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Event and Comment

Fodder Conservation on the Atherton Tableland.

THE problems of individuals are often the problems of the community and as such become matters on which the assistance of the Government is frequently sought for a solution. This is particularly so in the case of the man on the land. On the one hand, nature is bounteous and, conversely, sets up conditions which require more than ordinary treatment to enable farmers to reap the benefit of their industry.

In amplifying these remarks the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, stated that he had in mind the difficulties experienced and the loss of income suffered by settlers through the incidence of the white grub pest introduced in pastures on sections of the cleared rain-forest country on the Atherton Tableland.

Although many years of research have been devoted by departmental officers to determining the most suitable method of combatting white grubs, no effective way has yet been evolved for their extermination, but the work is still going on, and the day may not be far distant when the same success will be achieved as was the case with prickly-pear infestation. One definite result of material benefit has emerged, and

that is the conservation of fodder in pit silos which can be constructed at a very reasonable cost. In this way reserve supplies of rich milk-producing food for dairy stock can be built up as an insurance against those periods when the white grub outbreaks are severe.

To complete the work which had already been accomplished, a scheme for advances to meet the cost of putting down pit silos was inaugurated in September, 1938, whereby suitable loans were made to those farmers who were unable to provide funds from their own resources. Several settlers took advantage of the scheme and the results obtained to date have proved satisfactory, added Mr. Bulcock.

A survey of the position has now been made, and it has been decided to provide special funds this year for an extension of the project, of which the financing will be administered by the Rural Development Board. The value of the scheme in the matter of farm economics has been amply demonstrated, and farmers desirous of obtaining the necessary accommodation should get in touch with the Land Agent or the Inspector of the Bureau of Rural Development at Atherton to obtain the necessary application form. Officials of the Department of Agriculture and Stock and of the Land Administration Board will give every possible assistance to those who wish to avail themselves of the funds being provided. Each application will, of course, be dealt with on its individual merits.

As was the case in connection with last year's scheme, advances will not be restricted to present borrowers from the Bureau of Rural Development. Farmers whose properties are in the area where pastures are affected by the depredations of the white grub and who are carrying on dairying on a commercial basis will be eligible to apply.

Generally, the security required for an advance for a pit silo will be an order on the butter factory providing for small monthly payments of an amount sufficient to repay the advance and to meet the interest thereon within the time specified. A maximum repayment term of five years will be allowed, and the rate of interest on each advance will be 4½ per cent. per annum.

The Peanut Industry.

OF the newer agricultural enterprises in Queensland, peanut-growing is, probably, advancing most rapidly; and in order to make better provision for disease control and otherwise to protect the industry, legislation has now been passed by Parliament. In the course of his speech on the initiation of the Bill in committee, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said that the commodity board at present controlling the sale of the product had been remarkably successful, and that the board was in every way fitted to discharge its duties not only to suppliers, but also to the consumers. The risk of disease in the plant and the necessity for limiting its incidence were the chief reasons for introducing protective legislation.

His own view, the Minister said, was that the time to deal with a disease was when it first manifested itself. There was a disease that had affected the peanut industry in various parts of the world, known as rosette. If it ever established itself in the peanut-growing districts of Queensland it would be a very serious thing for the growers, because wherever it had become established in other parts of the world, the industry had become extinct.

This Bill dealt first with the question of control, continued the Minister. It followed generally the lines approved on very many occasions for the control of plant and animal diseases. They had had, of course, a good deal of experience in disease control in agricultural industries. There was the Diseases in Plants Act, but frequently certain deficiencies in that Act in relation to many of the diseases in sugar-cane were discovered and it became necessary to give an industry its own charter in respect of disease control, at the same time preserving those things applicable to it in the Diseases in Plants Act. The measures of control in the new legislation did not introduce any principle with which the Legislative Assembly was not acquainted.

Passing from the question of control, Mr. Bulcock dealt with the stability of the industry. The real basis of agricultural prosperity was the stability of rural industry, he said. Consequently, he was making an attempt, at the request of the growers, to give them the stability that was essential to the sound development of the peanut industry. It had to be remembered that the pool board which handled this crop had a greater capital investment probably than any other pool-controlled industry in Queensland. Since it had successfully managed the industry and since Parliament had almost every session reaffirmed the principle that the pooling system was a proper form of organisation, and since both sides of the House had always agreed to the application of this principle of organised marketing, it followed obviously that any action that could be taken to stabilise the industry and preserve that system should be taken.

Discussing the market demand, the Minister remarked that the capacity of the Australian market to absorb edible nuts could be calculated with great exactitude. Necessarily, the definition "edible nuts" excluded nuts used for oil-expression. He was not altogether satisfied that using peanuts for that purpose was a very economic method of sustaining the industry. The cost of recovery was such that the return so diluted the return from the sale of edible nuts that the grower did not get, at any rate, more than a reasonable price for what he had produced. Of course, even that always depended on a favourable and economic balance between the volume of edible nuts and oil nuts.

There was, he continued, a growing tendency in the industry to produce beyond the limits of what could be termed edible consumption. He sought to overcome that difficulty by establishing two pools; one to be the pool that would deal with the estimated volume of edible nuts required in any one year in Australia, and the other to be the pool that would treat the residue for oil-expression. The result would be that although it was not sought to impose any restriction on the production of nuts, everybody who was engaged in the industry would get a fair share of the Australian edible nut trade. The Peanut Board would be required to issue quotas on a tonnage basis equal to each grower's required contribution and the total of these contributions, of course, would be the estimated annual consumption of peanuts within the State.

If in any year the board should not be able to dispose of the estimated quantity in No. 1 pool, it would be transferred to No. 2 pool. If, on the contrary, the board had estimated its intake for No. 1 pool at a lower level than the actual consumption, it would transfer enough from No. 2 pool to No. 1 pool to make up the deficiency. This would mean that so far as the first pool was concerned there would be stabilisation of a very definite character.

White Grubs and Pasture Deterioration on the Atherton Tableland.*

D. O. ATHERTON, M.Sc., Research Officer.

INTRODUCTION.

THE carrying capacity of pastures on the Atherton Tableland has been seriously reduced in recent years. One beast to the acre was reputedly a common rate of stocking during the early years of settlement, but recently pastures have carried not more than a beast to 3 or 4 acres.

White grubs—larvæ of a Scarabæid beetle (*Lepidiota caudata* Blkb.)—are closely associated with marked pasture deterioration in the area east of the Barron River and between Malanda and Yungaburra. This area is outlined in Plate 226, and is referred to as the Peeramon district to simplify discussion.

The infested area was computed at 10,000 acres in 1930, but by the winter of 1935 it had increased to 25,000 acres. However, it is unlikely that white grubs are solely responsible for the deterioration of Tableland pastures. Soil fertility declines within a few years after the rain-forest is cleared in tropical countries experiencing high temperatures coupled with heavy rains (Jack, 1934; Corbet, 1935). Thus it is probable that Tableland soils have reacted in a similar manner, and then the problem at Peeramon becomes a composite one, in which the influence of white grubs is but one factor.

The results of entomological investigations have already been published (Smith, 1936), but a brief note on the life history and habits of the pest may clarify the subsequent discussion. The pest requires two

* Following the serious losses associated with white grubs in paspalum pastures on certain parts of the Atherton Tableland, the Secretary for Agriculture and Stock (Hon. Frank W. Bulcock) formed a White Grub Investigations Committee to elaborate methods of reducing such losses in the future. The committee, comprising the Director of Tropical Agriculture (chairman), the author (secretary), and three farmers, was formed in September, 1935, and the present report describes the results of the investigations extending over the ensuing three and a-half years. The White Grub Investigations Committee has now been replaced by the Tableland Experiments Committee, which handles a wide range of problems, including the continuation wherever necessary, of the various projects discussed in this report.

MAP SHOWING THE ATHERTON TABLELAND.

—•—•— Encloses mainly dairying districts.

+ + + + + Encloses mainly maizegrowing districts.

Area infested by *Lepidiota caudata* Blb.

Area infested by *Lepidoderma albohirtum* Waterh.

Area infested by *Lepidiota lævis* Arrow.

Plate 226.

years for the completion of its life cycle. Eggs are laid in the soil, within 4 inches of the surface, in November, December, and January. They hatch in about three weeks, and the larvæ pass through three instars during a growing period of approximately eighteen months. Full-grown larvæ descend in the soil between July and September and pupate in earthen cells at variable depths up to 2 feet, where the pupæ transform into the rather large, brown, adult beetles. Emergence occurs at dusk in the early summer, frequently on the evening following a heavy storm, and the beetles fly about in enormous numbers before mating on some prominent object, such as a large log, fence, or house. The beetles re-enter the soil before morning and remain hidden 1 or 2 inches below the surface until the following evening. Oviposition extends over a period of several weeks after emergence, and the evening flights occur regularly throughout this period. Beetle emergence cannot begin until summer rains have softened the soil down as far as the pupal chambers in which the adults are imprisoned. Consequently, when the rainfall prior to early December is insufficient to penetrate 1 or 2 feet of soil, the pre-emergence mortality is considerable, and may be high enough to constitute a temporary control of the pest.

The entomological investigations indicated that, in order to reach an economic solution to the problem, some attention to its agronomic aspects was desirable.

TABLE I.

RAINFALL AT MALANDA IN POINTS.

(JULY-NOVEMBER.)

Year.	July.	August.	September.	October.	November.
1916	417	144	458	46	158
1917	**28**	**221**	**36**	258	632
1918	289	350	**81**	**5**	**155**
1919	319	**50**	**284**	**7**	**90**
1920	**135**	**57**	**67**	**233**	**124**
1921	294	296	186	504	76
1922	**152**	**0**	**72**	**113**	**63**
1923	**81**	**170**	**18**	**20**	**212**
1924	1,107	332	218	155	645
1925	**41**	**224**	**61**	**13**	**127**
1926	59	121	309	2	213
1927	**273**	**0**	**99**	**162**	**18**
1928	**254**	**104**	**0**	2	539
1929	**27**	**104**	**105**	**39**	**255**
1930	357	87	80	476	135
1931	**115**	**93**	**71**	**143**	598
1932	170	317	**48**	**65**	**34**
1933	159	394	162	350	672
1934	251	43	387	125	750
1935	102	336	5	279	257
1936	480	**20**	**279**	**100**	106
1937	443	**217**	**159**	**67**	562

N.B.—Periods of three successive months in which the total rainfall is less than 4½ inches are shown in heavy type.

Almost the whole area now infested by white grubs was originally heavy rain-forest on morocco red or lighter-coloured soil derived from scoriaceous or sheet flows of basalt surrounding outliers of granitic rock. The annual rainfall varies from 67 inches (Malanda—22 years' average) to 81 inches (Gadgarra—16 years' average). In fourteen

of the twenty-two years for which Malanda rainfall records are available there was insufficient rain during three or more consecutive months between July and November to maintain productive pastures (Table I.). The arbitrary standards chosen to indicate periods too dry for the satisfactory growth of pastures—a total of less than 4½ inches for three consecutive months, with not more than 3 inches in any one month—may seem excessively high, but they are justified by local experience. Thus, some three to five months of inadequate precipitation can be expected in about two years out of three. This in itself, quite apart from any question of white grubs, is an important factor in limiting dairy production under the existing system of grassland farming. There is a good growth of grass in the summer months following early thunderstorms, and in most years, provided white grub damage is not severe, the pastures are productive until about the beginning of winter. From July onwards in normal years the feed available from paspalum pastures declines in quality and quantity during the dry spring and early summer months until the summer storms occur near the end of the calendar year.

Much of the rain-forest was cleared and the land seeded with Rhodes grass (*Chloris gayana*), paspalum (*Paspalum dilatatum*), and clover (*Trifolium* spp.) from twenty to thirty years ago. The paspalum became dominant on most farms within a few years, and on many of the properties the pasture has been more or less continually grazed ever since. Most of the land is still littered with partly-decayed rain-forest remains, such as tree trunks, stumps, and even dead Penda trees (*Xanthostemon pubescens*), the latter being left uncut when clearing, on account of their hardness. Very few farms have been extensively subdivided, and thus, in most cases, the adoption of rotational grazing as a normal part of farm management is at present impracticable. Various clovers have been re-sown more than once on many properties, but the only type which has persisted is white clover (*Trifolium repens*), and even this is successful only in comparatively wet areas or during a season with good winter and spring rains. With the exception of a few small areas recently treated, few of the pastures have received artificial fertilizers.

Attempts to establish and maintain lucerne (*Medicago sativa*) in the area were unsuccessful, even where the seed was sown in well-prepared ground. Maize rarely grew satisfactorily after the land had been in cultivation for a few years, and farmers were forced to rely on cow-cane, which, though unsatisfactory, was the only available reserve fodder for the dry season. Winter green feeds such as the cereals and field peas have been grown in some years, but usually the onset of the dry season before they mature makes them speculative crops, which are seldom of any value after August.

The problem as outlined was obviously a composite one, the entomological and agricultural difficulties overlapping, and with no simple solution apparent. The main lines of investigation suggested by a critical survey of the problem, are enumerated below—

(*a*) The control of white grubs by entomological means such as parasites, predators, diseases, insecticides, light traps, and pig-grazing;

(*b*) Better management of pastures by rotational grazing, mechanical renovation, and the addition of lime and fertilizers;

(*c*) The elaboration of suitable pasture mixtures for local conditions, with the inclusion of legumes and grasses other than paspalum, and the determination of methods for establishing such pastures;

(*d*) The elaboration of effective methods for establishing, maintaining, and utilising lucerne;

(*e*) Exploitation of the normally excellent summer weather conditions to grow fodder crops which can be stored for use during the dry season; this involves the selection of crop mixtures suitable for making protein-rich silage;

(*f*) Experimenting with fertilizers which may be used profitably on summer fodder crops.

CONTROL OF WHITE GRUBS.

Various white grubs occur as pests in many parts of the world, and numerous attempts to evolve control measures have been made (Jarvis, 1926; Luginbill, 1938; Neiswander, 1938). The greatest factor governing the method of control adopted is an economic one. For example, several species are pests in golf greens and parks, where they can be controlled by the incorporation of lead arsenate in the top layers of soil (Fleming, 1936; Neiswander, 1938). Others occur as pests of sugar-cane in Queensland, and methods of dealing with these by the use of soil fumigants have been in use for some years (Jarvis, 1926). Unfortunately, however, the problem of controlling white grubs in pastures is very different from that of their control in either of the examples quoted above. The cost of applying such control methods is in excess of the total annual return which can be expected from pastures used for dairying in North Queensland, and therefore, the use of insecticides is economically unsound.

Scoliid wasps are parasitic on the white grubs, and a Tachinid fly (*Palpostoma testacea* R.D.) is parasitic on the beetles. The percentage of parasitism is always extremely low, however, even under the most favourable circumstances, and it is unlikely that these or any other insects could be exploited as parasites for the control of indigenous white grubs.

A bacterial disease of the larvæ has been reported (Atherton, 1931; Smith, 1936), but, in spite of a mortality as high as 70 per cent. in the larvæ of heavily infested patches in the 1937 winter, a large flight of beetles occurred at the end of that year. Apparently larvæ outside the very heavily infested patches were not affected to any appreciable extent, and there is little prospect of using the disease organism for control purposes.

The Giant American Toad (*Bufo marinus*) was recently introduced by the Bureau of Sugar Experiment Stations into North Queensland, and the possible utility of such a predator on the adult beetles prompted the liberation of some fifteen to twenty thousand young toads on the Tableland. It appears that the toad may not be successfully colonised at altitudes greater than about 1,200 feet (Pemberton, 1935), and the mean altitude of the Atherton Tableland is about twice this figure. However, a number of the toads have reached maturity on the Tableland, and further developments can be watched with some interest.

During favourable storm seasons, enormous numbers of beetles are on the wing in the affected area in November, December, and January. The possibility of controlling the pest at this stage has been considered. The use of light traps was attempted (Smith, 1936), but only a very small percentage of the beetle population was attracted to the strong acetylene lamps used, and it is therefore improbable that light traps will be of any value for control purposes.

Reducing the beetle population by allowing pigs free range over pastures has been practised by some farmers during the flight season (Smith, 1936). The pigs become very partial to the beetles and consume enormous numbers when they have access to places in which the latter congregate.

A trial of this method of protecting pastures from white grub attack was initiated at the end of 1935. During the flight season, pigs were given free range over enclosed pastures at rates of four, three, two, and nil head per acre in one-acre fields. The animals made satisfactory gains in weight, though given maize grain only as a supplement to the beetles and pasture. They were later sent to the bacon factory, where there were no adverse comments on carcase quality after slaughter. The fences were removed from around the plots after the trial, and during the following year stock showed a preference for the pasture of the experimental area. White grub population counts from the various parts of the experimental area were planned for the winter of 1937, when damage by white grubs should have been evident; but, at the end of 1936, pigs were inadvertently given access to all pasture on the farm, including the old experimental area, during the flight season. Considerable rooting for grubs occurred in the old plots, and there was much more disturbance of the pasture in the plot which had carried no pigs than in any of the others. Examination of the area in 1937 showed that very few grubs were present, and no differences between the various plots of the old experimental area could be detected. The obvious preference for the control plot shown by the pigs at the end of 1936 indicates that white grubs were more prevalent in the part of the experimental area which had carried no pigs during the previous beetle flight. Thus it is reasonable to assume that allowing pigs free range over pasture during beetle flight affords some measure of protection to that pasture.

The period during which a grass shortage will occur on white grub infested farms can be predicted some eighteen months in advance (Smith, 1936), and methods of using this information are outlined in a later section of this report.

PASTURE MANAGEMENT.

The present methods of pasture management are frequently inadequate, quite apart from any question of white grub infestation. In the first place, there is no justification for allowing tree trunks and stumps to remain in the fields twenty to thirty years after clearing. These obstructions serve as centres for beetle concentration, and thus for grub infestation. The retention of 40 to 50-acre fields does not permit the best use of the available pastures, as it is impracticable to use such large fields for effective rotational grazing. It is often suggested that paspalum pastures become rootbound and unproductive when continuously grazed over a period of years. Pastures comprising one species

only—and that a grass—can never be as profitable as the ideal grass-legume sward type. Further, continuous grazing as practised on the Atherton Tableland must lead to impoverishment unless methods for re-establishing soil fertility, at levels capable of maintaining the productivity of pastures, can be devised.

Rotational Grazing.

Chemical analyses and feeding tests have shown that grasses and pasture plants possess their maximum feeding value in the young stages, generally after having made three or four weeks' growth (Grunder, 1933; Richardson, Trumble, and Shapter, 1932). Thus the best way to use a pasture is to keep it free of stock for about three weeks, and then feed off the growth as quickly as possible (Hodgson, 1933). Management along these lines is only possible on well-subdivided properties. Some means of cutting and storing surplus pasture when such is available is also necessary, as a pasture which has been allowed to grow rank falls off very considerably in feed value. Small silos of 10 to 20 tons capacity might be used for storing the surplus young grass, provided 3 to 5 per cent. of molasses is added to assist in curing.

A demonstration of rotational grazing on paspalum pasture was conducted in 1936. Three small adjacent 4-acre fields were provided, each giving access to permanent water. In the absence of suitable dairy cattle on the property, young steers were used, and these, grazed at the rate of a beast to 2 acres, made satisfactory gains in weight. It was considered that animals grazing under the rotational scheme made better gains than similar animals grazed continuously in a large paddock of otherwise similar pasture. Since this demonstration was conducted, several dairymen have subdivided their properties and adopted the practice of rotational grazing.

Renovation.

Methods of renovating old and unprofitable paspalum pastures in Southern Queensland have been described (McKeon, 1927; Winders, 1938). Comparable means of reinvigorating paspalum pastures on the Tableland are equally necessary, even when the grass is not known to be affected by white grubs.

Several dairymen on the Atherton Tableland began renovating pastures by the use of implements some ten to twelve years ago. The usual method is to clear the land of tree trunks and stumps and plough the sward during the wet season. Disc ploughs have always been used for the renovation, leaving a very rough surface. Stock are excluded for some months after ploughing, until the grass is well established again and has seeded. If rain falls soon after ploughing, this method of treatment gives very satisfactory results the first time it is done; pasture regrowth is quite vigorous, and the carrying capacity of the land is increased to a marked extent. The beneficial effects are, however, transitory. Within from five to seven years of treatment the renovated pasture has deteriorated again until it is little or no better than when treatment was first carried out. Further renovation is then necessary, and implements may again be used. The results from second and third renovation treatments are, however, much less spectacular and short-lived than those obtained when pastures are ploughed for the first time.

Several methods of renovation with readily available implements were investigated at Peeramon (Appendix I.). The pasture was old grub-infested paspalum, which had not been renovated or treated in any way since grassing was completed approximately twenty years previously. After clearing off old waste timber, the treatments were applied in duplicate at the beginning of November, 1935, and comprised ploughing with both disc and mouldboard implements, followed by harrows twice, once, and not at all, and control or untreated pasture. The early storms which were expected did not eventuate, and some eight weeks of dry, hot weather followed the ploughing. Under these conditions, the two "mouldboard-ploughed only" plots were much superior to any of the others. Examination of the area early in 1936 showed that *L. caudata* beetles had not entirely avoided the ploughed sections during the flight a few months before. Three years after treatment, the pasture on the "mouldboard-ploughed only" plots was still quite satisfactory, but recovery had been quite negligible in all of the other plots, and they were over-run with useless weeds and grasses.

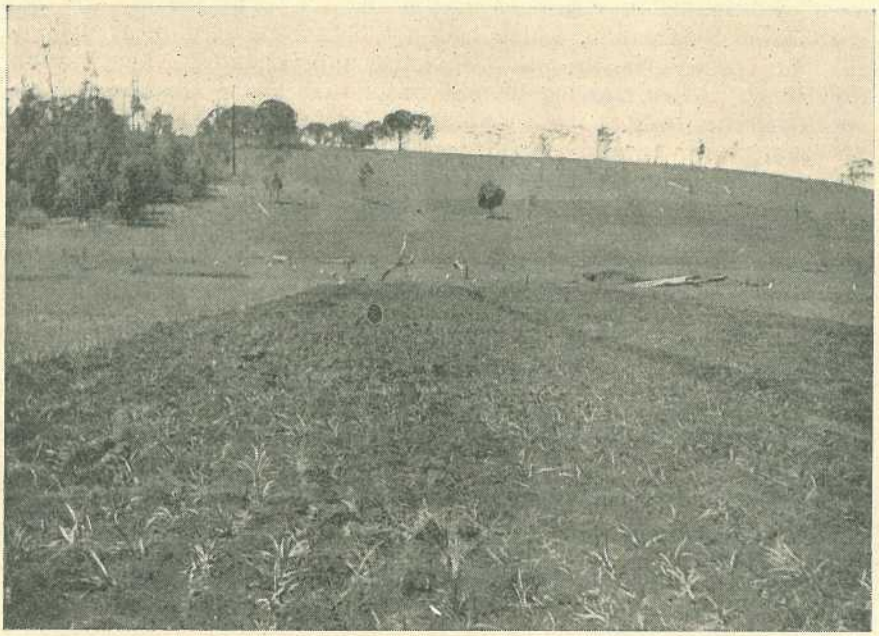
Sufficient data is available to suggest that renovation by ploughing cannot be regarded as anything but a palliative under Tableland conditions. In spite of its limitations, however, renovation could be exploited on more farms to improve old paspalum, pending the elaboration of more satisfactory methods of establishing and maintaining permanent pastures. Plough renovation of a sward containing both paspalum and white clover may temporarily suppress the legume (Appendix II.). This drawback has no great practical significance at the moment, as white clover does not occur in most of the old paspalum pastures in the grub-infested area.

Renovation and Manuring.

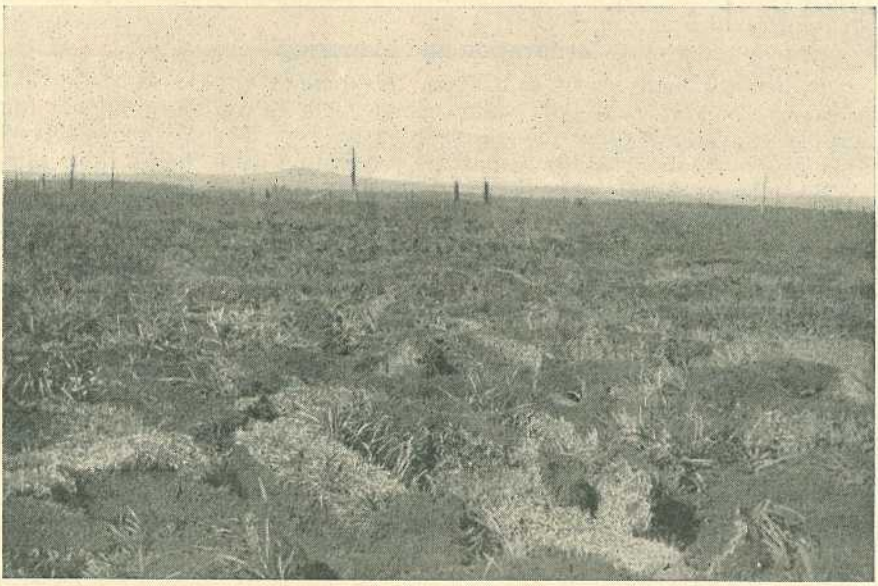
Chemical analyses of soils from the grub-infested area show that they may be very acid—pH values range from 4·6 to 5·7—and that the supply of available plant foods is frequently low. The possible effects of lime and various fertilizers in pasture renovation were therefore investigated. Two experiments were conducted and observational data obtained from each.

In the first experiment (Appendix II.) several treatments were applied to a pasture which was not severely grub-infested and carried an appreciable quantity of white clover. The treatments, liming with and without nitrogen as sulphate of ammonia, were applied to unploughed, mouldboard-ploughed, and disc-ploughed pasture. The land was ploughed about a month before the onset of the summer rains in 1935.

Observations in 1936 indicated that the clover had been suppressed in the ploughed plots, though still vigorous in the untreated area. There was no apparent response to lime by the clover or the grass. There was a very marked response to sulphate of ammonia on unploughed pasture. The nitrogen was applied in two equal dressings, and the growth response was evident within a few weeks of application in each case. The regrowth of paspalum was so vigorous on the ploughed plots that any possible effect of added nitrogen was almost completely masked, particularly after the first application in mid-January, 1936. The recovery of the paspalum was much more rapid in the mouldboard-ploughed than in the disc-ploughed area, and the surface of the ground



(*a*)



(*b*)

Plate 227.

WHITE GRUB INFESTED PASTURE RENOVATED BY PLOUGHING—(*a*) With a mould-board plough; (*b*) with a disc plough. Note the even surface favourable for rapid pasture re-establishment in the former.

was certainly more level (Plate 227). White grub injury, was quite obvious in the unploughed area during the first part of 1937, but there was no visible damage in the ploughed sections.

The land used for the second experiment with lime and fertilizers on pasture (Appendix III.) was grub-infested, and carried a poor pasture of paspalum, with which was associated carpet grass (*Axonopus compressus*) and a little kikuyu (*Pennisetum clandestinum*). This area had been twice renovated by ploughing during the ten years immediately prior to the initiation of the experiment. The old pasture was ploughed once, early in January, 1937, and then lightly harrowed to even the surface without destroying the grass. Quicklime was applied at rates of 4, 2, and nil tons per acre, and on each of the strips so treated nitrogenous (22 lb. N per acre) and phosphatic (22, 66, and 76 lb. P_2O_5 per acre) fertilizers were applied in duplicate. After the fertilizers were harrowed in, perennial Korean clover (*Lespedeza sericea*) was sown over the whole experimental area at the rate of 1 lb. per acre. White clover at 3 lb. per acre was sown on the whole area early in April.

Very disappointing results were obtained. Neither of the legumes was satisfactorily established, and none of the lime or fertilizer treatments effected any visible improvement in the pasture. After the addition of such appreciable quantities of lime, nitrogen, and phosphate, considerable differences between treated and control plots were expected, but none was observed. However, the experiment indicated that a single application of lime, phosphate, and nitrogen was of no value in the third renovation of this particular paspalum pasture. There is no evidence to indicate whether repeated annual applications of fertilizer would be of greater value than the single application.

Renovation and Replanting.

The recovery of paspalum pastures even after the first renovation by ploughing may not be satisfactory, particularly if some weeks of dry weather occur soon after treatment. Thus it was advisable to ascertain whether replanting would be of any value in conjunction with mechanical renovation. As mixed pastures are more valuable than single species swards, several grasses and legumes were sown in an exploratory experiment (Appendix IV.).

The area available for the trial comprised 3 acres of grub-infested old paspalum pasture invaded by carpet grass. Ploughing and harrowing were carried out in January, 1937, a disc plough being used. Replanting with four of the grasses was completed in February, but the sowing of the winter-growing grasses and the legumes was left until April. Five grasses—paspalum, purple-topped Guinea (*Panicum maximum* var. *coloratum*), Rhodes, woolly finger grasses (*Digitaria* spp.), a winter-growing grass mixture of Italian rye (*Lolium multiflorum*), Wimmera rye (*Lolium subulatum*), and prairie (*Bromus unioloides*), and five legumes—lucerne, white clover, red clover (*Trifolium pratense*), perennial Korean clover, and annual Korean clover (*Lespedeza striata*)—were planted. Each grass was sown with each of the legumes, each grass alone, and each legume alone. One treatment, of course, comprised renovation without reseeding.

The experimental area of 3 acres was fenced off as one field and grazed periodically by a herd of forty-five dairy cows for two to three hours daily whenever the pasture was at a suitable stage. The

grazing provided during the first year after renovating and replanting was equivalent to two beasts per acre per annum for between two and three hours daily. This is an improvement on the carrying capacity expected of the corresponding unimproved pasture.

Observational results of some value were obtained. The legumes, though germinating, were never strongly established, even where phosphate (22 lb. P_2O_5 per acre) was applied. A few lucerne plants grew, but these were not sufficiently numerous to materially improve the pasture. The Korean clovers were less satisfactory than the lucerne, and reseeding with both early in the summer of 1937-38 failed to establish either species in the sward. Both red clover and white clover failed. The winter grasses succumbed, apparently, to competition by renovated paspalum, which grew particularly well during the mild winter of 1937. All the species of *Digitaria* failed also. *D. eriantha* root sets, to the extent of 50 per cent. of those planted, rooted successfully, but a year later it was impossible to locate any.

There was no obvious indication that reseeding with paspalum improved the renovated pasture. Normally, however, the pasture is left undisturbed for some time after renovation, and this allows natural reseeding before grazing is attempted. The Rhodes grass was very successful, and not only provided a good bulk of feed, but also suppressed the various weeds which always occur in renovated pastures during the first year after treatment.

Purple-topped Guinea grass was sown at the rate of 5 lb. per acre, and although a germination test on the sample showed only 15 per cent. viable seed, the grass is well established in each of the three replications, and appears quite capable of meeting the competition of paspalum. The palatability of this grass is excellent, and it was always grazed off short whenever stock had access to the field. Unfortunately, it is killed back by frost, though coming away again very freely in the spring.

Replanting after Cultivation.

Failure, or at best, only partial success has attended efforts by local farmers to re-establish pastures after the land has been in cultivation for a number of years. These difficulties are probably due to soil-nutrient deficiencies, which can be remedied by the application of suitable fertilizers. It is very desirable that any such re-established pastures should contain at least one legume in association with one or more grasses.

The compatability of several grasses and each of three summer fodder legumes was investigated in a small observation trial (Appendix V.). The three legumes—lucerne, sweet clover (*Melilotus alba*), and annual Korean clover—were sown alone and with each of the following grasses in January, 1938:—Paspalum, Rhodes, woolly finger (*Digitaria Polevansii*), slender Guinea (*Panicum maximum* var. *trichoglume*), and purple-topped Guinea. This provided fifteen two-species mixtures and three legumes alone, all of which were planted in duplicate.

There was very strong competition from weeds over the whole area. All the grasses, except the *Digitaria*, made satisfactory growth, the vigour of Rhodes and the two types of Guinea being quite outstanding. None of the legumes grew well, either with the grasses or alone, until the following summer, but Korean clover appears least promising of the

three. Both lucerne and sweet clover made better growth during the winter than could have been expected from their appearance in autumn, possibly because of good rains in July. It seems that lucerne with either of the Guinea grasses and lucerne with Rhodes grass should make good two-species mixtures for local use.

The establishment of pastures on old cultivation is being investigated in two experiments.

The land used for the first trial had been under various crops for a number of years prior to the winter of 1935, when it was first made available for experimental purposes (Appendix VI.). Cropping results indicated a deficiency in plant foods. The whole field was, therefore, treated with lime and phosphatic fertilizer, and grew various crops, which are described in a later section of this report. Early in 1938 a heavy crop of sorghum and cowpea was ploughed in as green manure, and six weeks later a pasture mixture of lucerne, Rhodes grass, and prairie grass was sown.

Rather dry and unfavourable weather was experienced for some five weeks after sowing, but nevertheless the pasture made good growth. An excellent mixed pasture is now established, but its durability under normal management remains to be determined.

The land used for the second trial had also been in cultivation for a number of years, and showed a marked falling-off in yields of the staple crop—maize (Appendix VII.). Sorghum and Poona pea were grown on the field and ploughed in as green manure early in 1938. A mixture of wheat and lucerne was sown at the end of April, two months after ploughing in the green crop. Both species made excellent growth and, by the time the wheat had been grazed off, the lucerne was well established. The latter made an excellent response to the early storms in November, 1938, and was mown at the end of December. A paspalum and Rhodes grass seeds mixture was then sown, and promises to develop into a good permanent pasture.

LUCERNE.

Clovers have not been very successful in Tableland pastures, the general experience being that they fail within a year or two of sowing, presumably owing to the dry spring usually experienced in the district. The observed better growth of clovers in the moister parts of the Tableland and elsewhere if good rains occur in the spring supports this suggestion. Furthermore, the known deficiency of phosphates in the soils may be important. The available strains of clover are possibly unsuitable, and failure to inoculate with a suitable *Rhizobium* may also be a limiting factor.

In view of the comparative failure of clovers, and the dependability of summer rains on the Tableland, the investigation of summer legumes for pastures is essential. Lucerne is unquestionably the best legume for dairy cattle, and there is no doubt that the more extensive use of this crop is desirable. Very little lucerne has been grown in the Peeramon district of the Tableland in the past, though many unsuccessful efforts to establish the crop have been made. Even when the crop appears to be fairly well established, attacks by the leaf spot fungous disease *Pseudopeziza medicaginus* may cause wholesale spoilage. Furthermore, haymaking is difficult during the summer and autumn in such a moist climate. Nevertheless, these difficulties may not be insurmountable.

Lucerne in Pastures.

The experimental work already described indicated that the incorporation of lucerne in established paspalum pastures was not likely to be accomplished until the local fertilizer requirements of the crop are known.

Lucerne has since been established, however, after thorough cultivation and the addition of lime and phosphates to the soil. Promising grasses to grow in the pasture with lucerne are prairie, Rhodes, slender Guinea, and purple-topped Guinea. The experimental areas (Appendix VI. and VII.) in which lucerne is used as the pasture legume have not yet been sufficiently long established to yield completely reliable data.

Grazing Lucerne.

An experimental area of lucerne was established in the white grub belt at the beginning of 1936 in order to obtain some information on the difficulties associated with the establishment and maintenance of the crop, particularly when grazed as a pure stand (Appendix VIII.). Four acres of old paspalum pasture were ploughed at the end of 1935 and a crop of maize grown for silage. After thorough cultivation following the maize harvest, lucerne, inoculated with the appropriate *Rhizobium*, was sown early in June, 1936. Quicklime ($\frac{1}{2}$ ton per acre) was broadcast in two strips across the field, and superphosphate (33 lb. P_2O_5 per acre) applied in strips at right angles to the limed strips. There was no visible effect attributable to the lime, but the effect of phosphate was so marked that superphosphate has since been applied to the whole field annually.

The 4 acres are now subdivided into three fields approximately equal in area, and these are grazed off quickly in turn when the lucerne makes sufficient growth for the purpose. The herd, comprising about forty-five head of dairy cows, is used for grazing, the animals being allowed access to one field for one to two hours daily until the lucerne is eaten short. They are then placed in the second field, and finally into the third, each field being grazed in a similar manner to the first. The whole area is allowed to recover before grazing is again attempted.

This system of grazing has been practised since the end of 1936, and a satisfactory stand of the crop still persists on about half the field. It is noticeable that the lucerne is being crowded out by weeds and paspalum on the higher parts of the slope, but on the more level portion it still comprises about 80 to 90 per cent. of the herbage. The field was mown in March, 1937, to control an outbreak of *Pseudopeziza* leaf spot.

Increased cream production while the herd is grazed on the lucerne indicates that the crop is worth about £20 per acre per annum to the farmer. The fact that the crop has persisted for so long under harsh treatment indicates that successful exploitation should be quite practicable, even if resowing every three years is necessary.

Lucerne Silage.

It may not always be convenient or practicable to graze lucerne, and the conservation of any surplus supplies for use during the dry spring is clearly desirable. The weather during the summer, when lucerne grows most rapidly, is often unsuitable for haymaking,

on account of the extended wet periods which sometimes occur. The feasibility of conserving lucerne as silage was therefore investigated. The A.I.V. method, using mineral acids, is too expensive for local application, but the molasses modification is quite practicable, as supplies of the latter can be obtained from the sugar-cane districts near by.

In the absence of a suitable small silo for the purpose, a 44-gallon iron petrol drum was used. The lucerne was chaffed immediately after cutting, mixed with a solution containing equal volumes of molasses and water, at the rate of 1 gallon molasses solution to 100 lb. green lucerne, and then packed into the drum.

Three months after treatment, the seal was removed. Some 6 inches of the material at the top of the drum had rotted, but otherwise the silage was in good order. The cured silage appeared too moist and possibly too acid, but these disadvantages would be at least partially overcome by using less molasses, say, about 4 lb. per 100 lb. green lucerne. Chemical analysis of the silage showed that the values of nutrient materials compare favourably with those of green lucerne (Table II.).

TABLE II.

ANALYSES OF LUCERNE-MOLASSES SILAGE AND OF GREEN LUCERNE.

Determination.	Lucerne-Molasses Silage (Atherton).	Green Lucerne (Atherton).	Green Lucerne (U.S.A.).*
Water	75·36	73·53	74·60
Crude Protein	4·66	6·13	4·6
Crude Fat	0·52	0·40	1·0
Carbohydrate	10·20	10·90	10·4
Crude Fibre	5·96	6·13	7·0
Crude Ash	3·30	2·90	2·4
CaO	0·550	0·622	0·40
P_2O_5	0·062	0·148	0·06

* Figures quoted from "Feeds and Feeding" (Morrison, 1936).

Thus the local application of the molasses method of making lucerne silage is apparently quite practicable and will be valuable when more lucerne is grown.

FODDER CROPS.

The drop in butter production for the district during the dry spring and early summer indicates that the roughage then available contains insufficient nutriment for dairy cattle. It is sometimes possible to grow winter cereals for grazing early in the spring, but favourable growing weather does not always occur. Even during those years when winter crops can be grown there is still the probability of the dry season continuing long after the winter crops have been fed off. Winter cereals on the Tableland are also very susceptible to rust under the normal climatic conditions in winter. There may be some years in which winter crops could be grown for hay, but their occurrence is always problematical. However, even in 1915, the driest year recorded on the Atherton Tableland, there was sufficient summer rain to ensure the growth of summer fodder crops such as maize, sorghum, or cowpeas. Therefore, the logical procedure is to concentrate on the growth of

summer fodders for conservation, and to recognise winter cereals as desirable but not dependable crops under local climatic conditions.

Good haymaking weather is extremely rare during the late summer; thus it is advisable to concentrate attention on good silage crops rather than on those summer crops particularly adapted for conservation as hay. Maize is the best crop for silage, and receives preference over all others wherever it can be grown. Sorghum is second favourite as a silage crop, and heavy yields are produced in some districts.

Silage Crops.

The few farmers who have hitherto made silage on the Tableland have grown maize alone for the purpose. Maize provides a great bulk of fodder under suitable conditions of soil and climate, but the nutritive ratio is much wider than that required by dairy cows in a supplement to the poor pasturage in spring and early summer. There is not sufficient protein to balance the carbohydrates and fat. Maize silage has a sufficiently high content of digestible nutrients to keep milking cows in good condition, but a ration of maize silage and pasture must be supplemented by appreciable quantities of protein concentrates in order to maintain the herd's butterfat production at a profitable level. Suitable concentrates such as bran, cottonseed meal, and linseed meal are comparatively expensive and difficult to obtain on the Atherton Tableland. It is, therefore, sound economy to produce as much as possible of the proteins required on the farm itself. This is desirable in any district, of course, but it is more necessary on economic grounds in North Queensland than in most other districts of the State.

