and structure of the soil, physical conditions and soil surface, total amount of rain, nature (distribution) of rain, vegetal cover on the soil, and slope or gradient of the surface. Great tracts of country have been destroyed by soil erosion in South Africa, and the trouble is extending. Various steps are being taken to combat the menace. Tree planting is being undertaken. Soil-binding grasses are being sown down. Cultivation of "dangerous" country is restricted, and the growth of what are called erosion-producing crops, such as cotton, corn, and tobacco, is discouraged in some parts. Public money is being advanced on easy terms to land owners to help them arrest erosion extension.

Lamb Raising. Flock Improvement.

With the object of encouraging the expansion of the fat lamb breeding industry in Queensland, the Department of Agriculture and Stock has completed the purchase of a draft of 176 stud ewes and rams of the British breeds, most of which were selected from the studs of the Riverina district.

The purchase comprised 60 Border Leicester rams, 20 Border Leicester ewes, 20 Romney Marsh rams, 10 Romney Marsh ewes, 26 Dorset Horn rams, 10 Dorset Horn ewes, 25 Southdown rams, 8 Southdown ewes, and 2 Shropshire rams. All the sheep, which are first quality registered stud sheep, have been delivered, and their influence in the expansion of the fat lamb breeding industry will be of marked benefit to the flocks of the State.

Dairying Fundamentals.

Quality in milk and cream is not accidental—it is the result of care that conditions shall be satisfactory in a number of respects. The dairying fundamentals are:—

Healthy cows and attendants.
Wholesome feed and pure water.
Strict attention to cleanliness.
Prompt cooling.
Protection in transportation.
Frequent delivery to the factory.
Absence of feeds and weeds that produce objectionable odours and flavours.

PLATE 27.
A Tropical Home and Garden, North Queensland.

PLATE 28.
Sunset, Russell River, North Queensland.

OUR BABIES.

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

OUR CHILDREN OF THE WEST.

FEW things are so helpful as friendly but candid criticism. A Western newspaper lately remarked that our monthly articles on the feeding of children, though doubtless containing sound advice, were of little use to those who could not obtain the diets recommended. In this criticism there is some truth. We write for the whole State, but are not ignorant that in the west of Queensland there are special difficulties in acting on our advice. Difficulties, we say, not impossibilities.

It is not easy for a coastal Queenslander to appreciate these difficulties, for he lives in a fertile comparatively well-watered area. He cannot visualise an apparently boundless plain, level to the horizon in all directions, very scantily clothed, if at all, with small stunted timber arising from soil more or less (mostly less) concealed by tufts of dry grass, though at rare intervals and for short periods buried in luxuriant grass and herbage. Here nothing is less certain than rain. At long intervals it falls heavily. When it will come no one knows, but one assertion may safely be made. Out of every four years on the average three will be dry years. What a dry year out West means very few coastal dwellers know. Indeed, most Queenslanders know more of Abyssinia than of two-thirds of their own State. They may complain of their own hot days tempered by sea breezes and followed by cooler nights. They cannot imagine furnace heats often from 110 to 115 degrees continued for weeks together and accompanied by dry winds that wither all the surface vegetation.

From this arid region comes most of our wool, the greatest wealth of our State; and in this region our women and children suffer the hardest conditions. What the eye has not seen, the heart does not feel; and of all parts of this State the children of the West are the most neglected. Except for a very brief annual visit by train our Child Welfare Service has not reached them. Branch Clinics have been promised for Longreach, Barcaldine, Blackall, and Aramac, and we hope they will soon be opened. Similar branches are equally needed in Roma, Chinchilla, Mitchell, Charleville, Cunnamulla, and Quilpie. Want of knowledge is the greatest drawback to the health of women and children everywhere, but in our West more knowledge is wanted than elsewhere. It is no simple problem to adapt our race to the difficulties of an arid climate.

Recently some interest has been aroused in our Western children. It is a hopeful sign. Summer coastal holidays for ill-nourished children from the inland plains have been tried here and elsewhere with wonderful results. At this Christmas season let us remember those who need a seaside change more sorely than we do ourselves.

IN THE FARM KITCHEN.

TRIFLES.

Banana Trifle.

Take 6 bananas, 1 lemon, 2 sponge-cakes, ½-pint milk, 1 egg, 1 teaspoon cornflour, 1 gill cream, a few glace cherries, 1 strip angelica, 2 oz. castor sugar.

Peel and slice five bananas with a stainless knife. Line a glass bowl with thin slices of sponge-cakes, and spread the banana on this. Squeeze over them the juice of a lemon, sprinkle with 1 oz. castor sugar, and leave for half an hour. Put the lemon rind in the milk, and let it warm gradually for half an hour. Then take out the rind. Mix the cornflour to a thin paste with a little cold milk. Bring the flavoured milk to the boil, pour it on the cornflour, return it to the pan with half an ounce of sugar, and stir while it boils for four minutes. Take it off the heat, and when it ceases boiling pour it on to the beaten egg. Leave until only just warm, then pour it over the bananas. Whip the cream with a dessertspoonful of castor sugar. Pile it on the custard when cold. Decorate with sliced bananas, cherries, and angelica. Serve when required.

Banana and Pineapple Trifle.

Take 5 small sponge-cakes, 2 bananas, 1 tin pineapple blocks, a little castor sugar, 1 lemon, ½-pint cream.

Slice the sponge-cakes. Cut the bananas into rounds. Arrange them in alternate layers in a glass dish and squeeze the lemon juice over them. Empty the pineapple over all. Cover the dish and let the contents soak for one hour. Whip the cream lightly, add a few drops of vanilla essence, and pour over the trifle.

Pineapple Trifle.

Take 1 tin of pineapple, ½-pint packet pineapple jelly, 6 sponge fingers, ½-pint cream, 1 teaspoonful castor sugar, 2 oz. glace pineapple, 6 drops pineapple essence. The pineapple should be whole or in slices.

Cut the pineapple into rings, then cut each ring in half. Put the sponge fingers in a glass dish and pour a gill of pineapple juice over it. Place the cut pineapple all round the sides of the glass dish, standing them up. Pour the pineapple jelly, made according to directions, gently in and leave until set. Whip the cream with the sugar and essence, chop the glace pineapple, toss it into the cream, pile it on in a rough mound, and serve.

Apricot Trifle.

Take 1 round sandwich cake, ¼-lb. dried apricots, 2 oz. apricot jam, 1 oz. almonds, 1 gill cream, 1 teaspoonful Noyeau syrup, 2 oz. castor sugar.

Well wash the apricots, put them into a bowl, rather more than cover them with warm water, and leave for twenty-four hours. Then drain off the water, put it in

a stewpan with the sugar and boil quickly for three minutes. There should be half a pint of syrup. If there was not sufficient water from the apricots to make this, add water to make up the quantity. Put in the apricots and simmer until they are tender. Turn into a bowl to cool. Put the apricot jam in the sandwich and place it on a round dish. Drain off the syrup from the apricots, and when only just warm pour it over the sandwich. Leave for two hours. Blanch the almonds and slice them. Pile the apricots on the sandwich, mixing the almonds amongst them. Whip the cream until stiff, adding the Noyeau (if liked) and a little icing sugar. Put it into a forcing bag and decorate the top.

Apple and Nut Trifle

Take 1½ lb. apples, 2 oz. ground almonds, 2 oz. butter, 2 oz. sugar, 2 eggs, 1 gill cream, 2 oz. shelled walnuts.

Peel, core, and cut up the apples, put them in a saucepan with just enough water to prevent them burning (about two tablespoonfuls), and simmer until they are a soft pulp. Stir to prevent them sticking to the pan. Mash them with a fork and put them in a piedish. Beat the butter and sugar to a soft cream, add to it the ground almonds, well-beaten egg-yolks, and the whipped egg-whites. Pile this on the apple and bake in a slow oven for about three-quarters of an hour. When cool turn it out on a glass or fancy dish, and when quite cold whip the cream with a teaspoonful of castor sugar. Add to it the walnuts, skinned and chopped small. Pile on the trifle and serve.

Peach Trifle.

Take 4 ripe peaches (or a small tin of peaches), 2 oz. sugar, 1 small sponge sandwich, 2 oz. ratafias, ¼-pint cream, 2 glace apricots.

Skin, cut in half, and stone the peaches. Put the kernels into a saucepan with the sugar and a small teacupful of water. When the syrup boils, put in the peaches and simmer gently for ten minues. Turn into a bowl and set aside to cool. Cover the bottom of a glass dish with slices of sponge cake, put the ratafias on top, and pour over a quarter pint of peach syrup. Leave for one hour, then arrange the peaches. Whip the cream, pile it on, and decorate with the glace apricots cut in strips.

Meringue Trifle.

Take 6 pairs meringue cases, 3 sponge cakes, 2 tablespoonfuls jam, 1½ gills of cream, milk, sugar, vanilla essence, glace cherries, angelica.

Arrange the meringue cases in a dish in pairs to form a border. Whisk the cream until it stiffens, sweeten and flavour to taste. Split open the sponge cakes and then use them to fill up the centre of the ring, soaking each layer with a little milk (and rum if liked), and putting whipped cream between. Pile the remainder of the cream on top and decorate with two or three glace cherries and leaves of angelica.

Goblin Trifle.

Take some left-over rice pudding, custard, strawberry jam, ¼-pint cream, a few ratafias, hundreds and thousands. Allow 2 tablespoonfuls of rice pudding, 2 teaspoonfuls of jam, 1 gill custard, and 2 ratafias for each child.