The protein content of all fodder legumes is high, but most of them do not produce a high yield of dry matter per acre when grown alone. In many dairying districts, in Australia and in other countries, farmers have adopted a practice of growing maize and a legume together for silage. Both crops are planted at the same time, in the same drill, and the combined crop is harvested and made into silage in the one operation. In an American experiment, a combined crop of maize and soy bean increased the dry matter yield per acre by as much as 14 per cent., compared with the yield from maize alone. In this connection, Wiggins (1935) states that "Any good variety of silage corn and a suitable variety of soy beans, grown together in the same row and spaced at the rate of one corn plant to three soy bean plants in each nine inches of row, yield more digestible nutrients than does the same variety of corn grown alone at the optimum planting rate."

Thus, the investigation of maize-legume combined crops for local conditions should indicate one or more mixtures capable of yielding silage rich in digestible nutrients and with a suitable nutritive ratio. Some strains of maize developed on the Tableland by individual farmers are known to outyield all other commercial varieties in the district. Local maize types were, therefore, given first preference in maize-legume silage experiments. Heavy yields of sorghum have sometimes been obtained locally, and attention has also been given to this crop.

The legumes must fulfil certain conditions if they are to be suitable for combination with either of the other crops. They should reach silage maturity at the same time as the associated variety of sorghum or maize; increase the production of dry matter per acre; increase the percentage of protein in the total dry matter; and grow in such a manner that harvesting with either maize or sorghum is easily performed.

Maize, Poona pea (*Vigna sinensis*), and rice bean (*Phaseolus calcaratus*) were included in the silage-cropping programme in 1936-37. (Appendix VI.). All crops were planted at the same time, and the maize required approximately sixteen weeks to reach silage maturity. Poona pea matured in a shorter period, and was dead when the maize

(*b*)

(*a*)

Plate 228.

Silage Crops.—(*a*) Sorghum and Groit cowpea; (*b*) maize and rice bean.

was ready for the silo. Rice bean synchronised very will with the maize and was heavily loaded with green pods at the time of harvesting (Plate 228). Unfortunately, however, the bulk of the crop produced by the rice bean was inconsiderable (Table III.), and quite insufficient to warrant its use with maize unless the proportion of legume can be increased by variations in rates of planting or by some other means.

The effects of variations in rates of planting maize and rice bean were investigated (Appendix IX.) on another farm. Both maize and rice bean were sown in the same drill on the same day and duplicate plots of six spacing variations were sown. The maize was quite ready to harvest fifteen weeks after sowing, though the rice bean had not then commenced flowering. In the earlier experiment, the rice bean had been ready to harvest with the maize approximately sixteen weeks after sowing. Although there was considerable variation in the amount of rice bean in the variously planted plots—from 1·28 per cent. to 5·06 per cent.—the legume content in the combined fodder was never sufficiently high to materially improve the nutritive ratio of the silage (Table IV.). It is remarkable that, with so much variation in rate of planting, there was no significant variation in total yield of green material from treatment to treatment.

The failure of the maize and rice bean to synchronise as well in the second experiment as they did in the first may have been due to variable weather from season to season, soil differences between the two farms, and differences in the strains of maize or rice bean used in the experiments.

The values of rice bean, Groit cowpea, giant cowpea, and Otootan soy bean as legumes for use in combination with maize for silage were investigated in another experiment (Appendix X.). The crops were sown in limed (3 tons ground limestone per acre) soil, and a complete fertilizer (18 lb. 6; 54 lb. P_2O_5; 26 lb. K_2O) was applied in the drill at the time of planting. The drills were 3½ feet apart. The maize was sown as single grains 9 inches apart, and the legumes at the rate of 10 lb. per acre. Each of the legumes, except rice bean, was inoculated with the appropriate *Rhizobium* before planting. Duplicate plots were sown. Dry weather for some time after planting probably depressed yields and hastened maturity, for the crops were ready for harvesting fourteen and a-half weeks after sowing. Yields are recorded in Table V.

The yield of rice bean was not materially greater than in the spacing trial previously discussed. The yield of giant cowpea—3 tons green weight per acre—was qhite satisfactory, and comprised, roughly, 23 per cent. of the total green weight of the combined crop. Both soy bean and Groit cowpea—particularly the latter—synchronised well with the maize, and the nutritive ratio of the mixed crop was much better than that of the maize alone (Tables VI. and VII.).

A comparison of Groit cowpea and velvet beans for combination with maize was made on one farm independently of this investigation. These crops were fertilized with superphosphate only. Both mixtures handled well and contained fairly high percentages of legumes. The green weight of Groit cowpea was much higher than that of velvet bean, but there was not so much disparity in total nutrients per acre (Table VII.).

TABLE III.

SILAGE CROP, 1936-1937.

Treatments.	Sub. Block.	Yield Green Weight—Tons per Acre.			Percentage Legume.
		Total.	Maize.	Rice Bean.	
a	1	9·82	9·13	0·29	3·08
	2	6·89	6·85	0·04	0·58
	3	8·07	7·84	0·23	2·85
	4	10·32	10·04	0·28	2·71
	Mean	**8·66**	**8·45**	**0·21**	**2·42**
b	1	12·32	11·11	1·21	9·82
	2	14·00	13·39	0·61	4·36
	3	12·35	12·00	0·35	2·83
	3	13·92	13·40	0·52	3·74
	Mean	**13·15**	**12·48**	**0·67**	**5·10**
c	1	10·24	9·92	0·32	3·13
	2	15·06	14·19	0·87	5·78
	3	10·65	10·44	0·21	1·97
	4	8·35	8·18	0·17	2·04
	Mean	**11·08**	**10·69**	**0·39**	**3·52**
d	1	4·64	4·61	0·03	0·65
	2	6·26	6·20	0·06	0·96
	3	3·99	3·96	0·03	0·75
	4	3·10	3·05	0·05	1·61
	Mean	**4·49**	**4·45**	**0·04**	**0·89**
General Mean		9·35	9·02	0·33	3·53

Treatments (per acre)—

(*a*) Superphosphate at 75 lb. P_2O_5.

(*b*) Quicklime at 2 tons.
Dried blood at 25 lb. N.
Superphosphate at 75 lb. P_2O_5.
Sulphate of potash at 30 lb. K_2O.

(*c*) Quicklime at 2 tons.
Meatworks manure at 54 lb. P_2O_5 and 16 lb. N.

(*d*) No fertilizer or lime.

TABLE IV.

YIELDS FROM MAIZE-RICE BEAN SILAGE CROP, 1938.

Treatments (Rates of Planting).	Plot.	Yield—Tons Green Fodder per Acre.			Per cent. Legume.
		Total.	Maize.	Legume.	
A { Rows 4 ft. / Maize 9 in. / Bean 6 lb.	1	14·436	14·24	0·196	1·38
	2	12·750	12·48	0·270	2·13
	Mean	**13·593**	**13·36**	**0·233**	**1·74**
B { Rows 4 ft. / Maize 9 in. / Bean 8 lb.	1	13·776	13·26	0·516	3·89
	2	14·167	13·75	0·417	3·03
	Mean	**13·972**	**13·50**	**0·467**	**3·46**
C { Rows 3 ft. / Maize 9 in. / Bean 10 lb.	1	14·373	13·62	0·753	5·53
	2	14·734	14·21	0·524	3·68
	Mean	**14·554**	**13·91**	**0·639**	**4·59**
D { Rows 3 ft. / Maize 12 in. / Bean 10 lb.	1	14·600	13·88	0·720	5·18
	2	14·797	13·88	0·917	6·60
	Mean	**14·700**	**13·88**	**0·818**	**5·89**
E { Rows 3½ ft. / Maize 3 @ 1½ ft. / Bean 10 lb.	1	15·492	15·38	0·112	0·73
	2	13·644	13·42	0·224	1·67
	Mean	**14·568**	**14·40**	**0·168**	**1·17**
F { Rows 4½ ft. / Maize 6 in. / Bean 10 lb.	1	14·367	13·93	0·437	3·14
	2	14·518	14·06	0·458	3·26
	Mean	**14·443**	**14·00**	**0·448**	**3·20**
All Treatments		**14·302**	**13·84**	**0·462**	**3·34**

N.B.—All maize was sown as single grains except in E, where maize was planted in three grain groups.

TABLE V.

YIELDS FROM MAIZE-LEGUME SILAGE CROPS, 1937-1938.

Treatments.	Plot.	Yield—Tons Green Fodder per Acre.			Per cent. Legume.
		Total.	Maize.	Legume.	
A	1	11·05	10·21	0·84	7·60
	2	9·99	8·87	1·12	11·21
	Mean	**10·52**	**9·54**	**0·98**	**9·32**
B	1	13·02	10·27	2·75	21·12
	2	13·11	9·85	3·26	24·86
	Mean	**13·07**	**10·06**	**3·01**	**23·03**
C	1	13·80	10·66	3·14	22·75
	2	11·68	7·58	4·10	35·10
	Mean	**12·74**	**9·12**	**3·62**	**28·42**
D	1	10·05	9·15	0·90	8·96
	2	8·08	6·62	1·46	18·07
	Mean	**9·07**	**7·89**	**1·18**	**13·02**
All Treatments		**11·35**	**9·15**	**2·20**	**19·38**

Treatments—

A. Maize, single grains 9 in. apart; rice bean 10 lb. per acre.
B. Maize, single grains 9 in. apart; giant cowpea 10 lb. per acre.
C. Maize, single grains 9 in. apart; Groit cowpea 10 lb. per acre.
D. Maize, single grains 9 in. apart; Otootan soy bean 10 lb. per acre.

TABLE VI.

ANALYSES OF SILAGE CROPS GROWN IN 1937-1938.*

Determination.	Maize.†	Maize.‡	Soy Bean.	Rice Bean.	Velvet Bean.	Groit Cowpea.
			Percentage analysis of green crops.			
Moisture ..	52·97	55·10	70·73	77·95	63·22	80·82
Dry Matter ..	47·03	44·90	29·27	22·05	36·78	19·18
Carbohydrate	29·87	26·45	12·07	8·98	15·05	8·68
Fibre	10·96	12·20	8·03	7·40	11·70	5·86
Fat	1·35	0·70	1·67	0·50	0·92	0·33
Protein ..	3·24	3·95	5·73	3·78	7·06	3·03
Ash	1·62	1·60	1·77	1·40	2·05	1·28
			Percentage analysis of dry matter only.			
Protein ..	6·86	8·80	19·59	17·12	19·20	15·84
Fat	2·87	1·56	5·70	2·27	2·50	1·70
Fibre	23·31	27·17	27·45	33·56	31·82	30·55
Carbohydrate	63·50	58·90	41·23	40·70	40·90	45·23
Ash	3·46	3·57	6·04	6·35	5·57	6·67
CaO	0·46	0·67	2·05	2·72	1·93	1·92
P_2O_5	0·22	0·27	0·43	0·36	0·42	0·41

* These analyses are based on material growing in the experimental plots or in the farmers' own crops adjacent to such plots.

† Grown with superphosphate.

‡ Grown with a complete fertilizer.

TABLE VII.

TOTAL NUTRIENTS IN SILAGE CROPS GROWN IN 1937-1938.*

Fertilizer.	Crops.	Tons per Acre.	Starch Equivalent. (Cwt.)	Crude Proteins. (Cwt.)	Total Nutrients. (Cwt.)	Nutritive Ratio : 1.
Superphosphate only ..	Maize ..	8·250	72·35	5·35	77·70	13·5
	Vel. bean ..	1·142	6·58	1·62	8·20	4·1
	MIXTURE	**9·392**	**78·93**	**6·97**	**85·90**	**11·32**
Superphosphate only ..	Maize ..	7·632	66·93	4·95	71·88	13·5
	Groit Cow-pea ..	3·087	9·43	1·87	11·30	5·0
	MIXTURE	**10·719**	**76·36**	**6·82**	**83·18**	**11·20**
Complete fertilizer plus lime	Maize ..	9·120	73·30	7·20	80·50	10·2
	Groit Cow-pea ..	3·620	11·10	2·20	13·30	5·0
	MIXTURE	**12·740**	**84·40**	**9·40**	**93·80**	**8·98**
Complete fertilizer plus lime	Maize ..	7·88	63·40	6·22	69·62	10·2
	Soya bean..	1·18	5·63	1·35	6·98	4·2
	MIXTURE	**9·06**	**69·03**	**7·57**	**76·60**	**9·12**

* Data based on material growing in the experimental plots or in the farmers' own crops adjacent to such plots.

It is possible to suggest from the results of these experiments the trend of future developments, and to indicate the possibilities of some legumes in combination with maize for silage. Giant cowpea grows well, but matures later than maize. Furthermore, this legume is entirely procumbent, and therefore quite unsuitable for harvesting with maize for silage. Rice bean yields in the combined crop are low and, unless they can be improved by cultural or other means, this legume is unlikely to be of any value for silage purposes. Velvet bean, although not included in the experimental trial, showed promise when grown by a farmer. Groit cowpea combines very well with maize, and has yielded nearly 29 per cent. by weight of the green crop and over 10 cwt. of total nutrients per acre (Table VII.). Ototan soy beans grown with maize, though producing only 13 per cent. of the total green weight in the mixture, yielded almost 7 cwt. of total nutrients per acre (Table VII.) and improved the nutritive ratio of the silage appreciably. Soy beans are successfully combined with maize for silage overseas, and suitable varieties may ultimately be established here.

The nutritive ratio (approximately 11 : 1) of the green materials grown with superphosphate only was retained in the silage (Table VIII.). The analysis of maize grown on limed soil with a complete fertilizer shows a much higher percentage of protein than that of maize grown with superphosphate only (Table VI.). The latter crop was planted ten days before the former, and had the advantage of more favourable weather conditions at planting time.

TABLE VIII.

COMPARATIVE ANALYSES—GREEN MATERIAL AND SILAGE.*

Foodstuff.	Material.	Moisture.	Dry Matter.	Carbo-hydrate.	Fibre.	Fat.	Protein.	Ash.	Nutri-tive Ratio.
Maize and Velvet Bean	Green ..	54·21	45·79	28·10	11·12	1·30	3·70	1·67	11·32
Maize and Velvet Bean	Silage ..	68·53	31·47	20·74	6·48	0·63	2·46	1·16	11·64
Maize and Groit Cowpea	Green ..	60·95	39·05	23·76	9·49	1·06	3·17	1·51	11·20
Maize and Groit Cowpea	Silage ..	71·24	28·76	17·72	7·05	0·55	2·30	1·15	11·31
Mean	Green ..	57·58	42·42	25·93	10·31	1·18	3·44	1·59	11·26
Mean	Silage ..	69·89	30·12	19·23	6·77	0·59	2·38	1·16	11·48

* These analyses are based on material growing in the experimental plots or in the farmers' own crops adjacent to such plots.

Sorghum has been grown with legumes on several occasions during the past three years, but these mixed crops have not been made into silage. Only one variety of sorghum (red Kaffir) has been used, as this type is reputed to be more rust-resistant locally than the considerable number of others which were grown experimentally in North Queensland between ten and fifteen years ago.

Sorghum was grown with Poona pea on two occasions. In the first trial (Appendix VI.) the mixed seed was sown in drills 3 feet apart. The crop reached silage maturity in eleven weeks, and the maximum yield was 11·7 tons per acre, comprising 9·1 tons sorghum and 2·6 tons Poona pea. In the second trial (Appendix VII.) the mixed seed was sown through a wheat drill and ploughed in as green manure nine and

a-half weeks after sowing. The sorghum was about three weeks off and the Poona pea about a week off silage maturity when ploughed in. The total green weight per acre then varied from 12 to 19 tons, with a mean of 14 tons, and the two components were present in approximately equal amounts by weight.

The sorghum was grown with Groit cowpea on one occasion, and was also ploughed in as green manure ten weeks after sowing (Appendix VI.) when both components of the mixed crop were some weeks off silage maturity (Plate 228). A number of sample cuttings indicated a green crop weighing just over 13 tons per acre comprising 53 per cent. cowpea.

Chemical analyses of any of these sorghum-cowpea mixed crops are not available, but it is quite obvious from the figures quoted that high yields of green materials can be obtained. The nutritive ratio of a 50-50 sorghum-cowpea crop would be approximately 6·6 : 1, calculating from the sorghum analysis given by Morrison, 1936, and Groit cowpea analysis in Table VI., and further investigations of sorghum-cowpea mixed crops for silage are warranted.

Maize for Grain.

Very little attention has been given to maize as a grain crop during these investigations, though it plays a definite part in local dairying practice as a valuable carbohydrate concentrate for both dairy cattle and pigs.

The Atherton Tableland is probably the most reliable maize-producing area in Queensland (Annual Reports, Department of Agriculture and Stock), but grain yields are not uniformly satisfactory throughout the district. Considerable difficulty has been experienced by dairy farmers attempting the growth of maize in the wetter areas, and on many of these farms the production of good crops has been impossible. Some experiments with fertilizers on grain yields of maize are described in a later section of this report. These indicate that phosphatic fertilizers will greatly enhance the chances of obtaining good crops, particularly when the wet season is not sufficiently prolonged to cause serious damage by cob rot (*Diplodia zeæ*). The rice weevil (*Calandra oryzæ*) is the only insect pest of any importance to the stored grain locally, but standard methods of controlling this pest are effective.

Fodder Crops and Fertilizers.

Sorghum was one of the first cultivated fodder crops planted at the inception of these investigations. The yield of green material for silage obtained was only about 3 tons per acre (Appendix VI.) and the crop was a commercial failure. Germination of the seed was not at fault, and the rainfall should have been sufficient for the crop. There was no indication of damage by insect pests or diseases. Therefore, it was assumed that the crop failure was in some way associated with a soil factor, though whether a plant-food deficiency, faulty physical condition, or some deleterious substance was uncertain.

Crop failure was not uniform over the whole field (Plate 229) for, although there were large patches in which seedlings failed to develop past that stage, there were others in which the crop grew well. To distinguish between these areas and to facilitate discussion, they are hereinafter referred to as "bad patches" and "good patches" respectively. The location of good and bad patches over the whole western

half of the field was carefully plotted by recording the growth made in fifty-six quadrats, each covering about 100 square feet. The quadrats were regularly spaced—17 yards apart from north to south and 11 yards apart from east to west. A numerical value, between 0 and 10, was allotted to the growth made in each quadrat—allocation of the value being made from judgment only, and not from weighed production. The value 0 represents complete failure where the plants died after reaching a height of 3 or 4 inches, and 10 represents satisfactory growth (Plate 230). The obvious variability in growth from quadrat to quadrat is far in excess of that normally encountered in field uniformity trials and suggests that some factor other than chance was responsible for the good and bad patches in the area.

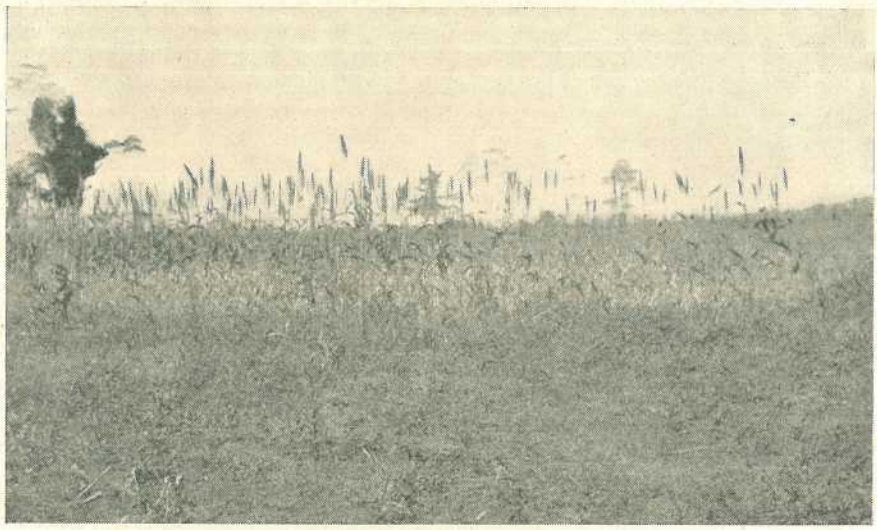


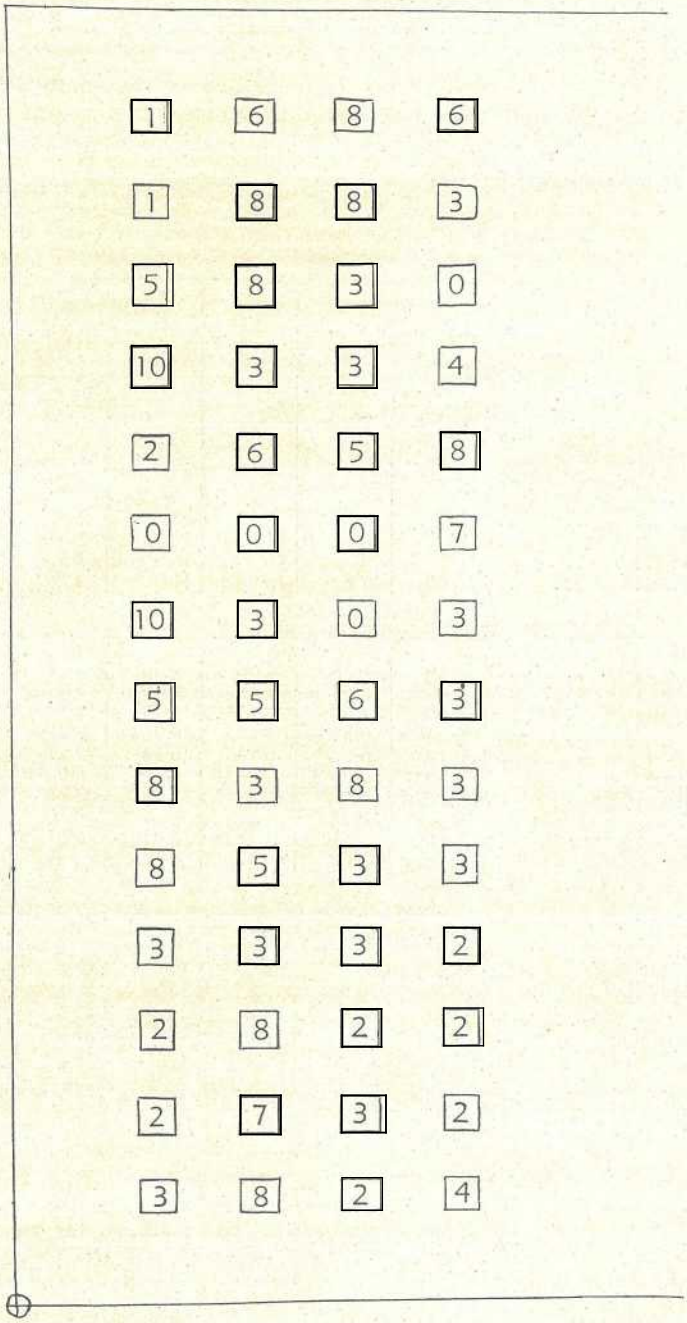
Plate 229.

INITIAL SORGHUM CROP AT PEERAMON, SHOWING "GOOD" AND "BAD" PATCHES THE LATTER IN THE FOREGROUND.

Four composite soil samples were collected from this field for chemical analysis. Two of the samples were taken from the northern end, one representing good-patch soil to a depth of 6 inches from three sites, and the other representing bad-patch soil taken similarly. Similar methods of sampling were used to collect good-patch and bad-patch soils from the southern end of the field.

The chemical and physical analyses of these samples indicate several striking differences between the soils. The most obvious difference is that the bad-patch soils are considerably more acid (pH 4·5) than the good-patch soils (pH 5·5). This difference is probably linked with the fact that bad-patch soils contain less lime (CaO), less magnesium (MgO), and less potash (K_2O) than the good-patch soils (Table IX.). The bad-patch soils contain more nitrogen (0·266 per cent.) than the good-patch soils (0·236 per cent.); this might also be linked with the lower pH value through the effect of the latter partially controlling the destruction of organic matter by micro-organisms in the soil. On the other hand, it might be linked with the greater proportion of colloidal

GROWTH IN QUADRATS, 1936



S. W. CORNER

Plate 230.

materials in the bad-patch soils. The content of phosphates is very low in both types of soil, but whereas the content of HCl soluble P_2O_5 is approximately the same in each (0·15 per cent. and 0·14 per cent.), the citric acid soluble P_2O_5 is higher in the bad-patch soils (0·0051 per cent. and 0·0031 per cent.). The mechanical fraction sand plus silt is higher (42·9 per cent.) in the good-patch soils than in the bad-patch soils (28·4 per cent.)—these portions can be described as inert material. The remainder, or colloidal materials, including fine silt, clay, and organic matter, comprise 57·1 per cent. and 71·6 per cent. in the good-patch and bad-patch soils respectively.

TABLE IX.

ANALYSES OF COMPOSITE SOIL SAMPLES FROM GOOD PATCHES AND BAD PATCHES (PEERAMON).

Determination.	"Good Patch" Soil.*			"Bad Patch" Soil.†		
	A.	B.	Mean.	A.	B.	Mean.
pH	5·7	5·2	5·5	4·6	4·4	4·5
Specific Gravity	1·13	1·13	1·13	1·13	1·11	1·12
Capacity for Water (%)	48	54	51	48	53	51
Capill. inches—						
3 hrs.	7	11·25	9·13	9·5	7·75	8·63
6 hrs.	9	13	11	10·5	8·25	9·38
12 hrs.	14	16	15	14	11·75	12·88
24 hrs.	16·25	17·5	16·88	15	14	14·5
Percentage in air-dried Soil.						
Moisture	5·09	4·86	4·98	4·75	5·17	4·96
Humus	2·66	2·52	2·59	2·69	2·55	2·62
Loss on Ignition	12·80	13·13	12·97	12·27	12·80	12·54
Nitrogen	0·236	0·235	0·236	0·265	0·266	0·266
HCl soluble P_2O_5	0·13	0·16	0·15	0·14	0·14	0·14
Citric Soluble P_2O_5	0·0033	0·0028	0·0031	0·0052	0·0050	0·0051
HCl sol. Fe, Al, Mn.	35·92	38·76	37·34	37·04	36·59	36·82
HCl soluble Ca?	0·39	0·26	0·33	0·19	0·12	0·16
Citric soluble CaO	0·1929	0·1118	0·1474	0·0165	0·0183	0·0174
HCl soluble K_2O	0·23	0·05	0·04	0·02	0·02	0·02
Citric soluble K_2O	0·0106	0·0094	0·01	0·0118	0·0091	0·0105
Mechanical Analysis.						
Sand 0·04–2·0 mm.	31·5	21·9	26·7	17·1	15·2	16·2
Silt 0·01–0·04 mm.	15·5	16·9	16·2	13·6	10·8	12·2
Fine Silt 0·002–0·01 mm.	23·3	31·8	27·6	28·2	29·0	28·6
Clay—under 0·002 mm.	14·1	13·7	13·9	26·1	29·6	27·9
Organic Matter	15·5	15·7	15·6	15·0	15·4	15·2

* Soil growing good crops without fertilizer.
† Soils in which crops failed wholly or partially.

During the spring following the failure of sorghum as a field crop some pot experiments were conducted with soil from both good and bad patches. As a shortage of the exchangeable bases—lime, magnesia, and potash—coupled with high acidity, was associated with the bad patches, and as the total phosphate was low throughout the field, the effect of added lime and phosphate to both types of soil in pots was investigated. The effect of added organic matter as goat dung in addition to lime was also investigated, sorghum being used as the test crop.

The results of the experiments provided some very suggestive data:—

(1) Bad-patch soils.—Air-slaked quicklime at 1 to 4 tons per acre effected an improved growth roughly proportional to the rate of application. Superphosphate at 120 lb. P_2O_5 per acre improved growth to much the same extent as meatworks manure at 100 lb. P_2O_5 and 30 lb. N per acre. Organic matter in the form of 10 tons goat dung per acre with air-slaked quicklime at 4 tons per acre improved growth to a remarkably high level.

(2) Good-patch soils.—Air-slaked quicklime at 4 tons per acre effected some improvement, and the same quantity of lime together with superphosphate at 120 lb. P_2O_5 per acre effected slightly greater improvement. The effects of lime and phosphates on these soils were not so marked as were the effects of the same materials on soil from bad patches.

The suggestions obtained from the above pot experiments were incorporated in a field trial of silage crops during the 1936-37 summer (Appendix VI.). The field was divided into four equal blocks for the application of lime and fertilizers. Poona pea, sorghum and Poona pea, and maize with rice bean were strip-planted across the blocks.

Lime and fertilizer treatments comprised the following:—

(*a*) Superphosphate at 75 lb. P_2O_5 per acre;

(*b*) Quicklime at 2 tons, superphosphate at 75 lb. P_2O_5, dried blood at 25 lb. N, and sulphate of potash at 30 lb. K_2O per acre;

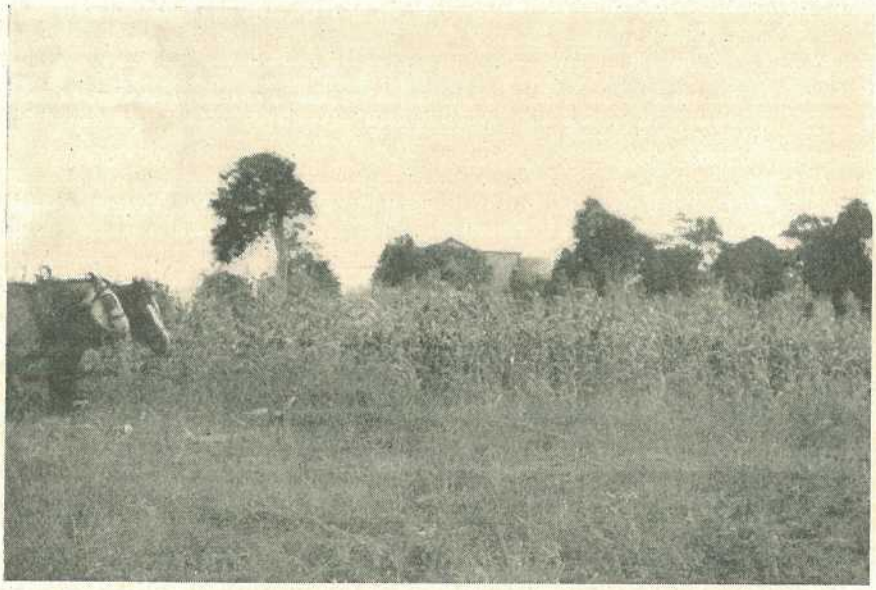
(*c*) Quicklime at 2 tons, meatworks manure at 54 lb. P_2O_5, and 16 lb. N per acre;

(*d*) No fertilizer treatment.

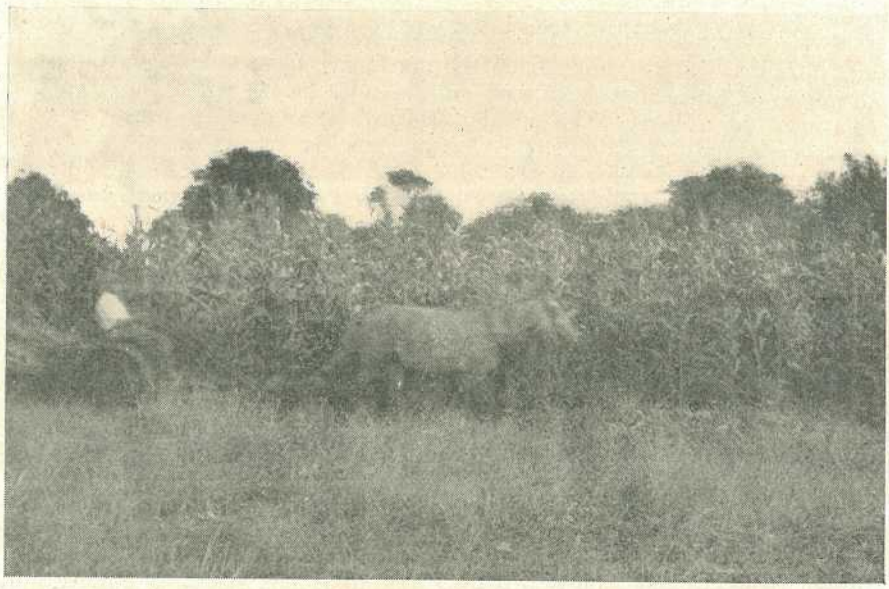
Representative yields from the maize-rice bean strip were obtained by cutting four rows from each of the four blocks when the crop had matured for silage. The yields obtained expressed in tons per acre are reproduced in Table III. Certain conclusions are suggested tentatively from the figures in the table: (1) The greatest effect is due to phosphates; (2) the effects of nitrogen and potash are small; (3) the effect of lime is considerable, though not so great as the effect of phosphate.

The use of phosphates on maize for silage and for grain was extended in the white grub infested area during the 1937-38 summer season. Good crops were grown with phosphates on three farms in addition to the one containing the experimental area just described (Plate 231). Two of the crops were matured for grain, and the other comprised maize and legumes for silage.

Phosphates were applied on one farm to three different fields, two of which had been cropped with maize for various periods. Treatments comprised either 50 lb. P_2O_5 as superphosphate or 40 lb. P_2O_5 and 11 lb. N as meatworks manure per acre. The results (Table X.) clearly indicate that the addition of phosphates increases the yield of grain irrespective of the length of time the land has been in cultivation. There appears to have been very little difference in yields obtained from either of the fertilizer treatments, but the yield in bushels per acre after fertilizer compared with yield from untreated sections, given in parentheses, after eight years' cultivation 27·4 (11·5), after four years' cultivation 29·0 (12·7), and the first crop after grass 71·4 (49·5) demonstrates conclusively that the addition of phosphate pays.



(*a*)



(*b*)

Plate 231.

MAIZE AT PEERAMON.—(*a*) Without phosphate; (*b*) with phosphate.

TABLE X.

MAIZE GRAIN YIELDS AFTER APPLYING PHOSPHATE COMPARED WITH YIELDS FROM UNFERTILIZED LAND.

	Treatments.	Number of Plots.	Mean Yield Bushels per Acre.	*D. zeæ* Loss Bushels per Acre.	Per cent. Loss.
A	Untreated	2	11·5	9·1	44
	Meatworks	2	27·5	19·0	41
	Superphosphate	1	27·3	14·9	35
B	Untreated	3	12·7	12·8	50
	Meatworks	4	29·0	9·6	25
	Superphosphate	1	28·8	14·8	34
C	Untreated	3	49·5	1·3	2·5
	Meatworks	2	71·4	0·7	1·0

A. Eighth successive maize crop after pasture.
B. Fourth successive maize crop after pasture.
C. First maize crop after pasture.

N.B.—Meatworks at 2 cwt. per acre—i.e., 11 lb. N, 40 lb. P_2O_5.
Superphosphate at 2 cwt. per acre—i.e., 50 lb. P_2O_5.

The yield figures are here reduced to a level of 14 per cent. moisture, allowing 56 lb. to a bushel.

When harvesting the plots to obtain figures for yields from the various treatments, some attention was also given the percentage of ears affected with *Diplodia zeæ*, a common cob rot in the district. The depression of the potential yield caused by this disease was afterwards calculated (Table X.). It is interesting to note that losses tended to be less on fertilized sections, and that such losses increased enormously after the land had grown maize crops successively for a number of seasons.

SUMMARY AND CONCLUSIONS.

On farms which have been established thirty to forty years on the Atherton Tableland, the carrying capacity of pastures was at least 100 per cent. greater during the first ten years after felling, clearing, and grassing than it is at the present time. Paspalum is the dominant grass in this district.

Storms and monsoonal rains are assured during the summer and always provide sufficient moisture for the growth of summer crops. A dry season of three to five months' duration can generally be expected between July and November.

Enormous numbers of white grubs—larvæ of the Scarabæid beetle *Lepidiota caudata* Blkb.— infest many old pastures in the Peeramon district and destroy all of the grass roots to within 1 to 2 inches of the surface. This activity is greatest just before winter, and accentuates the shortage of feed during the dry season.

There are thus two factors reducing the productivity of pastures in the Peeramon district during the winter and spring—the dry season, which affects almost all farms alike, and the white grubs, whose

incidence varies from farm to farm and even from field to field within the farm. Pastures produce little or no feed in areas of heavy grub infestation during the dry season.

Most pastures have not been cleared of tree trunks and stumps, nor have the fields, generally, been sufficiently subdivided to permit rotational grazing.

The more readily available clovers have been widely sown, but white clover is the only type to become established, though its distribution is very erratic and it normally fails during the dry season. Prior to this investigation no one had established and maintained a stand of lucerne in the Peeramon district for more than one year, though odd plants had flourished for many years.

Maize has not generally grown well after pasture in the white grub area, except perhaps for a year or two, even where the soil was free of white grubs. Cowcane was, until recently, the only crop grown successfully as a fodder reserve for the dry season, though its cream-producing properties are inadequate. Winter cereals seldom provide feed after August, when fodder supplies are at a minimum owing to the dry weather prevailing then.

Several chemical analyses of soils from the grub-infested area indicate soil acidities ranging from pH 4·5 to pH 6·0. "Bad patches"—i.e., areas showing poor growth of cultivated crops—are associated with high acidity and deficiencies of lime, phosphate, potash, and magnesium in the Peeramon district. Fertilizers were seldom, if ever, used in the area prior to the investigations described in this report.

Previous experience supported by these investigations emphasises the fact that white grubs are not solely responsible for the deterioration of pastures in the Peeramon district of the Atherton Tableland. It appears that soil deterioration inevitably follows the destruction of rain-forest which must precede agricultural development in the humid tropics,, and thus the local menace of white grubs must be regarded in its true perspective as but one aspect of a complex agricultural problem. White grub injury by *Lepidiota caudata* larvæ in the Peeramon district of the Tableland appears to be confined to pastures. No direct attack on cultivated crops has been recorded.

The control of white grubs in pastures by the application of insecticides or by the use of light traps is not practicable. Some relief may be obtained by encouraging predators such as the Giant American Toad (*Bufo marinus*), which has been introduced in considerable numbers from the adjoining coastal sugar-cane fields, for, although the altitude may inhibit breeding, some introduced individuals have survived the Tableland climate for over a year. Enormous numbers of beetles are destroyed by pigs if the latter are given free range over pastures during the beetle flight season. To take advantage of the protection from grub injury afforded by pigs, all boundary and cultivation fences should be pig-proofed either with additional barbed wires or with pig netting. Thereafter the farm should be so managed that immature baconers are available throughout the season in which beetle flight can be expected.

The reduced carrying capacity of deteriorated or grub-infested pastures must be offset by changed methods of farm management. Every effort should be made to remove all the dead timber which, acting as centres for the concentration of beetles immediately before egg-laying,

is a menace to pastures. The existing large paddocks on many farms would provide much better grazing if cut into smaller fields of 5 to 10 acres, which would permit rotational grazing. Old grub-infested and unprofitable paspalum pastures can be reinvigorated temporarily by ploughing, preferably with mouldboards. The productivity of such renovated pastures can be increased by seeding with Rhodes grass, slender Guinea, or purple-topped Guinea during the wet season when renovation is completed. The germination of these Guinea grasses is both exceptionally low and very variable, but an attempt to make seed commercially available is justified. Where the contours of the land are favourable, the small fields should eventually be included in a system of crop rotations in which resown pastures figure as the main crop. Such resown pastures should comprise several species including a legume, and for the latter purpose lucerne has shown promise under local conditions. The repetition of earlier failures with lucerne may be prevented to some extent by planting inoculated seed in land which has received lime and phosphate in additon to thorough cultivation and green manuring, and by applying superphosphate annually. Lucerne may be included in pastures, it may be grazed in a pure stand, or, when a surplus is available, it may be made into silage after treatment with molasses. It is desirable that greater attention be given the storage of surplus summer lucerne as molasses silage and less effort wasted in abortive attempts to cure hay in the summer.