Place a layer of jam in the bottom of a glass dish. Spread the rice pudding on top, then pour the custard over. When set cover with whipped cream and decorate with ratafias and hundreds and thousands.

Old-fashioned Trifle.

Take 1 pint cream, 1 pint custard, 6 sponge cakes, 1 dozen macaroons, ¼-lb. ratafias, strawberry jam, ½-pint sherry, ¼-pint brandy, ¼-pint water. The sponge cakes should be stale.

Mix the sherry, brandy, and water together. Spread a layer of jam on the bottom of a fancy glass dish. Cut the cakes in half, dip them into the wine and water, and put a layer of them on the jam. Then dip some macaroons and ratafias in the wine and put them with the layer of sponge cake. Pour some good thick custard over. Now add more jam-soaked cakes and custard, letting the cakes pile high in the centre. Whip and flavour the cream, put into a forcing bag, having a large rose pipe, and force this out on top of the cake mixture. The top of the cream can be ornamented with crystallised fruits, sweets, or anything that may be suitable and convenient. The trifle should be prepared some hours before it is to be served, and the cream is added at the last minute.

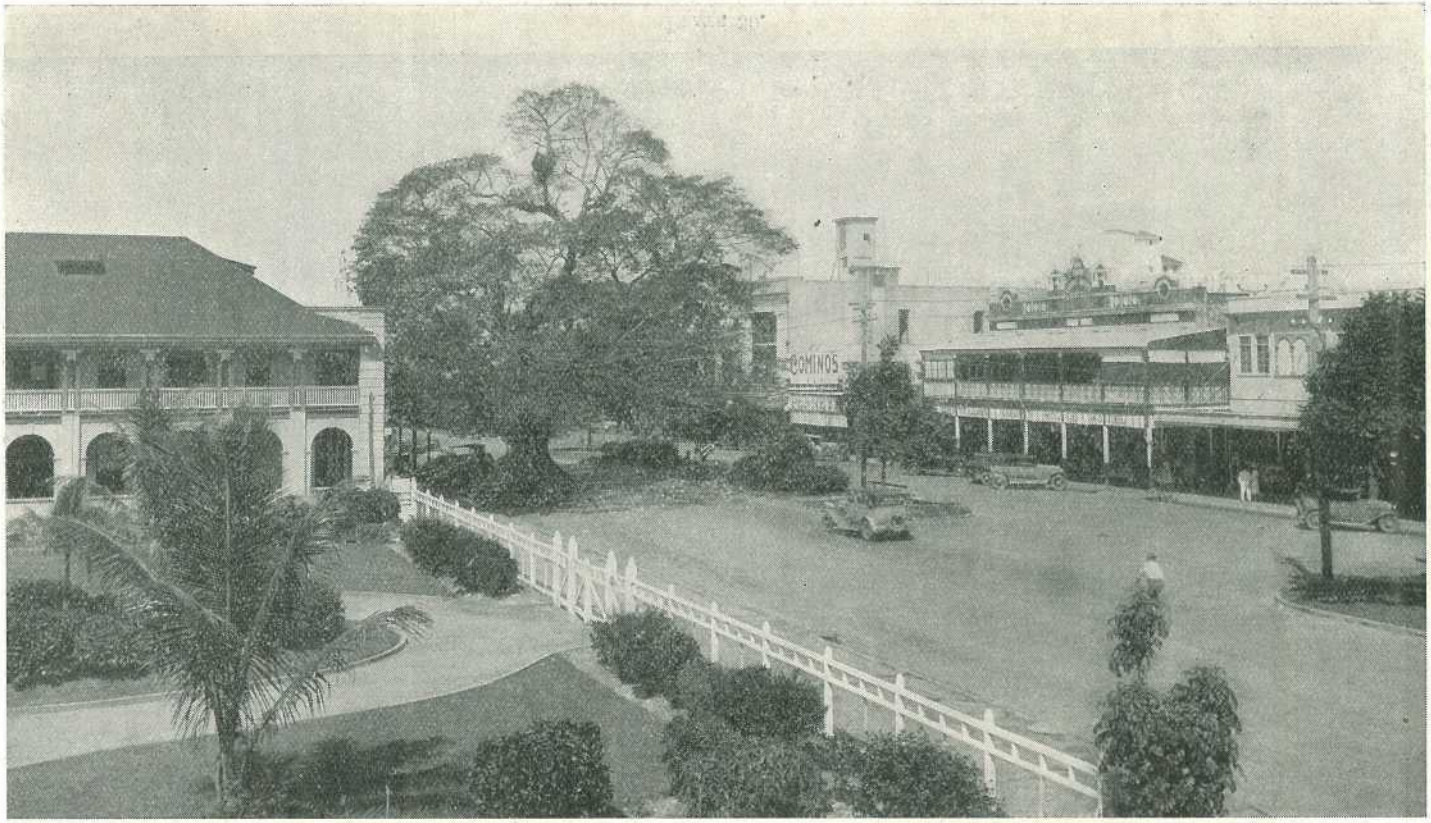

PLATE 29.
Abbott Street, Cairns, showing the "Tree of Knowledge."