A dry season can be expected to extend over several months during the latter part of the calendar year. During this dry season no pasture, whether grub-infested or otherwise, can be expected to provide satisfactory grazing. Therefore it is essential for profitable dairying that conserved fodder be available for use in the dry season. Silage is undoubtedly the form of conserved feed best suited to the requirements of the Atherton Tableland, and a roofed circular pit is a very satisfactory type of silo in this area. A combined maize and legume crop for silage can be produced on most, if not on all, farms in the area, provided superphosphate is added when sowing the crop. Experimental evidence clearly indicates that such combined crops, when grown with superphosphate, produce heavy yields of green materials and cure into superior silage. It is very desirable that every advantage be taken of the fact that severe outbreaks of white grubs can be predicted some eighteen months in advance, and, when a severe outbreak is expected, additional supplies of silage provided.

ACKNOWLEDGMENTS.

The present investigation of white grubs and pasture deterioration has been made possible by the generous co-operation of several organisations and many individuals, and to all of these the thanks of the author are extended.

Thanks are due in particular to the members of the Atherton Tableland White Grub Investigations Committee for their constant interest, constructive criticism, and practical assistance; to the Atherton Tableland Co-operative Butter Association for the loan of accommodation for meetings and equipment; to Messrs. A.C.F. and Shirleys Fertilizers Ltd. for the donation of fertilizers; and to various farmers for the land and assistance which made the various field experiments possible.

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APPENDIX I.

PEERAMON PASTURE EXPERIMENT.

Object.—To determine the utility of farm implements for renovating white grub infested paspalum pasture.

Land.—The experimental area is quite close to the township of Peeramon, at the base of a slope, and is fairly level. The land had never been ploughed.

Pasture.—Paspalum heavily infested by white grubs.

SUMMER, 1935-36.

Treatments—

A. Disc-ploughed before double harrowing.
B. Disc-ploughed before single harrowing.
C. Disc-ploughed only.
D. Untreated.
E. Mouldboard-ploughed before double harrowing.
F. Mouldboard-ploughed before single harrowing.
G. Mouldboard-ploughed only.

Procedure.—Each treatment strip comprised half an acre 5 chains long and 1 chain wide. The old timber was removed and treatments completed by the end of 1935. The whole area then was fenced off and stocking controlled in order to favour the recovery of the pasture.

Results.—Plough renovation in this field was disappointing, except on the strips renovated with mouldboards only. Very dry weather was experienced for eight weeks after the ploughing, and this probably killed a percentage of grass which would normally have recovered in favourable weather. Examination of the pasture early in 1936 indicated that ovipositing beetles had not entirely avoided ploughed land, as first-stage grubs were then present.

The following conclusions were drawn from the experiment:—

(*a*) Mouldboard-ploughing is a safer and more effective method of renovation than disc-ploughing.

(*b*) No harrowing is necessary to hasten pasture re-establishment.

(*c*) Cultural renovation should not be attempted before the beginning of the wet season.

APPENDIX II.

MALANDA PASTURE EXPERIMENT.

Object.—To ascertain whether lime and nitrogen, if applied to ploughed and unploughed white grub infested pastures, effect any improvement in carrying capacity.

Land.—The area used in this experiment adjoins the main road between Malanda and Atherton and is about 2 miles from Malanda. The soil is red, more or less typical of the area, and derived from basalt. At the beginning of the experiment the pH was about 5·5. The land is almost level, falling away slightly to the north-east.

Pasture.—The original pasture comprised paspalum and Rhodes grasses mixed with some white clover, and the sward was not in flourishing condition. The field was almost uniformly infested with white grubs, though the infestation was not severe.

SUMMER, 1935-36.

Treatments—

A. Quicklime, ½ ton per acre;

B. Quicklime, 1 ton per acre;

C. No fertilizer or quicklime;

D. Quicklime, ½ ton, with sulphate of ammonia, 3 cwt. per acre;

E. Quicklime, 1 ton, with sulphate of ammonia, 3 cwt. per acre;

F. Sulphate of ammonia, 3 cwt. per acre—

each of the above pasture treatments over each of the following:—

(*a*) Pasture unploughed;

(*b*) Pasture plough-renovated by discs;

(*c*) Pasture plough-renovated by mouldboards.

Procedure.—The field was first cleared of tree stumps, &c. One-half of the area was then ploughed, partly with mouldboards and partly with discs. Each treatment was applied to an area 5 chains by 1 chain, the lime being applied shortly before ploughing in late November, about two months before the onset of general rains. The sulphate of ammonia was applied in two equal dressings, in mid-January and at the end of April. The whole area was grazed after 1st March, the ploughed section and the unploughed section separately, as the former was expected to provide more feed than the latter.

Results.—It was soon apparent that recovery of the pasture on the ploughed section was superior to that on any part of the unploughed section. The growth of paspalum in the former was so vigorous early in 1936 that any effect of the lime and/or nitrogen was completely masked. Recovery was more rapid after mouldboards than after discs. White clover was almost absent from the ploughed section during the autum and winter of 1936, although it was fairly abundant in the unploughed section at the same time. Thus plough renovation may temporarily suppress any white clover which is present in the pasture before treatment.

There was never any indication that the application of lime had any effect on the pasture, but there was a definite response to nitrogen each time it was applied to unploughed pasture. A slight response to nitrogen, even in the ploughed section, was noticeable in May, 1936, after the second application of sulphate of ammonia.

More grazing was provided by the ploughed section than the other, the relative figures for ten months being 158 and 125 cow-days respectively. These figures may under-estimate the real difference, because the animals grazed less on the unploughed section and made up the deficiency when allowed access to the other. During the first year after treatment, the best strip on the unploughed section was quite inferior to anything in the ploughed area.

APPENDIX III.

MT. QUINCAN PASTURE EXPERIMENT.

Object.—To ascertain the comparative value of lime and different types of phosphatic and nitrogenous fertilizers for treating old pastures after plough renovation.

Land.—The land used was almost level country adjoining the road to Kureen, the red soil being typical of the locality.

Pasture.—Paspalum was the dominant grass, though some patches of kikuyu and carpet grass were also included. The pasture had been previously ploughed for renovation twice, the last time three years before the initiation of this experiment.

SUMMER, 1936-37.

Treatments.—Plough renovation followed by—

A. No fertilizer;

B. P_2O_5 22 lb. per acre as superphosphate;

C. P_2O_5 66 lb. per acre as superphosphate;

D. P_2O_5 76 lb. per acre, N 22 lb. per acre } as superphosphate and sulphate of ammonia;

E. P_2O_5 76 lb. per acre, N 22 lb. per acre } as bonedust and sulphate of ammonia;

F. P_2O_5 76 lb. per acre, N 22 lb. per acre } as meatworks manure—

the fertilizers being applied in two randomised blocks.

The following liming treatments were applied, each to a strip comprising one-third of the area:—

(*a*) No quicklime;
(*b*) Quicklime, 2 tons per acre;
(*c*) Quicklime, 4 tons per acre.

Procedure.—The whole area was renovated by ploughing early in January, 1936, and the lime applied to appropriate plots immediately. Two weeks later the fertilizers were applied. Korean clover was then broadcast at 1 lb. per acre over the whole area, and the seed harrowed in. At the beginning of April, white clover was broadcast at 3 lb. per acre, also on the whole area. The pasture was lightly stocked when recovery was sufficient to permit grazing.

Results.—Little or no response was obtained from any of the several treatments. No differences from plot to plot could be seen at any time throughout the year 1937-38 in spite of favourable growing weather. Korean clover and white clover failed to persist though they germinated satisfactorily.

APPENDIX IV.

BUTCHER'S CREEK PASTURE EXPERIMENT.

Object.—To ascertain whether the response of white grub infested pastures to plough renovation can be improved by resowing immediately after renovation.

Land.—The experimental area is on gently sloping country quite close to the Boonjie road, the soil being lighter in colour than that about Peeramon and further to the west.

Pasture.—Paspalum was still the dominant species, though it had been suppressed in a number of places by carpet grass. The pasture was grub-infested, carpet grass being particularly noticeable where heavy infestation had previously destroyed the paspalum.

SUMMER, 1936-37.

Treatments.—Plough renovation of the whole experimental area followed by a sowing of the following pasture plants, each of the grasses being sown with each of the legumes:—

A. No grass;
B. Paspalum, 5 lb. per acre;
C. Purple-topped Guinea, 5 lb. per acre;
D. Rhodes, 10 lb. per acre;
E. Wholly finger grasses by root sets—6 feet by 4 feet apart;
F. Winter grass mixture—

Wimmera rye, 5 lb. per acre;
Italian rye, 5 lb. per acre;
Prairie, 12 lb. per acre.

(*a*) No legume;
(*b*) Lucerne, 2 lb. per acre;
(*c*) White clover, 2 lb. per acre;
(*d*) Red clover, 2 lb. per acre;
(*e*) Annual Korean clover, 2 lb. per acre;
(*f*) Perennial Korean clover, 2 lb. per acre.

There were three replications of each of the thirty-six treatments, and superphosphate at 1 cwt. per acre was applied to two of the three.

Procedure.—The land was cleared of tree stumps, &c., disc-ploughed, harrowed, and fenced off in January, 1937. The surface after ploughing was so rough that several harrowings were necessary to leave the surface reasonably level.

All grasses, except the winter mixture, were planted in half-chain strips in February, 1937, each treatment recurring once in each of three blocks. The five legumes were sown in long strips across these three blocks in April, 1937, the winter grasses being sown at the same time. After sowing the legumes, two of the blocks were treated with superphosphate at 1 cwt. per acre.

Both the Korean clovers were resown at the end of 1937.

Results.—Stocking was carefully controlled, the experimental area being grazed as one field at suitable intervals from June, 1937, onwards.

There was no evidence that any of the winter grasses was established. Some of the woolly finger rootlets struck, but failed to persist. The paspalum benefited from the plough renovation, but it is doubtful whether reseeding with this grass was an additional advantage. Both Rhodes grass and purple-topped Guinea grass have grown very well. These species have increased the volume of pasture available, but whereas Rhodes does not appear to be relished by stock once it has reached the stage of seeding, the purple-topped Guinea is apparently so palatable that it is eaten off short soon after stock are allowed access to it. The observational evidence indicates that reseeding with either Rhodes or purple-topped Guinea would be a profitable adjunct to plough renovation. Both species tend to check the development of weeds, which are generally troublesome during the first year after renovation.

APPENDIX V.

KUREEN PASTURE EXPERIMENT.

Object.—To obtain information of the habits of some grasses and legumes when grown together as two species grass-legume mixtures.

Land.—Old pasture land which had been cleared and plough-renovated ineffectively some years previously.

SUMMER, 1937-38.

Treatments.—Duplicate plots of the following:—Lucerne, sweet clover, and annual Korean clover at the rate of 3 lb. per acre, each in combination with each of the following grasses:—

A. Paspalum, 10 lb. per acre;

B. Rhodes grass, 5 lb. per acre;

C. No grass;

D. Woolly finger root sets—2 feet by 2 feet apart;

E. Purple-top Guinea root sets—2 feet by 2 feet apart;

F. Slender Guinea root sets—2 feet by 2 feet apart.

Procedure.—Thorough cultivation followed by an application of quicklime at 2 tons per acre and fertilizer (N 17 lb., P_2O_5 60 lb., K_2O 28 lb.) as meatworks and sulphate of potash. All the plots were planted early in January, 1938.

Results.—All of the grasses, except woolly finger, were strongly established in a few months. The legumes, on the other hand, made little progress until the following summer. Lucerne appeared to be the most promising legume for combination with any of the grasses, but further results can be expected.

APPENDIX VI.

PEERAMON ROTATIONAL CROPPING EXPERIMENT.

Object.—To establish a method of rotational cropping extending over several years, and culminating in a grass-legume pasture which would be regarded as the main crop.

Land.—The area available for this experiment was on the common morocco-red basaltic clay. It is on gently-sloping country, about ½ mile from a granitic outlier. The field had been in cultivation for a number of years before being devoted to experimental work, though there had been an appreciable but gradual decline in productivity. Experimental treatment of the field has now extended over a number of years.

SUMMER, 1935-36.

Treatments.—

A. Maize and rice bean sown in the same drill;

B. Sorghum and rice bean sown in the same drill.

Procedure.—These crops were grown for silage. The maize and bean were in drills 3 feet 8 inches apart in the eastern half of the field. The red Kaffir sorghum and bean were sown in drills 3 feet apart in the western half of the field. All crops were sown in mid-January, 1936.

Results.—Yields were extremely low, large areas producing little or no crop at all. The sorghum was more subject to failure in bad patches than the maize. The rice bean failed to germinate, faulty seed being responsible. The total yield of green silage material from the whole field was under 3 tons per acre. The estimated growth values of the sorghum in regularly-spaced quadrats were recorded in the western half of the field. Growth values range from 0 (complete failure) to 10 (satisfactory growth).

SUMMER, 1936-37.

Treatments.—

A. Poona pea only;

B. Sorghum and Poona pea;

C. Maize and rice bean.

The following treatments were applied in four blocks, traversing the three-crop treatments:—

A. P_2O_5 75 lb. per acre as superphosphate;

B. Quicklime, 2 tons per acre;
N 25 lb. per acre as dried blood;
P_2O_5 75 lb. per acre as superphosphate;
K_2O 30 lb. per acre as sulphate of potash;

C. Quicklime, 2 tons per acre;
P_2O_5 54 lb. per acre as meatworks manure;
N 16 lb. per acre as meatworks manure;

D. No fertilizer or quicklime.

Procedure.—The lime and fertilizers were applied in December and January after the field had been well prepared. The crops were sown in mid-January—maize at 12 lb. per acre, and rice bean at 4 lb. per acre, sorghum and Poona pea both at 8 lb. per acre, and Poona pea alone at 12 lb. per acre. The Poona pea seed was inoculated before sowing.

Results.—Both the Poona pea alone and Poona pea with sorghum were ready for cutting eleven weeks after sowing; these crops could not be used for silage then, as the maize with rice bean was not nearly mature. The estimated yield of sorghum and Poona pea on the best part of the lime and complete fertilizer block was nearly 12 tons of green material per acre, containing 28 per cent. Poona pea. Both these crops, on the western half of the field, were ploughed-in for green manure between eleven and twelve weeks after sowing.

The maize and rice bean were ready for cutting sixteen weeks after sowing, and harvesting commenced then. The maize was still green, though the grain was fully formed and beginning to harden, and the rice bean bore a heavy crop of pods which were still green. Four drills of the crop were cut and the two components harvested separately. The yields from the variously fertilized blocks are recorded in Table III.

Winter, 1937.

Treatments.—The whole 6 acres in the field—three from which silage was harvested, and three which had been green-manured with Poona pea and sorghum—were all planted with a mixture of wheat and field peas.

Procedure.—The field was ploughed immediately the silage harvest was complete. The wheat and peas were planted at the end of May. This crop suffered droughty conditions throughout its growth and was grazed off by dairy cows during September.

Results.—The residual effect of fertilizers was noticeable, growth on the old lime plus complete fertilizer block being most superior. Growth over the whole 3 acres which had received green manure was at least twice as great as the growth on that part of the field from which silage had been harvested.

Summer, 1937-38.

Treatments.—A green manure crop comprising red Kaffir sorghum and Groit cowpea at 6 and 15 lb. per acre respectively was planted over the whole field after liming the previously unlimed strips. Superphosphate at 1 cwt per acre was applied over the whole field.

Procedure.—After thorough cultivation and manuring, crops were planted in mid-December, the seeds being mixed and sown through a wheat drill—i.e., in drills 7 inches apart.

Results.—The combined crop made excellent growth, but the residual effect of fertilizer from the previous summer was still discernible. Random sample weighings were made just before the crop was ploughed-in ten weeks after sowing. Each sample was cut from 17·11 square yards (a strip the width of the drill and half a chain in length), and three samples were taken from each of the previous summer's fertilizer blocks. The cut weights are recorded in Table XI.

TABLE XI.

Silage Crop Yields in Fertilizer Experiment, 1937-1938.

Block.	Cut.	Green Weights—Lb. per Plot.			Tons per Acre.
		Sorghum.	Cowpea.	Total.	
(a) ..	1 ..	23	40·5	63·5	8·02
	2 ..	57	64	121	15·28 } Average 12·1
	3 ..	47	56	103	13·00
(b) ..	1 ..	57	48	105	13·26
	2 ..	85	52·5	137·5	17·36 } Average 17·03
	3 ..	77	85	162	20·46
(c) ..	1 ..	..	..	110	13·89
	2 ..	..	..	106	13·39 } Average 13·77
	3 ..	52	59	111	14·02
(d) ..	1 ..	23·5	67	90·5	11·42
	2 ..	35	48·5	83·5	10·54 } Average 9·38
	3 ..	26	23	49	6·19

This green manure crop was excellent, and, although the ploughing-in occurred when both the sorghum and the cowpea were just beginning to flower, a good bulk of green material was turned into the soil.

Winter, 1938.

Treatments.—Establishment of a balanced pasture comprising lucerne, Rhodes grass, and prairie grass.

Procedure.—A month after ploughing-in the green crop, the field was cultivated with a heavy tandem disc implement. A fortnight later—early in April—inoculated lucerne was sown through a seeds drill at 3 lb. per acre after broadcasting Rhodes at 5 lb. per acre and prairie at 10 lb. per acre. Drilling-in the lucerne served to cover the grass seed, and no further cultivation was given, except that the field was rolled on the following day.

Results.—Some weeks of dry weather occurred after planting, but a good storm at the beginning of July enabled the pasture to become established by the middle of August. The feed was grazed off at this time.

Recovery of the lucerne and Rhodes was excellent after the early storms at the end of 1938 and a good pasture is now established. Observations on its productivity under normal management will continue.

APPENDIX VII.

MALANDA ROTATIONAL CROPPING EXPERIMENT.

Object.—To establish a balanced pasture on land which has deteriorated in fertility after being in cultivation for a number of years.

Land.—The field used for this experiment is composed of red soil on gently sloping country.

Procedure.—After thorough cultivation in 1937, a green manure crop of Poona pea, 20 lb., and red Kaffir sorghum, 6 lb. per acre, was planted without fertilizer in mid-December. This crop made excellent growth, the weight of green material reaching a mean of 14 tons per acre when it was ploughed under, nine and a-half weeks after sowing. The legume comprised about half of the crop.

A seeds mixture comprising Florence wheat at 30 lb. and lucerne (inoculated seed) at 3 lb. per acre was sown in April, 1938, two months after ploughing-in the green manure. At the end of the following December paspalum and Rhodes grass at 10 lb. and 6 lb. per acre respectively were sown.

Results.—The lucerne-wheat mixture grew well and provided good grazing for the dairy herd during the winter, being grazed off three times. At the end of August, after mowing to destroy weeds and the remains of the wheat, the lucerne appeared to be established. This component made a very good recovery during the storms of early summer, and the grasses, sown after mowing, appeared to be established. It thus appears that a satisfactory pasture may be built up by the methods outlined. Observations on its productivity under normal management will continue.

APPENDIX VIII.

PEERAMON LUCERNE EXPERIMENT.

Object.—To determine some of the difficulties associated with lucerne-growing in the white grub area.

Land.—This experimental field is 4 acres in extent, situated in a corner between the creek and the western boundary fence. About 2 acres on the bank of the creek are level, but beyond this there is a gradual rise to the south-west corner. The soil appears to be typical of the locality, but no analyses are available.

Pasture.—Before initiating the experiment the land carried an old slightly grub-infested paspalum pasture.

SUMMER, 1935-36.

Procedure.—The land was ploughed twice towards the end of 1935, and harrowed again early in January. Maize was planted in drills in mid-January.

Results.—Maize harvested for silage four months after planting yielded approximately 12½ tons per acre. This cropping treatment effectively cleared the land of weeds, and also helped to smother the surviving paspalum.

WINTER, 1936.

Treatments.—Lucerne was planted over the whole area and then the following fertilizers were applied in blocks:—

A. No fertilizer or lime;
B. P_2O_5 at 33 lb. per acre as superphosphate;
C. Ground limestone at 1 ton per acre;
D. Ground limestone at 1 ton per acre;
P_2O_5 at 33 lb. per acre as superphosphate.

Procedure.—Immediately the maize was harvested the lime was spread, the land ploughed and thoroughly cultivated. Inoculated lucerne seed was sown at 10 lb. per acre early in June. Superphosphate was not applied until the end of the year, when summer storms are normally expected.

Results.—Establishment of the lucerne was patchy at first, but the crop survived the dry season comparatively well.

SUMMER, 1936-37, AND AFTER.

Procedure.—The crop was mown early in January, yielding more than ½ ton of hay per acre. The next growth was grazed off by dairy cows in February. In March the lucerne was attacked by Pseudopeziza leaf spot. The available feed was grazed off, and the remainder then mown and removed from the field.

During the winter the field was divided into three approximately equal areas by light two-wire fencing, and since then the lucerne has not been mown. Whenever the crop has made sufficient growth for the purpose, the herd of dairy cows has been utilized to graze down each of the small areas in turn.

Results.—Two and a-half years after planting, this lucerne still provided very profitable grazing, and it seems that the use of inoculated seed and annual applications of phosphate will do a great deal to overcome the difficulties associated with the crop in the white grub infested area. There is no evidence that the use of lime in this field was of any material value.

APPENDIX IX.

PEERAMON SILAGE CROP EXPERIMENTS.

Object.—To ascertain whether the percentage of legume in a maize-rice bean silage crop mixture can be increased by variations in the rate of planting both components.

Land.—The land was old cultivation on typical red soil.

SUMMER, 1937-38.

Treatments.—The land was limed and fertilized and the following combinations of crops planted in duplicate:—

A. Rows, 4 feet; maize single grains, 9 inches; rice bean, 6 lb. per acre.

B. Rows 4 feet; maize single grains, 9 inches; rice bean, 8 lb. per acre.

C. Rows, 3 feet; maize single grains, 9 inches; rice bean, 10 lb. per acre.

D. Rows, 3 feet; maize single grains, 12 inches; rice bean, 10 lb. per acre.

E. Rows, 3 feet 6 inches; maize three grains, 18 inches; rice bean, 10 lb. per acre.

F. Rows, 4 feet 6 inches; maize single grains, 6 inches; rice bean, 10 lb. per acre.

Procedure.—Ground limestone at 3 tons per acre was applied to the field in October. The land was drilled out towards the end of November and the following fertilizer applied to the drills:—Meatworks at 3 cwt. per acre, and sulphate of potash at 56 lb. per acre. The seeds were sown in these drills at the end of November.

Results.—The yields from the various plots (Table IV.) show that, under the climatic conditions experienced and when rice bean was grown with a maize maturing for silage in fifteen weeks, the percentage of rice bean in the combined crop was not materially increased by any of the rates of planting adopted. The legume had not commenced flowering when the crop was harvested, even though the maize was quite ready for the silo.

APPENDIX X.

PEERAMON SILAGE CROP EXPERIMENT.

Object.—To ascertain the value of various legumes for growing with maize to produce a protein-rich ensilage.

Land.—This trial was immediately adjacent to the one described in Appendix IX. above.

SUMMER, 1937-38.

Treatments.—The land was limed and fertilized and the following combinations of crops planted in duplicate:—

A. Maize single grains at 9 inches apart; Rice bean at 10 lb. per acre.

B. Maize single grains at 9 inches apart; Giant cowpea at 10 lb. per acre.

C. Maize single grains at 9 inches apart; Groit cowpea at 10 lb. per acre.

D. Maize single grains at 9 inches apart; Otootan soy bean at 10 lb. per acre.

All combinations planted in rows 3½ feet apart.

Procedure.—Lime and fertilizer was applied exactly as in Appendix IX. above. All of the crops were sown in the drills at the beginning of December.

Results.—The yields of the various combined crops are recorded in Table V. Both Groit cowpea and Otootan soy bean show promise for combination with maize for silage.

Red Scale on Citrus Trees.*

J. HAROLD SMITH, M.Sc., Senior Research Officer.

THE red scale† is one of the best-known pests of citrus in Queensland, although it is usually more troublesome in subcoastal orchards than in coastal areas, where other species are equally, if not more, destructive. Almost all varieties of citrus may be attacked, but the problem facing the grower is frequently complicated by local conditions of some importance. In coastal areas south of Gympie, the red scale is a secondary pest. Lemons are certainly infested, but the acreage under this crop is relatively small. Young trees of other varieties may also suffer, but tend to throw off the attacks before they have been bearing for many years. Further north, at Howard, red scale is more common and is of particular interest in the Emperor of Canton mandarin, a loose-skinned early variety commonly grown in the district. On the Emperor mandarin, scale insects on the fruit in February and March tend to be enmeshed by the rapidly growing rind and remain on the fruit even after being killed by the application of effective control measures. In Gayndah and other subcoastal citrus districts, lemons are an important crop, which, together with grape fruits, Valencia oranges, and Beauty of Glen Retreat mandarins, constitute the more important red scale susceptible hosts.

LIFE HISTORY AND HABITS.

Red scale (Plate 232) occurs on the trunk, foliage, and fruits of citrus trees, frequently in such numbers that masses of encrusted scales can be peeled away intact. In midsummer all stages are represented from the minute "crawler" to the adult female, which is approximately one-twelfth of an inch in diameter. The adult female is flattened, yellowish in colour, and more or less pear-shaped, but is not normally seen as such, for it secretes a characteristic greyish-red or pink-tinged parchment-like scale, under which it shelters. The secretion of this scale begins as soon as the crawler settles down in a permanent position, and the type of scale depends on the sex of the individual. In the female the scale is round, with a slightly raised centre, and growth takes place evenly in all directions. Development continues until maturity, and, indeed, until death. The male has a somewhat similar scale, but the core is off-centre and the outline is oval rather than circular. Unlike the female, the male spends only part of its life under the scale, from which it finally emerges as a delicate winged adult capable of a very weak flight.

The female reproduces for most of its adult life. The eggs hatch within the body of the insect, the minute "crawlers" escaping from the scale and wandering about for some time. They tend to move to the more exposed parts of the tree, a habit which explains the normally heavy infestation on the fruit. Distribution from tree to tree and from orchard to orchard by wind and birds may occur at this stage. Very shortly they settle down in permanent positions and commence to secrete the covering scale, the size of which increases with the growth of the underlying insect. The limbs are lost at the first moult.

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* Entomological Leaflet No. 29 was originally issued in 1935. The present text has been entirely rewritten to meet advisory requirements.

† *Aonidiella aurantii* Mask.

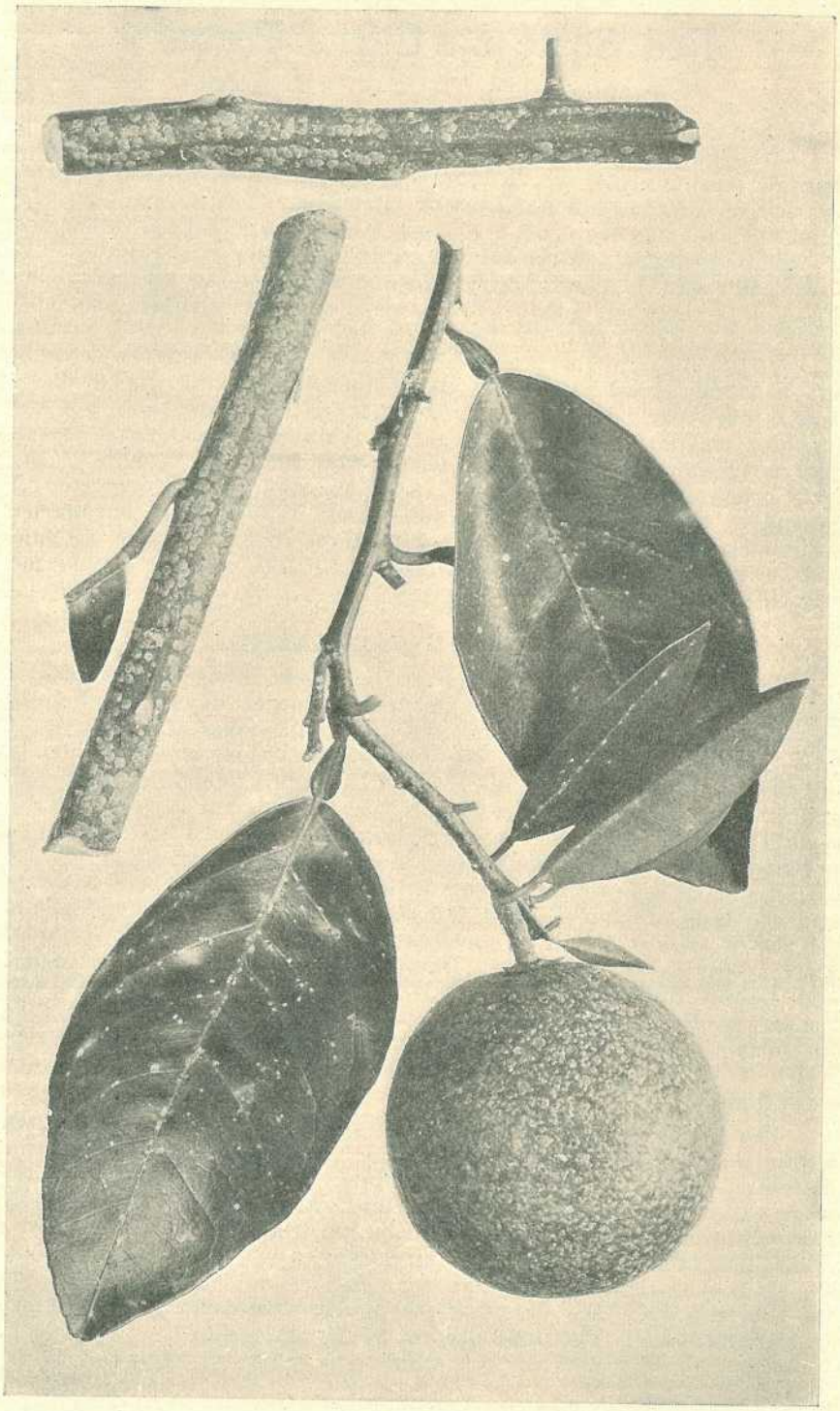


Plate 232.
RED SCALE.—Showing infestation of fruit foliage, and woody twigs.

Meanwhile feeding takes place, sap being abstracted from wood, fruit, or leaves by the elaborately constructed mouthparts.

The rate of development from birth to maturity varies with the season, being more rapid in summer than in winter, when the bulk of the scale population, in fact, dies. Five or six generations may be completed in a single year, and, as each female normally produces about eighty young in Queensland, the health of the trees can be seriously affected if control measures are not applied. Dieback of the younger twigs follows, tree vigour is impaired, and the scale population on the fruit necessitates cleaning before marketing—an expensive and time-consuming task, which in some varieties may be both incompletely effective and harmful to the fruit.

The red scale population varies from season to season and from tree to tree. In the former case, climatic conditions are responsible, for in the wet coastal areas, where the pest is normally of no great importance, a dry season or a succession of dry seasons is accompanied by an abnormal increase in the red scale population. The same phenomenon has been frequently recorded in subcoastal irrigated orchards, but there the effects on the trees can to some extent be countered by judicious watering. Variations in red scale incidence from tree to tree may be due to a number of factors, but there can be little doubt that the habit of growth and general health of the host have some bearing on the amount of infestation. Unthrifty trees, particularly in the coastal belt, are more subject to attack than normally vigorous trees.

CONTROL.

Precautionary Measures.

Freedom from infestation for many years can frequently be maintained in a newly established orchard if adequate precautions are taken to ensure that all nursery stock introduced into the area is clean. Young trees purchased from outside sources should be carefully examined when delivery is taken. Bady-infested plants should then be destroyed, but those carrying only a nominal amount of scale may be planted after first being fumigated. In addition, young trees should be periodically examined in the orchard so that any small development of the pest can be checked at an early stage.

Parasites.

Several parasites have been recorded from the red scale, and, in some years, they may destroy the bulk of the pest population. Their attacks are very variable, however, and the grower can seldom rely on them to solve his red scale problem. They are invariably most active when the red scale population is much higher than should normally be the case in a well-managed orchard, and are best regarded as a useful, though fickle, adjunct to the grower's campaign against red scale.

Choice of Control Methods.

In practice, red scale is kept in check by fumigation, fumigation supplemented by spraying, or spraying alone, the choice of method depending partly on local conditions and partly on the facilities at the grower's disposal. Fumigation is unquestionably most effective, but

suitable sprays, thoroughly applied and correctly timed, do extremely good work. The red scale control programme adopted by the grower will be determined by—

(*a*) The equipment and labour available—When fungicides must be applied to the trees, an efficient power spray is a necessity in the orchard. Many growers naturally hesitate to incur the expense of fumigation sheets if the pest and disease problem can be reasonably handled without them. In some districts this is quite practicable; in others, both sets of equipment are indispensable in properly managed orchards, and the grower must regard the power spray as a first essential, to be supplemented by fumigation facilities as soon as may be practicable.

(*b*) Location.—In coastal areas, particularly where the rainfall is heavy, fumigation is seldom practicable and requires special precautions and considerable experience which are rarely at the grower's disposal. The spray technique is thus the only one available.

(*c*) Pests and disease associations.—Though most scale insects can be controlled by a spraying programme, some other citrus pests—e.g., the larger horned citrus bug—are better dealt with by fumigation, which is also effective against the red scale. If these are the only important pests and citrus diseases are of no consequence, fumigation facilities alone may meet the requirements of the orchard.

Fumigation.

Only one fumigant—hydrocyanic acid gas—is used at all extensively in Australia for the control of the red scale and other citrus pests. In Queensland, daylight fumigation is practised chiefly in the Gayndah district, but also in other subcoastal areas, and to a lesser extent in drier coastal regions such as Howard.

Hydrocyanic acid gas can be prepared in a variety of ways. The old pot method in which the gas was evolved by the interaction of potassium cyanide with sulphuric acid and water has been superseded in the orchard by the use of calcium cyanide, which gives off the gas very quickly on exposure to moist air. Calcium cyanide is available in dust and briquette forms, the latter having to be crushed on the orchard in a special machine. The calcium cyanide thus reaches the tree as a dust, distribution being accomplished preferably by mechanical blowers, though some growers, not possessing the necessary apparatus, introduce the dust into the tents by hand-casting from a suitable flat dish or plate. In practice, octagonal sheets of light-weight tightly woven durable calico are used, the size depending on the average tree dimensions and varying from 30 feet to 80 feet in diameter. The most popular size is 40 feet in diameter, which should cover a well-shaped 13-feet-high tree. In any case, sheets should be made larger than is strictly necessary, to allow for tree growth from year to year and to ensure adequate ground overlap.

Calcium cyanide reacts with moisture in the air and liberates hydrocyanic acid gas. Normally, even in dry weather, there is ample moisture to release all the available gas, but in practice fumigation should not be attempted in extremes of heat or humidity, for either may induce severe burning. A slight amount of tip-burning is of little consequence, and some growers try to adjust dosages to produce such symptoms of burn. Fumigation charts issued by distributors of calcium cyanide dusts and

calcium cyanide briquettes give dosage schedules for a wide range of temperatures and humidities. Tent measurements, temperatures, and humidities must be correctly recorded in determining dosages when the sheets are placed in position; otherwise gas concentrations greater than those permissible in the orchard may cause injury to the trees.

Certain precautions are essential in fumigation, the neglect of which can cause injury even when volumes and dosages are accurately calculated. The chief are—

(*a*) A reasonable time should elapse between the application of a copper fungicide and fumigation. The period varies with humidity and rainfall, and is longer following Bordeaux than colloidal copper—the two fungicides principally used. As a precautionary measure, single trees of each citrus variety carrying a copper fungicide should be fumigated to determine the safety or otherwise of fumigation before the whole orchard is treated.

(*b*) Susceptibility to injury is particularly noticeable when soil conditions are very wet or very dry, when the fruit is very small—less than ¾ inch in diameter—and when young growth is abundant. Commonsense care alone is necessary, treatment being applied only when cultural conditions are normal.

(*c*) Fumigation should not be attempted when trees are carrying free moisture in the form of rain—e.g., after a shower—or as dew. Ill-effects may also follow the use of damp sheets.

(*d*) High temperatures increase the risk of injury. Dosage charts adopt some conventional method of indicating the probable safe limits for treatment.

(*e*) Fumigation should not follow oil sprays until at least a fortnight has elapsed; otherwise injury may occur. Red scale control is unlikely to raise this problem, for both treatments are fatal to the insect, and would not normally be used in such rapid succession.

Spraying.

Three sprays* can be used for the control of red scale in Queensland.

The first, white oil, is purchasable as an emulsion which merely requires dilution with water before use. Various proprietary brands of white oil are on the market.

The second, resin-caustic soda-fish oil, is an excellent general-purpose scalicide, which is particularly useful in districts where red scale is only one of a number of insect pests. The spray concentrate containing 10 lb. of finely ground resin, 3 lb. caustic soda, 1½ lb. fish oil in 2 gallons of water can be prepared on the orchard and diluted before use with 38 gallons to make 40 gallons of spray. A soft soap compounded to the above formula is on the market and merely requires dissolving in a specified amount of water to give the identical spray.

* For further information on insecticides (including fumigants), see Pamphlet No. 48 issued by this Department.

In some districts a general-purpose scalicide other than resin-caustic soda-fish oil is preferred when red scale is one of several species infesting citrus trees. Soap-soda-oil is the spray concerned. The spray is prepared by dissolving 3 lb. of a shredded high-grade laundry soap in a minimum of water to which 8 lb. of washing soda have been added. The concentrate, together with 1½ gallons of white oil, is added to 75 gallons of water in the spray vat with the agitator working and applied immediately.

Timing Control Operations.

Owing to the rapid rate at which the red scale increases in numbers, an excellent kill at any particular time does not necessarily keep the population low during the following twelve months; the progeny of even a few survivors may be sufficient to build up appreciable populations in a comparatively short period. The timing of control measures may therefore be considered from two angles:—

(*a*) The health of the tree.—Any control measure which keeps the tree free from injurious populations for a relatively long period makes a far greater contribution to the health of the tree than one which, while giving temporary relief, permits early repopulation. From this point of view, February, March, and April treatments are the most valuable; the kill is excellent, subsequent rains and cool weather slow down development, and, as a result, appreciable scale populations do not normally appear until late summer of the following year.

(*b*) Freedom of fruit from infestation.—Only rarely do trees handled by a good orchardist carry sufficient red scale to affect the health of the tree, and his problem is primarily that of keeping the fruit clean. On some late varieties of citrus, e.g., Valencias, autumn treatments allow sufficient time for dead scales to drop before the fruit is harvested. On earlier types, e.g., grapefruit, dead scales may still adhere to the fruit when harvested, but cleaning is relatively simple. In Emperor of Canton mandarins the position is complicated, for the rind tends to grow over the scales which, whether dead or alive, are embedded in the rind and it is difficult, if not impossible, to remove them completely.

If seasonal conditions permit, control operations should be carried out from mid- to late- February, particularly in early-maturing varieties, in order to ensure the harvesting of clean fruit. In some years, when autumn is dry and warm, a build-up of the pest may take place before July, but any necessary check can be applied in midwinter by fumigation or a resin-caustic soda-fish oil spray.

Not infrequently, however, monsoonal rains clash with the optimum time for treatment, and control measures have to be deferred from four to six weeks. This is of little consequence in late-maturing varieties, but any such delay tends to make the removal of scale insects from early fruits more difficult.

The red scale population should never be allowed to get out of hand. The above programme will normally be adequate, but, like all programmes of this kind, the best results can only be obtained if the trees are healthy and thus capable of naturally resisting infestation.

The Brown Dog Tick (Rhipicephalus sanguineus).

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

Description.

THIS is the common tick infesting dogs in Queensland. It is found practically everywhere within the State, even in the hottest and driest areas. The female tick (Plate 233; fig. B), when fully engorged with blood, is about one-third to one-half an inch in length and bluish-grey in colour. The male (Plate 233; fig. A) is smaller than the female and uniformly brownish in colour. The male is an intermittent feeder, never attaching to the one place for very long, and is usually seen moving actively among the hairs of the coat. The female, on the other hand, remains attached to the one spot until she is fully engorged.

When feeding, the tick inserts a club-shaped structure into the skin. This structure is armed with rows of recurved hooks. Any attempt to remove a tick by force invariably results in leaving this holdfast organ, or "head," as the layman calls it, behind in the skin.

Many people confuse the brown dog tick with the common cattle tick. A true cattle tick has pale flesh-coloured legs, whilst in the dog tick the legs are dark-brown.

A.—Male. B.—Female.

Plate 233.

THE DOG TICK (*Rhipicephalus sanguineus* Latr.) (A) AND (B).

Life History.

The female tick, when fully engorged with blood, drops from the dog and crawls to some sheltered spot. Here, after laying 1,000 to 3,000 eggs, the female dies. The eggs hatch in from nineteen to sixty days, according to the season of the year, and give rise to tiny larval ticks, little larger than a pin's head in size. These attach themselves to a dog at the first opportunity and are fully fed in from three to seven days. Dropping off the dog, they seek a hiding-place, where, in from six to twenty-three days, they cast their skins and become nymphs. In a few more days the nymphs are ready to feed and attach themselves to the first dog they come into contact with. In four to nine days the nymphs are engorged, drop off, and in another twelve to twenty-nine days cast their skins to form adult males and females. These young males and females quickly attach themselves to a dog, and in six to thirty days the females are fully engorged, when they then drop off and lay their eggs.

Economic Importance.

Under the very favourable conditions of our climate, the brown dog tick is capable of breeding very rapidly. Heavy infestations are common, and the loss of blood associated with the worry and irritation causes a great drain on the vitality of dogs. In other countries this tick is a vector of a serious fever in dogs, but, fortunately, this disease is not present in Australia.

Occasionally the tick may be carried into dwellings by dogs, and, whilst seldom attacking the human occupants, it can, at times, become so numerous as to be considered an important household pest.

Control.

The brown dog tick is a purely domestic pest in that it is found only in association with dogs. Its control is by no means simple, for attention has to be given not only to the treatment of infested animals, but also to the animals' sleeping places, where larvæ, nymphs, and young adults abound. The fact that these stages are able to survive for long periods without feeding—young adults, for example, over seven months—adds further difficulties to its control. This, then, becomes largely a matter of patient effort, but if the following recommendations are rigidly carried out control may eventually be accomplished:—

(1) Whilst arsenical and phenolic dips may kill any ticks on the dog, they do not prevent the larvæ, nymphs, and young adults lying waiting in the animal's sleeping quarters and other places from attaching themselves successfully shortly afterwards. The only insecticide of any value in preventing immediate reinfestation is derris. Derris may be used as a powder and is shaken well into the coat and on to the skin. It may also be applied in the form of a wash. The wash is made by soaking 2 oz. of derris powder in 1 gallon of water overnight. Next morning, just before it is used, sufficient soap is added to promote a good lather. The wash is allowed to dry on the coat. Derris should be kept away from the animal's eyes, as it may cause them to become inflamed. It should be used very cautiously with young puppies, especially of delicate breeds.

Treatment with derris should be given every six or seven days until the animal remains free from ticks. When using this treatment, examine the ears, eyelids, and in between the toes, and remove by hand any ticks seen.

(2) Burn or boil all old bedding and inspect and cleanse the bedding weekly. Clean up all litter around the animal's sleeping quarters and burn.

Spray the kennel with creosote oil or crude oil, forcing the spray into all cracks and crevices. Creosote oil is caustic if it comes into contact with animals.

Treatment is simplified if the animal's sleeping quarters are confined to the one place.

(3) Infested dwellings, especially if the ticks are very numerous, are best treated by fumigation. Crude oil or creosote oil may be used as sprays in outhouses, but are not suitable for use among furniture, &c. Although the ticks are fairly resistant to ordinary fly sprays, they can be killed if they are thoroughly wetted.

Dogs should be kept out unless they are to be used as traps for the free ticks, in which case the above recommendations for the treatment of the dogs must be strictly adhered to.

The Window Bud.

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

THE budding method described below has been evolved by the author of this article, particularly for the propagation of mangoes, but it has been tested on various other fruits such as citrus, litchis, and cashews, and found to be equally successful. The method is especially useful in the working of stocks of 1 inch to 3 inches in diameter, and so may be used in place of grafting, which is usually done on stocks of this size. The great advantages of the method are the elimination of large and exposed wounds and the holding of the bud in close contact with the stock. The latter consideration is of particular importance in the case of mangoes, which show a pronounced tendency towards the formation of thick corky layers of tissue under the buds with the ordinary T or inverted T methods of budding, thus causing an unsightly and frequently weak union.

Briefly, the method consists in the placing of an ordinary shield bud under a flap of bark turned back from the stock and the cutting of a "window" in the flap before replacing it, through which the bud is exposed to view.

The Operation in Detail.

A budding knife with a sharp pointed blade, such as that illustrated in fig. 1, is required. Two methods have been used in cutting the flap. It may be done in three cuts, one (A in fig. 2) horizontal across the stock, and two vertical (BB), ½ inch to 1 inch apart, extending from the horizontal cut towards the base of the stock for a distance of about 2 inches. Or it may be done with the point of the budding knife in two cuts, starting at XX in fig. 3, drawing the knife upwards on converging lines to a common point Y. The flap of bark should then be loosened with the point of the knife at the corners AB or Y, as the case may be, and gently pulled away from contact with the wood. This is an important point, as the action of tearing the bark away exposes exactly the cambium layer. Further, it gives an indication as to whether the stock is in a fit state to work, as the bark will only peel cleanly and easily when the stock is in an active condition.

A window is then cut out of the centre of the flap. It should be not more than one-quarter of an inch wide by five-sixteenths of an inch long. It is cut most easily with the point of the knife from the inside of the flap, which is bent over for the purpose, the tension on the bark assisting in easing the cutting (figs. 4 and 5).

An ordinary shield bud is then cut from the scion material, the petiole or leaf stalk, if present, being cut back to a stub of about one-tenth of an inch. The bud should be cut rather large, about an inch and a-half to two inches long. It is inserted without undue delay under the bark flap, and placed in such a position that the bud is visible through the window (fig. 6).

The flap should then be bound back in position with raffia and the whole sealed with grafting tape, the bud being completely covered. After a period of eight to ten days for citrus, up to three or four weeks for mangoes, the tape is removed and the raffia cut. If the operation

Fig. 1.

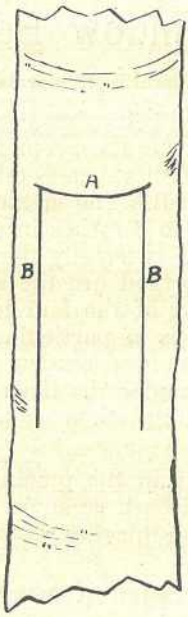


Fig. 2.

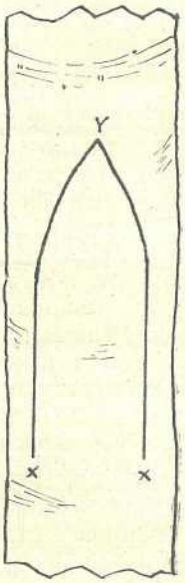


Fig. 3.

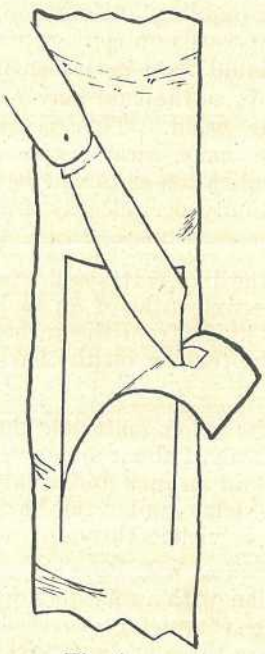


Fig. 4.

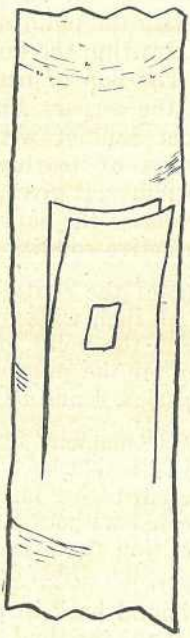


Fig. 5.

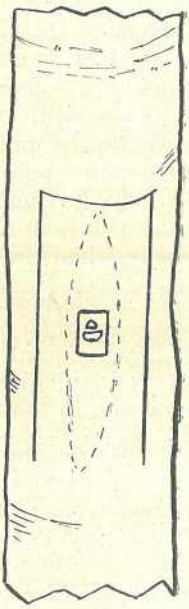


Fig. 6.

Plate 234.

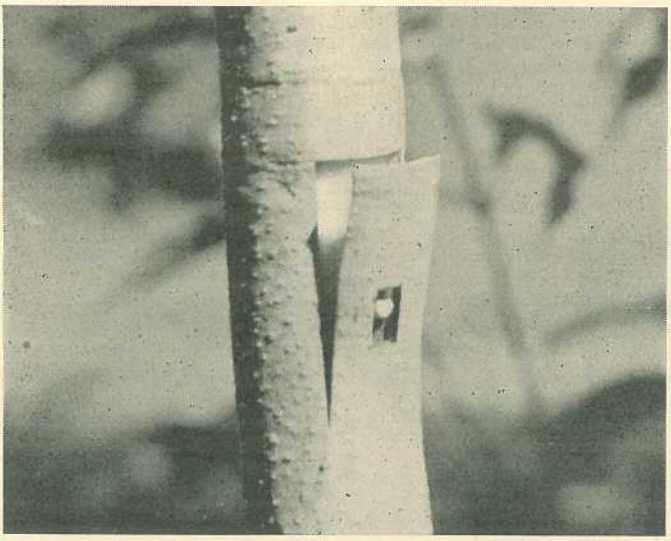


Plate 235.
THE WINDOW BUD.—Placing the bud.

has been well performed, the whole flap will have re-united with the stock, and the only evidence of its removal will be the window and a narrow line of new tissue along the cuts. The stock may then be ring-barked above the bud, or cut and bent over, to start the bud into growth. After growth has commenced, the stock may be headed back in the usual way.

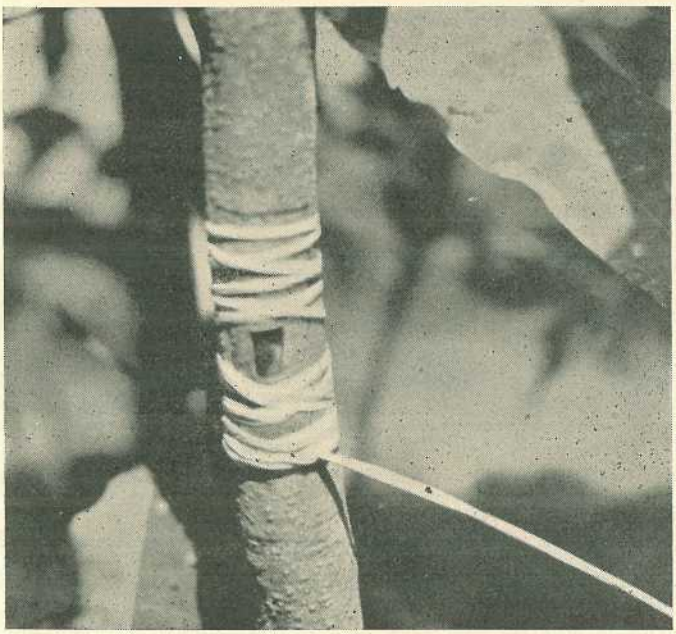


Plate 236.
THE FLAP TIED IN POSITION AFTER INSERTING THE BUD.

In this, as in all other budding methods, success lies in cleanliness and neatness in making the several cuts, and in working the stock when it is in active or flush condition, with bud-wood dormant. Cleanliness of tools is assured by the frequent wiping of the blades with a soft cotton cloth saturated with alcohol or methylated spirits. Neatness also

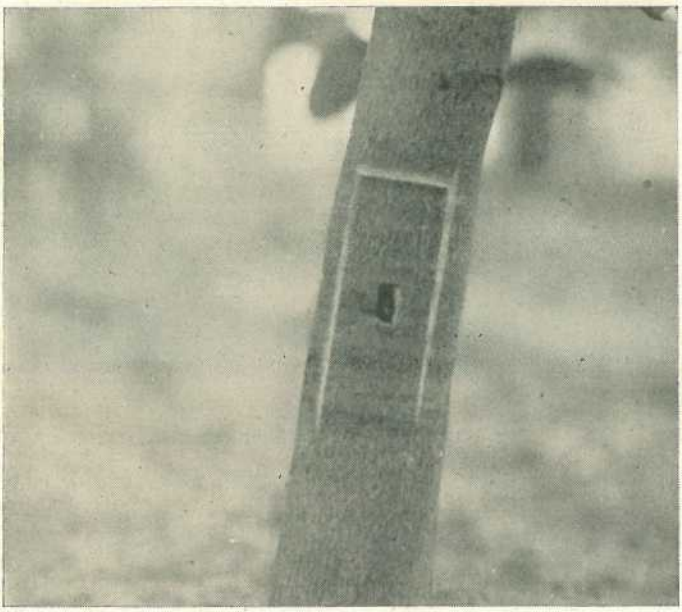


Plate 237.

A Successful Bud on Lemon Stock.—Note the neatness of the union.

is assured by maintaining a razor edge on the budding knife. A blade which will not shave is too blunt for budding. A good quality smooth butcher's steel used after every five or six cuts will keep the blade at the required keenness. Active, flush condition of stock may be assured by applying a liquid manure dressing of 1 oz. of sulphate of ammonia in 1 gallon of water several days before commencing the budding.

MARKING FRUIT TREES.

Because it is found impracticable to apply corrective methods immediately to drone fruit trees, or to trees known to require some specialised treatment for disease at some more opportune time, it is wise not to leave future identification of the tree to guesswork. The simplest way of marking such trees is by tying a narrow strip of cloth—preferably white—to a conspicuous limb.

In the case of individual trees giving light annual crops, pruning may be at fault. It is possible, too, that an individual tree may be a host of some serious pest that has not yet established itself throughout the orchard. The white rag indicator will serve as a reminder at a time later on when the necessary control can be conveniently applied. By marking the tree, the observant orchardist also will be able to note from time to time the efficiency of the control applied.

Unsuitable varieties and poor fruit types observed during harvesting and marked are not likely to be overlooked when reworking is being done in the proper season if they can be easily identified.

Hand versus Machine Milking.

A COMPARISON OF THE HYGIENIC QUALITY OF THE MILK PRODUCED.

E. B. RICE, Dairy Technologist.

THE relative merits of hand and machine milking, from the viewpoint of clean milk production, is an oft-debated subject among dairymen. Certainly there is usually less "visible" dirt in machine-produced milk because of the milk passing direct from the udder into a closed system, and thus largely eliminating contamination from the milker's hands and from dust falling into a pail; but it is to be remembered that it is often the "invisible"—that is bacterial—contamination from milk residues remaining on imperfectly washed and sterilised surfaces of dairy utensils, which most seriously deteriorates milk and cream.

In the course of a survey of milk supplies to cheese factories, supported by farm instructional visits, covering the period 24th July, 1938-30th September, 1939, information was accumulated as to whether the milk samples from individual suppliers were produced from herds milked by hand or by machine, with a view to ascertaining—

(1) The relative proportions in which hand and machine milking are carried out;

(2) The comparative hygienic quality of the milk ordinarily produced in Queensland from each system.

It is, of course, generally recognised that milk of the highest bacterial purity can be obtained either by hand or by machine, but notwithstanding refinements incorporated in modern milking plants, calculated to improve the sanitary quality of the milk produced, the releaser type of machine, as universally used in Queensland, still possesses, especially in a warm climate, a potential contaminatory source of great magnitude—teatcup assembly, rubber tubing, dropper tubes, and overhead milk pipeline, &c. The scarcity of farm labour, other economic factors and the desire to avoid the drudgery of hand-milking, have inevitably had a tendency to popularise the use of milking-machines by Queensland farmers, and the present investigation was deemed desirable in order to ascertain whether, under ordinary farm methods of cleansing and sterilising milking machines, they are capable of supplying milk of suitable hygienic quality.

Extent of Hand and Machine Milking.

The survey included all suppliers, exclusive of those owning only a few cows and not depending on dairying as a chief source of livelihood, to the forty-eight cheese factories situated on the Darling Downs. The results are set out in Table 1.

TABLE 1.

NUMBER OF HAND AND MACHINE MILKERS.

—	Number.	Percentage.
Hand-milked	381	58·35
Machine-milked	272	41·65
Total	653	100·00

The total number of suppliers was 653, of whom 381, or 58·35 per cent., milked their herds by hand; and 272, or 41·65 per cent., had installed and were using milking machines. As the cheese factories extend over many parts of the Downs, from points situated so far apart as the factory centres in the Toowoomba, Dalby, Bell, Pittsworth, Millmerran, and Warwick districts, the results of the inquiry may be taken as a fairly reliable guide for all the dairy farmers on the Darling Downs—approximately 3,000 in number—and reflect the extensive employment of mechanical milking in that part of the State; and they also probably depict fairly truly the position throughout Queensland. Furthermore, as machines are usually installed on the larger farms, it is reasonable to assume that the actual quantity of milk produced by machine is probably equal to, or only slightly less than that produced on farms where the herds are hand-milked.

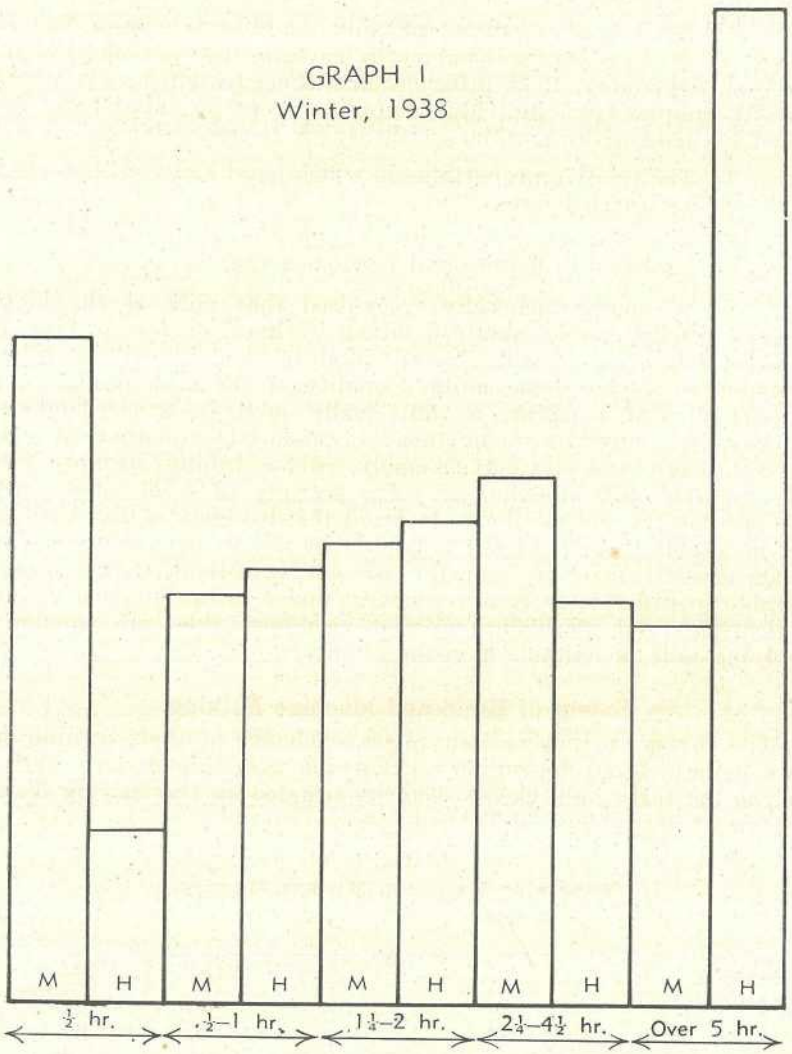


Plate 238.

Hygienic Quality of Hand and Machine Milk.

The methylene blue reductase test (ref. 1) was used to determine the sanitary quality of the milk, the results being classified into five grades:—

Grade 1.—Reducing methylene blue in 5 hours or more.

Grade 2.—Reducing methylene blue between 2¼ and 4½ hours.

Grade 3.—Reducing methylene blue between 1¼ hours and 2 hours.

Grade 4.—Reducing methylene blue between ½ and 1 hour.

Grade 5.—Reducing methylene blue in less than ½ hour.

All samples may be regarded as surprise samples, the suppliers receiving no prior notification of any intention of visiting a factory. In order to obtain as complete information as possible about each milk suppy for instructional and advisory purposes, the procedure followed was to do methylene blue reductase tests on both night's and morning's milk in the summer period and on night's milk only in the winter, as well as direct microscopic observations, the Wisconsin curd, fermentation and sediment tests. For the purpose of this paper, however, the results obtained in the methylene blue tests on samples of night's milk only were utilised, for it is well known that in milk produced and handled in a careless manner bacterial multiplication is more rapid than in hygienically produced milk and, therefore, tests on samples of night's milk taken upon their arrival at the factory next morning—thus allowing a period for bacterial multiplication of about sixteen hours—more reliably indicate the original quality of the milk than tests carried out on morning's milk in which bacterial development has not become active by the time of its arrival at the factory.

TABLE 2.

RESULTS OF TESTS FOR WINTER PERIOD 24TH JULY-30TH SEPTEMBER, 1938.

Machine-milked samples	110
Hand-milked samples	136
Total number of samples	246

		Distribution of Samples According to Reduction Times—				
		Less than ½ hour	½ – 1	1¼ – 2	2¼ – 4½	5 and over
Machine - milked samples	Number ..	29	18	20	23	20
	Percentage	26·36	16·36	18·18	20·91	18·18
Hand-milked samples	Number ..	11	23	26	22	54
	Percentage	8·09	16·91	19·12	16·18	39·70

For the purposes of *The Dairy Produce Act* the winter period is officially recognised to be from 1st April to 30th September, and the summer period from 1st October to 31st March. Tables, 2, 3, and 4 and accompanying graphs show the results of the tests for the three periods covered by the investigation—portion of winter 1938, winter 1939, and summer 1938-1939.

TABLE 3.

RESULTS OF TESTS FOR WINTER PERIOD 1ST APRIL-30TH SEPTEMBER, 1939.

Machine-milked samples	255
Hand-milked samples	410
Total number of samples	665

		Distribution of Samples According to Reduction Times—				
		Less than ½ hour	½ – 1	1¼ – 2	2¼ – 4½	5 and over
Machine - milked samples	Number ..	18	29	34	57	117
	Percentage	7·06	11·37	13·33	22·35	45·88
Hand-milked samples	Number ..	15	31	45	80	239
	Percentage	3·66	7·56	10·98	19·50	58·30

TABLE 4.

RESULTS OF TESTS FROM SUMMER PERIOD 1ST OCTOBER, 1938-31ST MARCH, 1939.

Machine-milked samples	207
Hand-milked samples	319
Total number of samples	526

		Distribution of Samples According to Reduction Times—				
		Less than ½ hour	½ – 1	1¼ – 2	2¼ – 4½	5 and over
Machine - milked samples	Number ..	115	36	36	17	3
	Percentage	55·56	17·39	17·39	8·21	1·45
Hand-milked samples	Number ..	138	62	50	46	23
	Percentage	43·26	19·44	15·67	14·42	7·21

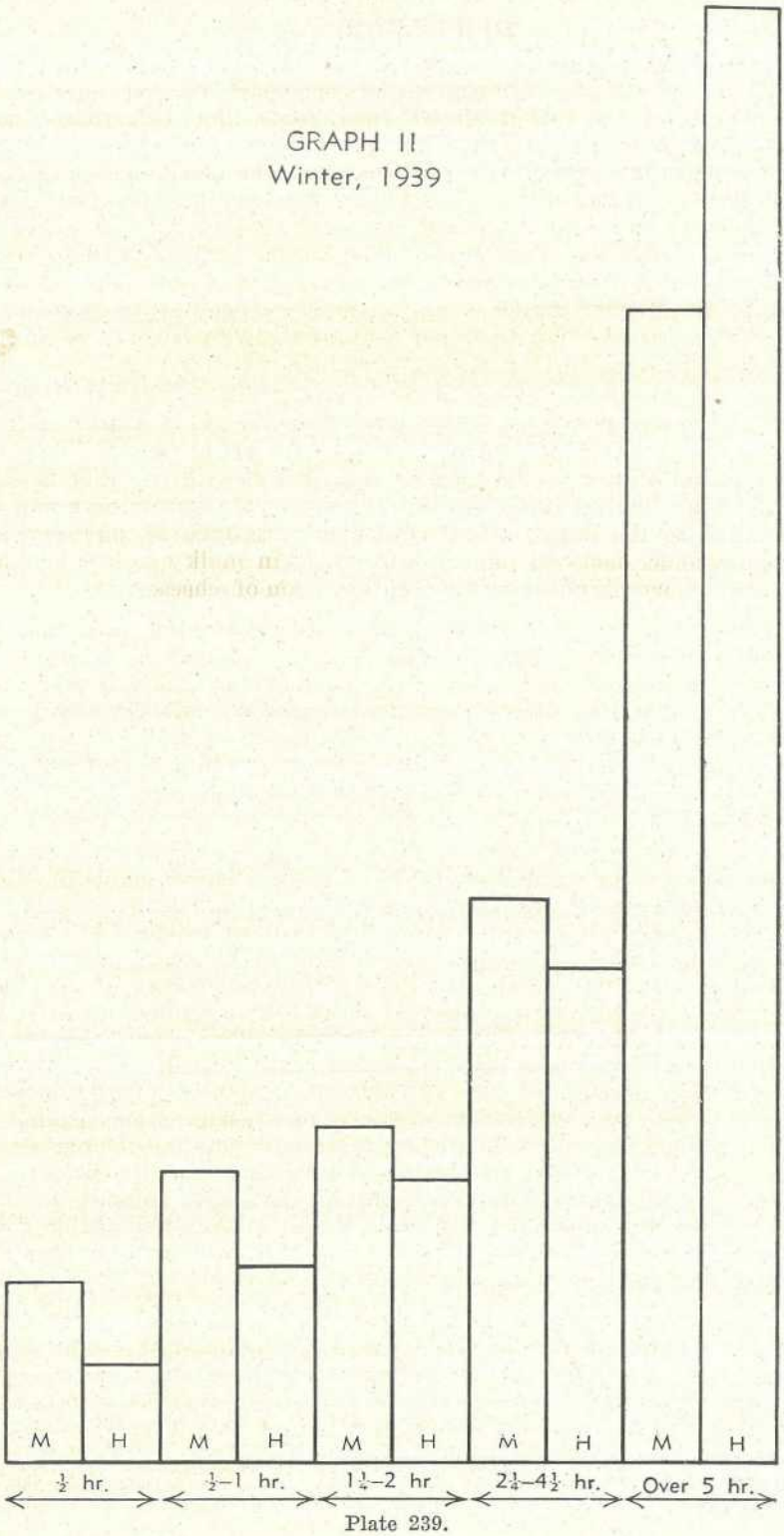

GRAPH II
Winter, 1939
M
H
M
H
M
H
M
H
M
H
½ hr.
½–1 hr.
1¼–2 hr
2¼–4½ hr.
Over 5 hr.

Plate 239.

DISCUSSION.

It will be plainly seen from the tables that in each seasonal period the percentage of samples of machine-produced milk which was placed on the lowest grade (methylene blue test under half-an-hour) is much greater than the percentage of suppliers of hand-drawn milk in this grade. On the other hand, the percentage of samples of machine-produced milk qualifying for the highest grade (methylene blue test over five hours) is considerably lower than the percentage of hand-drawn samples. Thus in the 1938 winter period, 42·72 per cent. of machine-milked samples and 25·00 per cent. of hand-milked samples fell into the inferior grades 4 and 5, the corresponding figures for the 1939 winter period being 18·43 per cent. and 11·22 per cent. Similarly, in 1938 there were 18·18 per cent. machine-milked and 39·70 per cent. of hand-milked samples placed in the highest grade, as against 45·88 per cent. and 58·33 per cent., respectively, in the 1939 winter period. Incidentally, the decided increase in quality in the second compared with the first winter period may be regarded as evidence that farmers are taking an interest in the periodical tests made on their milk and are responding to the departmental efforts to encourage by advisory and instructional methods an improvement in milk quality as the first and chief means towards ensuring an elevation of cheese quality.

Table 4 shows that in the summer period 55·60 per cent. of machine and 43·30 per cent. of hand-milked samples reduced methylene blue in less than half-an-hour, while 27·00 per cent. of machine and 37·30 per cent. of hand samples lasted more than one hour (grades 1 to 3 inclusive). Only 1·40 per cent. of machine-milked and 7·20 per cent. of hand-milked samples were in the highest grade, and producers of such milk are deserving of congratulation on their sound methods of production.

Results of samples taken on the second day of a visit to a factory showed that, except on abnormally hot nights, it is reasonable to expect milk produced under ordinary farm conditions and held overnight to last at least two hours in the test applied to it on reaching the factory next morning. The mean temperature of the night's milk on arrival at the factory next day exceeded 74 deg. F. on a number of occasions. Unless produced with scrupulous care, milk held overnight for fifteen to sixteen hours in this State, where mechanical cooling is not economically justifiable, and arriving at such temperatures will decolourise methylene blue rapidly, because of the excessive development of the original bacterial flora; and the results obtained on such occasions cannot be fairly regarded as representing the usual quality of the factory's milk supply. It is clear from the figures in this table that the problem of producing milk which will keep well in the usual summer evening temperatures experienced in this State is more difficult than that faced by producers in most cheese-producing countries, and can only be solved by exercising the utmost care in production.

Although each table reflects very clearly the inferiority of machine-produced milk in comparison with that drawn by hand, this must not be construed as an indictment of milking machines—for some users of milking machines achieved excellent results—but rather emphasises their serious potential contaminatory influence, and the urgent desirability of the adoption of an improved dairy-shed hygiene technique by the majority of users of milking machines. In this connection, steam sterilisation, recognised to be the most effective method of caring for

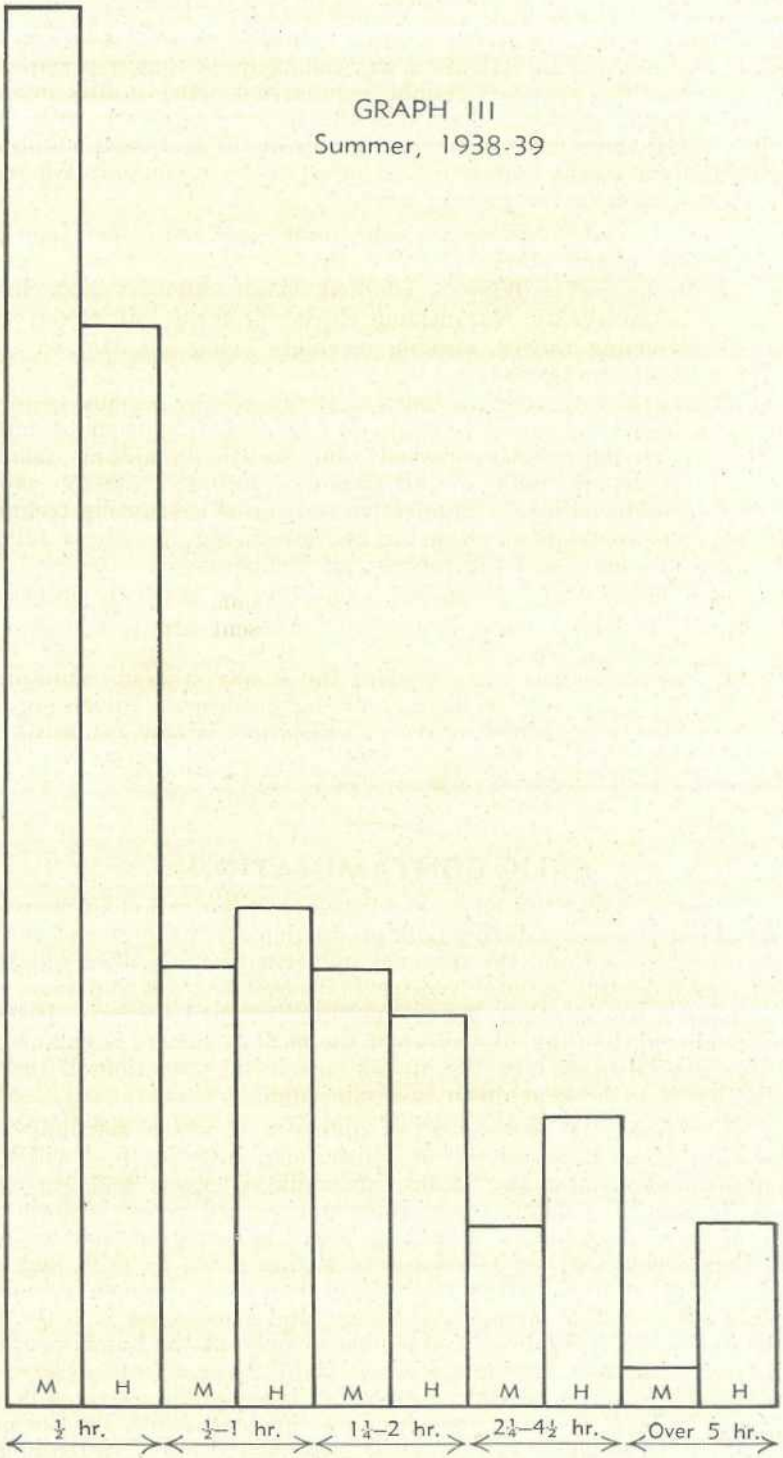

GRAPH III
Summer, 1938-39
M
H
M
H
M
H
M
H
M
H
½ hr.
½–1 hr.
1¼–2 hr.
2¼–4½ hr.
Over 5 hr.

Plate 240.

dairy utensils, probably offers an outstanding advantage. Unfortunately, however, so few sterilisers were being used during last summer (and none when the investigation was commenced) that it is impossible to include in this paper any reliable comparison between milk produced on farms using milking machines which are equipped with steam sterilisers and those without them. In view of the increased adoption of sterilisation in recent months, it is hoped to have comparative results at the conclusion of the present summer.

Summary and Conclusions: The most significant facts emerging from the investigation are:—

1. Mechanical milking is adopted on an extensive scale by the suppliers to Queensland cheese factories situated on the Darling Downs, milking machines being installed on almost half the farms.
2. The investigation revealed that one of the serious factors in bacterial contamination and rapid deterioration of milk is the imperfectly washed and sterilised milking machine. Although milk of satisfactory sanitary quality can be produced by the application of a proper cleansing technique, the methods of cleansing and sterilising at present followed by most users of machines are inefficient.
3. Milk produced by milking machines is decidedly inferior to that produced by hand-milking under present farm practices in this State.
4. The importance of an efficient and simply applied technique for washing and sterilising milking machines. Steam sterilisation, as enjoined by recent legislation, is now compulsory.

Reference 1.—This Journal, August, 1938, p. 173-179.

MILK CONTAMINATION.

Numerous researches have established that the two chief sources of bacterial contamination during milk production are the degree of sterility of the utensils used and the personal influence of the milker, but significant contamination occurs from several other sources and may even, on occasion, outweigh that due to the firstmentioned factors. It has to be remembered, too, that the effect of the various factors is cumulative; so it is essential to exercise the utmost care in all operations if the contamination is to be kept down to a minimum.

Two objects, the contaminatory influence of which may appear to be of only minor importance, but which cause infection and which are often overlooked on many farms, are milkers' stools and leg ropes. Since, by merely touching one—either stool or leg rope—bacteria may be transferred from one to the other, it will be apparent that by handling dirty stools and leg ropes before sitting down to milk and then milking without first having washed the hands—a common practice—bacteria may be transferred to the teats and from them into the milk in the bucket, as it is almost impossible to prevent the hands becoming moistened with milk during milking. Both those objects deserve the same consideration as all other causes of infection in clean milk production. It is a common precedure on the best farms in European countries to have metal stools for the milkers and chain fastenings for the cows, or, if wooden stools are preferred, to clean them daily.

Feeding of Working Horses on Cane Farms.*

M. WHITE.

THERE are text book standards for feeding horses when idle, at light, medium, or heavy work, but so many factors enter into successful horse management that set standards, if slavishly followed, may be more harmful than useful. For example, opinions will differ widely as to what is hard work. In ploughing, much depends upon the condition of the ground, the type of soil, the slope, and the season. The state of the farming implements is also important. The condition in which harness is kept, the weather, and, in the tropics, even the colour of the animal, all have a bearing on how hard a horse can be expected to work. Finally, the temperament of the horse and the skill of the driver cannot be too strongly emphasised. It follows, then, that any instructions given must be regarded as guides only, and the common sense of the owner will decide whether or not he is feeding his horses well enough for the work he expects them to do.

For simplicity, the amount of food to be offered daily is expressed in pounds of food to each hundred pounds liveweight of horse. A heavy, well-built draught will weigh from 1,700 to 1,800 lb. A well-grown spring cart type will be in the neighbourhood of 1,100 lb.

For all practical purposes, the cane farmer may class his foods under three main headings:—

(1) Roughage, which is mainly for filling and comfort;

(2) Carbohydrate concentrates for energy production;

(3) Protein concentrates for maintenance of muscle and organs.

Where foods are of good quality, the vitamin content is adequate. Extra minerals should be supplied as rock salt for working horses. Roughage may be supplied as grass, hay, green crops, or cane tops (chop-chop).

The second group includes the cereals, their by-products and molasses. While oats is the best single feed for horses, its use in the canelands is restricted because of other cheaper, and more easily procured grains. Wheat is not widely used though its by-products, bran and pollard are well known. In glut years, with a low ruling price, such as at present, some wheatmeal of good quality may profitably be fed even in maize-producing centres. At present this is also true of barley. Grain sorghums are rapidly coming into prominence and may, within the next few years, become serious competitors of maize. Maize is usually the most valuable grain for horses in the cane areas, but farmers should not be wed to the idea that it is the sole grain for their horses. Molasses, as a cheap by-product of his own industry, has a direct appeal to the cane farmer.

The third group includes:—

(*a*) The seed cake preparations, e.g., linseed, cottonseed, peanut, and coconut meals.

(*b*) Meatworks by-products, e.g., sterilized meat and blood meals.

* This article summarises two interesting lectures delivered by Dr. White at the Sugar Agriculture and Tractor School, held at Gatton College in January, 1939.

Idle horses can be kept in good condition on roughage alone. If the food is of poor quality, three to four pounds of molasses daily should be given. Horses at light work require about one and one-third pounds of hay, or four to five pounds of green feed, and a half pound of concentrates, for each hundred pound liveweight. Horses at medium work should be fed one pound of hay, or three to four pounds of green feed, plus three-quarters of a pound of concentrates, for each hundred pound liveweight. Horses at hard work need about the same allowance of roughage as when at medium work, but the concentrate allowance should not fall below one pound, and it might easily be one and one-third pounds, per hundred pound liveweight.

It has already been pointed out that the cheapest roughage in the cane areas is grass and chop-chop. Fodder, however, is largely bought, and a note on the relative values of the common chaffs may not be out of place. Lucerne has one notable advantage over the other common chaffs. When it is used, there is no need to include protein-rich foods (cottonseed, linseed, &c.) in the concentrate allowance. However, if the price of lucerne per ton is greater than that of oaten or wheaten chaffs plus the cost of two hundred pounds of protein concentrate, it is, in general, not worth the extra money.

The concentrates fed are chiefly grains, their by-products, and molasses, but these in the absence of lucerne do not provide sufficient protein in the ration. It is therefore necessary to replace one pound of the grain by one pound of protein concentrate for horses at light work. For horses at heavy work, two pounds are substituted.

As maize is the standard grain used in the cane areas, farmers should know how it may be substituted by other energy-producing foods.

Oats.—About seven pounds of oats may replace six of maize. Oats may entirely replace the maize in the ration.

Barley.—Provided the grain is crushed, barley may be substituted almost pound for pound for maize. Better results are obtained by adding a little bran.

Wheat.—Sound wheat may replace an equal weight of maize, but the grain should be crushed. Heavy feeding of wheat should be avoided, as it may cause colic. It may, however, form half the concentrate mixture for horses on hard work, if the horses are accustomed to it gradually.

Grain Sorghums.—Crushed grain sorghums may be used in place of maize. In the absence of green feed some bran should be included to counteract the constipating effect of sorghum.

Molasses.—Three pounds of heavy molasses may be used in place of two of maize. Molasses should not entirely replace grain in the ration. One-half of the grain ration for hard working horses may be replaced by molasses in the above proportions.

The protein-rich concentrates most commonly used are linseed, cottonseed and peanut meals. These are interchangeable. When coconut meal is fed, only the best quality should be used. It falls slightly below linseed meal as a source of protein but is a richer source of energy. Meat meal of the best quality only, should be used for horses. It should be introduced gradually. A little over one pound of high-grade meat meal will replace two pounds of vegetable protein meals.

In arranging the three feeds for working horses, it is important to reserve about one-half of the total daily roughage for the evening meal. The morning and midday feeds are eaten just before work starts, and these feeds should contain between them, about three-quarters of the energy-producing foods, i.e., the concentrates. Too much roughage in these feeds prevents the horse from eating sufficient concentrates in the time at his disposal—particularly if he is a slow eater. The long overnight spell gives the horse time to digest the bulky evening meal.