PLATE 30.
On the Cook Highway, Cairns to Port Douglas.

PLATE 31.
A HIGHWAY THROUGH THE JUNGLE.—On the Cairns Tableland Road, North Queensland.

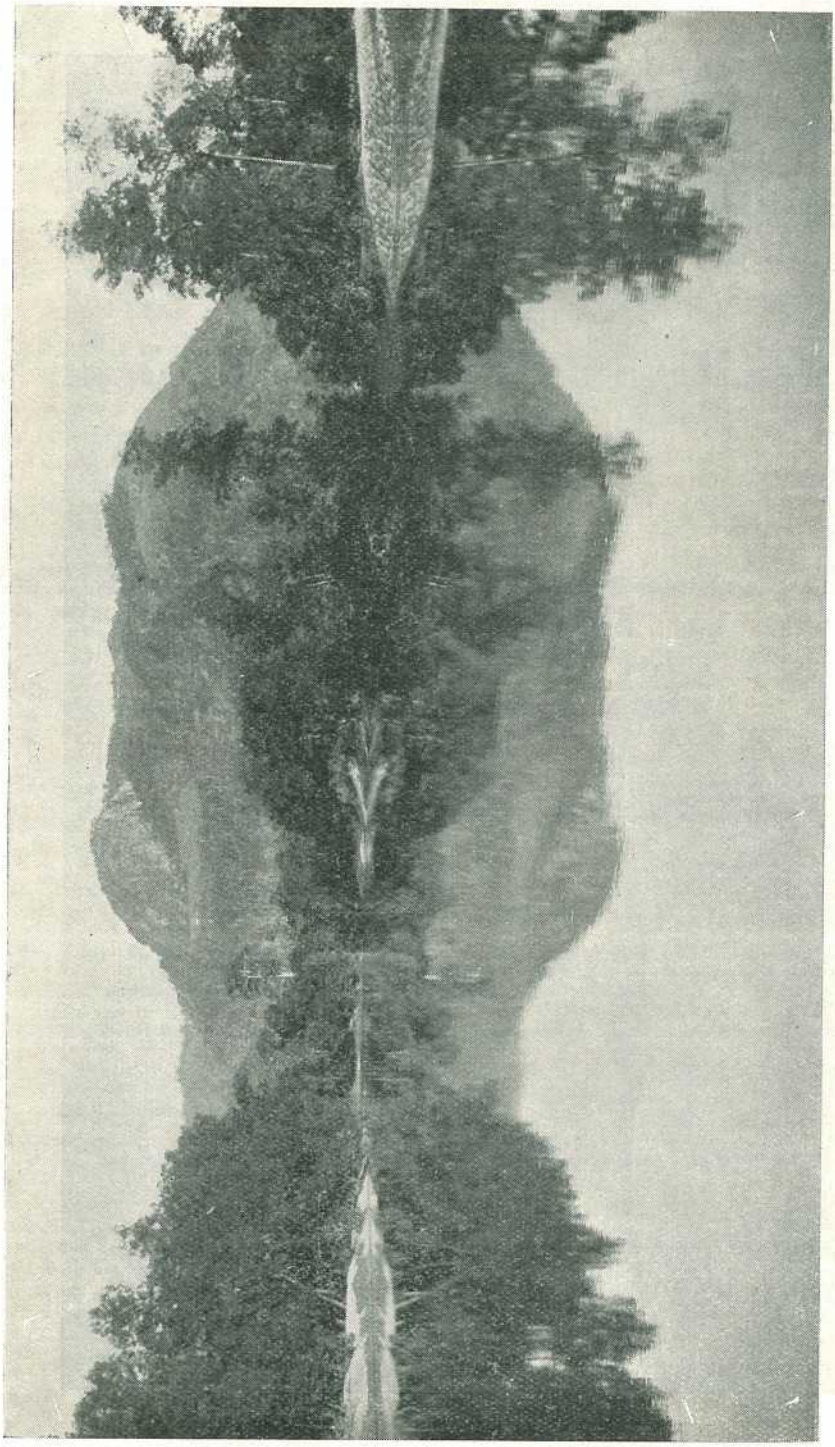

PLATE 32.
The Barron River, North Queensland.

Orchard Notes for February.

THE COASTAL DISTRICTS.