Some horses are inclined to "bolt" their food. This may most readily be overcome by using a shallow feedbox at ground level. This makes the food more difficult to "bolt." Another plan, if the corn is grown on or near the farm, is to feed it in cob. Failing the above, the simplest method is to place two or three large smooth stones in the feedbox.

An important point, too often missed in feeding horses, is never to feed musty material, and always to clean out the boxes. The nose bags too should receive attention. They should be turned inside out after use, and at least once a week steeped in soap suds and rinsed clean. Nothing puts a horse off his feed more than the decomposing remnants of previous feeds.

On idle days the concentrate part of the ration *must be* reduced to at least half the normal amount.

The watering of working horses is important. Water in the morning. Just before the midday feed a short draught should be allowed. Water again after the feed. After the day's work, and before unharnessing, the horse should be watered again. If green feed is supplied in the evening meal, horses may not require any more water for the day. If the feed is dry, they usually like another drink.

MAKE THEM PULL TOGETHER.

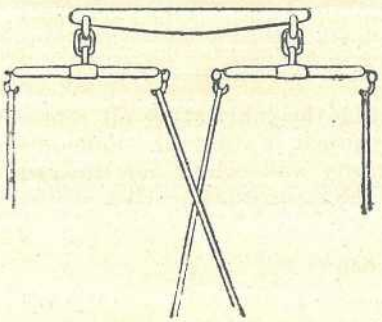


Plate 241.

Here is a device which has been found very successful in breaking in young horses to pull together. Simply unhitch the inside traces and cross them, as shown in the drawing.

Charcoal Gas for Farm Tractors.*

SOME time ago prominence was given in the Bulletin to a newly constructed tractor which was designed to operate on suction gas, generated from charcoal. Though the trials of this unit appeared to be satisfactory, it is understood that the firm which constructed it does not propose to proceed further with the unit.

Interest in some emergency form of fuel, particularly for use in farm areas, has again been stimulated by the outbreak of hostilities, which may eventually threaten the continuity of supply of motor fuels to this country. At the same time, it is probable that farmers in some areas, where wood is plentiful and fuel oils are expensive, might adopt the charcoal producer unit even for normal use. An interesting article on this subject appeared in a recent issue of the "Agricultural Gazette of New South Wales," and the more important features of this contribution are presented here in brief.

Experimentation with charcoal fuel has been carried out over a number of years, but until recently, successes have been shortlived as a result of ineffective cleaning, resulting in the deposition of tar in the cylinders, and excessive wear due to solid particles of fuel entering the engine. The rapid burning out of grate and fire box was a further shortcoming of earlier types. Two modern burners have been demonstrated in New South Wales during the past two years, and 26 of these units have been put into operation since May last, with a substantial number about to follow. Better cleaning apparatus has removed the tar and dirt problem, and some owners, after limited experience, state that the engine wear is now less than with oil fuel.

Cost figures, based on data from 15 owners, showed:—

Per 10-hour Day.	Full Load.	Light Load.
Charcoal used	4-7 bags.	3½-6 bags
Cost	5s. to 8s. 9d.	4s. 4½d. to 7s. 6d.
Kerosene used	16-24 gallons.	15-20 gallons
Cost	20s. to 30s.	18s. 9d. to 25s.
Actual averages—		
(*a*) Charcoal	6s. 6½d.	5s. 1½d.
(*b*) Kerosene	25s. 1d.	21s. 5d.

With charcoal gas, the lubricating oil retains its body and colour longer, as it is not subject to dilution. Some owners claimed that the oil retained its viscosity and colour for upwards of 150 hours. The average oil costs for the units under review showed—

	s.	*d.*	
With charcoal	1	6	per day.
With kerosene	4	4	per day.

On the basis of a 70-hour week, on full load, the saving in fuel and oil with the charcoal unit was therefore more than £7 per week.

* From *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), October, 1939.

The cost of charcoal is set down at 1s. 3d. per bag of 50-lb., but it is suggested that this could be reduced where the farmer produces his own. Farmers placed nearer the burning plant are able to secure bulk supplies for 1s. 1d. per bag.

It is found that a loss of power of some 13 per cent. is experienced when kerosene is replaced by charcoal gas. It is pointed out that this could be overcome with a cylinder bore $\frac{1}{4}$ inch greater than normal: in some cases, little loss of power could be detected where the bore was increased by only $\frac{1}{8}$ inch.

It is claimed that, with proper care, the fire risk for crop harvesting was not more than when using kerosene. In Western Australia, a large insurance company does not differentiate between kerosene and charcoal fuels in fixing insurance premiums.

It is admitted that charcoal is less convenient than kerosene, for the following reasons:—

1. Loss of time; average, 30 minutes per day;
2. Unit more bulky and less rigid; requires more frequent servicing;
3. Visibility in judging steering space reduced;
4. Accessibility of engine and transmission reduced;
5. Two stays have to be removed to operate belt and pulley drive.

Some farmers consider the plant equally or more convenient for the following reasons:—

1. Simplicity of operation;
2. Not same trouble in maintaining fuel supply;
3. Engine may be allowed to idle for longer period without overheating, and no oil dilution;
4. No cash outlay if farmer burns his own charcoal.

It is further stated that with charcoal, cleaning the plant and sieving and burning charcoal is a dirty job; when the charcoal burns low, the upper half of the burner becomes very hot, which may cause discomfort in hot weather. On the other hand, there are no engine fumes, and the engine runs cooler and more smoothly, with less noise.

Should any owner not be satisfied with charcoal gas, it is pointed out that a change back to kerosene fuel may be made by fitting the normal sleeves and pistons. Moreover, the charcoal gas requires a hot spark, and the magneto must be in excellent condition for the purpose.

Repairs to the charcoal unit involve renewing the grate every two or three years, and the fire box every four or five years. The cost of supplying and fitting a charcoal gas unit amounts to about £105, to which must be added £15 to £20 for converting the engine to suit the charcoal gas fuel.

A significant fact was that all owners interviewed by the writer of the article were entirely satisfied with the functioning of the units.

H.W.K.

Fodder Canes.*

ARTHUR F. BELL.

THE Sugar Experiment Stations Act gives authority for the control of plantings of fodder canes and this control is being exercised within mill areas.

A mill area is defined as the general area, of both assigned and unassigned land, which embraces the lands assigned to the particular mill. That is, for example, if the assigned land ran in two forks up adjacent creeks, then the unassigned area between these forks would be included in the "mill area."

Fodder canes are just as likely to harbour diseases as canes grown for milling and consequently it would be illogical to impose control upon planting of milling canes, while ignoring fodder canes. Accordingly, cane which is grown for fodder purposes within a mill area must be either one of the varieties approved for milling or an approved fodder cane as set out hereunder:—

Variety of Sugar-cane.	Mill Area.
Uba, Co. 290, and "Improved Fodder Cane"	Mossman, Hambledon, Mulgrave, Babinda, Goondi, Mourilyan, South Johnstone, Tully, Macknade, Victoria, Invicta, Kalamia, Pioneer, and Inkerman.
Uba and "Improved Fodder Cane" ..	Proserpine, Farleigh, Racecourse, Pleystowe, Marian, Cattle Creek, North Eton, and Plane Creek.
90 Stalk, "Improved Fodder Cane," and C.S.R. 1 (also known as E.G.)	Bingera, Fairymead, Millaquin, Qunaba, Gin Gin, Isis, Maryborough, Mount Bauple, Moreton, Eagleby, and Rocky Point.

Returns received from canegrowers earlier in the year reveal the fact that comparatively few grow purely fodder canes and consequently some difficulty may be experienced in obtaining supplies, but the variety 90 Stalk, which is approved for southern mill areas, may be obtained from the Queensland Acclimatisation Society, Lawnton.

The present list of approved fodder canes is only tentative and will probably be revised as soon as further tests are made. Heretofore, the Bureau has not paid attention to this class of cane, but it is probable that a number of our discarded seedlings could be utilized for this purpose, especially some of the vigorous types which are discarded on account of somewhat low sugar content from the milling point of view. In future, our field officers will bear in mind the question of fodder canes when selecting seedlings or when setting out disease resistance trials.

We have mentioned above that this restriction on the growth of fodder canes applies to both assigned and unassigned land within a mill area. Canegrowers receiving this Bulletin would render a good service to their neighbours if they brought this information before the notice of such neighbours as grow cane for fodder purposes but are not suppliers to a sugar mill.

A number of enquiries have been received regarding elephant grass, but it should be noted that there are no restrictions on the cropping of this plant nor do restrictions on fodder canes apply to dairying districts outside the general cane areas.

* From *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), October, 1939.

Composition of Superphosphate (Super) and Nauru Phosphate.

R. A. TAYLOR, A.A.C.I., Inspector and Examiner, Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

NUMEROUS enquiries as to the meaning of terms in common use on superphosphate labels demonstrate the necessity of publishing information with respect to the composition of this material.

Terms repeatedly used are as follows:—

20·5 per cent. Water-soluble Phosphoric Acid;

22·0 per cent. Super;

45·0 per cent. Soluble Phosphates;

48·0 per cent. Tricalcic Phosphate;

40·0 per cent. Gypsum.

As will be seen from a study of the composition of superphosphate, one of these terms (40 per cent. Gypsum) is definitely erroneous, while several of the others are misleading.

In the chemical estimation of phosphates the percentage of phosphoric anhydride (P_2O_5) is ascertained. This gives a common value for all phosphates for comparative purposes.

Phosphoric anhydride (P_2O_5) is usually called phosphoric acid, and throughout this article this latter name is adhered to—in accordance with common practice.

If true chemical nomenclature is adhered to, however, phosphoric acid is really the material formed by the addition of water to phosphoric anhydride. It is mentioned later, under the designation "free acid"; the chemical formula is H_3PO_4.

Three forms of calcium ortho-phosphate occur in superphosphate. These three forms are—

Monocalcic phosphate—$CaH_4(PO_4)_2$.

Dicalcic phosphate—$Ca_2H_2(PO_4)_2$.

Tricalcic phosphate—$Ca_3(PO_4)_2$.

The firstnamed—monocalcic phosphate—is soluble in water, and is present in superphosphate.

The second is largely soluble in citric acid solution, and is the active constituent in basic phosphate.

The third is largely insoluble in citric acid solution, and is present in Nauru phosphate rock and bone.

It is not possible to completely separate the three forms of calcium phosphate from one another on a basis of "soluble in water," "soluble in citric acid solution," and "insoluble in citric acid solution," but the monocalcic phosphate can be taken as being completely soluble in water, while the other two forms are insoluble in water; where small quantities of dicalcic and tricalcic phosphates are present, however, as in superphosphate, the "soluble in citric acid" method may be taken as giving a representation of the proportion of these two forms present.

It must be emphasised, however, that the whole of the tricalcic phosphate in Nauru phosphate rock or in bone is not citric acid insoluble; nor is the whole of the dicalcic phosphate present in basic phosphate or other materials soluble in citric acid solution.

Nauru Phosphate Rock.

Nauru phosphate rock is a natural product obtained from Nauru Island. From this raw material the superphosphate sold in Queensland is made.

The following table demonstrates the composition of a typical sample of Nauru phosphate (last column) as deduced from the actual analysis (first column) :—

NAURU PHOSPHATE ROCK.

TABLE I.

Actual Analysis.		Allotment of Findings.			Composition.	
		Phosphoric Acid (P_2O_5).	Lime (CaO).	Loss on Ignition.		
	%	%	%	%		%
Total Phosphoric Acid (P_2O_5)	39·8	39·0	46·1	..	Tricalcic Phosphate [$Ca_3(PO_4)_2$] ..	85·1
Iron and Alum. Oxides [$(FeAl)_2O_3$]	0·7	0·8	..	..	Iron Al. Phosphates [$(FeAl)PO_4$] ..	1·5
Fluorine (F)	0·5	..	0·7	..	*Calcium Fluoride (CaF_2)	1·0
		..	2·5	2·0	Calcium Carbonate ($CaCO_3$)	4·5
		..	**1·1	..	Calcium Silicate ($CaSiO_3$)	2·3
		..	..	1·0	Organic Matter	1·0
		39·8	50·4	3·0		
Total Lime (CaO)	50·4					
Loss on Ignition [Carbon-dioxide (CO_2)—2·0]	3·0					
Free Water	1·5	..	..	..	Free Water (H_2O)	1·5
					**Silica (SiO_2), &c.	3·1
						100·0

* It is possible that the fluorine is actually present as calcium fluo-phosphate, as in certain American rock phosphates.

** Certain allotments are necessarily arbitrary. SiO_2 was not estimated, but is generally present in excess of 3 per cent. The CaO has been divided between phosphate, carbonate, fluoride, and silicate, the first three being calculated equivalents of the respective acid radicals, and the silicate receiving the quantity remaining. The expression Silica (SiO_2), &c., covers silica and elements present in small amounts but not estimated.

The amount of phosphoric acid present in the above is 39·8 per cent.—all being in the water-insoluble form. It should be noted that, on account of this insolubility, fineness is an important factor governing the availability of the phosphoric acid.

To convert the insoluble tricalcic phosphate in Nauru phosphate rock to water-soluble monocalcic phosphate, a calculated amount of sulphuric acid is added, and superphosphate—an abbreviation of the correct term (''calcium superphosphate'')—is formed.

Superphosphate.

The following table sets out the composition of a typical sample of superphosphate as deduced from the actual analysis (first column) :—

SUPERPHOSPHATE.

TABLE II.

Actual Analysis.		Allotment of Findings. Phosphoric Acid (P_2O_5).	Lime (CaO).	Sulphur trioxide (SO_3).	Water (H_2O) (Combined).	Composition.	
	%	%	%	%	%		%
Water-sol. Phosphoric Acid (P_2O_5)	20·5	0·8	..	..	..	*Free Acid (H_3PO_4)	1·1
		19·7	8·1	..	2·5	*Monocalcic Phosphate [$CaH_4(PO_4)_2 \cdot H_2O$]	35·0
Cit.-sol. Phosphoric Acid (P_2O_5)	0·5	0·5	0·4	..	0·3	Dicalcic Phosphate [$Ca_2H_2(PO_4)_2 \cdot 4H_2O$]	1·3
Cit.-insol. Phosphoric Acid (P_2O_5)	1·0	1·0	1·3	..	..	Tricalcic Phosphate [$Ca_3(PO_4)_2$]	2·3
		..	1·9	2·7	1·2	Gypsum (Dihydric Calcium Sulphate $CaSO_4 \cdot 2H_2O$)	5·8
		..	17·3	24·7	..	Anhydrite (Anhydrous Calcium Sulphate $CaSO_4$)	42·0
Fluorine (F)	0·3	..	0·5	..	..	Calcium Fluoride (CaF_2)	0·7
Iron and Alum. Oxides [$(FeAl)_2O_3$]	1·0	..	..	1·0	..	Iron-Aluminium Sulphate [$(FeAl)_2(SO_4)_3$]	2·0
Silica (SiO_2) and Insoluble	2·2	..	..	..	..	Silica (SiO_2) and Insoluble	2·2
Free Water (H_2O)	7·6	..	..	..	..	Free Water (H_2O)	7·6
		22·0	29·5	28·4	4·0		100·0
Lime (CaO)	29·5						
Sulphur Trioxide (SO_3)	28·4						
Combined Water (H_2O)	4·0						

* The water-soluble P_2O_5 is actually contained in the free acid and the monocalcic phosphate.

The actual chemical forms—in relation to degree of hydration—in which the mono, di, and tri calcic phosphates occur in superphosphate are set out variously by different authorities.

It is considered, however, that the forms as set out in the Journal of Industrial and Engineering Chemistry Anal. Editn., Vol. 7, p. 401, are correct—except for the tricalcic phosphate, which is probably a portion of the unchanged Nauru phosphate rock, and consequently would be in the anhydrous form $Ca_3(PO_4)_2$.

The representative formulæ are, therefore, accepted for purposes of this article as—

Mono—$CaH_4(PO_4)_2 \cdot H_2O$.

Di—$Ca_2H_2(PO_4)_2 \cdot 4H_2O$.

Tri—$Ca_3(PO_4)_2$.

The free acid (H_3PO_4) shown in Table II. is actually water-soluble, and its equivalent as phosphoric acid (P_2O_5) is, therefore, included in the 20·5 per cent. water-soluble phosphoric acid, shown on the typical label.

A true statement of the water-soluble phosphoric acid would, therefore, be—

19·7 per cent. water-soluble phosphoric acid (P_2O_5) as monocalcic phosphate.

0·8 per cent. water-soluble phosphoric acid (P_2O_5) as free phosphoric acid.

20·5 per cent. total water-soluble phosphoric acid (P_2O_5).

It will be seen from the table that, although the object of the process is to obtain water-soluble phosphoric acid (monocalcic), small quantities of dicalcic phosphate and tricalcic phosphate are present. These are really "impurities" due to the great difficulty economically of making any commercial process 100 per cent. perfect.

As, however, the water-soluble phosphoric acid is the "object" of the process, the di and tri calcic forms are not recognised by the Queensland Fertilisers Act of 1935. In fact, a superphosphate guarantee reading 20·5 per cent. water-soluble phosphoric acid (P_2O_5), and *nothing else,* is considered ideal and leads to no confusion.

It should be noted that excessive fineness is of no value with superphosphate as contrasted with Nauru phosphate rock, which requires to be finely ground—as stated previously.

The calcium sulphate is largely present as anhydrite ($CaSO_4$), only a small portion being in the form of gypsum ($CaSO_4 \cdot 2H_2O$). According to A. P. Belepol'ski and A. A. Taperova—Journal Chem. Ind. (U.S.S.R.), 15, No. 3, 44 (1938)—X-ray studies show that, even after superphosphate has been stored for two years, the calcium sulphate is still present chiefly in the form of anhydrite.

In the light of the above information, it is now possible to review the terms quoted in the beginning of this article.

20·5 Per Cent. Water-soluble Phosphoric Acid.

As already stated, this refers to the phosphoric acid (P_2O_5) present as monocalcic phosphate and free acid in the superphosphate.

It is the *only guarantee* required to be stated on the label by the Queensland Fertlisers Act of 1935.

22 Per Cent. Super.

This refers to the total phosphoric acid (P_2O_5) and includes, as well as water-soluble, the citric acid-soluble and insoluble phosphoric acid present in the dicalcic and tricalcic phosphates. This term is disregarded by the Queensland Fertilisers Act.

45 Per Cent. Soluble Phosphates.

This is the figure obtained by calculating the 20·5 per cent. phosphoric acid (P_2O_5) present as monocalcic phosphate and free acid to its equivalent as tricalcic phosphate. This expression is not used in Queensland.

48 Per Cent. Tricalcic Phosphate.

This figure is obtained by calculating the 22 per cent. total phosphoric acid (P_2O_5) present in all forms to its equivalent as tricalcic phosphate. This expression also is not used in Queensland.

40 Per Cent. Gypsum.

Actually in superphosphate, only a small percentage of gypsum (dihydric calcium sulphate) is present, the bulk of the calcium sulphate being in the anhydrous form—anhydrite. As this portion of the super. is a "by-product" only, it is actually of little importance.

In conclusion, the following point is worthy of interest:—

Nauru phosphate rock is an unadulterated natural product; superphosphate is manufactured in Australia from finely-ground Nauru phosphate rock and sulphuric acid. It will thus be observed that superphosphate, as described herein, does not contain "filler" in any sense of the word, the whole of the material as sold being the product obtained from the process without addition or admixture of any kind.

CULTURES FOR THE INOCULATION OF GREEN MANURE CROPS.

Canegrowers are reminded that cultures for the inoculation of seeds of cowpea and Poona pea seed are again available on application. This service was inaugurated last year and was very favourably received, and cultures sufficient for the inoculation of nearly 2,000 acres of Poona pea and cowpea were despatched to canegrowers in all parts of the State. A number of the recipients of these cultures have written expressing their great satisfaction with the crops produced after inoculation.

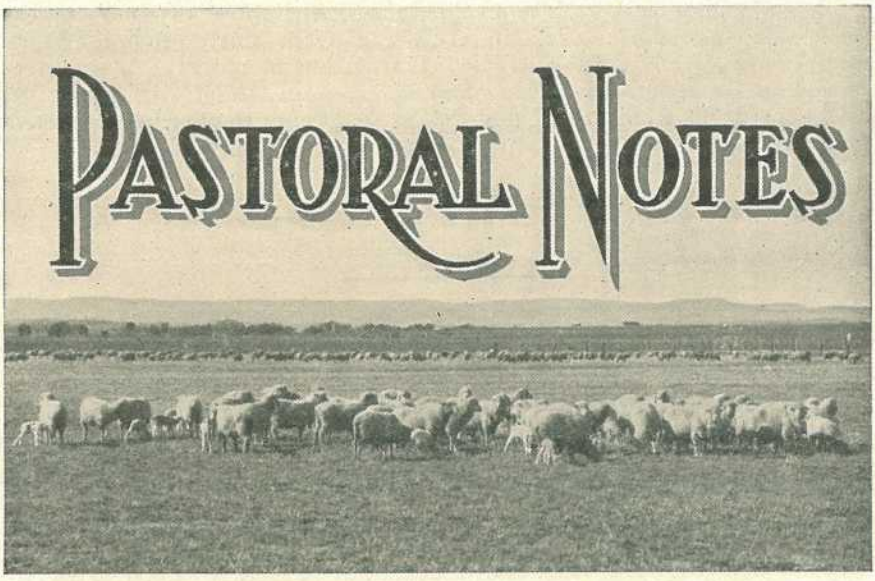
The inoculation of the seed is a very simple matter and full directions are forwarded with each lot of cultures. The cultures will keep satisfactory for about a month if stored in a cool dry place, but as far as possible they should be ordered for delivery just prior to the proposed date of planting.

Leguminous crops inoculated with the right type of nitrogen-fixing bacteria can obtain their supplies of nitrogen from the air instead of from the soil and, consequently, when such a green manure crop is ploughed in the soil is enriched by just that much nitrogen. These bacteria can live in the soil for a considerable period and the crop may become inoculated naturally after planting, but even if it does become inoculated, and forms root nodules, it does not follow that the particular bacteria are the most efficient strain. Undoubtedly the best practice is to make sure that the most efficient strain of bacteria is present by the simple practice of inoculating the seed with a tested strain before planting.

Inoculation of the seed is, of course, only one step towards ensuring a good green manure crop; it is still necessary to plant sound seed in a good seed bed, have soil acidity corrected, and have suitable conditions of moisture. To obtain best results, also, the green manure should be planted as soon as practicable after ploughing in trash and not after a bare fallow.

Applications for cultures should be made to The Director, Bureau of Sugar Experiment Stations, Brisbane; each application should be accompanied by the sum of one shilling and should state the number of bushels of seed it is desired to inoculate.

A.F.B.



Horse Botflies.

AS summer approaches horses may become greatly troubled by botflies. These flies are bee-like in appearance and possess two wings and a slender pointed abdomen. When laying eggs, the female fly hovers around the horse with the abdomen curved beneath the body. This has given the erroneous impression that the botfly stings, but its abdomen is held in this position merely to facilitate the deposition of its eggs. The eggs are laid on the hairs of the chest, throat, mane, shoulders and legs of the horse, but more frequently on the hairs of the throat and the inside of the forelegs.

In time, the larvæ develop within the eggs and hatching occurs when the horse licks or rubs the spot on which the eggs are present. In some way or other, the hatched larvæ reach the mouth of the horse and then burrow into the flesh of the tongue and cheeks. Here they remain for a little while, but eventually make their way into the stomach. When fully grown they are passed out of the animal with the dung, burrow into the ground and pupate. In the pupæ the adult botflies are formed and they emerge after a period of a few weeks.

Botflies are harmful to horses in two ways. Firstly, the horse instinctively recognises them as enemies and makes desperate efforts to prevent the female botflies approaching and laying eggs. During the botfly season, horses thus become very difficult to manage in harness, and may also hurt themselves in their attempts to avoid the flies. Secondly, the bots in the stomach may cause serious trouble. Each bot has a pair of stout hooks in its mouth, and also rows of hooks around its body. These hooks irritate the lining of the animal's stomach, and may cause ulcers and other ill-effects.

Various methods have been devised to prevent the botflies from approaching horses and laying eggs. One of the simplest and most successful is a piece of canvas attached to the horse's noseband and headstall so that it covers the throat completely. Deep sheds or brush shelters also will give protection, as the botflies will not follow the horse out of the sunlight.

For the removal of the bots from the horse's stomach, carbon bisulphide is advised. This is given in a capsule after twenty-four hours' starvation at the rate of 6 cubic centimetres—about one ordinary teaspoonful—for every 250 lb. weight. The best time to treat a horse for bots is about May or June, for at this time of the year all eggs on the body will have hatched and, as no flies are about, the horse cannot become reinfested immediately after treatment.

CLASSING THE WOOL CLIP.

As the great bulk of the wool produced in Queensland is merino, there is no great difficulty in having it classed properly. Most Queensland pastoralists keep their sheep in as good condition as seasonal and other circumstances permit, and do everything else necessary to produce a good clip of wool.

To add to the benefit of good flock management, the clip should be classed to best advantage. The large flock owner realises that it pays to obtain the services of a highly qualified classer to do the work. It has been the get-up of these clips which has gained for Queensland clips the confidence of buyers. To retain this confidence and to have it extended to manufacturers is most important. It should be understood that station brands are well known to both buyers and manufacturers, and if the wool is classed and baled in keeping with the requirements of the trade, the owner is bound to obtain the full benefit of a properly classed clip.

Some buyers deal chiefly in long staple, and others require shorter wools, and they will buy with confidence if they are sure of getting the type they require, and not a mixture of lengths and qualities. Yield also has a considerable influence on values; and as values are based on suitable length and spinning quality, as well as yield, the importance of maintaining lines of even standard should be obvious. As the wool is purchased on a clean-scoured base, the purchaser of greasy wool must calculate the percentage of the clean product he will obtain, therefore the more even respective lines are in length, spinning, quality, character, soundness, colour and condition, and yield, the more accurate he will be in appraising the true value of each class. Not only in large, but also in the smaller clips correct classing is important, especially under changing selling conditions. Arrangements have been made for the purchase of the whole of the Australian wool clip by Great Britain, with control of selling procedure vested in a central wool committee.

All wool has now to be submitted for appraisement, and experts appointed by the central committee are responsible for its valuation. This means that classing to obtain the best returns for the grower will be even more necessary than under the former system of auction sales, although both brokers and their experts receive and handle clips as usual.

Where small owners are concerned, the expense of a qualified classer may not be warranted, especially where family labour is utilised. To assist them, the Department of Agriculture and Stock is prepared to instruct them in the classing of their own clips.

Farmers' Wool Scheme.—A scheme also is in operation which is limited to those who run 1,500 sheep or less, British breeds and crosses, and odd lots, bags and butts from any holding, for which 10s. per bale is charged for classing. The only preparation necessary is the removal of wet stains. An advance of 60 per cent. of the estimated value of the wool free of interest to owners running less than 1,500 sheep is made on consignments.

—*Jas. Carew.*

CATTLE FATTENING.

There are large tracts of well-grassed land in South-eastern Queensland on which fattening of bought store cattle is practised. These cattle are usually animals which fatten into "heavies." Older stock can "handle" roughage much better than yearlings, and it takes less time and trouble to get them ready for market; but, in general, they do not give as good a net return as "baby beef."

The reasons are—

(1) Buying of stores is a more speculative business and the outlay greater.

(2) Disease, drought, and other retarding influences make the money loss, if any, greater.

(3) The trade does not favour "heavies."

(4) Although the relative cost per 100 lb. is higher with the "young stuff," more can be bought for the same money.

(5) The young animal lays on both flesh and fat—i.e., it fattens while it grows.

(6) The trade pays more for the finished carcase.

(7) There is *always* a market for well-finished lightweights.

There are certain requisites for turning off baby beeves the year round—

(1) On the part of the buyer, a sound knowledge of what "good doers" look like;

(2) On the property—well-planned subdivision, improved pastures, cultivation, and fodder conservation.

Improvements require a considerable outlay of capital, but in all cases where management has been sound the returns have made it well worth while.

It should always be remembered that the improvements are permanent, and that they enhance the value of the property.

SHEEP ON THE FARM.

Sheep should have a permanent place on any farm on which conditions are suitable. One of the advantages of sheep is that they provide two distinct sources of income annually—wool and mutton—besides their natural increase.

In Queensland, merino sheep constitutes about 97 per cent. of our total number. This breed is especially adapted to conditions in the central and western districts of the State, but when forced to breed and develop in an unsuitable environment, constitutional weakness is a real risk.

British breeds have been developed and maintained under conditions where environment has influenced adaptability to Queensland conditions. In mixed farming districts these breeds—especially the pure-bred rams—can be used with advantage. The Corriedale originated in New Zealand, and the improvement of the breed has been progressive both there and in Australia. In Queensland, the Corriedale is regarded as a dual purpose sheep coming between the merino and pure British breeds, overlapping both in adaptability to a considerable degree.

In sheep breeding, local conditions should decide the system of production.

Sheep-breeding under diversified farming conditions where the British breeds are used is entirely different from merino-breeding in the West. The merino is bred under purely pastoral conditions, and the progeny is retained for wool and mutton production. With the imported mutton breeds, the aim of the farmer is to dispose of the progeny at the earliest marketable age. To do this successfully, two major points should be observed—

(1) The use of pure-bred rams of quick-maturing qualities suitable to location and conditions.

(2) Availability of suitable pasture or cultivated crops for ewes as soon as their lambs are dropped, and for topping off the lambs.

Other considerations of importance are the suitability of the ewe flock for wool production as well as for breeding; economy in pasturing the ewe flock from the time the lambs are taken off until the next drop of lambs; the general health of the flock and freedom from parasites; fodder provision for carrying the flock successfully through periods of scarcity; and culling the breeding flock for age while they are still capable of being fattened and sold at a profit. To start successfully in breeding, whether for wool, mutton, or for fat lambs, healthy sheep are essential. This may mean paying more for young sheep, but it will generally prove the best and safest policy.

THE CORRIEDALE AS A FARMER'S SHEEP.

As an all-round general utility farmer's sheep, nothing beats the Corriedale. There is no better ewe for the production of fat lambs. Joined with one of the Downs rams—such as the Dorset Horn or the Southdown—the lambs they produce are first-class.

Corriedale ewes are docile, good doers, and great milkers.

In Queensland there is a tendency to breed the Corriedale too fine, thus defeating the object for which the breed was evolved.

No finer wool than a 56 counts should be tolerated in the Corriedale stud. To get the fleece as fine as merino counts can only be done at the expense of constitution—one of the Corriedale's most important characteristics. Growers of pure-bred Corriedale sheep would be well advised to cull rigorously any animal showing too fine a tendency.

SOME EVILS OF OVERSTOCKING.

Stocking capacity is a point in the management of pastoral lands which is often neglected. It should be accepted as a truth that two well-fed sheep will give a greater monetary return than three half-fed animals and more than four half-starved sheep. The return from properly nourished sheep would be probably even higher were their greater resistance to internal parasites taken into consideration. Some of the evils of overstocking—altogether apart from total losses—are loss in wool per head, as the result of unthrifty growth; a possible break in the staple; poor lambings; a distinct loss on those animals which should be turned off as fats; and last, but not least, the erosion of country, of which overstocking is an important cause.

From the point of view of returns alone, it will be found that over a period of years a property stocked well within its carrying capacity will average far better returns than one where overstocking is the policy of the management.

Some graziers put forward the argument that, taking lean years into consideration, they have to stock to over-capacity to make ends meet. This policy is, however, considered to be wrong, especially when returns are averaged over a number of years.

CARELESS BRANDING.

Slovenly methods in the branding of stock, particularly cattle, are in evidence far too frequently, the results being most undesirable in many respects. Quite often the carelessness with which the branding irons are applied involves cruelty, although it may be unintentional.

It is cruel to hold the hot iron on an animal until the skin is burnt through, and it cannot be justified on the score of necessity. This practice may be due to underheated irons, but, on the other hand, it may be due to over-hot irons held on the skin a fraction of a second too long, or with too much pressure. Such branding causes blotches, and very often the actual letters or figures are undecipherable. The skin in the area involved is ruined for tanning purposes, and festering sores may result. Identification of the animal by means of such a brand is rendered very difficult, if not impossible.

It is a well-known fact that, on large stations, where thousands of calves are branded yearly, and where speed is a factor in the handling of large mobs, the standard of branding is much higher than on some small holdings—such as farms, where only two or three calves may be branded at irregular periods.

Dairy Cattle—Pure-bred or Grades?

THE question is often asked: Which is the more profitable—pure-bred or grade dairy cattle? The difference in value of pure-bred and high-grade dairy cattle lies in the higher selling price of the pure-bred. Dairy farms which are so equipped that they can handle the record work effectively will find more profit in pure-bred than in grade cattle. There is a steady market for high-quality pure-bred cattle at prices which net good returns to the breeder. Whether pure-bred stock will show the best results with any particular dairy farmer depends, however, on his keeping authentic records, and also on his ability as a salesman. Pure-bred cattle which a breeder is unable to sell are no more valuable to him than an equal number of good grades.

A herd of carefully selected grade cows will produce as heavily as the average pure-bred herd, for the reason that they can be culled more closely, as their lower value does not encourage keeping an animal which is not a profitable producer. There is always a good demand for the female offspring at payable prices. Any person going in for dairying for the purpose of producing milk or cream, and not with the idea of gaining a large part of his income from the sale of stock, may do quite as well with grades as with pure-breds.

As in most things, success with dairy cattle depends on the individual farmer himself, and whether grade or pure-bred cattle are more desirable can be settled only when the particular conditions surrounding the individual case are considered.

It is sometimes stated that grade cows are better than pure-bred animals. This is not so, but it is true that some grades are better than some pure-bred stock.

One very important fact to remember, however, is that the herd sire should always be a pure-bred. Unfortunately, this is not sufficiently understood by some Queensland dairy farmers, and this accounts to a very large extent for the poor type of dairy cattle one sometimes sees when travelling through the country.

VARIATIONS IN CREAM TESTS.

Many dairy farmers sometimes wonder why their factory returns show variations in the fat tests of their cream. Actually, variations are bound to occur.

Conditions under which milk is separated lead to changes in cream tests, as shown by the following facts:—

The separator should always be run at the speed directed by the manufacturer. It is better to turn at too high a rate than too low, for, in the latter case, the fat loss in the skim milk is increased in proportion to the decrease in the number of revolutions.

The milk must be allowed to enter the bowl freely during separation. The level is automatically controlled by the float, and if the flow is partly shut off, a higher testing cream will result. An over supply will result in a lower testing cream, and, more important still, excessive fat loss will occur.

Milk is at the best temperature to be separated as it comes from the cow, as it is less viscous than at lower temperatures, so runs easily through the separator, and more perfect separation of the fat results. At lower temperatures, due to the viscosity of the milk, separation becomes more difficult with greater fat losses. It is doubtful whether any machine will do good work if the milk is below 80 degrees Fahrenheit.

The quantity of skim milk or water used to flush the bowl usually varies considerably from day to day, and may cause a variation in the test of 2 to 5 per cent., depending on the quality of cream. Vibration of the separator causes the skim milk and cream to be shaken together, so that they do not find their way to their respective outlets. Fat losses are increased by the escape of fat globules through the skim milk outlet.

Other factors which influence fat losses are the cleansing of the separator and the condition of the milk, but these should not cause any difficulty where there is a proper appreciation of the necessity of hygienic methods.

There is a daily variation in the fat content of the mixed milk from the herd, and this is sometimes appreciable. This affects the test of the cream, but does not influence the quantity. For example, if a herd produced 100 lb. of milk with a fat test of 4 per cent., there would be 4 lb. of butterfat, while, if the fat were 5 per cent., 5 lb. of butterfat would be the result.

SELECTING A DAIRY HEIFER.

In the selection of a dairy heifer, the form and general character will, to a great extent, indicate whether she will develop into a good producer. When a heifer is quite young, the trained eye of the judge can see its dairy value and can discern the dairy type as distinct from the beef type. The production records of her ancestral dams on both sides are important factors in determining her future dairy value, while constitution is also important.

The form of the heifer with a future as a profitable producer is, in miniature, that of a good type, fully-developed dairy cow. Dairy

characteristics are indicated by an absence of surplus flesh; she is somewhat angular and spare. The head is typical of her breed, the eyes large and bright, and muzzle large, ears of average size, neck lean and lengthy, sloping with the shoulders. She is sharp over the shoulders, ribs well sprung, with good heart girth. The forequarters are light. Digestive capacity is indicated by the depth through the barrel from the centre of the back to the navel. Good depth indicates ample capacity to convert food into milk. The greater the depth through the middle, the greater the production is likely to be. The back is straight. There is a good length from the hip to the pin bones, and from the hip to the flank. The thighs are flat and free from fleshiness; the line of the thigh is incurving. The bones should be light and not coarse. The tail should be thin and free from flesh. All of these points should indicate that there is no tendency to lay on flesh.

The udder (as yet undeveloped), milk veins and wells are reliable indications of the heifer's future value as a dairy cow. The skin covering and surrounding the immature udder is soft and loose with teats well placed. The milk veins can be followed with the finger and milk wells gauged. Comparatively well-developed milk veins and large milk wells also are important points in judging a dairy heifer.

CREAM DELIVERY IN SUMMER.

Frequent and early delivery of cream to butter factories in summer is an important point in dairy practice. Daily delivery is not always possible in some districts, but nothing less than a four times a week delivery should be the rule from October to March, inclusive.

The holding up of supplies and delaying the cream carrier for the purpose of making certain that the morning's cream goes with the cream obtained previously should be avoided. The mixing of newly produced warm cream with older and cooler cream is not infrequently the cause of cream being graded down on delivery at the factory platform.

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

It has been reported that some dairy farmers make a practice of holding up the cream carrier for the purpose abovementioned, and, even were this not detrimental to their own cream, it is somewhat selfish and unfair to neighbouring farmers who desire their cream to arrive at the factory as early as possible.

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

A sound summer slogan for all cream suppliers is: "Frequent and early delivery and test around forty!"

COST OF LOSSES IN SEPARATION.

Every dairyman knows that a loss of milk-fat in separating means loss of money, but many do not realise the full extent of the loss. There is a small amount of fat which is not recoverable by mechanical separation; so this loss is unavoidable. A loss of 0·08 per cent. is not excessive, but if it is higher, either the mechanism or the manipulation of the separator is at fault.

The table hereunder will give some idea of the position when the actual loss of fat exceeds the amount which is not recoverable by mechanical means.

Assuming that the average yield of milk is the modest amount of 1 lb. of commercial butter to 23 lb. of milk, the loss will be as follows:—

Per cent.			Commercial Butter.
Loss of	0.08 is equal	to loss of	1 lb. in 50 lb.
„	0.09 „	„	1 lb. in 44 lb.
„	0.1 „	„	1 lb. in 40 lb.
„	0.2 „	„	1 lb. in 20 lb.
„	0.3 „	„	1 lb. in 13.3 lb.
„	0.4 „	„	1 lb. in 10 lb.
„	0.5 „	„	1 lb. in 8 lb.
„	0.6 „	„	1 lb. in 6.6 lb.
„	0.7 „	„	1 lb. in 5.7 lb.
„	0.8 „	„	1 lb. in 5 lb.
„	0.9 „	„	1 lb. in 4.4 lb.
„	1.0 „	„	1 lb. in 4 lb.

On the same basis of yield of butter from milk, a herd of cows producing 50 gallons of milk a day will produce in one year 187,062 lb. of milk yielding 7,482 lb. of commercial butter, which at 1s. per lb. is worth £374 2s.

A loss of ·1 per cent. would cause a loss of £9 7s., and a loss of 1 per cent. would be equivalent to a loss of £93 10s.

This example will serve to emphasise how necessary it is that a separator should be maintained in perfect order and be operated continually at its correct speed.

A HANDY MILK CAN CART.

Here is an illustration of a cart for easy handling of heavy milk cans. By simply tilting the handle, it picks up the cans easily. The drawing explains the

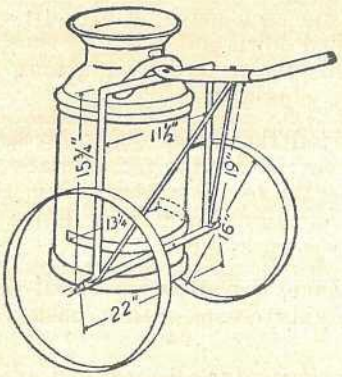


Plate 242.

dimensions. This device will accommodate 5-gallon cans just as easily as the larger ones.