FEBRUARY in coastal Queensland is frequently a wet month, and, as the air is often heavy with moisture and very oppressive, plant growth of all kinds is rampant, and orchards and plantations are apt to get somewhat out of hand, as it is not always possible to keep weed growth in check by means of cultivation. At the same time, the excessive growth provides a large quantity of organic matter which, when it rots, tends to keep up the supply of humus in the soil, so that, although the property looks unkept, the fruit-producing trees and plants are not suffering, and the land is eventually benefited. When the weed growth is excessive and there is a danger of the weeds seeding, it is a good plan to cut down the growth with a fern hook or brush scythe and allow it to remain on the ground and rot, as it will thereby prevent the soil from washing, and when the land is worked by horse power or chipped by hand it will be turned into the soil. This is about the most satisfactory way of dealing with excessive weed growth, especially in banana plantations, many of which are worked entirely by hand.

The main crop of smooth-leaf pineapples will be ready for canning, and great care must be taken to see that the fruit is sent from the plantation to the cannery with the least possible delay and in the best possible condition. The only way in which the canners can build up a reputation for Queensland canned pineapples is for them to turn out nothing but a high-class article. To do this they must have good fruit, fresh, and in the best of condition.

The fruit should be about half-coloured, the flesh yellowish, not white, of good flavour, and the juice high in sugar content. Over-ripe fruit and under-ripe fruit are unfit for canning, as the former has lost its flavour and has become "winey," while the latter is deficient in colour, flavour, and sugar content.

For the 30 or 32 oz. can, fruit of not less than 5 in. in diameter is required, in order that the slices will fit the can; but smaller fruit, that must not be less than 4 in. or, better still, 4¼ in. in diameter, and cylindrical, not tapering, can be used for the 20-22 oz. can.

Bananas for shipment to the Southern States should on no account be allowed to become over-ripe before the bunches are cut; at the same time, the individual fruit should be well-filled and not partly developed. If the fruit is over-ripe it will not carry well, and is apt to reach its destination in an unsaleable condition.

Citrus orchards require careful attention, as there is frequently a heavy growth of water shoots, especially in trees that have recently been thinned out, and these must be removed. Citrus trees can be planted now where the land has been properly prepared, and it is also a good time to plant most kinds of tropical fruit trees, as they transplant well at this period of the year.

A few late grapes and mangoes will ripen during the month, and, in respect to the latter, it is very important to see no fly-infested fruit is allowed to lie on the ground but that it is gathered regularly and destroyed.

Strawberries may be planted towards the end of the month, and, if early ripening fruit is desired, care must be taken to select the first runners from the parent plants, as these will fruit quicker than those formed later. The land for strawberries should be brought into a state of thorough tilth by being well and deeply worked. If available, a good dressing of well-rooted farmyard manure should be given, as well as a complete commercial fertilizer, as strawberries require plenty of food and pay well for extra care and attention.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE marketing of later varieties of peaches and plums and of mid-season varieties of apples and pears, as well as of table grapes, will fully occupy the attention of fruitgrowers in the Granite Belt, and the advice in these notes for the two previous months with regard to handling, grading, packing, and marketing is again emphasised, as it is very bad policy to go to all the trouble of growing fruit and then, when it is ready to market, not to put it up in a way that will attract buyers.

Extra trouble taken with fruit pays every time. Good fruit, evenly graded and honestly packed, will sell when ungraded and badly packed fruit is a drug on the market. Expenses connected with the marketing of fruit are now so high, owing to the increased cost of cases, freight, and selling charges, that it is folly to attempt to market rubbish.

During the early part of the month it will be necessary to keep a careful watch on the crop of late apples in order to see that they are not attacked by codlin moths. If there is a slightest indication of danger, a further spraying will be necessary, as the fruit that has previously escaped injury is usually that which suffers the most.

Fruit fly must also be systematically fought wherever and whenever found, and no infested fruit must be allowed to lie about on the ground.

Grapes will be ready for market, and in the case of this fruit the greatest care in handling and packing is necessary. The fruit should never be packed wet, and, if possible, it is an excellent plan to let the stems wilt for a day at least before packing. This tends to tighten the hold of the individual berries on the stem and thus prevent their falling off.

In the western districts winemaking will be in progress. Here again care is necessary, as the better the condition in which the fruit can be brought to the press the better the prospect of producing a high-class wine.

Where necessary and possible citrus trees should be given a good irrigation, as this will carry on the fruit till maturity, provided it is followed up by systematic cultivation so as to retain a sufficient supply of moisture in the soil.

Farm Notes for February.

REFERENCE was made in last month's Notes to the necessity for early preparation of the soil for winter cereals, and to the adoption of a system of thorough cultivation in order to retain moisture in the subsoil for the use of crops intended to be raised during the season. The importance of the subject, and its bearing in relation to prospective crop yields, is made the excuse for this reiteration.

Special attention should be given to increasing the area under lucerne (broad-leaf Hunter River) wherever this valuable crop will grow. Its permanent nature warrants the preparation of a thorough tilth and seed-bed, and the cleansing of the land, prior to sowing the seed, of all foreign growths likely to interfere with the establishment and progress of the crop. Late in March or early in April is a seasonable period to make the first sowing providing all things are favourable to a good germination of seed.