Paddocks for Pigs.

FARMERS who have not already adopted the practice are advised to give careful consideration to the advantages of running pigs on the grazing system as compared with the intensive penning system which, until a few years ago, was the recognised practice of most pig keepers.

There is little doubt that the old custom of confining pigs to small pens resulted from the desire to produce very fat carcases. Present-day buyers demand leaner pork and bacon; so it is necessary to alter pig-raising practice accordingly, especially in respect of breeding, feeding, and penning. Provided pigs are bred to the correct type—that is, pigs intended for light porkers bred from quick-maturing stock, and pigs intended for baconers bred from later-maturing stock—they may be kept under grazing conditions from birth until fit for slaughter with very good results. Pigs kept in paddocks throughout their lives have a tendency to grow rather than fatten, and it is the lean, growing pig, and not the fat pig, which is required for meat.

When grazed, pigs find a lot of their food in the form of pasture or forage crops specially grown in the pig paddocks, and these foods usually require less labour and are cheaper than other pig foods. The pigs not only do their own harvesting, but also return a good amount of manurial matter to the soil, thus maintaining or improving soil fertility.

With the run of a good paddock containing some pasture or green crop, there is very little chance of pigs suffering from mineral or vitamin deficiency. This is a decided advantage over the intensive penning system, in which ill-health often results from a lack of knowledge or care in attempting to supply a complete diet. Penned pigs often suffer from dietetic disorders, and when turned out on pasture recover rapidly.

Under the intensive system, it is necessary to have buildings, floors, and drains well constructed in order to maintain a safe standard of hygiene. This also means extra labour and water for cleansing pens.

There is little, if any, difference in the costs of establishing a good paddock piggery and a good intensive piggery. One of the most important features of a paddock piggery is that the work of tending the pigs is much more congenial, for the only cleaning-up of the piggery consists of cultivating or resting the pig paddock and moving the sheds and troughs, which should be built on skids to allow of easy transport.

Probably the most practical method of controlling worm infestation in pigs is to run them in paddocks which can be cropped, fed off, and ploughed in rotation. This system and the use of moveable equipment is a very satisfactory method of pig raising under Queensland conditions.

ROUNDWORM IN PIGS.

Frequently, pig farmers ask for an explanation as to why their young pigs do not grow at a normal rate and do not reach bacon weight till, perhaps, about twelve months old. Some also state that losses among their young pigs have occurred at intervals over a number of years.

One of the chief causes of these troubles is a roundworm which is often found in large numbers in the small intestine. When a herd is infested the worms are frequently passed by the pigs, and, as they may measure up to 15 inches in length, are easily seen in the dung in the sties. The animals become infested through swallowing an egg which contains a very minute worm. These eggs hatch in the small intestine, and the small worms to which they give rise burrow into the intestinal wall and are carried by the blood stream into the liver and lungs. The young worms then leave the lungs and crawl up the windpipe into the mouth. They are then swallowed, and so reach the intestine once more, and this time they settle down and grow to maturity. The presence of the young worms in the liver and lungs causes serious disorders which may cause death, usually from pneumonia. If the animal survives, it remains stunted and sickly, and may have a short, hard cough.

This worm is, fortunately, in a way, harmful only to animals under about four or five months old, and in these young animals the effects of an infestation may be very prominent just after weaning.

The worms are easily removed with oil of chenopodium. Details of treatment with this drug may be had on application to the Animal Health Station, Yeerongpilly.

Treatment, however, should not be regarded as the only measure to be adopted for the control of this worm. Prevention of infestation is far more important, and this can only be ensured by strict attention to sanitation and other measures aimed at preventing the young pig picking up the worm eggs which are passed out in the dung. The regular removal of all manure, the maintenance of a high standard of sanitation in the sties and yards, and a paddock system of rearing go a long way to keep the infestation below the point at which it becomes harmful. Furthermore, the fact that pigs on a good balanced ration can fight more effectively against the evil effects of the worms than animals which are regarded as merely farm scavengers should not be overlooked.

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire ..	White Leghorns, Australorps, Rhode Island Reds, and Langshans
F. J. Akers, Eight Mile Plains	Elmsdale ..	White Leghorns and Australorps
E. J. Blake, Rosewood ..	Sunnyville ..	White Leghorns, Australorps, White Wyandottes and Rhode Island Reds
R. H. & W. J. Bowles, North Rockhampton	Gienmore Poultry Farm and Hatchery	White Leghorns and Australorps
J. Cameron, Oxley Central ..	Cameron's ..	Australorps and White Leghorns
M. H. Campbell, Albany Creek, Aspley	Mahaca Poultry Farm and Hatchery	White Leghorns and Australorps
J. L. Carrick & Son, Manly road, Tingalpa	Craigard ..	White Leghorns
N. Cooper, Zillmere road, Zillmere	Graceville ..	White Leghorns
R. B. Corbett, Woombye ..	Labrena ..	White Leghorns and Australorps
T. G. Crawford, Stratford ..	Rho-Isled ..	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme ..	White Leghorns, Australorps, and Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros. ..	White Leghorns
Rev. E. Eckert, Head street, Laidley	Laidley ..	Australorps, White Leghorns, and Langshans
Elks & Sudlow, Beerwah ..	Woodlands ..	Australorps and White Leghorns
W. H. Gibson, Manly road, Tingalpa	Gibson's ..	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros. ..	White Leghorns
G. Grice, Loch Lomond ..	Kiama	White Leghorns
J. W. Grice, Loch Lomond ..	Quarrington ..	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. & C. E. Gustafson, Tannymorel	Bellevue ..	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby ..	Anconas and White Leghorns
J McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Australorps, and Brown Leghorns

Name and Address.	Name of Hatchery.	Breeds Kept.
A. Malvine, junr., The Gap, Ashgrove	Alva ..	White Leghorns and Australorps
H. L. Marshall, Kenmore ..	Stonehenge ..	White Leghorns and Australorps
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White Leghorns, and Langshans
J. A. Miller, Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, Brown Leghorns, and White Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric Hatcheries	White Leghorns
J. W. Moule, Kureen	Kureen ..	White Leghorns and Australorps
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Silver Campines, and Light Sussex
S. V. Norup, Beaudesert Road, Cooper's Plains	Norup's ..	White Leghorns and Australorps
H. W. & C. E. E. Olsen, Marmor	Squaredeal Poultry Farm	White Leghorns, Australorps, Black Leghorns, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Rhode Island Reds, Light Sussex, White Wyandottes, Langshans, Khaki Campbell and Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Oxley Central	..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Australorps, Langshans, Rhode Island Reds, and Brown Leghorns
G. R. Rawson, Mains Road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View Poultry Farm	White Leghorns and Australorps
H. K. Roach, Wyandra	Lum Burra ..	White Leghorns and Australorps
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, The Gap, Ashgrove	Smith's ..	White Leghorns and Australorps
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
A. J. Teitzel, West street, Aitkenville, Townsville	Teitzel's ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's Poultry Farm	White Leghorns and Australorps
W. A. Watson, Box 365, P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Herberton road, Atherton	Weaver's Stud Poultry Farm	Wyandottes, Indian Game, Barred Rocks, Australorps, White Leghorns, Anconas, Rhode Island Reds, Buff Orpingtons, Black Orpingtons, and Buff Leghorns.
T. Westerman, Handford road, Zillmere	Zillmere ..	Australorps and White Leghorns
H. M. Witty, Kuraby	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	Brown Leghorns, White Leghorns and Australorps
R. H. Young, Box 18, P.O., Babinda	Reg. Young's ..	White Leghorns, Brown Leghorns and Australorps

FEEDING COSTS IN THE FOWLYARD.

Every effort should be made to keep production costs down to a minimum. On many farms this is being done, but on many more feeding costs are excessive.

The actual costs of foodstuffs is governed by supply and demand; therefore no material saving can be made at this point. Any change in the present ration fed is of doubtful value, because such a change may result in lowering the egg yield. Again, it is doubtful whether any substitute for the existing rations would be economical.

This only leaves the actual practice or management of feeding open to question. Summed up, the cost of production is governed to a great extent by the food consumed and the wastage. Any reduction in food consumption is followed by a reduction in egg production; therefore feeding costs cannot be reduced by feeding less food.

Food wastage is an appreciable factor in feeding costs. This applies irrespective of the actual cost of foodstuffs, to dry mash, wet mash, and grain feeding. By far the greatest wastage occurs in the dry-mash system of feeding. This fact has been pointed out to many farmers, who have immediately remedied the fault. Faultily constructed hoppers are the cause of nearly all the wastage that occurs with the dry-mash system.

There are many different designs of dry-mash hoppers, and a plan of a suitable hopper can be obtained free on application to the Department of Agriculture and Stock, William street, Brisbane. This hopper has other important features besides economy. The most important part of any feed hopper is the feeding trough, which should provide ample space for the birds to eat, at the same time preventing any waste.

The hopper recommended embraces these features within certain limits. It also permits the mash to fall freely. It must be understood, however, that some mashes will run or feed more freely than others. Therefore, no one hopper will prevent different grades of mash overfilling the trough and allowing the mash to be easily scratched out. The hopper referred to has a lath along the front of the trough, and if the mash runs too freely and if wastage occurs, this lath can be shifted to reduce the space. This hopper is easily and cheaply constructed.

Recently one poultry farmer installed several of this class of hopper, and he stated that, although production was maintained at the same level, the hoppers brought about a saving in food costs of approximately £4 per week. Some time ago another farmer installed similar hoppers and reduced feeding costs from five bags to three bags of laying mash each week. These two illustrations should be sufficient to demonstrate that wastage can be prevented. In the latter instance, the farmer was confident that there had been no wastage of food on his farm.

To find out if wastage is occurring, a rough estimate may be obtained by looking up the purchases of foodstuffs for the previous month or a longer period. As the birds consume approximately equal quantities of mash and grain, the quantities (by weight) purchased should be approximately the same. If the quantity of ingredients for a mash exceeds the quantity of grain purchased, it indicates that the excess quantity is being wasted.

A more accurate method is to count the number of birds in one shed, then empty the hopper, refill it, and record the weight of mash supplied; the period which the mash lasts will indicate the true position, as each bird will consume on an average 2 oz. of mash daily. For example, 100 birds supplied with 100 lb. of mash will consume it in eight days; if it lasts only six days each bird is wasting 4 oz. weekly; if it lasts seven days there is a wastage of 2 oz. per bird weekly. Such a small wastage is outlined—of 2 oz. per bird weekly—does not appear to be of great importance, but with a flock of 1,000 birds this would amount to 6,500 lb. in a year and would cost about £35, based on present feeding costs.

By putting into practice the advice offered, wastage will be minimised and the margin of profit increased.

BLACK COMB DISEASE IN FOWLS.

Black comb disease in poultry occurs frequently throughout the State from October to March. It usually affects laying hens, and is responsible for heavy losses to the industry either by death or decreased egg production.

Where treatment is prompt the mortality does not appear to be as extensive as when treatment has been delayed. Again, early treatment appears to assist in getting affected birds back into production much more quickly than when it has been deferred.

The first indication of the disorder is a bird's pronounced loss of appetite, followed in the course of a few hours by a darkening of the comb. In fact, it is not uncommon for 25 per cent. of the flock to have a very darkened comb within twenty-four hours of the first sign of the trouble.

In the early stages of this disease the temperature of sick birds rises. This induces thirst. As the disease develops, little desire for water is in evidence, and as treatment for this trouble is given by means of the drinking water, the necessity for prompt action is obvious.

On further examination of the sick birds, it will be found in most cases that the crop is full—an indication of the suddenness of the attack. This condition of the crop has caused many breeders to attribute the trouble to the food and water. As the disorder advances, the legs of the Leghorns particularly, become very much darkened in colour; and if the feathers of a bird of any breed are turned back, the skin will be found to be darker than usual. Diarrhœa has been observed in some cases, but it is not apparent in all affected flocks.

The mortality from this disorder appears to be governed largely by the general condition of the flock and the rapidity with which treatment is applied. Where prompt measures have not been taken, losses have been as high as 20 per cent.; but where early treatment is given deaths have been as low as 1 or 2 per cent. The loss from deaths, however, is not the only important factor. Egg production has been observed to fall from 60 to 5 per cent. within six or seven days.

Treatment.—Several proprietary mixtures are used with apparently beneficial results, but, in perference to deferring treatment until these mixtures are procurable, the breeder is recommended to administer Epsom salts to the birds in the drinking water at the rate of 1½ to 2 oz. to the gallon.

SOME POINTS IN POULTRY MANAGEMENT.

In poultry farming, culling serves two important purposes. By getting rid of the culls, all of the feed goes to the laying hens; and only the best hens remain in the flock to serve as future breeding stock.

Other sound points in poultry farming include care in the handling and marketing of eggs. Eggs are considered to be one of the best of foods, yet in spite of that fact the quantity consumed by Queenslanders (estimated on an annual *per capita* basis) is extraordinarily low. Why more eggs are not eaten is probably because their regular dietary value is not more widely appreciated. There are other reasons, too; for instance, the delivery of dirty-shelled eggs and the production of fertile eggs in hot weather. Clean nests, clean floors, and clean containers will soon overcome the dirt difficulty; while selling off all the male birds at the close of the hatching season is the answer to the other problem. Eggs should be gathered two or three times daily, and marketed at least twice weekly in hot weather.

In looking after poultry, even with the best of care, we often overlook a very common source of trouble, and that is the house fly. Flies can go a long distance and carry germs and contamination from a diseased flock, or from microbe-infested filth. The industrious pullet will chase and catch flies just for the fun of it, and, at the same time, take in all sorts of germs or worms. So it would be wise to clean up every attraction for flies and spray the fowl-houses just before cleaning them out. For general health reasons, apart from the requirements of the fowl run, it pays handsomely to swat the fly.

PROTECT EGGS FROM MOULD.

Under humid summer conditions, eggs are more prone to decomposition than at cooler periods of the year. This is not because of the effect of the climate on the egg itself, but because of the rapidity with which mould growths develop during warm weather. If it were practicable to prevent the egg coming in contact with moulds, decomposition of the egg from this cause would not occur.

If fowlyards are allowed to become littered with straw, dry grass, and similar material, mould spores will develop abundantly. Consequently, the poultry farmer is advised to clear away all rubbish, and do all that he can to prevent the development of moulds.

Dampness in any degree is conducive to the rapid growth of moulds; consequently, every precaution should be taken to ensure that the nesting material is dry and clean, and that the eggs and fillers used for packing them are dry.

Two recent examples of how easily the quality of eggs may be depreciated are cited:—In one case it was found necessary, because of a muddy poultry run, to wash every egg. The washing was well done, stains were removed with an odourless sandsoap, and the eggs were clean when packed; but, unfortunately, they were packed in strawboard fillers, with a slight bead of moisture on the shell. In the course of two days, when these eggs had reached the market, quite a number of rots had developed. As the poultry farmer concerned had a reputation for

marketing good eggs, the agent retained the eggs that were apparently good on arrival for a further two days, but, on testing, many more rots were found.

The second case was that of a farmer who had well-grassed runs for his fowls. Although nests were provided, many of the hens nested in the grass. Complaints as to the quality of the eggs were received by the agent to whom these eggs had been consigned, with the result that the next consignment to reach the floors was carefully candled. Candling disclosed a number of rots. Eggs which were in apparently good condition were retained on the floors for another two days and again candled, when more rots were revealed. This led to an investigation by the Department of Agriculture and Stock, when it was found that only the eggs that had been laid in the grass were affected, and that the rottenness was caused by mould growths which had gained access through the pores of the shell. Providing the hens with more clean nests and so discouraging them from laying in the grass corrected the trouble.

These examples indicate how easily the quality of eggs can be affected, and that it is essential—particularly during hot, humid weather—to protect eggs from decomposition caused by moulds.

SIZE OF EGGS.

Although the internal quality of the egg is of primary importance in determining price, the factor of size cannot be overlooked. Eggs are usually graded for sale according to size; but those averaging 24 oz. to the dozen are in greatest demand, not only in Queensland, but in the markets to which our surplus production is consigned.

In these circumstances, every poultry raiser should strive to produce eggs that meet the requirements of the market. To do this, it is necesary to select breeders that will reproduce progeny capable of laying the maximum number of eggs closely approaching 2 oz. in weight. Most poultry keepers when selecting their breeders know very little about the early performance of their stock in respect of size of egg—particularly the size of egg that a hen laid during her first year of production. As a breed is more prolific during the first laying year, it is then that the egg size is of particular importance.

All pullets when commencing to lay produce an egg very much undersized. Some birds take a considerable time before their eggs reach the most desirable commercial size and others, again, may take only a week or two. As it is an inherited factor, egg size is one of the chief points to be considered in selecting future breeders. Many pullets—the breeding stock of the future—will be coming into production within the next month or so, and it is suggested that poultry breeders who are not entirely satisfied with the size of egg from their flocks should take the opportunity of selecting and marking pullets that commence to lay eggs of a 2-oz. standard early in life. Many of these birds may have to be rejected for some purpose or other, consequently the number selected should be large enough to allow for a reasonable percentage of rejections.

Kikuyu Grass—A Good Pasture but a Bad Weed.

INTRODUCED from East Africa some years ago, Kikuyu grass has gained favour with dairy farmers, although many old-established stands now seem to be declining in productivity.

Kikuyu grass is a perennial which spreads rapidly over and through the ground by means of running stems. Both the surface and underground runners root freely at the nodes, anchoring the plant firmly in the ground and forming a dense turf which stands heavy trampling by stock. The stems carry a large quantity of leaf, and the stems also are very succulent. Under good conditions, Kikuyu grass makes a very good dense growth, often 2 feet or more in height.

In Queensland the grass has adapted itself fairly well to different districts. It does best under warm, moist conditions, but will withstand a considerable degree of cold and keep green in spite of fairly severe frosts. For this reason it is very valuable for late autumn and early winter feed. Its drought resistance is fairly good, and some success with the grass is reported from the Burnett and Darling Downs.

Kikuyu grass spreads most quickly and yields most heavily on loose, rich soils; and while it may provide fair grazing on some less fertile soils of a sandy or clayey nature, it is advisable to restrict plantings to rather productive soils, unless in special circumstances—such as when a grass is required for rough places or as a soil binder to prevent erosion. Kikuyu grass makes a heavy drain on the soil, and periodical ploughing or severe cultivation is necessary to improve the soil conditions.

In Australia, Kikuyu grass sets seed very rarely, and commercial supplies are not available. It is necessary to establish the grass by planting pieces of the runners.

In addition to its value as a pasture grass, Kikuyu grass has some value for bracken control. If planted out in bracken, Kikuyu attracts stock, which trample down the fern while feeding on the grass.

Although a very valuable grass in its place, Kikuyu grass may become a troublesome weed if it is permitted to encroach on ploughed land. For this reason, it should not be planted near areas likely to be required for cultivation. In wet weather portions of the grass are often broken off by grazing animals, and these pieces may be carried on the hooves to other portions of the farm, and become established after tramping in. Patches started in this way on land required for cultivation should be dug out immediately.

LUCERNE HAY.

Baled lucerne hay, or lucerne chaff, and maize grain are now recognised as the basis of all supplementary or drought feeding, if the fodder has to be transported over long distances. Increased attention is, therefore, being given to the production of good quality lucerne hay. Good hay containing 45 per cent. to 50 per cent. of leaf will always command a good price, while a weathered or sweated consignment will be hard to sell.

Very careful handling is required from the time lucerne is cut until it is stacked or baled for market. Prime lucerne hay should be green in colour, dry, free from weeds or rubbish, and should contain a high proportion of leaf. Prevailing climatic conditions are naturally an important factor, and, whenever possible, cutting should commence in bright, fine weather. Lucerne should be cut shortly after the first flowers have appeared, when numerous young shoots will usually be observed at the base of the crowns. When the plants are allowed to become over mature, actual loss of weight and feeding value occur, as leaf will be lost, and the stems will harden, thereby becoming largely indigestible. It is customary to commence mowing in the morning as early as possible, after any heavy dew has evaporated. During fine, hot weather, raking may commence about midday. Raking into windrows should, if practicable, be completed by nightfall, as much leaf may be lost if the lucerne is left too long in the swath. After wilting for a few hours in the windrows, fork into high narrow cocks which encourage the natural transpiration of moisture better than if broad flat cocks are made. If rain occurs the lucerne will require turning to prevent the formation of mould, but during fine, hot weather it is possible to stack within two days of cutting. Excess moisture will induce mould, and possibly combustion in the stack, while if the lucerne is allowed to become too dry, it will lose appreciatively in palatability, weight, and appearance. Before carting, the stems should be tested by twisting them between the hands, when any excess moisture will become evident.

Wherever possible, lucerne hay should be stored in shed, but if it becomes necessary to stack it in the field, a framework of logs should be laid down, care being taken to keep the centre of the stack high during building. Large stacks which are likely to be held for some years may be protected by thatching or by a temporary galvanised-iron roof.

Proximity and accessibility to the chief markets is obviously an important factor in the profitable production of lucerne hay for direct sale.

SEEDS OF NATIVE GRASSES.

Within recent years a considerable amount of interest has been shown both by pastoralists and by dairymen in the sowing-down of pastures of drought-resistant native grasses. Many of the graziers who have sought information concerning the availability of native grass seeds have desired to utilise the seed for the artificial reseeding of natural pastures which have been thinned out by drought. Numerous other sheep and cattle-raisers have been eager to sow down, on their own properties, drought-resistant native grasses from other parts of the State. The heavy losses sustained in many dairying districts during the recent drought stimulated a desire in many dairy farmers to test out the most renowned of the native pasture grasses under their local conditions.

The grasses in most demand for the purposes outlined above are the Mitchell grasses. There are four distinct types of Mitchell grasses (Curly Mitchell, Hoop Mitchell, Barley Mitchell, and Bull Mitchell), and of these, perhaps, the best one for general purposes is the Curly Mitchell.

Seed of Curly Mitchell is now being collected in large quantities for commercial purposes. If sown broadcast about 4 lb. an acre should suffice to give a good stand; and this quantity may be reduced by half if the seed is sown in drills with a combine.

In some circumstances, one or more of the other three types of Mitchell grasses are to be preferred to the Curly Mitchell, but so far as can be ascertained no seeds of these types are yet available.

While the purchaser of Mitchell grass seed has at present little choice in the matter of the origin of the seed (practically all of the seed being harvested in northern New South Wales), he should bear in mind that seed collected in his own district or in a district with similar climatic conditions is likely to be better for local sowing than seed from other sources.

Seed of Australian blue grass has been on the market for many years. This, also, is harvested in New South Wales, and, consequently, may not be as valuable as locally collected seed for sowing in Queensland.

GOOD SEEDS.

Although nearly everyone will agree that better seeds mean better crops, it must not be overlooked that better cultivation means better seeds.

Seeds to be good must have a high germinating capacity, be true to variety name, and free from weed seeds, inert matter, and disease or insect infestation. No matter how careful the grower may be, all crops will contain some plants other than those which it is intended to produce. A cleaning machine should, therefore, be used before the seed is offered for sale. In Queensland, as in every other part of the world, the most critical buyers will be found among the merchants with efficient cleaning machinery.

A modern seed-cleaning plant can make good samples of uncleaned seeds better, but it cannot make bad samples good. With a full knowledge of their machinery possibilities, most merchants are willing to

buy on a clean seed basis. They are not, however, inclined to purchase poor samples, and the usual market for seeds of indifferent quality is with dealers who have little appreciation of impurities. The actual seed-user who insists on buying his supply on a price rather than on a quality basis encourages the vendors of goods of inferior quality. Unfortunately, seeds of indifferent quality usually carry a large profit to the seller.

Good seeds cost money to produce and money to clean, and the general improvement of farm seeds rests largely with the farmers themselves. When practically every farmer insists on a high-grade product the demand for poor-quality seeds will cease. Only the best-quality seeds are worth buying.

WHY BIRDS SHOULD BE PROTECTED.

At this time of the year, when birds are nesting, an earnest appeal is made to all to become interested actively in the preservation of wild bird life. The value of birds in our rural economy is incalculable. It has been well said that the service that birds render in protecting forest trees "is more nearly indispensable to man than any other benefit they confer on him. Were the natural enemies of forest insects annihilated, every tree would be threatened with destruction, and man would be powerless to prevent the calamity. He might make shift to save some orchard or shade trees; he might find means to raise some garden crops; but the protection of all the trees would be beyond his powers. Yet this herculean task ordinarily is accomplished as a matter of course by birds and other insectivorous creatures without trouble or expense to man."

During recent grasshopper visitations, many thousands of starlings were to be seen feeding on the insects, but starlings were not alone in their assault on the common enemy. Every insectivorous bird fed to fullness on the hoppers. The indiscriminate shooting of bush birds has, therefore, nothing to commend it from any point of view.

Fortunately, very few native birds are not protected legally, but even the despised crow is a friendly ally in the continuous war against insect pests. Crows eat grasshoppers, and it takes a lot of hoppers to fill the craw of a crow. The crow also is an energetic scavenger. It eats carrion and maggots. From maggots come blowflies, and the loss to Australian woolgrowers caused by blowfly infestation runs into milllions of pounds annually.

THE PRESERVATION OF CONCRETE.

Concrete floors and troughs often show signs of wear soon after being laid down, a fault which is generally caused by the action of acids in milk and other pig foods. Unless properly surfaced, concrete becomes pitted, and may eventually break up. This deterioration may be prevented, or, at least, delayed by the right use of a special type of silicate of soda, which is cheap and easy to apply. "Quartzite" is its trade name, and when it is mixed with water the solution thus obtained is sprinkled on the surface of the concrete. It is soon absorbed, and, combining with the concrete, forms a tough coating which is resistant to water and acids under ordinary farm conditions.

To prepare the solution for use, one gallon of "Quartzite" silicate of soda is thoroughly mixed with four gallons of water. The five gallons of solution will be enough for three applications to an area of 300 square feet of concrete. Very dry or porous concrete will require a fourth application.

When making new concrete floors, the surface should not be finished off very smoothly, as stock will have difficulty in standing on it when it is wet. When the concrete is firm and almost dry, the solution of silicate of soda is applied with a spray pump, a watering can with a fine sprinkler, or a mop. The solution should not be flooded on; just as much as the concrete can quickly absorb is all that is required. A second, and later, a third application of the solution should be made as the surface dries out each time. For new concrete, three applications should be sufficient.

If so desired, the "Quartzite" may be added directly to the concrete when being mixed, at the rate of one-fifth of a pint of full strength for every bag of cement used. The "Quartzite" is added to the water used for mixing the cement. Care should be taken to ensure that the correct quantity is used, as too much "Quartzite" may make the mix sticky, and set too quickly.

When the first set of the concrete is complete, coat the surface with a solution of the "Quartzite" in the proportion of one part in four of water.

Worn floors and troughs may be renovated in the following way:— "The surface should first be scrubbed thoroughly with soap and hot water to remove grease and dirt. The cleaned surface should then be painted with the undiluted "Quartzite" and dusted while still wet with dry cement powder. This sets in a few minutes and provides a surface to which the layer of new concrete binds firmly. This layer consists of one part of cement to three parts of clean fine sand. When firm and drying, treat with the silicate of soda solution as suggested for new concrete.

Sound floors and troughs also will benefit by treatment with silicate of soda. The surface should be freed from grease as beforementioned. Four applications of solution will probably be necessary, and twenty-four hours after the last application any solution remaining should be removed from the surface.

Concrete floors and troughs treated in this way last longer, are easier to clean, and dry more quickly than untreated concrete. For best results, the concrete should afterwards receive a light treatment once a year.

When ordering silicate of soda for conditioning concrete, the purpose for which it is required should be stated, to ensure obtaining the right material.

A REGRASSING EXPERIMENT.

On a stock reserve at Condobolin, New South Wales, no vegetation had grown for many years. The surface soil had blown away and only scalded clay remained. As a result of reclamation work by the local pastures protection board and the Soil Conservation Service, the plain is now carrying a fair cover of herbage. A crop of oats, grown without fertilizer, was not grazed or harvested, but allowed to remain to protect the surface and re-seed. Other seeds of grass and herbage blown across the reserve by the wind were caught and fixed, and it now seems that permanent vegetation will be restored on what was quite a barren area. Other experiments were tried, but this one is reported to have been the most successful.

Marketing Bananas.

DURING hot weather, bananas which have been cut and left exposed to the sun for only a short period soon become quite unfit for sale, and the pulp is eventually reduced to a soft, "boiled" condition. Cutting should be done in the early morning, before the heat becomes severe, and care should be taken to keep the fruit covered completely, even from the early morning sun, while waiting to be carried or wired to the packing-shed.

The fruit should at all times be handled with the greatest care—in fact, the less it is handled the better—and for this reason it is wise to have the packing-shed right in the plantation, if possible. On cutting the bunch it should not be laid carelessly at the foot of the stem, which usually means it rests on a bed of sticks and dead weeds. A bed of leaves is easily and quickly formed if the bunch must be set down in the plantation, although a better plan is to carry it straight into the shed or to the end of the wire and there place it upright on bags or trash with the stalk leaning against a rail provided for the purpose. In this way, possible damage will be reduced to a minimum.

On being dehanded, the fruit should be allowed to "drain" for a few hours. Packing immediately after dehanding sweats the fruit in the case and makes bruising much easier. Care should be taken to ensure that fruit which is "sprung" or in the early stages of ripening is not packed, as it will quickly be reduced to pulp and be unsightly in a case of otherwise sound bananas. No fruit should be packed for southern markets from bunches in which some of the fingers are already showing colour indicating ripening. The fruit should be dehanded just at the collar joining the fingers to the main stalk. The most suitable knife for this work is one of a sharp, flexible, and very narrow type.

There is a right and wrong way to separate the hands into singles, if a "single" pack is desired. Tearing the bananas apart endways often peels part of the skin from the fruit and also bruises the stem,

thus setting up an entrance for organisms which cause blackend. The correct method of separating into singles is to grasp the cluster firmly with both hands at the stem end, then twisting one hand forwards and the other backwards, the fruit is separated easily and without any damage to the stalk end.

On completion of packing the cases should be packed on their sides in a cool, shady position to await transport to rail or market.

Should it be desired to use the "cluster" pack, the same method should be adopted, separating three or four instead of the single finger. If a cluster of three or five is used, a single banana should be added to make it a four or six. The secret of clusters is to have the fruit in twos.

THE CHOKO.

The choko is a popular vegetable, grown largely in Queensland for both market and home use. It has the advantage that, once planted, it comes into bearing each year from the original root. The plant will die down only during the coldest months, and in the spring will shoot again from the tuber which is formed under the ground.

The choko requires a rich loamy soil to which has been added a heavy dressing of well-rotted stable manure. Additions of dried blood and bone dust, or of manure during growth, are of great benefit, as, being a perennial and a heavy feeder, the choko's food requirements are considerable.

The method of planting the choko differs greatly from that used for other varieties of the same family. Whole choko fruits are used as planting material, the growth coming from the shoot from the kernel in the fruit. The fruit should be planted on the side with the broad end sloping downwards and the stem end slightly exposed.

A trellis is essential to satisfactory growth, although, if planted near a fence or old stump, the plants will spread over it very quickly. When chokos are grown commercially, it pays to erect a suitable trellis. This may be done with logs or rough timber. Sometimes an ordinary "T" trellis is used, over which strong fencing wire is stretched.

A good permanent trellis may be constructed as follows:—Two rows of strong posts are set firmly in the ground with a height of about 6 feet 6 inches above the surface, the rows being about 9 feet apart and the posts about 8 feet apart in the rows. The tops of the posts support cross timbers on which fencing wire is stretched with about 18 inches between the wires to carry the vines. Stays support the outside posts, and wires for trellising also should be stretched on these.

The choko takes some months to come into full bearing, but will commence to bear fruit generally about four to five months after planting. The plants seem to improve with age when properly cultivated and manured.

There are two varieties, the green and the cream. The cream-coloured variety is the more popular.

Chokos should be picked fresh and, after having been pealed, should be cut into suitable portions and boiled or baked.

BANANA CULTIVATION.

In normal seasons there is no tool so useful as a strongly-made four-pronged forked hoe with prongs about 7 inches long and a fairly short handle. With such a tool it is possible to cultivate hillside land to a depth of 6 or 7 inches and to easily bury the dead trash by the same operation. The waste stalks can be placed sideways across the hill and the soil turned in against them, thus hastening their decomposition. The method of using a forked hoe is to drive it into the ground with a good easy swing, then canting the handle slightly and at the same time pulling towards the user. This action turns the top soil under and leaves the surface somewhat roughened. Good cultivation at least twice each year should be the objective. It keeps the plants well down in the soil, and with a good short-handled forked hoe it is surprising how great an area can be covered in a day.

A long-handled light hoe is awkward to manipulate, and is of little use to a banana-grower farming under ordinary conditions.

The oft-explained method of desuckering, in certain seasonal circumstances, always gives beneficial results. Some soils are only capable of carrying one bunch and one following sucker at the one time; others are capable of carrying up to three bunches to the stool with suckers placed correctly to produce the second crop. When the unwanted sucker has been cut off at ground level and gouged out, it is an excellent plan to throw a couple of handfuls of soil into the newly made hole, thereby stopping the "bleeding" effect so noticeable, an effect which is very definitely harmful in dry weather. The plantation should always be trashed before desuckering, and, in ordinary seasons, by making the digging operations the last of the necessary trio most of the waste vegetative matter lying on the surface will be worked into the soil, to, in due course, enrich the land by building up humus, a substance so necessary in all forms of agriculture.

LADY FINGER BANANAS—CULTURAL METHODS.

The fruit of the Lady Finger variety of banana has a very pleasant flavour, its keeping qualities are good, and it is always in demand.

Alluvial flats with a subsoil of free clay suit the variety best, but it can be grown succesfully on hillsides of even contour where the rainfall is copious and regular, and where shelter is provided from heavy winds.

Thorough preparation of the soil is necessary, and, where possible, it should be worked to a depth of at least 12 inches. Healthy butts, at least nine months old, with a minimum diameter of 6 inches, are the best planting material. On the loamy flats, the distance apart should be 18 feet by 16 feet, with three followers; on hillsides and other less favoured sites, 15 feet by 15 feet, with two followers.

To prepare for planting with two followers, the butt should have about 2 feet of the pseudo stem left and all visible eyes or buds gouged out with the exception of two, which should be on opposite sides. The same method is adopted for three followers, except that three buds are left spaced equally round the butt.

Two, or, as the case may be, three suckers will appear in a short time after planting and trees are allowed to grow, but all other growth must, for at least nine months, be removed as soon as convenient after it appears above the soil. After the selected suckers have made two-thirds of their growth towards maturity, giving them a height of approximately 8 feet, a follower can, under favourable conditions, be selected on each plant in a straight line away from the parent plant and left to form the fruiting material for the second crop. The growth habit by which successive suckers may be selected in a straight line away from the original plant will persist for the life of the plantation, and all other growths should be removed as soon as possible. By careful attention to this and other cultural methods, maximum returns can be expected and realised.

Periodical applications of fertilizer, when the soil is of average fertility, will have beneficial results.

Cultivation should be shallow to avoid destroying the root system.

The planting of Mauritius beans down the centre of each row at a distance of 30 inches between plants would ensure a good mulch during hot summer weather and considerably retard weed growth.

Covering of the fruit with a suitable material, as advocated for Cavendish and Mons Marie varieties, during their maturing periods amply repays the grower.

HUMUS IN THE CITRUS ORCHARD.

Humus is an organic compound formed by the decay of vegetable matter in the soil, and is of great value in the citrus orchard.

Comparatively small amounts of humus are present in hot, dry localities on account of the higher temperatures. In such areas the humus is burnt out of the soil rapidly and does not accumulate to the same extent as it does in a moist or cool climate. Humus possesses the power of retaining moisture in the soil, whilst other advantages are that it makes heavy soils more porous, and sandy soils more cohesive.

It is possible to maintain a high humus content in the soil by annually working in vegetable matter—such as stable manure, green cover crops, leaves, and weeds—for these, if used, supply decaying vegetable matter to the soil.

When the humus content is low, sandy soils lose water quickly, and heavy soils become hard and baked after heavy rains. Under such conditions trees make poor growth, and the tops of the trees become thin. Small fruit may be formed, and it is subject to sunburn and splitting.

It is, unfortunately, difficult to obtain anything like adequate supplies of stable manure or similar material of a humus-forming nature, and, in order to make up the deficiency, the growing of green manure crops between the trees at times to correspond with the rainy season is recommended. Growing cover crops during dry periods is not desirable, because trees must not be deprived of the available soil moisture at such times. Under average conditions, green crops should be planted in citrus orchards about February and may be turned under about June.

TOMATO MARKETING.

A heavy spring crop of tomatoes in Southern Queensland districts is in prospect. A comparison of prices during the past season places the Southern Queensland output in a secondary position. There is strong reason to believe that this is influenced by (1) poor maturity of fruit, and (2) faulty packing. Another comparison shows that coloured fruit brings much better prices than green fruit. The question naturally arises as to why green fruit should be delivered when a higher price is obtainable for coloured grades.

No difficulty in marketing coloured fruit should occur until late in the season. By that time supplies will have begun to ease off, enabling extra care to be taken. Growers may achieve a desirable maturity standard by picking only matured fruit, and packing to a colour standard, any green fruit being left in a cool place until fit for a later consignment.

Difficulties may be experienced on large plantations, but these may be largely overcome by appointing one of the workers as a special packer. Having everybody on the farm doing all sorts of work does not make any man an expert in any particular job. A specialist in any type of work becomes fast and expert, always doing better work than the jack of all trades.

In furthering the aim of better packing, free tuition is available to growers from the Department of Agriculture and Stock by applying to the Under Secretary.

THE AFTER CARE OF GRAFTS.

Any deciduous fruit trees which have been grafted this season should be examined from time to time, and when the growth is about 8 inches long the wax cloth and string should be cut through with a sharp knife to allow for expansion; otherwise the string will cut into the bark and ruin the graft. Many grafts are ruined each year because of growers omiting to do this necessary work.

When cutting, first cut through the wax cloth and string only; do not remove the wax cloth. The scion will push it off, and until then it serves a very useful purpose in protecting the cut surface of the limb from the sun and spores of fungus diseases.

Many fungus diseases are what might be called wound parasites, and an unprotected cut surface is an easy place of entry for them.

Do not allow shoot growth from the stock to overcrowd or rob the scions, and when checking any such growth, note whether any grafts have failed; if so, thin out the shoot growth so as to allow two or three shoots to develop sufficiently and in the right place, so that they can be budded to take the place of the dead graft.

The best time for the budding of these shoots will be from the end of January to the middle of February. The shoots to be budded must be making growth, or else there will be no sap flow to form the union.

The buds should also be taken from the current season's growth, and from shoots that are still making growth. The buds should be cut from about the centre of the shoot, as they will prove more satisfactory than those taken from near the base or tip.

The Fruit Market.

J. H. GREGORY, Instructor in Fruit Packing.

OCTOBER was a month in which fruit supplies were in the doldrums. Many varieties of fruit reached the end of their season, and the new season fruit was only starting to arrive. Some small consignments of early stone fruits came on to the markets, and regular lines of mangoes were received.

The usual seasonal warning against marketing immature fruit is given to growers. The present tomato crop has illustrated the necessity for care in this connection. The season opened with prices at a level of 15s. and prospects of the maintenance of high values, but growers, through sending immature fruit, reduced values in a few days to below 8s. a case.

Green pineapples still form the basis of complaint on Southern markets. It is hard to understand why growers have to be continually advised not to pack immature fruit.

Prices for good quality bananas remain at satisfactory levels. Many consignments show the effects of the cold, dry period we have just passed through, the fruit being of a thin, angular type.

Mangoes are now arriving in increasing quantities. Northern growers will do well, but should not use a stick to remove the fruit from the trees. Many cases contain bruised and damaged fruit.

Passion fruit prices remain firm.

Apples are now deteriorating in quality, and Southern growers would be well advised to carefully select hard varieties and smaller sizes for this period of the year. Very soon the competition with stone fruits will be keenly felt.

Growers are reminded again that the age-old basis of marketing still pays best:—

"Quality fruit, packed well and handled carefully."

The following were the ruling market prices during the last week of the month of November, 1939:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Small, 5s. to 9s.; sixes, 10s. to 12s. 3d.; sevens, 12s. to 14s.; eights, 9s. to 14s.; nines, to 15s.

Sydney.—Cavendish: Sixes, 8 to 13s.; sevens, 13s. to 15s.; eights and nines, 15s. to 18s.

Melbourne.—Cavendish: Sixes, 12s. to 14s.; sevens, 14s. to 16s.; eights and nines, 16s. to 18s.

Adelaide.—Cavendish: 18s. to 24s. per case.

Lady's Finger.—1½d. to 6½d. per dozen.

Pineapples.

Brisbane.—Smoothleaf: 1s. to 6s. per dozen; 4s. to 7s. per case. Ripley: 1s. 6d. to 3s. per dozen; 7s. to 9s. per case.

Sydney.—Smoothleaf: 6s. to 8s. per case.

Melbourne.—Smoothleaf: 8s. to 10s. per case.

Adelaide.—Smoothleaf: 10s. to 14s. per case.

Papaws.

Brisbane.—Yarwun, 5s. to 8s. tropical case; Gunalda, 4s. to 6s. bushel; Locals, 3s. to 5s. bushel.

Sydney.—7s. to 10s. tropical case.

Melbourne.—8s. to 12s. tropical case.

Special quality higher.

Mangoes.

Brisbane.—8s. to 10s. bushel.

The season for sending mangoes to southern markets is now approaching. Intending exporters must remember that only high-class varieties are saleable on the Melbourne and Sydney markets.

Avocados.

Brisbane.—Good quality fruit is selling at 6d. each, supplies now being short.

Passion Fruit.

Brisbane.—First Grade, 12s. to 17s.; Seconds, 8s. to 12s.

Sydney.—8s. to 19s. per half bushel.

Melbourne.—8s. to 18s. per half bushel.

CITRUS FRUITS.

Oranges.

Brisbane.—9s. to 13s. 6d. per case; Second crop fruit, 5s. to 7s. Imported packing shed brands, 11s. to 13s.

Lemons.

Brisbane.—Locals, 6s. to 12s. Special brands higher. Victorian, 13s. to 15s.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Democrat, 10s. to 15s.; Granny Smith, 10s. to 17s.; Sturmer, 10s. to 13s.; Crofton, 10s. to 16s.

Sydney.—Delicious to 20s. per case. Granny Smith, 15s. to 16s.

Pears.

Brisbane.—Winter Nelis, 10s. to 16s.; Winter Cole, 11s. to 17s.; Josephine, 12s. to 17s.

OTHER FRUITS.

Tomatoes.

Brisbane.—Ripe, 2s. 6d. to 4s.; Choice Coloured, 7s. to 9s.; Green, 3s. to 6s. Northern fruit wasting.

Sydney.—Cleveland, 3s. to 8s. Special coloured lines from Coff's Harbour selling to 20s.

MISCELLANEOUS VEGETABLES, &c.

Cucumbers.—Locals: 5s. to 10s. bushel. Northern: 4s. to 7s. Sydney: 8s. to 14s. bushel.

Pumpkins.—Sydney: 4s. to 6s. bag.

Marrows.—Sydney: 8s. to 9s. large case.

Lettuce.—9d. to 2s. 6d. dozen. Specials: 3s.

Cabbages.—2s. to 3s. dozen.

Beans.—Brisbane: 9s. to 12s. sugar-bag; old, 3s. to 6s. Melbourne: 4d. to 7d. lb.; some old arriving dry.

Peas.—Brisbane: 10s. to 13s. sugar-bag; poor quality lower.

Beetroot.—3d. to 8d. bundle.

Carrots.—Brisbane: 3d. to 8d. bundle. Sydney: 4s. to 7s. quarter.

Parsnips.—9d. to 1s. 3d. bundle.

Rhubarb.—9d. to 1s. 3d. bundle.

SELECTING THE DEEP SUCKER IN BANANA CULTURE.

As the result of the favourable seasonal conditions, banana plantations are now making a flush of suckers. On the selection of the best sucker on each plant will depend the success of the following crop, and the future life of the plantation.

The corm of a banana plant produces at least two rings of buds which at growing periods burst into growth. Of these, the top circle is about 2 inches from soil level and the lower circle is usually 2 or 3 inches below the top circle. Suckers from any of these buds do not send forth the correct follower.

At the base of the corm a bud is produced which bursts into growth at a particular stage in the life of the parent plant. From plantation trials extending over several years, it has been found that the parent plant sends out the correct follower sucker when it has made three-quarters of its growth.

The maturity of a banana plant is governed not by the time it is in the soil, but by the nature of the conditions during its growth. The deep follower produced at the right stage by the parent plant has more vitality, and its roots are deeper, and it retains its sword leaves longer. The shallow follower, on the contrary, develops its mature foliage early and the corm rises above soil level, thereby preventing the effective functioning of its higher root.

The careful digging out of a three-quarter mature plant will reveal the habit of sucker formation, both shallow and deep. If suckers are planted with the side of severance down-hill, the general experience is that the correct follower will invariably appear just where it is wanted—*i.e.*, up-hill.

Brisbane Show (1939) Champions.

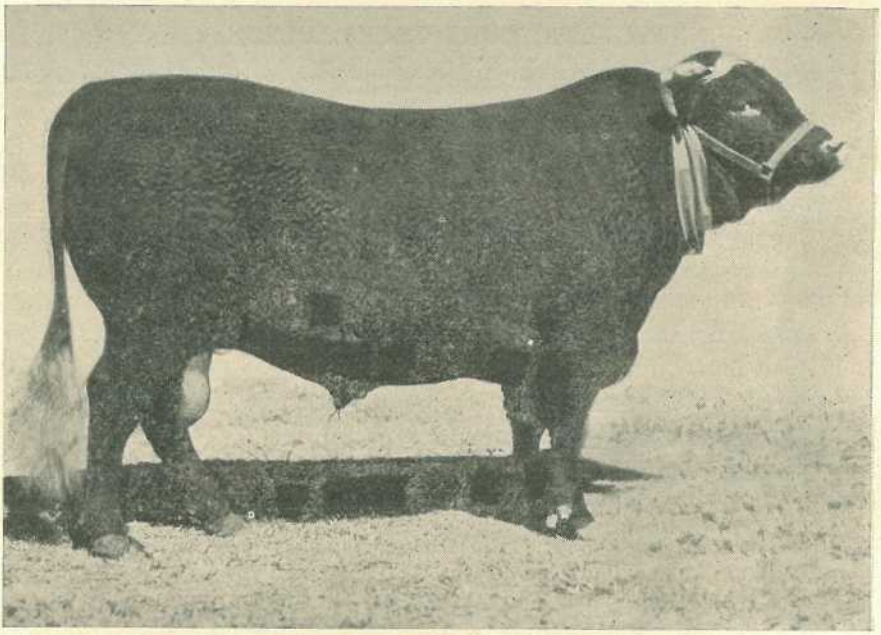


Plate 243.
DEVONCOURT SNUG 166 1st.—Champion Devon bull, the property of Mr. R. A. Howell.

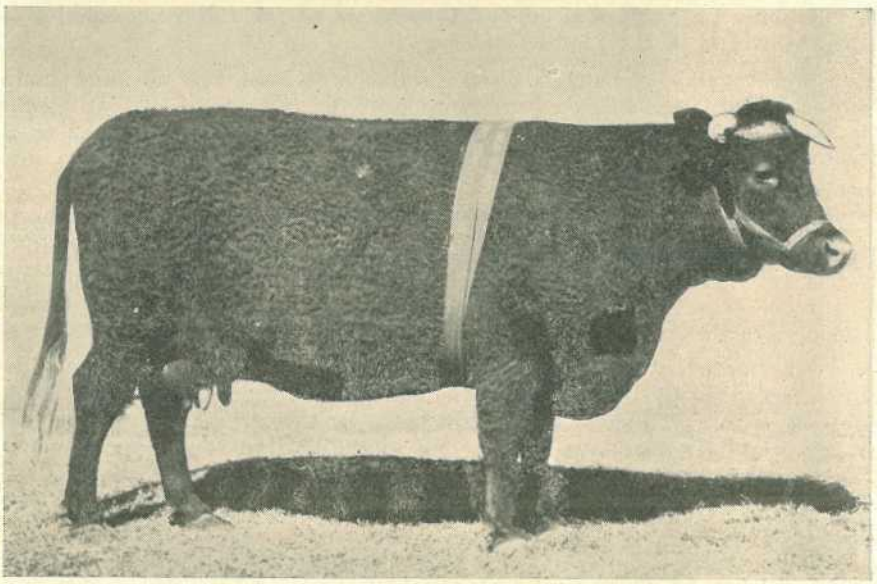


Plate 244.
DEVONCOURT LUSTY 110V.—Champion Devon cow, the property of Mr. R. A. Howell.

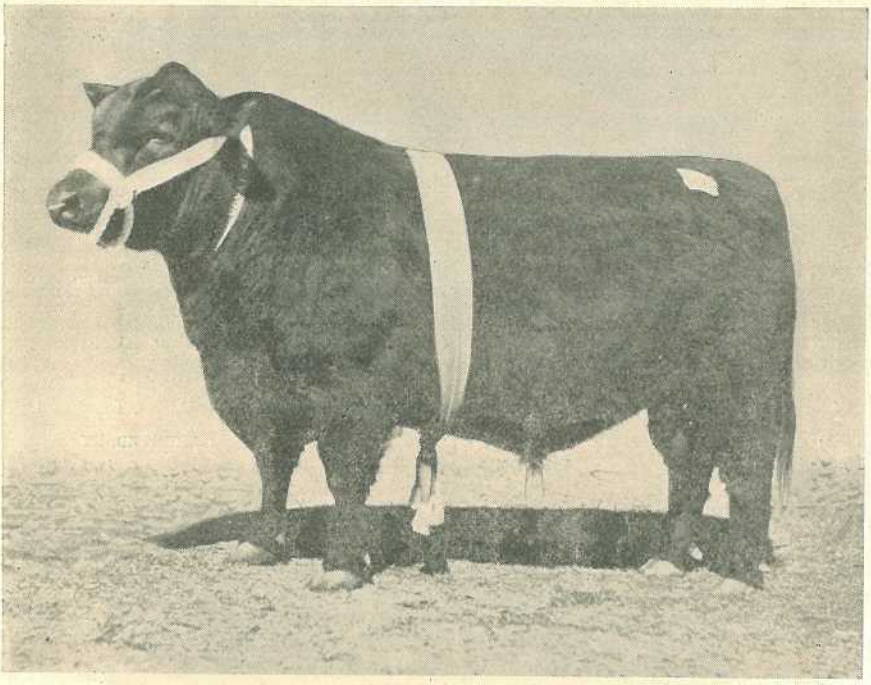


Plate 245.
ABINGTON MAX II.—Champion Aberdeen Angus bull, the property of Mr. N. L. Forster.

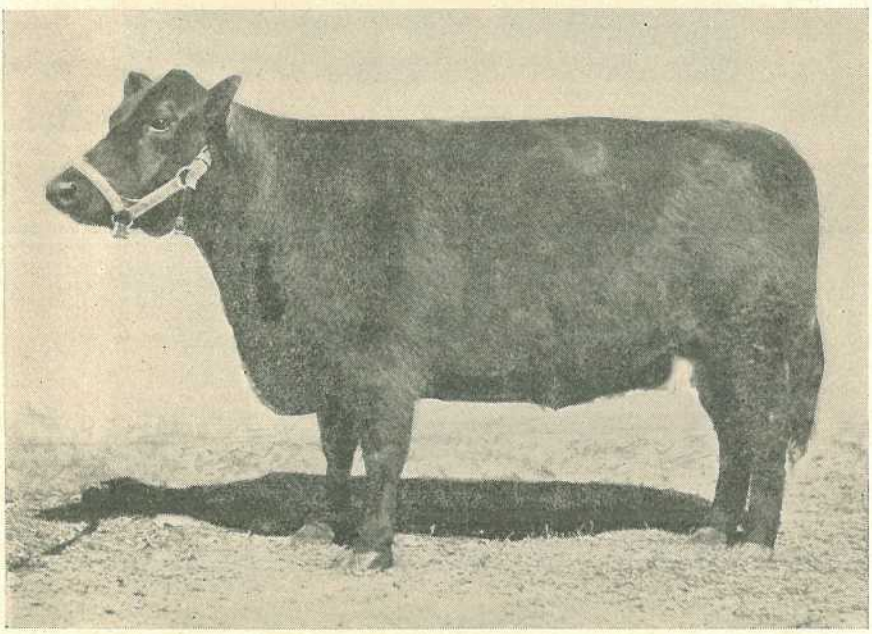


Plate 246.
ELEGOSA OF BALLINDALOCH.—Champion Aberdeen Angus cow, the property of Mr. J. M. Newman.

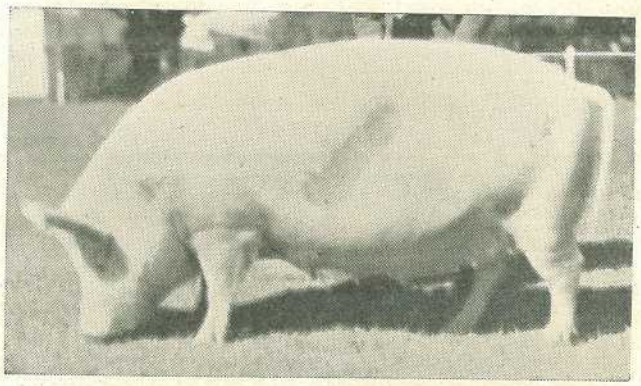


Plate 247.

CHAMPION LARGE WHITE SOW, "MITTADALE PEG." EXHIBITED BY MR. A. T. LEY, KINLEYMORE.

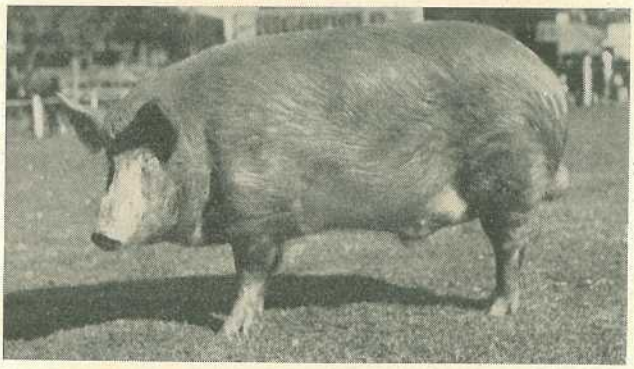


Plate 248.

CHAMPION TAMWORTH BOAR, "WATTLEDALE LUCKY PRINCE." EXHIBITED BY MR. J. BARKLE, SUNNYBANK, Q.

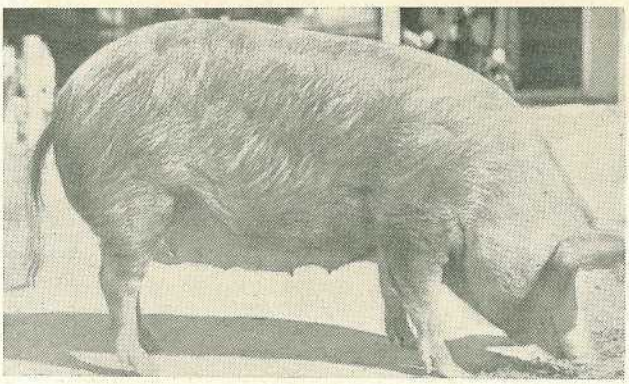


Plate 249.

CHAMPION TAMWORTH SOW. MR. J. BARKLE'S "WATTLEDALE PATRICIA."

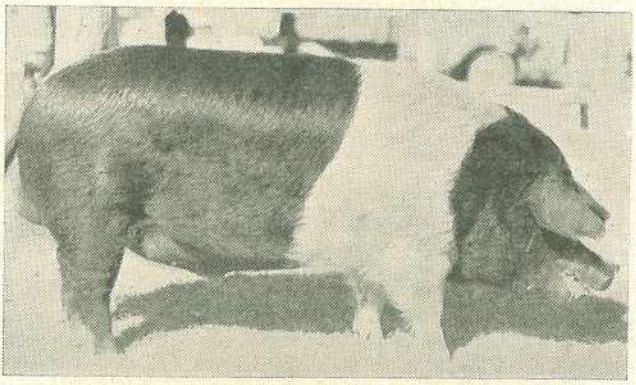


Plate 250.

CHAMPION WESSEX SADDLEBACK BOAR. MR. H. THOMAS'S "ARMORE VALE PIONEER."

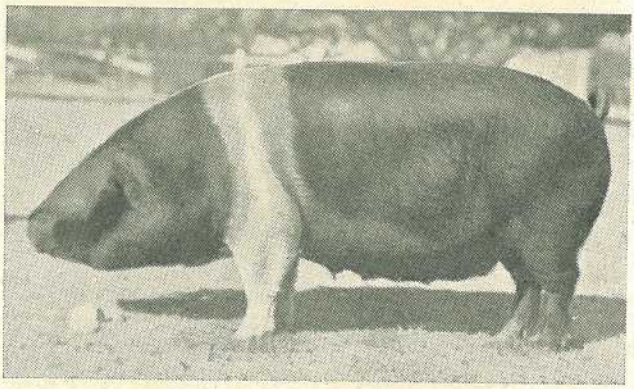


Plate 251.

CHAMPION WESSEX SADDLEBACK SOW. MR. R. TURPIN'S "PENSILVA ACE 5TH."

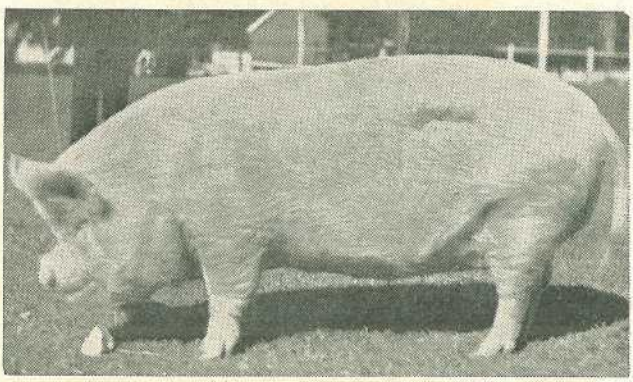


Plate 252.

CHAMPION MIDDLE WHITE SOW, "TURO BORONIA 2ND." EXHIBITED BY MR. J. H. TEAGUE, BELLIMBOPINNI, N.S.W.

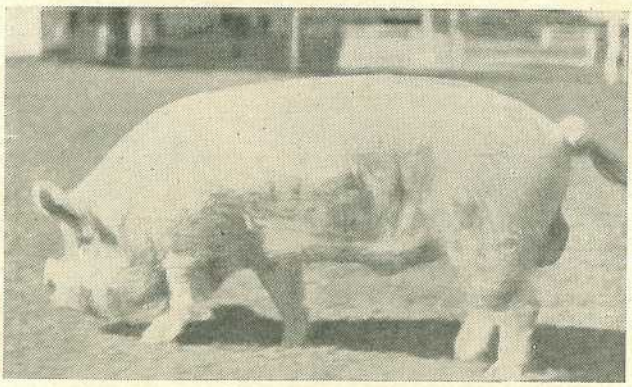


Plate 253.

CHAMPION MIDDLE WHITE BOAR. MR. T. WALLACE AND SON'S "QUEEN STATE CORONA 2ND."

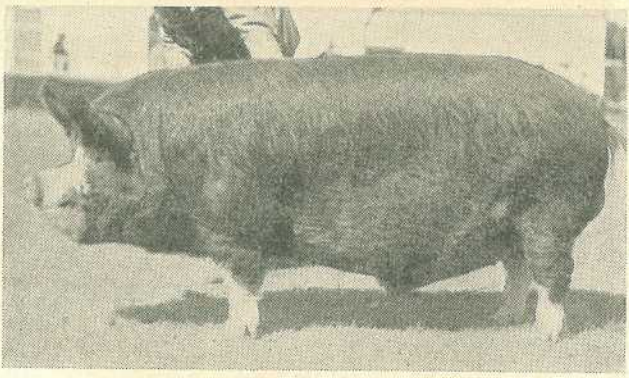


Plate 254.

CHAMPION BERKSHIRE BOAR, "MARVEL LONGFELLOW," THE PROPERTY OF MR. H. T. ROGERS, NEWRYBAR, N.S.W.

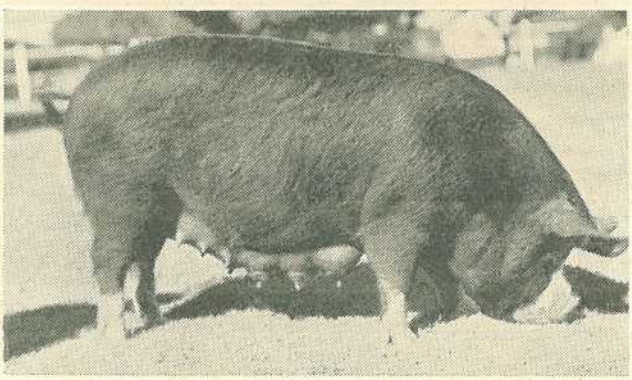


Plate 255.

CHAMPION BERKSHIRE SOW, "ROSELOCH ESTA." EXHIBITED BY MESSRS. M. PORTER AND SONS, WONDAI, Q.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and the Jersey Cattle Society production charts for which were compiled during the month of September, 1939 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (STANDARD, 350 LB.).				
Rosenthal Dove 17th	S. J. H. Mitchell, Rosenthal, Warwick	9,596·96	398·437	Rosenthal Carbine
JUNIOR, 4 YEARS (STANDARD, 310 LB.).				
Merridale Patience	H. D. Giles, Merridale, Biggenden	8,878·6	334·028	Reflection of Blacklands
SENIOR, 3 YEARS (STANDARD, 290 LB.).				
Chelmer Milkmaid	E. O. Jeynes, Raceview	9,990·15	407·077	Chelmer Douglas
Pilton View Olga 3rd	P. D. Fiechtner, Pilton View, *via* Greenmount	7,836·25	302·088	Navillus Venies Sheik
SENIOR, 2 YEARS (STANDARD, 250 LB.).				
Blacklands Miss Jean 16th (365 days)	J. Meier, Mount Mort, Grandchester	16,326·2	652·56	Sultan 2nd of Blacklands
Ardilea Broady	W. Hinrichsen, Ardilea, Clifton	7,538·5	328·419	Midget Shiek of Westbrook
Ardilea Silk	W. Hinrichsen, Ardilea, Clifton	7,697·5	323·771	Midget Shiek of Westbrook
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Laguna Maggie	F. G. Lamkin, Kaimkillenbun	7,094·07	283·001	Morden Marcus
Werona Vale Handsome 5th	A. H. E. Black, Kumbia	5,640·19	280·93	Park View Faro
Cedargrove Gusty 5th	P. D. Fiechtner, Pilton View, Greenmount	7,816	280·058	Cedargrove Winlad
JERSEY.				
MATURE COW (STANDARD, 350 LB.).				
Fauvic Rejoice	H. Cochrane, Fauvic, Kin Kin	6,680·9	399·768	Zingara King
JUNIOR, 4 YEARS (STANDARD, 310 LB.).				
Lorine of Calton	D. R. Hutton, Bellgarth, Cunningham	6,994·21	371·82	Redford Glory's King II.
Oxford Enid	J. Sigley, Millaa Millaa	5,972·65	311·383	Oxford Golden Lad
JUNIOR, 3 YEARS (STANDARD, 270 LB.).				
Carnation Fair Lassie	R. J. Crawford, Inverlaw, Kingaroy	5,722·37	345·607	Carnation Dainty Boy
Carnation Marie	R. J. Crawford, Inverlaw, Kingaroy	4,954·25	287·304	Carnation Dainty Boy
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Bellgarth Violet 2nd	W. E. Lewty, Leyburn	4,995	275·696	Bellgarth Golden King
Tecoma Pretty	W. Semgreen, Tecoma, Coolabunia	5,063·9	270·102	Bruce of Inverlaw (Twin)
Lermont Bellette	J. Schull, Lermont, Oakey	4,701·55	243·291	Woodside Golden Volunteer
Lermont Bertha	J. Schull, Lermont, Oakey	4,564·9	233·892	Lermont Officer

General Notes

Staff Changes and Appointments.

Mr. A. G. Smyrell, Inspector of Stock, Bowen, has been appointed also an inspector under the Diseases in Plants Acts.

Miss P. Watts (Bundaberg) has been appointed an assistant cane tester for the remainder of the sugar season at the Maryborough Mill.

Constable J. H. Seawright has been appointed also an inspector of brands at Torrens Creek.

Sergeant J. Imhoff (Herberton) has been appointed also an inspector under the Slaughtering Act.

Mr. B. W. Haydock, Thorneside, via Birkdale, has been appointed an honorary protector of fauna.

Mr. W. G. Batchler (West Bundaberg) has been appointed an honorary inspector under "*The Sugar Experiment Stations Acts,* 1900 *to* 1938."

Following are additions to the list of honorary protectors appointed under "*The Fauna Protection Act of* 1937":—Messrs. E. C. Hill, Gracemere; E. H. Lascelles, Goorganga, Proserpine; H. S. Martin and J. Burgess, Bororen.

The undermentioned have been appointed as honorary rangers under "*The Native Plants Protection Act of* 1930":—Messrs. R. J. Ironside and W. L. Gilliam, Dalrymple Heights; A. J. Seeleither, patrolman, Enoggera Waterworks-Mount Nebo road; A. Ross, patrolman, Samford-Mount Nebo road; C. G. Patrick, Mount Glorious.

Constable W. J. Daybell, Rolleston, has been appointed also an inspector under the Brands Acts.

Mr. W. J. Park, inspector of dairies, has been temporarily transferred from Toowoomba to Biloela.

The officer in charge of Police, Townsville, has been appointed also an acting inspector of stock.

Mr. J. Hienchey, Airdmillan road, Ayr, has been appointed an honorary protector under "*The Fauna Protection Act of* 1937."

Mr. W. E. Hamley, Inspector, Diseases in Plants Acts, and agent under the Banana Industry Protection Acts, has been transferred from Burleigh Heads to Brisbane.

Mr. W. R. Vacher, Mackay Cane Diseases Control Board, has been appointed an honorary inspector under "*The Sugar Experiment Stations Acts,* 1900 *to* 1938."

Mr. J. C. Baker, Clerk of Petty Sessions, Nambour, has been appointed chairman of the Moreton Local Sugar Cane Prices Board and an agent of the Central Sugar Cane Prices Board. Similar appointments have been given to Mr. J. Gaffney and H. A. Galloway, Clerks of Petty Sessions at Mossman and Proserpine, respectively, in respect of the Mossman and Proserpine local boards.

Mr. P. Cook, maintenance patrolman on the New England Highway between Rathdowney and Mount Lindesay, has been appointed an honorary ranger under "*The Native Plants Protection Act of* 1930."

Messrs. C. Flesser, J. J. Jope, W. Welch, T. Parker, A. F. Johnson, G. Knight, D. J. MacClelland, C. F. Greenwood, J. C. Muldoon, I. H. Kerr, and C. Kouskos, of the Canungra and Binna Burra areas, have been appointed honorary fauna protectors and honorary rangers under the Native Plants Protection Act.

Sergeant (2nd Class) J. Duhoff (Herberton) and Constable C. R. Kuhl (Adavale) have been appointed also inspectors under the Slaughtering Act.

Rural Development Board—Appointment of Mr. R. P. M. Short.

An Order in Council has been issued under "*The Rural Development Co-ordination of Advances Act of* 1938," appointing Mr. R. P. M. Short, Under Secretary, Department of Agriculture and Stock, to be a member and chairman of the Rural Development Board. In addition to the chairman, the present members of the Board are—Messrs. J. L. Callaghan (member of the Land Administration Board) and E. A. Crosser (Accountant, Treasury Department).

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. W. D. Francis, Botanist.

Barbed-wire Grass.

D.S. (Maleny)—

The grass is barbed-wire grass, *Cymbopogon refractus*. This grass is a native species widely spread in coastal and subcoastal Queenland. In some districts it is known as "turpentine grass" because of its peculiar odour. Stock do not seem particularly fond of it, although it is probably of some value in its earlier stages. It often replaces kangaroo grass in South-east Queensland when that grass is eaten out, and is usually found associated with it.

Regarding paspalum grass, Kikuyu, Rhodes, elephant grass, and clover, we have sent you two pamphlets, Nos. 50 and 52, in which you will find notes on them.

Plants from Rockhampton District Named.

O.L.H. (Rockhampton)—

The specimens from Westwood have been determined as under:—

1. *Ipomoea sinuata*, a member of the convolvulus or morning glory family. A native of tropical America.
2. *Bryophyllum pinnatum* (B. calycinum). A native of tropical regions of the world. Popularly known as "liveleaf" or "live-for-ever."
3. *Pedilanthus tithymaloides*, a native of tropical America.
4. *Tecomaria capensis*, Cape honeysuckle. A native of South Africa.

None of them is known to be harmful to stock, with the exception of No. 3.

This plant might be harmful if eaten in quantity, as it is closely allied to the *euphorbias*. However, it is a garden plant and so far as we know, is not readily accessible to stock. None of the plants is known to cause taint in milk.

The specimens from the Caves have been determined as follows:—

1. *Stachytarpheta dichotoma*, a native of tropical America.
2. *Stachys arvensis*, stagger weed, a native of Europe. This plant causes staggers or shivers in working or travelling stock.

Neither is known to cause taint in milk.

The Common Vetch.

B.B. (Kelvin Grove)—

The specimen is the Common Vetch, known botanically as *Vicia sativa*. It is a leguminous plant native to the Mediterranean region. It is a fairly good fodder, especially in a mixed pasture. If growing densely on a cultivation, it can be ploughed in with benefit as a green manure. In a pasture, it is not such a good fodder plant as the common white clover.

Blady Grass.

D.S.M. (Dunedin, New Zealand)—

The Malayan name "Malang" is applied to *Imperata cylindrica*, var. *Koenigii*, the common blady grass. This is very prevalent in New Guinea and the Malayan region. As this species is so common in the grasslands of New Guinea, it is probable that it is the one used for obtaining salt from its ashes.

Parramatta Grass.

M.G. (Peeramon, North Queensland)—

The specimen is one of the rat's tail grasses, sometimes also known as Parramatta grass. Its botanical name is *Sporobolus capensis* (*Sporobolus berteroanus*). It is a native of South Africa. It is an inferior grass which often appears in paspalum pastures when they are eaten fairly low. It also appears alongside paths, and tracks on farms. It is advisable to eradicate it before it obtains a hold on your farm. The grass is most easily destroyed by mattocking.

Corn Spurry.

N.E.H.C. (Nambour)—

The plant is the corn spurry (*Spergula arvensis*). It is a common weed in Europe and temperate Asia, and is frequently seen in Eastern Australia where it is common in sandy loams.

Coast Burr Grass.

W.C.H. (Wondai)—

The grass is coast burr grass (*Cenchrus echinatus*). It is a native of the tropics of the world, and appears to be spreading down the coast from the north. It is a very undesirable grass, especially because of its burrs. It is of little value as a fodder, except in its very young stages. It would be advisable to eradicate it by pulling it up by the roots and burning it.

Medic Burr.

J.P.C. (Rockhampton)—

The specimen is a leguminous plant allied to the clovers, and is commonly known as medic burr. Its botanical name is *Medicago denticulata*. It is a native of Europe, and is now very widely spread in Australia and in Queensland, where it is most abundant on the Darling Downs. It is a good fodder for stock, and its feeding value is somewhat similar to that of the white clover, but will grow in poor soils and drier climates. Like white clover, too, medic burr is likely to cause hoven or bloat in cattle or sheep, if they are turned into a paddock in which it is growing abundantly. Generally, however, it is not present in pastures in sufficient bulk to cause trouble because of that.

Vanilla.

F.W. (Bowen)—

Vanilla has been grown in the Cairns district. As this crop requires a hot and moist climate, there is some doubt whether it would grow in the Bowen district, where the humidity might not be high enough. One reason why vanilla has not been grown commercially in Queensland is the usual handicap of labour. In most countries where the vanilla is grown, cheap native labour is employed.

Phalaris Grasses.

W.M.C. (Gayndah)—

The specimens represent one of the phalaris grasses, *Phalaris tuberosa* or *Phalaris minor*. These two plants resemble each other very closely, and it is rather difficult, in the absence of ripe seed, to determine them, without knowing whether the plant is a perennial or annual. *Phalaris tuberosa* is a perennial species, while *P. minor* is annual. The former, naturally, is much more valuable as a fodder, and is fairly extensively cultivated on the Darling Downs. *P. minor* often occurs as a weed of cultivation, but is sown to a slight extent. Both are related to the Toowoomba canary grass (*Phalaris canariensis*).

Rural Topics

More about Cowbail Ballads.

There must be something in this idea of the susceptibility of milking cows to music, and that they let down their milk very much easier when their ears are tickled with a "concord of sweet sounds." At least one dairy farmer who is determined to try the idea out on his place on one of the rivers just below the New South Wales border, has installed an all-electric wireless set, from which music flows while the cows are being milked with machines. We hope yet to learn, however, what a cow's musical taste may be—whether it extends to grand opera or not, or whether she responds to jazz tunes or crooning. It would be "a fair cow" if the morning physical jerks session were accidentally turned on! Time will tell, and who knows but that some day we shall have a special musical broadcast for milking time.

Clothing made from Milk.

The United States Agricultural Department reports the development of methods of production of synthetic wool from casein. It is stated that to make a suit of men's clothing from the material approximately 5 gallons of milk are required. The total cost of a pound (1 lb.) of casein "wool" is given at half a dollar, and as the material required for a suit weighs about 3 lb., the total price would be a dollar and a half, or about 6s. in Australian money—a figure very much lower than for the equal weight of a genuine woollen cloth. The yearly milk yield per cow is stated to suffice for the making of thirty-five men's suits, and at present the U.S.A. is producing 35,000,000 lb. of milk casein a year. The report adds that as the possibilities of milk production in the States are unlimited, the yearly output of casein could be easily increased.

Stilts in the Orchard.

Stilts are coming into use in orchards in the United States in place of ladders. The stilts are said to be safer and speedier in getting around. The stilts are made of adjustable tubes of aluminium alloy, one tube sliding inside the other. The tubes can be locked in any stage, increasing the wearer's position above the ground from between 2 and 3 feet to nearly 6 feet. The cast aluminium footplates are also adjustable for different-sized shoes. Each stilt weighs 9 lb. On one of them a carrier is provided for pruning and other tools.

Electricity for the Countryside.

The recent electricity agreement under which a large area of the countryside extending along the near North Coast will be served with electricity before long, opens up all sorts of possibilities for the farm and the farm home in districts at present outside the range of electricity supply.

Electric power has made a wonderful difference to the life of the man on the land—and to the women on the land as well. It has lightened the burden to both the farmer and his wife in very many ways. Wherever a supply is available, electricity has revolutionised rural conditions and on the farm, in some instances, it has converted drudgery into comfortable and pleasant work.

Quick Ripening of Tomatoes.

A new method for the quick ripening of tomatoes with the aid of oxygen has been developed by science workers in Russia. Green tomatoes placed in a room and subjected to the effect of oxygen ripen within six days, while, ordinarily, under cold climatic conditions the ripening process takes over a month. At present nearly eight thousand (8,000) acres are planted with tomatoes in the Leningrad province of Russia, in addition to large quantities grown under glass. The new method is regarded as of considerable value to tomato growers and canneries.

Goat Dairies.

America now has licensed goat dairies, in which all equipment is sterilised and the milk, after cooling, is bottled in sterilised cartons. The industry is growing, and for goat's milk it is claimed that it is sweet and palatable and rich in the elements necessary for nourishing the human body.

Reducing Lightning Risks.

Valuable animals are often killed by lightning, and in Queensland the experience is not uncommon. Here is a suggestion from an engineer for protecting wire fences from lightning charges. Cattle often camp alongside a fence, especially if it is anywhere near a shelter belt of trees, during a storm. Along every sixth post in the fence a heavy wire is extended across the fence wires and into the ground. Strong staples are used to keep the crossing wire contacts. These grounding or earthing wires are set more closely along the fence near shade trees and other spots where animals usually camp.

Snake as an Incubator.

Five chickens hatched in Matara, South Ceylon, recently had the extraordinary experience of having been for some time in the stomach of a snake. It appears that a couple of days before the chickens were hatched, a snake swallowed seven eggs while the hen was sitting on them. This was noticed by the poultryman, who later killed the snake, cut it open, and retrieved the eggs from the reptile's in'ards. Two of the eggs were broken; the other five were washed and placed again under the sitting hen, and two days later five healthy chickens were hatched.

Oratory and Cheese.

No anthology contains a poem in praise of cheese, but that article of diet, if it inspires no verse, seems, at any rate, to be capable of stimulating oratory. In the course of a recent debate in the United States Senate on foreign policy, a senator created a temporary diversion (in two senses of the word) by calling attention to the national service rendered by his own State as the home of 185,000 dairy farms and 2,000 cheese factories. Having expended much eloquence on Wisconsin's "juicy grasses," "sweet-scented clover," "luscious lucerne," and "cool spring water," he predicted that if his colleagues in the Senate would eat more Wisconsin cheese it would make them more "rational and reasonable," and would enable them to maintain the suppleness, vitality, and stamina of youth. The worthy senator went on to claim that an increase in its eating would prevent tuberculosis, would cure nervousness in children, would make rouge unnecessary for women, and ——well, that's enough. But anyhow, there is no doubt that his own State and industry lost nothing by his advocacy.

Pigs Killed by Kindness.

Here is the experience of a New Zealand farmer which shows how animals can be killed by kindness. In this case, the farmer fed his pigs on meal and skim milk right from the store stage up to the point when he had a top line—so it looked —of six splendid baconers. He sent them to the factory and they were all condemned. He was astounded when he got the report and started straightaway to investigate. The pigs were condemned as unfit for human consumption, through pleurisy and pneumonia, from which tuberculosis had developed.

"Impossible," he told the slaughtering inspector, "Why, my fattening pens are quite draught-proof, the pigs are bedded almost out of sight, and they are never cold. How could they get pneumonia?"

He then was questioned more closely as to his methods, for the inspector was a bit curious himself. They had been such a fine lot of baconers. It was then revealed that every evening the farmer made a practice of forking in fresh hay for bedding, but instead of cleaning out the old litter he continually spread the new hay on top. As time went on, the bedding grew until the pigs were almost out of sight at night time. That was the actual cause of the trouble. Each night the cold from wet underneath layers of hay struck upwards, while on top the pigs were too warm. For the pigs, it was like sleeping with a radiator at one side and a refrigerator at the other. No wonder the pigs died of kindness!

Beef in Rubber Wrappings.

An experiment in wrapping frozen meat in rubber is now in progress and results are awaited with great interest. Last May a parcel of frozen beef wrapped in rubber was shipped from Brisbane and we have yet to learn what Smithfield has to say about it. Some little time ago an experimental shipment of lamb in rubber wrappings was sent to London from New Zealand and reports from Smithfield on its turn-out were quite enthusiastic. The wraps are made of latex rubber, and are said to leave no odour or taste in the meat. After being expanded, the rubber containers are slipped over the meat and made to shrink tightly around it, forming a close protective and transparent skin, which is said to be very tough under low temperatures and to protect the meat during shipping.

A Good Droving Job.

Queensland drovers have many fine records to their credit, and another good one was put up recently when well over 5,000 cattle were delivered on Tanbar after twelve weeks on the road from Rocklands in the Northern Territory. From Rocklands to Tanbar—which is on Cooper's Creek in Far Western Queensland—the distance is 720 miles, and the delivery was made practically without the loss of a beast. The cattle—Shorthorn steers and cows chiefly—travelled in four mobs and did the long journey without loss of condition. Before setting out the cattle were inoculated and dipped, and this performance is a tribute to their constitution and walking ability.

Cattlemen will be interested in the method adopted on Rocklands to get young cattle used to handling while on the road. At weaning time they are taken in hand by a station team of musterers and herded by day and yarded every night for a fortnight. They are watered, of course, before being yarded for the night. To accustom them to even closer handling, after being yarded, the station hands walk and ride close to the cattle all night. They thus become quite used to men moving among them once they are started on the road. Consequently, they make good campers on the stock route, and all risk of rowdiness or rushing is cut out. To travel 60 miles a week for three months and hold condition and to be delivered without loss speaks for the droving ability of the men in charge.

Examine Horses' Bits.

It is a good thing to see that the bridle bit is not worn at the ends, or in the centre, if a two-piece bit.

A few years ago, while looking at a man's team, I was wondering why their mouths were sore at the outside, or at the end of the bits (writes a correspondent). I told him that his bits had got worn sharp where they connect with the ring on the bit. This is caused by the bit being worn sharp with a lot of wear or through very long usage. A person should keep a lookout for this trouble, as wear of this kind makes a lot of misery for the poor dumb animal, and especially if he has a cruel or thoughtless driver.