Dairymen would be well advised to practise the raising of a continuity of fodder crops to meet the natural periods of grass shortage, and to keep up supplies of succulent fodder to maintain their milch cows in a state of production.

Many summer and autumn growing crops can still be planted for fodder and ensilage purposes. February also marks an important period as far as winter fodder crops are concerned, as the first sowings of both skinless and cape barley may be made at the latter end of the month in cool districts. Quick-growing crops of the former description, suitable for coastal districts and localities where early frosts are not expected, are Soudan grass, Japanese and French millet, white panicum, liberty millet, and a similar kinds belonging to the Setaria family. Catch crops of Japanese and liberty millet may also be sown early in the month in cooler parts of the State, but the risk of early frosts has to be taken.

Maize and sorghums can still be planted as fodder and ensilage crops in coastal districts. In both coastal and inland areas, where dependence is placed largely on a bulky crop for cutting and feeding to milch cows in May and June, attention should be given to Planters' Friend (so-called Imphee) and to Orange cane.

In most agricultural districts where two distinct planting seasons prevail, the present month is an excellent time for putting in potatoes. This crop responds to good treatment, and best results are obtainable on soils which have been previously well prepared. The selection of good "seed" and its treatment against the possible presence of spores of fungoid diseases is imperative. For this purpose a solution of 1 pint of formalin (40 per cent. strength) to 24 gallons of water should be made up, and the potatoes immersed for one hour immediately prior to planting the tubers. Bags and containers of all kinds should also be treated, as an additional precaution. "Irish Blight" has wrought havoc at times in some districts, and can only be checked by adopting preventive measures and spraying the crops soon after the plants appear above the ground. Full particulars on the preparation of suitable mixtures for this purpose are obtainable on application to the Department of Agriculture, Brisbane.

Weeds of all kinds, which started into life under the recent favourable growing conditions, should be kept in check amongst growing crops; otherwise yields are likely to be seriously discounted. The younger the weeds the easier they are to destroy. Maize and other "hoed" crops will benefit by systematic cultivation. Where they are advanced, and the root system well developed, the cultivation should be as shallow as possible consistent with the work of weed destruction.

First sowings may now be made of swede and other field turnips. Drilling is preferable to broadcasting, so as to admit of horse-hoe cultivation between the drills, and the thinning out of the plants to suitable distances to allow for unrestricted development. Turnips respond to the application of superphosphate; 2 cwt. per acre is a fair average quantity to use when applied direct to the drills.

Where pig-raising is practised, land should be well manured and put into good tilth in anticipation of sowing rape, swedes, mangels, field cabbage, and field peas during March, April, and May.

QUEENSLAND WHEATS.

In the current "Journal of the Australian Institute of Agricultural Science," Mr. H. Wenholz, B.Sc., Agr., Director of Plant Breeding, Department of Agriculture, New South Wales, pays a graceful tribute to the work of Mr. R. E. Soutter, Agricultural Research Officer (Wheat and Maize), Department of Agriculture and Stock, Queensland, and formerly Manager of the Roma State Farm, in the following terms:—

Florence has been the leading variety of wheat in Queensland for many years, but whereas it occupied 50 per cent. of the area in 1924, this proportion has dropped to 16 per cent. in 1934. Pusa 4 and Clarendon have also been very popular wheats in Queensland for some time, but the efforts of Mr. R. E. Soutter, working under great disabilities in breeding wheat at a State farm outside the main wheat belt, are being slowly but surely rewarded. His three best varieties, viz., Three Seas (CCC), Flora, and Cedric, evolved respectively in 1920, 1923, and 1925, occupied between them in 1934 about one-third of the wheat area in Queensland, and nearly another 10 per cent. is occupied by other wheats of his breeding such as Novo, Amby, Warchief, Duke of York, Watchman, &c. Soutter's chief objectives in breeding wheats for the Queensland climate are early maturity, high grain quality, and resistance to stem rust, combined with productiveness, and it is a tribute to his capabilities that he has evolved three varieties which have these characters and which have so largely taken the place of Florence, for this variety is itself so good in all the characters mentioned.

In Memoriam.

MR. EDMUND JARVIS.

By the death of Mr. Edmund Jarvis, of Boston street, Clayfield, which occurred on 18th December, Queensland loses one who made no mean contribution to the success of her sugar industry. For many years Mr. Jarvis carried out investigations in the entomological branch of that industry and published numerous bulletins, pamphlets, and articles on his discoveries. In this way he helped the cane farmers to fight the worst insect pests with which they have had to contend. For many years he was a regular contributor to this Journal.

The late Mr. Jarvis was a native of Devonshire, England, where he was born sixty-six years ago. Coming to Australia, he first settled in Victoria, but in 1908 he joined the Queensland Department of Agriculture and Stock as an assistant entomologist. In 1914 he was sent to Gordonvale, and took charge of the entomological laboratory of the Bureau of Sugar Experiment Stations there and upon the resignation of Dr. J. F. Illingworth in 1921 he was appointed to the charge of sugar-cane entomological work throughout the State. He was transferred to headquarters in Brisbane last year.

Mr. Jarvis was a great lover of nature, and was exceptionally gifted as an artist. In addition to his many notable illustrations in scientific papers, his love of nature found expression in the painting of many exquisite water colours. He had a particularly fine collection of paintings—his own work—of the variegated foliage of many varieties of acalypha and other flamboyant tropical plants. He was also an accomplished musician. His first scientific publication was "Notes on Insects Damaging Sugar-cane in Queensland" (1916), the finest comprehensive account of Queensland sugar-cane pests published up to that time. Other important publications included "Queensland Cane Insects and Their Control" (in three series), and "The Economy of Cockchafer Beetles."

The late Mr. Jarvis had a personality of great charm, a retiring nature, and a very friendly disposition marked by a constant unobtrusive desire to help others, particularly his fellow-officers. Mr. Hubert Jarvis, a well-known entomologist and artist, is a brother.

Deep sympathy is extended to the widow of the late Mr. Jarvis and their family of four children, and to other bereaved relatives, in their great sorrow.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF NOVEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1935, AND 1934, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov., 1935.	Nov., 1934.		Nov.	No. of Years' Records.	Nov., 1935.	Nov., 1934.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	2·46	34	1·25	8·42	Clermont	2·07	64	..	2·20
Cairns	3·97	53	2·91	5·12	Gindie	2·23	36	..	7·57
Cardwell	4·19	63	4·35	8·46	Springsure ..	2·23	66	0·05	6·17
Cooktown	2·57	59	0·38	3·38					
Herberton	2·64	49	1·80	6·26					
Ingham	3·94	43	1·04	5·81					
Innisfail	6·36	54	4·64	4·92					
Mossman Mill ..	4·37	22	3·88	5·48	*Darling Downs.*				
Townsville	1·91	64	0·37	3·06					
Central Coast.					Dalby	2·82	65	0·58	5·46
					Emu Vale	2·77	39	0·26	2·55
Ayr	1·81	48	0·16	6·70	Hermitage	2·71	29	0·09	1·74
Bowen	1·31	64	0·37	2·13	Jimbour	2·64	47	0·20	7·11
Charters Towers ..	1·47	53	0·04	1·23	Miles	2·67	50	0·37	4·86
Mackay	3·16	64	0·81	3·38	Stanthorpe	2·76	62	0·70	2·52
Proserpine	3·01	32	0·81	6·05	Toowoomba ..	3·38	63	0·39	3·65
St. Lawrence ..	2·46	64	0·15	8·86	Warwick	2·66	70	0·17	2·25
South Coast.									
					Maranoa.				
Biggenden	2·89	36	..	5·76					
Bundaberg	2·75	52	0·15	13·93	Roma	2·22	61	0·56	7·40
Brisbane	3·77	84	1·26	5·68					
Caboolture	3·59	48	0·48	8·25					
Childers	2·86	40	..	5·78					
Crohamhurst ..	4·61	42	1·76	7·97					
Esk	3·30	48	1·61	4·05					
Gayndah	3·02	64	0·05	7·32					
Gympie	3·30	65	0·18	7·73	*State Farms, &c.*				
Kilkivan	2·63	56	0·10	5·04					
Maryborough ..	3·26	64	1·52	5·77	Bungeworgorai ..	2·53	21	..	8·39
Nambour	4·14	39	0·95	7·42	Gatton College ..	3·03	36	0·31	2·83
Nanango	2·80	53	0·16	7·50	Kairi	2·42	21	..	4·91
Rockhampton ..	2·47	64	0·07	7·02	Mackay Sugar Experiment Station	2·91	38	0·79	3·81
Woodford	3·34	48	0·71	7·29					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—NOVEMBER, 1935.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·88	88	72	96	17	67	5	38	5
Herberton	..	81	60	93	15	51	4, 13, 14	180	10
Rockhampton	30·00	90	67	104	15	62	11	7	1
Brisbane	30·04	81	63	98	14	57	1	126	5
Darling Downs.									
Dalby	29·99	88	59	97	21	47	18	58	4
Stanthorpe	..	80	52	92	21	38	18	70	3
Toowoomba	..	81	55	92	21	47	18	39	3
Mid-Interior.									
Georgetown	29·87	99	72	103	1, 4, 5, 14, 15	63	10	44	1
Longreach	29·92	97	66	104	13, 21	55	7	10	3
Mitchell	29·97	91	61	101	21	47	18	87	4
Western.									
Burketown	29·85	95	75	103	14, 19	64	18, 19	62	2
Boulia	29·86	101	70	110	20	50	17	62	2
Thargomindah	29·92	93	67	109	20	56	17, 18	8	1

ASTRONOMICAL DATA FOR QUEENSLAND.

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

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	January. 1936.		February. 1936.		MOONRISE. Jan., 1936.	Feb. 1936.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	p.m.
1	5·0	6·50	5·25	6·47	11·24	1·34
					p.m.	
2	5·1	6·50	5·25	6·47	12·27	2·34
3	5·1	6·50	5·26	6·46	1·31	3·33
4	5·2	6·51	5·26	6·45	2·33	4·25
5	5·2	6·51	5·27	6·45	3·37	5·10
6	5·3	6·51	5·28	6·44	4·40	5·51
7	5·3	6·51	5·28	6·44	5·38	6·27
8	5·4	6·52	5·29	6·43	6·29	6·59
9	5·5	6·52	5·30	6·42	7·23	7·28
10	5·6	6·52	5·31	6·42	7·53	7·58
11	5·7	6·52	5·32	6·41	8·27	8·27
12	5·7	6·52	5·32	6·40	9·0	8·58
13	5·8	6·52	5·33	6·39	9·31	9·30
14	5·9	6·51	5·34	6·38	9·59	10·8
15	5·10	6·51	5·35	6·37	10·30	10·47
16	5·11	6·51	5·36	6·36	11·0	11·35
17	5·11	6·51	5·36	6·36	11·34	
						a.m.
18	5·12	6·51	5·37	6·35	a.m.	12·27
19	5·13	6·51	5·38	6·34	12·10	1·25
20	5·14	6·50	5·38	6·33	12·55	2·27
21	5·15	6·50	5·39	6·32	1·46	3·34
22	5·16	6·50	5·40	6·31	2·42	4·41
23	5·17	6·50	5·40	6·30	3·43	5·50
24	5·18	6·50	5·41	6·29	4·48	6·56
25	5·18	6·49	5·42	6·28	5·59	8·3
26	5·19	6·49	5·43	6·27	7·2	9·10
27	5·20	6·49	5·43	6·26	8·10	10·18
28	5·21	6·49	5·44	6·25	9·13	11·24
						p.m.
29	5·21	6·48	5·45	6·24	10·19	12·28
30	5·22	6·48			11·23	
31	5·23	6·48			12·29	

Phases of the Moon, Occultations, &c.

2 Jan.,	☾	First Quarter	9 12	a.m.
9 ,,	○	Full Moon	12 42	a.m.
17 ,,	☽	Last Quarter	10 36	a.m.
24 ,,	●	New Moon	12 36	p.m.
31 ,,		First Quarter	9 36	a.m.

Apogee, 15th January, at 9.48 a.m.
Perigee, 26th January, at 3.30 a.m.

On the 4th the Earth will arrive at that part of its orbit which brings it nearest to the Sun; it will then be 3,120,000 miles nearer than on 4th July. It might be expected that our hottest day would be when the Sun is nearest, but meteorologists are aware of many other conditions which affect the temperature, and know that it is impossible to foretell a month beforehand what the temperature will be.

There will be a total eclipse of the Moon in the early hours of the 9th. The Moom will enter the Umbra, or darker part of the Earth's shadow, at 2.28 a.m. It will be in the deepest part at 4.9, and will not emerge till 5.51, three-quarters of an hour after Sunrise. The phases of the Moon will show that it will be rather less than halfway between Perigee and Apogee. The previous Perigee having been on 31st December, it will traverse the Earth's shadow where it is more than the average width. Between the time of entering the Umbra and leaving will be 3 hours 23 minutes.

On the 16th Venus and Jupiter will be apparently within a degree and a half of one another, between Scorpio and Sagittarius. They will be about 3 hours before the Sun and nearly due north-east at sunrise, being best seen about an hour and a half earlier, when nearer the eastern horizon.

On the 16th Mercury in Capricornus, will be at its greatest elongation, 19 degrees east of the Sun, and will not set till one hour eight minutes after it.

Observers who notice the Moon and Jupiter in the early hours of the 21st will see the planet about 4 degrees (eight times diameter of Moon) to the north-eastward. On the following morning Jupiter will appear to be 12 degrees (twice length of Cross) west of the Moon.

On the 26th, Mars and Saturn, though in orbits 745 millions of miles apart, will appear to be within one degree of one another. They will be visible on the western horizon an hour after sunset wherever that part of the sky is clear.

7 Feb.	○	Full Moon	9 19	p.m.
16 ,,	☽	Last Quarter	1 45	a.m.
23 ,,	●	New Moon	4 42	a.m.
29 ,,	☾	First Quarter	7 28	p.m.

Apogee, 12th February, at 4.6 a.m.
Perigee, 24th February, at 8.24 a.m.

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

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

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