When a bit becomes worn it should be thrown away, as new ones cost very little and they would mean a lot of comfort for the horse. We should remember that the horse is one of our most faithful servants, and all he gets in return is his living. He cannot speak for himself. Neither has he any hands like we have. His lips convey the food to his mouth. He appreciates kindness shown him. The Scripture says: "A merciful man is merciful to his beast." Sometimes well-meaning people fail to notice little things of this kind.

—*The New Zealand Farmer.*

Good Milk Publicity.

The English Milk Publicity Council has produced a pleasing poster which is a cut-out of a charming, smiling girl against a blue background, with the slogan on a strip in the foreground—"It's not Luck—it's Milk."

An All-Electric Farm.

No dim journeys with a hurricane lamp on winter mornings. Cow-bails lit by electricity; above them a motor light casting a beam across the pig pens. Milking machines and separator electrically driven, and skim milk pumped direct from the separator room to the pig-feeding troughs. It all sounds like a farmer's dream, yet it is an actual fact on a Dorrigo dairy.

In addition, silage is raised from a pit silo by an electric hoist and chaffed by electric power. Water from a big well is delivered to the bails and to the house, and work in the home is lightened by various electrical appliances. Even the firewood is cut by electric power. Dairying is done in comfort, and all the old drudgery has gone.

It sounds fantastic, but there it is. Electricity has been applied to every dairy operation on this farm at North Dorrigo, below the border in New South Wales. And the cost of all this "white coal," which comes from the Dorrigo power plant on the Beilsdown River, is only £17 10s. a year!

In its schemes for extending the use of electricity, the Queensland Electricity Board, no doubt, visualises its application to rural industry in districts in which either hydro-electric plants are practicable or which are within reasonable reach of power-houses already established.

A New Way to Use Whey.

New facts have been brought to light on the make-up and value of whey for general purposes. A new evaporating plant for this milk by-product is now in use in Denmark, and it promises excellent results. Although Danish farmers use a large quantity of whey for animal-feeding, an enormous surplus quantity has had to be run off during cheesemaking, and which has had until now no commercial value. The evaporation process produces a solid product which can be mixed with bran and other substances used in stock foods. The solid content of whey is 6 per cent., and, provided that the cost of evaporation can be kept low enough to prove a commercial proposition, there seems to be no reason why the new process should not be of great value to the dairy industry.

In Denmark especially—and it is conceivable that the same thing may happen in Queensland—the utilisation of every dairy by-product is of first-rate importance. It has, therefore, been decided that the new stock food will be made use of on Government farms in different parts of Denmark to determine its value.

An Experiment in Foodstuff Distribution.

America is trying an experiment in the distribution of farm products. To people in receipt of public relief tickets which will enable them to collect sixpence-worth of certain surplus foodstuffs for every shilling they receive from public funds are being given. Thus, a person who draws £1 a week in "dole" can also draw ten shillings-worth of certain foods. The chief commodities concerned at present are oranges and dairy products; it is possible that meat also may be included later.

That certainly means extending the home market for foods in over-abundance, and it will be interesting to read the results of this new experiment in rural economics.

Isolation Pen for Sick Pigs.

The distance between isolation pens for sick pigs and the pig yards or dairy structures is not so important as the relationship of these structures from another point of view. Thus, while advising a minimum distance of, say, 150 feet, it should be emphasised that such isolation pen should be so placed that—

(*a*) No drainage from it can spread to the main stics or any of the dairy buildings; and

(*b*) That if healthy pigs are allowed to wander, the isolation pen should be so guarded that they cannot make contact with it.

Ordinarily, therefore, the isolation pen should be on lower ground, and, if in the paddock in which pigs wander, should be protected by fencing in such a way that healthy pigs cannot come in contact with it.

Wholesome Milk.

Normal milk can only be produced by a normally healthy herd, fed on wholesome and non-taint-producing fodders. If only one cow in the herd is not in normal health her milk production will be sub-normal and, if mixed with the milk from the remainder of the herd, the quality of the whole may be seriously affected. Cleanliness should be exercised during the whole process of milking, and all utensils and surroundings kept clean.

If the milk is intended for human consumption, cooling and aerating will allow the feed flavours to be given off, and the reduction in temperature will check bacterial development.

Control of Moths in Woollen Fabrics.

It is reported that the Scientific Research Institute of Soviet Russia has discovered a process by which woollen materials can be protected from the ravages of moths. The process is said to consist of saturating the wool with special fluoride compounds at the same time as it is dyed or washed, and that it can be done without complicating mill production.

Dairy Production in Queensland.

Queensland supplies almost half of Australia's exports of dairy products. Here are the latest official figures: The production of Queensland butter has increased by nearly 50 per cent. and butter exports from the State have almost doubled. That is in addition to supplying nearly half of the total Commonwealth butter exports.

These figures are revealed in a summary of the activities of the dairy industry during the first half of the 1938-1939 season by the Commonwealth Statistician.

Merino Fleece Quality.

Investigations now being made at the McMaster Animal Health Laboratory seem to lead to the conclusion that, with a better knowledge of skin characteristics, sheep breeders may be in a better position to improve both the quality and quantity of their fleeces.

A special study of various factors associated with weight and density in merino fleeces—two things every sheep man is interested in particularly—is being made. If certain present indications are confirmed fresh fields of sheep-breeding will be opened up. What is being done, among other things, are detailed studies of the microscopic structure of merino sheep skins and the number, type, and arrangement of the wool fibres in different parts of the body surface. Microscopic studies may, under the new technique which is being developed, give a clue to some of the chief things sheep men may want to know about the covering of the particular sheep under observation.

Not the least important determination which can be made by this means is the number of fibres per square inch of the sheep's skin—a factor of very great importance in fleece density and one having great influence on the weight of wool produced by any sheep.

The structure of the skin, as studied under the microscope, may determine the type of fleece and, to a large extent, the amount of wool an animal may produce, and may also determine the way in which the sheep will respond to its environment.

So far, this work is still in the laboratory stage, but so promising have been the results to date that big things may be expected before very long.

Music in the Stockyard.

The old maxim that "music hath charms to soothe the savage breast" is often misquoted as "music hath charms to soothe the savage beast." Now we know why—or at least we have some justification for the misquotation. At the Smithfield fat stock show in London (as reported in the *New Zealand Farmer*) recorded music by the old masters was played in order to keep the stock fat and happy. It seems, according to the show secretary, that the excitement of being on exhibition for a week often makes fat stock lose weight. Hence music to cheer them up and keep their condition. The secretary cites the example of milkmaids singing as they milk contented cows, the music presumably making them contented. But the fat stock exhibitors are using real guile in their selection of appropriate music. Naturally, Beethoven's "Pastoral Symphony" has first choice. Bach's compositions are considered to be too restless, and selections from Wagner are likely to make the milk curdle. Mozart and Hadyn sends the fat cattle to sleep, and Delius' "On Hearing the First Cuckoo in Spring" makes the fat wethers remember their youth. Highland steers show pleasure when the bagpipes are played, but the pipes cannot be kept going too long because of the acute stress it causes among the non-Scottish breeds of stock. After that—and if it is true—who will dare deny that "music hath charms . . ."?

Care of the Fat Lamb Ewe Flock.

Some farmers have the prospective mothers of the fat lamb drop too fat for the purpose. This is wrong in two ways. Firstly, with too much condition a light lambing is likely; and, secondly, feeding the ewes at mating time on grown crops is wasteful and unnecessary.

The ewes should be in strong store condition. It is advantageous to "flush" the ewes on green feed a fortnight before mating. No feed is too good for the flock when the lambs are dropped.

Beware of jetting with an arsenical preparation before joining. This results very often in a poor lambing. If jetting is necessary, the job should be done six or seven weeks before the rams are joined.

Crutching the ewes a month before lambing is advisable.

Careful watch should be maintained for internal parasites, and systematic drenching undertaken so as to free the ewes of the pest long before the lambing season.

Avoid unnecessary yarding with the in-lamb ewes.

Provide a lick suitable to compensate for known deficiencies in the pastures.

Pedigree Stock Breeding.

Great Britain is often referred to as the world's stud stock farm, so looking through the last annual reports of several breed societies it is not surprising to learn that pedigree stock-breeding was the brightest section of British agriculture in 1938. Good beef bulls were in good demand, and although no record export prices were realised, it was evident that overseas confidence in British pedigree stock continues at a high level. Many excellent types were exported to Australia, an influx of new blood which is very welcome.

Another interesting fact reported is that, although some lamb producers are under the impression that twin ewe lambs are liable to be sterile, this is not the case, and in fact many studs of British breeds of sheep are built up on twin ewes in order to give increased fertility, and drops of over 200 per cent. are not unlikely in such cases.

Molasses as Stock Food.

Some interesting observations on the effect of placing molasses in the drinking water troughs for sheep have been recorded in the Riverina district in New South Wales. The effect was definitely beneficial on sheep in dry areas.

Another method of using molasses has been tried successfully in Queensland, and that is by spraying it on to dry grass, which is thus made palatable to stock. Where it has been tried in a dry time, the sheep follow in the tracks of the sprayer and eat up every blade of the sweetened grass, and, incidentally, eat out an area which becomes, in consequence, an effective fire break.

Molasses spraying of dry pastures has interested quite a number of pastoralists, with whom it has become merely a question as to the quickest and cheapest way of spraying it. Spraying, however, has not yet become practicable on anything like a big scale.

Future of the Fat Lamb Industry.

One of the foremost authorities in fat lamb raising in the South said in the course of conversation recently that, in his opinion the future of the lamb industry lies not only in the finding of new markets, or in the exploitation of the home trade, but in the growers themselves forming a definite policy as to what they are going to breed on their farms and sticking to it.

This is the only way in which continuity of supply and uniformity of type can be guaranteed. There is no doubt that he has hit the nail squarely on the head, for, as anyone who has had some experience in the business knows, switching and swapping from lambs to wool and back to lambs—as one or other becomes more profitable—is not a very wise practice. The man who does that is always a season too late to get any benefit from his chopping and changing. The fact is that a policy should be planned and stuck to consistently in order to get the best of the available market.

Fat lamb raising is not just a sideline job, and it is good business to concentrate either on meat or wool; it is obviously no good trying to do both, especially if export restrictions are applied. If that happens, the man with the quality lamb will come out on top of the grower of the inferior type. The grower's job really is to find the ideal types for his own district, settle that type, and cut out all the rest. It is possible to have too many breeds, and reduction of breeds to a minimum is the first step towards uniformity of type.

Having decided the policy and the type of sheep best suited for a district, the next thing is to get the land into condition to carry out those plans. Pasture improvement is essential. So also is an adequate reserve of fodder to provide supplementary feeding in a dry time. The lamb should not be exposed to the risk of a check in development at any period of its growth. Once checked, it is a difficult job to start it growing again. And here is another point: Much of our lamb-raising country has a short season and lambs must be got off before the grass seed falls or the feed dries off.

The Tail of a Cat.

Things happened when a cow that a farmer was milking stepped on a cat's tail. The cat scratched the cow; the cow kicked the farmer's wife and broke her left leg. When the farmer tried to pull his wife from under the cow, the animal became excited and kicked the farmer, breaking his left leg, and that's that. *Moral: Keep cats out of the cow yard.*

Farm Notes

DECEMBER.

EARLY-SOWN crops of sweet sorghums, Sudan grass, millet, and maize, intended for fodder purposes, will now be in an advanced stage of growth, and where pastures are in fair condition there may be a surplus over immediate requirements. Every effort should, therefore, be made to conserve any surplus growth in the form of silage, hay, or stover.

Trench, pit, or stack silage is recommended as economical and profitable means of conservation where an overhead concrete silo is not available. However, it is the autumn-harvested crops which usually provide the greatest bulk of conserved fodder, so December sowings of suitable bulky summer fodder crops are best for that purpose.

In localities where lucerne does not make satisfactory growth, the cowpea will often provide an alternative protein-rich fodder, besides being a valuable rotation crop of benefit to the soil. Cattle will not take readily to green cowpea, preferring the fodder in an advanced stage of growth, but once accustomed to it, they will graze freely on it.

Sowings of main crop maize will be continued during the month where conditions are suitable, utilising late-maturing varieties such as Improved Yellow Dent, but in districts where early frosts are experienced, the mid-season or early varieties are preferable.

Buckwheat is recommended as an early-maturing alternative fodder crop, or as green manure where it is desired to plough under within 6-8 weeks. Besides being a good fodder, buckwheat is valued as a bee plant, while the seed makes excellent poultry feed. Wheat-harvesting will be practically finished this month. Growers are therefore advised to give the land a preliminary working immediately after the burning or grazing of stubble, in order to conserve succeeding summer rains to the fullest extent. Even where the land is too hard for adequate ploughing, a light working with disc cultivation or sundercut will be found very beneficial.

Experience in recent years has proved that adequately summer-fallowed land invariably produces profitable yields.

December is usually a busy month, through the successive sowings of a variety of fodder and grain crops, together with the scarifying of row crops already established.

CHEAP HORSE BRUSH.

To make a horse's body brush from an old yard broom, cut the back of the broom as shown by the dotted line. Nail a wide piece of leather on to the wooden part, trim the bristles, and the brush is finished.

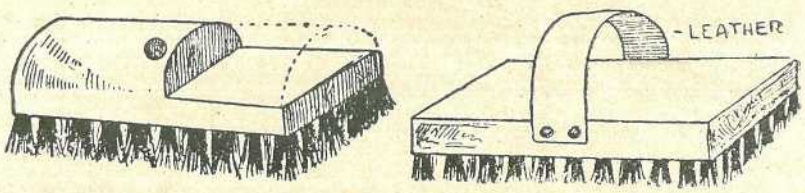


Plate 256.

Orchard Notes

DECEMBER.

THE COASTAL DISTRICTS.

PLANTING of pineapples and bananas may be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these Notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every change to get a good start; if checked when young, they take a long time to pull up and the fruiting period is considerably retarded.

Citrus orchards require constant attention; the land must be kept well worked and all weed growth destroyed. Spraying for scale insects should be done where necessary.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to quit.

Peaches, plums, papaws, and lemons will be in season during the month.

Examine potatoes and tomatoes for Irish blight, and melons and kindred plants for downy and powdery mildew. Use bordeaux or burgundy mixture for Irish blight and downy mildew, and sulphur dust or lime sulphur spray for powdery mildew.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

EARLY-ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle. The season of any particular variety is so short that it must be marketed and consumed as quickly as possible. All early-ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. Early-ripening fruits should, therefore, be carefully graded for size and quality, handled and packed with great care, and nothing but choice fruit sent to market.

Orchards and vineyards should be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later-ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, unless, of course, there is a good fall of rain to provide an ample supply of moisture.

Codling moth and fruit-fly regulations should be observed in order to keep these pests under control; otherwise the later-ripening fruits are likely to be attacked severely by these pests.

Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

MATERNAL AND CHILD WELFARE SERVICE.

History.

SOON after our Welfare Centres, which were known as Baby Clinics, were established in Queensland in 1917 by the Government, a booklet, containing thirty-one pages and entitled "Notes for Mothers," was distributed to the mothers by the Clinic nurses. In 1924 the booklet underwent revision, parts being rewritten and additions made, and it grew to twice its original size. In 1928 a further revision was carried out, and the volume issued from the press under the title of "The Queensland Mothers' Book." Since that time revisions and additions have been made periodically. During the last year the book underwent further revision, sections of it were re-written and additions, including several illustrations, were made. As a result of this the volume became so bulky that it was decided to publish it in two parts, one part being entitled "Care of Mother and Child," the other "The Expectant Mother." These are being issued to mothers at the Maternal and Child Welfare Centres.

Each part contains a foreword by the Hon. E. M. Hanlon, M.L.A., Minister for Health and Home Affairs, and a preface by Sir Raphael Cilento, Director-General of Health and Medical Services.

For the Mothers of Queensland.

The books are written for the use of the mothers of Queensland. The directions and advice given are founded upon the experience in the

care of expectant mothers and in the feeding and care of infants and children up to school age gained during the last twenty-one years of Maternal and Child Welfare Service throughout the State. While it is hoped that mothers will read these books, and put them away carefully where they can find them when they need them, we do not wish them to think that, when they possess these books, it will be no longer necessary for them to visit the Welfare Centre.

Every Child an Individual.

Each child requires to be studied individually, and a personal interview with a nurse, who is specially qualified to advise mothers, is worth much more than the reading of books. Mothers are advised to read the books in conjunction with regular visits to the Welfare Centres.

Advice by Correspondence.

Mothers living in sparsely populated areas and those who, for one reason or another, are unable to visit these centres, are invited to write to the nurse in charge of the nearest centre, and give her the particulars of their children's progress, notes on which they are invited to make on the plain sheets included in the books.

Mother and Child.

After stating the aims and objects of the Maternal and Child Welfare Service, this book describes the conditions essential for baby's health. In the section on infant feeding, stress is laid upon the value of natural feeding, and upon the fact that almost all mothers can feed their babies, either wholly or partly, if they desire to do so, and that even a small quantity of natural food is valuable and helps baby to digest any artificial food which he may need. It is pointed out that mother's milk is always ready and no troublesome preparation is required.

In cases where they experience any difficulty mothers are recommended to seek the help of a child welfare trained nurse. For use in the feeding of older children menus are included. Suggestions for the fillings of sandwiches for school children are made. Chapters on the care of the teeth, the training of the child, and the prevention of disease follow. The first-aid treatment of emergencies is given. Information regarding the choice preparation and cooking of food is provided, and many recipes are included. Reference to Western difficulties is made in another section. The book finishes with a few hints on economical housekeeping.

THE EXPECTANT MOTHER.

Ante-Natal Care.

This book opens with a section on ante-natal care and healthy motherhood. A section is devoted to the expectant father who can do much to help his wife during her period of expectancy. He is urged not to treat her as an invalid, but to encourage her to continue her usual interests, to take regular exercise stopping short of fatigue, to have sufficient sleep, fresh air, sunshine, and recreation of the right kind. The husband is advised to see that his wife receives the necessary ante-natal care from the earliest months and to assist her in carrying out the instructions which she received in regard to diet, care of the teeth, and general health, all of which aim at keeping her well and contented.

Special Exercises.

A list of special exercises is included. These are designed to improve her muscle tone as well as her general health.

Clothing.

Recommendations in regard to clothing are made. Directions for making a maternity belt are given.

Diet.

In the section on diet, requirements of the expectant mother are dealt with in some detail. The importance of milk, cheese, butter, eggs, meat, vegetables, fruit, and bread containing wheat-germ, is emphasised. Specimen menus for one day are included.

Complications.

Advice in regard to the complications of pregnancy is given.

Post-Natal Care.

The care of the mother and the child following the confinement is dealt with.

Special Exercises.

These are planned to enable the mother to regain muscular tone. It takes a little time to do these exercises, but if they are begun early, and continued regularly, the mother will be well rewarded by her increased fitness, by her feeling of wellbeing, as well as by her improved appearance.

Baby Clothing.

In the Appendix, illustrations of patterns and directions for making baby's outfit are given. These include vest, petticoat, dress, nightgown, jacket, bonnet, and shawl.

These books are issued at the Maternal and Child Welfare Centres, and mothers are invited to apply personally to the sister in charge of the nearest centre (Baby Clinic).

Plate 257.

On the Way to School.—A charming group study on the Goomeri-Gayndah road, near Boubyjan. The lake in the background is part of a sanctuary for wild fowl and is usually teeming with bird life.

IN THE FARM KITCHEN.

FOR HUNGRY HOLIDAY-MAKERS.

PICNIC MEAL I.

Jellied Veal.
Salad and Dressing.
Apple Tartlets and Cream.
Flummery.
Picnic Loaf Cake.

Jellied Veal.

Take 1 lb. cooked veal, ½ lb. cooked ham, ¼ teaspoonful nutmeg, ¼ teaspoonful pepper, 4 hard-boiled eggs, 1 oz. gelatine, ½ pint clear stock, salt to taste.

Mince finely the veal and ham. Season with nutmeg, pepper, and salt. Cut the hard-boiled eggs into thick slices. Take a square or oblong mould and fill with alternate layers of sliced eggs and minced veal and ham. Dissolve the gelatine in the stock, and when just hot pour into the mould. When cold, remove from the mould and serve on a bed of lettuce.

Apple Tartlets.

Take ½ lb. good short pastry, 6 apples, 4 oz. sugar, 1½ gills water, cloves.

Peel 1 quarter, and core the apples. Make a syrup by bringing water and sugar to the boil. Add apples and a clove or two and cook until quite tender. Beat well and allow to cool. Roll the pastry out thinly and cut into rounds, using a large cutter for the rounds to line the patty-tins and one a little smaller for the covers. Line the tins, fill with apple, wet the edges of the pastry with water, and cover the top. Make a small hole in the centre to allow the steam to escape. Glaze top with water and sprinkle with castor sugar, and bake in a quick oven until pastry is crisp and a pale brown. Turn out of tins to cool.

Flummery.

Take 1½ cupfuls cold water, 1 small cupful sugar, 1 tablespoonful gelatine, 1 tablespoonful flour, 6 passion fruit or three oranges.

Blend the flour quite smoothly with a little water. Put flour, sugar, gelatine, and water into a saucepan and stir till boiling. Boil well for seven to ten minutes to thoroughly cook the flour. Pour into a basin to cool. When cool, add passion fruit, or, if oranges are used, the grated rind and juice. Beat in a cool place till stiff and creamy. Pile into a deep dish and place on ice till required.

Picnic Loaf Cake.

Take ¾ lb. sifted flour, ½ cupful cleaned currants, ½ cupful stoned raisins, 2 oz. glace cherries, ½ teaspoonful salt, 8 oz. butter, 2 eggs, 1 cupful castor sugar, ½ cupful mixed candied peel, 1 oz. blanched almonds 3 teaspoonfuls baking powder, ½ cupful milk, ½ cupful sultanas.

Beat butter to a cream with the sugar. Sift flour with salt and baking powder into another basin. Beat eggs well, add to butter, and add flour and milk alternately to beaten eggs until all these ingredients are incorporated. Stir in chopped peel and almonds, halved cherries, chopped raisins, currants, and sultanas. Bake in a greased loaf-tin lined with two layers of greased paper in a moderate oven for one and a-half hours.

PICNIC MEAL II.

Aberdeen Sausage, Cold Ham.
Tomatoes.
Large Mince Pie.
Coffee Sandwich.

Aberdeen Sausage.

Take 1 lb. lean steak, ½ lb. bacon, 1 egg, 1 cupful breadcrumbs, 1 tablespoonful tomato sauce, 1 tablespoonful Worcester sauce, salt and pepper to taste, browned breadcrumbs.

Mince the steak and bacon and add them to the other ingredients. Beat the egg, add the sauces, and stir into the meat mixture. Mix well and form into a sausage shape. Place in a well-greased pudding cloth; roll up and tie the ends

securely close to the sausage. Stitch up the centre of the cloth to keep the water out. Put into a pan containing plenty of boiling water and boil steadily for two hours. Unroll and cover all over with browned breadcrumbs and allow to get quite cold. Garnish with salad and parsley.

Large Mince Pie.

Take about 1 lb. flaky pastry, mincemeat as required.

Roll out the pastry to almost a quarter of an inch thick. Take a sandwich tin and cut a round large enough to cover the top. Again roll the remainder of the pastry thinly and cut out a round large enough to line the tin. Press it into shape and fill with mincemeat. Damp round the top edge of the pastry and fix the lid on to it. Press the edges together. Decorate the edge with a fork. Brush over with milk. Bake in a hot oven for about twenty to thirty minutes, and until golden brown.

Coffee Sandwich.

Take ¼ lb. butter, 6 oz. sugar, 8 oz. flour, 3 eggs, 1 teaspoonful baking powder, 1 tablespoonful rice flour, 3 tablespoonfuls coffee essence, ½ lb. icing sugar.

Cream the butter and sugar, add beaten egg-yolks, then sifted flour, baking powder, and rice flour, one tablespoonful coffee essence, and lastly fold in stiffly-beaten egg-whites. Divide between two well-greased sandwich tins and bake in a moderate oven for from fifteen to twenty minutes. Turn on to a sieve to cool. Put together with jam or whipped cream and cover with a soft icing made by mixing two tablespoonfuls coffee essence with half a pound of icing sugar just warm, and pour quickly over the cake.

The following recipes will also help the picnic hostess:—

Moulded Tongue.

Take 4 cooked sheep's tongues, ¼ lb. ham, 2 hard-boiled eggs, chopped parsley, 1 pint savoury jelly, a few stuffed olives, 2 sweet gherkins.

Cut the tongues in slices and ham in small pieces, slice the eggs, chop the parsley, and cut olives and gherkins in slices or strips. Set a quarter-inch of jelly in the bottom of a mould; a square or diamond shape looks more effective. Arrange the ingredients in layers, setting a little jelly between each layer. When the mould is completely filled, set in the ice chest to become quite firm. Serve with salad and a suitable dressing with it. Substitute cooked rabbit for tongue for moulded rabbit.

Vegetables in Jelly.

Take 1 cupful celery cut into dice, ½ cupful diced carrots, ½ cupful green peas, ½ cupful cooked haricot beans, ½ cupful diced beetroot, ½ cupful shredded white heart cabbage, ½ cupful chopped walnuts, 1 tablespoonful gelatine, ¼ cupful cold water, 2 cupfuls boiling water, 2 egg-yolks, pinch dry mustard, pinch pepper and salt, ½ pint best olive oil, 1 tablespoonful white wine, vinegar.

Cook and prepare the vegetables, but slice up the cabbage raw, and if liked the celery may be put through the mincer. Mix all the vegetables together. Dissolve the gelatine in cold water, then add the boiling water, stir till this is well mixed and leave till it begins to set, then mix this with the prepared vegetables. Rinse a mould out with cold water, put the gelatine and vegetables in this, and set away till required. Make a mayonnaise and then turn out the vegetable mould, pour the mayonnaise over and decorate with chopped walnuts.

TO MAKE THE MAYONNAISE.—Beat up the egg-yolks, stir in the dry mustard, pepper, and salt, and mix well, then add the white wine, vinegar, and beat well. Next pour in the olive oil drop by drop, beating thoroughly. This home-made mayonnaise may be used for all kinds of cold dishes. A tablespoonful of cream may be added.

SANDWICH FILLINGS.

Cheese and Mustard.

Put cheese and mustard pickle through the mincer together, using proportions to suit the taste. Spread on buttered bread.

Cheese Sandwich.

Cream the yolk of a hard-boiled egg with one tablespoonful melted butter, add a little salt, white pepper, and mustard, and a quarter-pound grated cheese. Stir in a tablespoonful vinegar, spread on bread with lettuce leaf, and lay on rings of egg-white.

Scrambled Egg Sandwich.

Scramble eggs in the usual way, then break up with a fork and add a very little mayonnaise or enough melted butter to make of spreading consistency. Use on white bread.

Chutney Sandwich.

Toast squares of crustless bread on one side. Butter untoasted side and spread half the slices with chutney or chilli sauce. Cover with a second slice of toast and serve.

CHEESE ON THE MENU.

Milk is a perfect food except for one drawback. It is highly perishable. Not so cheese.

This nutritious food conserves a considerable amount of the proteins, fats, minerals, and vitamins contained in milk, and, moreover, it has one marked advantage —its keeping quality. Nor is it more expensive. Far from being a luxury, cheese is really an economy, since it has been calculated that a pound of cheese is equal in food value to three quarts of milk.

In spite of these obvious advantages, the fact is Australians eat very little cheese. In this way they neglect a very valuable and tasty food.

Cheese is not an ordinary food, because the various blends and degrees of ripening or maturity provide an infinite variety of flavours and textures. While the taste for many of the fancy cheeses requires the palate of a connoisseur, for every-day use Cheddar cheese has an agreeable and delicate flavour that, in either mild or fully matured form, gives a balance and a refreshment to any meal.

Processed cheese is a modern addition to the wide range of textures and flavours, which this valuable food has to offer. Processed cheese combines the smooth, even texture of mild cheese with the delicate flavour of the matured varieties.

By skilful blending a uniform product is obtained, which is emulsified, pasteurised, and packed in tinfoil for convenience of distribution and serving.

It is in the partnership of cheese with the other foundation foods that the true taste value of each can be heightened and varied. In a lettuce salad, with fresh fruit, or with egg, cheese is the chief resource of the craftswoman, who wishes her servings to be "different."

Cheese combines most effectively with apples and celery. In a vegetable salad, the artistry of natural colour combination can be manifested in the bright green of the lettuce, the ruddy hues of the tomato, the white and yellow of the egg, and the old gold of Cheddar cheese.

Squares of cheese mounted on coloured toothpicks are an attractive savoury at any meal or entertainment, while a jar of grated cheese can be used to heighten the flavour of the breakfast, scrambled egg, or luncheon sandwich filling.

Cheese, well masticated, is as digestible as milk, and there are many nutritional reasons for including it in the daily diet of young children.

Hot Stuffed Eggs with Cheese.

Two hard-boiled eggs, 2 teaspoons grated cheese, salt, cayenne, about 2 cups white sauce. Cut eggs in half. Remove yolks and mash finely. Add seasonings and grated cheese and about 1 tablespoon of sauce or the same of cream. Stuff the eggs with the mixture. Put in greased fire-proof baking dish. Pour white sauce over and heat thoroughly.

GIVING FLIES THE BLUE.

We all know what a pest the common house fly is in summer—a creature of filth and a conveyor of filth and disease.

Very satisfactory results for the control of flies in glazed buildings have been obtained in Latvia by coating the inner surface of all glass in the building with a paste of moderate consistency made from whiting and coloured with methylene blue. Experiments showed that the effects of mid-shades of blue on the fly may be described as similar to snow-blindness. Daubing with a sponge was found the best way of applying the paste.

Tree Heritage.

Following is an extract from an article by "Waratah" in "The Sydney Morning Herald":—

TO-DAY is the day of the tree. In garden, park, along sidewalk or open country, it is our one great relief against growing piles of masonry and cold, cheerless cement roads.

A tree is the emblem of Nature's greatest handiwork, a giver of shade and restfulness, a softening influence on our lives, and the insignia of all beauty-lovers.

No suburb, town, or landscape is complete without its planted trees. A treeless area is drab and uninteresting. According to the number, selection, and care of its gardens and trees in a settlement, it is almost possible to assess accurately the aesthetic and cultural tastes of the residents.

Trees and shrubs are companions to grow up with. Their association during our earlier years becomes a landmark on our memory. How many of us can forget that childhood's picture of the trees we climbed and sheltered under, and how much they formed a part of our home-ties!

These are sufficient reasons to support my plea for the trees.

It is idle to say there is no room for a tree in a small area. Some of the best trees I know are growing almost at street level, and adjacent to the house. Glorious trees, these are giving wonderful shade in summer, and, dropping their leaves early, allow winter sunlight full play! What more could we desire than that?

That is the essence of value in tree planting—placing them to the best advantage. Nature has generously provided varieties to stand up against strong winds—comely and decorative even these. Others are for shade and avenue purposes—dignified and spreading—while still others are for the essential use of specimens in lawn or border. There are trees with beautiful flowers—as the jacaranda and Cape chestnut; trees with glorious autumn tints, and splendid trees such as our noble gums—straight and clean of trunk, beautifully marked and with splendid shining branches, disdainfully thrown out, but making harmonious pictures. To me there is nothing more majestic—nothing more complete and restful than the gums. . . . . There is something uplifting about these trees, and it is a tonic and a joy to live among them. All along the sightline, these blue gums spread their regal heads, and yet we never tire of them. Pity the day when they are cut down to make way for "progress"!

Every building allotment should preserve its quota of trees to retain this standing beauty and irreplaceable heritage. Every home builder should see that some at least of the trees on his holding are preserved for his district and his own soul-satisfaction. It is the only way.

There is a small cleared and tree-bordered square near Pennant Hills that is almost hallowed ground. It must have been a fine old place that graced the area in days gone by—I have not yet heard the story—as a fine grouping of trees remains to testify. English oaks are here, and elms, cypresses, and brush box—even Chinese weeping elms. Those trees always hold a touch of romance.

Across the way there is a reserve of blue gums, noble and picturesque —incomparable in their setting.

A friend just back from Redcliffs, near Mildura (on the Murray), where the summers are sizzling, tells me of the avenues, or belts, of trees (white cedars and others) bordering the allotments. They are gratefully accepted for shade by travellers and workers. In season, they are beautiful in flower. Without those trees the going would be much harder.

Albury has its avenues of kurrajongs and other lovely species. Almost every home holding has its trees. Bathurst is planted with a specific variety—all lovely decoratives—in almost every street. Home gardens have beautiful trees. They are the greatest charm of this "City of the Plains."

In coastal country, jacarandas and Cape chestnuts take pride of place as flowering trees. The Flame Tree (*Brachychiton acerifolia*) gives us a blaze of glory to remember, but it is a variable doer in regard to flowering. Bauhinias are wonder trees when in full bloom—a mass of purple or white. They have the additional virtue of not growing too big. All soils suit them, but a warm situation is best.

Silky oaks, grown properly in a good soil, are grand—brilliant in flower. The Queensland chestnut (*Castanospermum australis*) similarly treated is one of the noblest decoratives we have.

Then there is a yellow-flowered cousin of the Pittosporum—*Hymenospermum flavum*—a small tree, and a fitting companion to the Bauhinias for restricted gardens.

Keep the camphor laurels away from tiny areas and garden beds. Their work is for colour making on a grand scale.

Magnolias are full of grandeur. The large white flowered "Bull-Bay" tree is still sporting a flower in odd places.

Where the site is warm and sheltered, and the soil deep, free, and moist (not badly drained), the "Fire" or "Wheel" tree (Stenocarpus) is a picture tree, graceful and shapely, and rich with blooms of fiery scarlet. With these conditions, it grows into a big tree.

Here, also, grow the Queensland lemon-scented gum (*Eucalyptus citriodora*), a poem of tree beauty—supple, and delicate as a wisp. It is our daintiest tall tree. Not for the dry hills and wind-swept positions are these two. Many of the kurrajong hybrids will stand up to hard going, and they are trees of great decorative value. . . . . All are evergreens in the truest sense. . . . .

EASY SCRUB FEEDING.

Thoughtless men cut down useful fodder trees; others merely lop off the top branches. Both ways are wasteful, and regrowth is a matter of months, or even years. The most economical method is to flail the leaves off. By stripping the foliage in this way, the twigs remain to make new growth within a few weeks, when the process can be repeated.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1939 AND 1938, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of years' records.	Sept., 1939.	Sept., 1938.		Sept.	No. of years' records.	Sept., 1939.	Sept., 1938.
North Coast.	In.		In.	In.	*South Coast–contd.*	In.		In.	In.
Atherton	0·74	38	0·41	0·95	Gatton College ..	1·53	40	..	0·86
Cairns	1·67	57	0·58	0·81	Gayndah	1·54	68	0·05	0·10
Cardwell	1·52	67	0·28	0·94	Gympie	2·10	69	0·06	1·66
Cooktown ..	0·56	63	0·30	0·13	Kilkivan	1·67	60	..	0·11
Herberton ..	0·55	53	..	0·35	Maryborough ..	1·91	68	0·16	0·68
Ingham	1·58	47	0·05	0·90	Nambour	2·44	43	0·50	0·86
Innisfail	3·51	58	3·69	3·00	Nanango	1·80	57	0·16	0·95
Mossman Mill ..	1·67	26	0·91	0·47	Rockhampton ..	1·28	68	..	0·01
Townsville ..	0·75	68	..	..	Woodford ..	2·12	52	0·42	0·95
Central Coast.					*Central Highlands.*				
Ayr	1·29	52	..	..	Clermont ..	0·99	68	..	0·02
Bowen	0·79	68	..	0·07	Gindie	1·03	40	..	0·27
Charters Towers ..	0·78	57	..	..	Springsure ..	1·29	70	..	0·63
Mackay P.O. ..	1·53	68	0·34	0·14	*Darling Downs.*				
Mackay Sugar Experiment Station	1·44	42	..	0·18	Dalby	1·66	69	0·01	0·56
Proserpine ..	2·04	36	0·38	0·84	Emu Vale ..	1·74	43	0·54	0·95
St. Lawrence ..	1·24	68	..	0·16	Hermitage ..	1·54	33	..	0·94
South Coast.					Jimbour	1·45	51	..	0·37
					Miles	1·33	54	0·07	0·96
Biggenden ..	1·50	40	..	0·13	Stanthorpe ..	2·27	66	1·17	2·18
Bundaberg ..	1·55	56	0·11	0·31	Toowoomba ..	2·09	67	0·14	0·58
Brisbane	1·99	87	0·45	0·99	Warwick	1·81	74	0·48	1·41
Caboolture ..	1·80	52	..	0·39	*Maranoa.*				
Childers	1·75	44	..	0·32					
Crohamhurst ..	2·59	46	0·35	0·83	Bungeworgorai ..	0·94	25	..	0·15
Esk	2·06	52	0·27	0·63	Roma	1·39	65	..	0·58

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1939.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	30·02	81	66	96	28	55	29	30	4
..	..	75	50	85	27	39	4, 29, 30	..	..
Herberton									
Rockhampton	30·11	79	54	91	21	45	4	..	..
Brisbane	30·14	74	51	84	21	44	13	45	3
Darling Downs.									
Dalby	30·14	74	41	82	26	27	13	1	1
Stanthorpe	..	67	33	77	26	21	13	117	4
Toowoomba	..	71	42	79	10	30	13	14	2
Mid-Interior.									
Georgetown	30·03	88	55	92	21, 22, 23, 27	41	5 5	..	..
Longreach	30·11	82	49	92	26	35		..	..
Mitchell	30·13	75	39	88	26	28	13	..	..
Western.									
Burketown	30·04	86	61	95	28	49	4	..	..
Boulia	30·11	83	53	94	25, 26	42	1	..	..
Thargomindah ..	30·13	78	47	90	25	39	5	..	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	November, 1939.		December, 1939.		MOONRISE. Nov., 1939.	Dec., 1939.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·3	6·9	4·50	6·31	9·49	10·17
2	5·2	6·10	4·50	6·30	10·45	11·1
3	5·1	6·11	4·50	6·30	11·34	11·45
4	5·0	6·12	4·50	6·33	..	..
					a.m.	a.m.
5	5·0	6·12	4·50	6·34	12·17	12·27
6	4·59	6·13	4·50	6·34	1·0	1·8
7	4·58	6 14	4·51	6·35	1·45	1·49
8	4·58	6·14	4·51	6·36	2·26	2·33
9	4·57	6·15	4·51	6·37	3·9	3·19
10	4·56	6·16	4·51	6·38	3·52	4·7
11	4·56	6·17	4·51	6·38	4·39	4·59
12	4·55	6·18	4·52	6·39	5·28	5·52
13	4·54	6·18	4·52	6·40	6·18	6·45
14	4·54	6·19	4·52	6·40	7·10	7·41
15	4·53	6·20	4·52	6·41	8·4	8·34
16	4·53	6·21	4·53	6 41	8·58	9·27
17	4·53	6·22	4·53	6·42	9·52	10·17
18	4·52	6·23	4·53	6·42	10·34	11·8
19	4·52	6·23	4·54	6·43	11·36	11·58
					p.m.	p.m.
20	4·52	6·24	4·54	6·44	12·26	12·49
21	4·51	6·25	4·54	6·44	1·18	1·41
22	4·51	6·25	4·55	6·45	2·7	2·35
23	4·51	6·26	4·55	6·45	3·0	3 32
24	4·50	6·27	4·56	6·46	3·54	4·29
25	4·50	6·28	4·56	6·47	4·49	5·27
26	4·50	6·28	4·56	6·47	5·47	6·25
27	4·50	6·29	4·57	6·48	6·45	7·19
28	4·49	6·30	4·58	6·48	7·44	8·11
29	4·49	6·30	4·58	6·49	8·38	8·59
30	4·49	6·31	4·59	6·49	9·30	9·44
31			5·0	6·50		10·26

Phases of the Moon, Occultations, &c.

4th	Nov.	☾ Last Quarter	11	12 p.m.
11th	,,	● New Moon	5	54 p.m.
19th	,,	☽ First Quarter	9	21 a.m.
27th	,,	○ Full Moon	7	54 a.m.

Perigee, 8th November, at 7.0 a.m.
Apogee, 20th November, at 5.0 a.m.

At 10 p.m. on the 19th Mars will be 6 deg. south of the Moon at first quarter. The Moon will set near midnight, and Mars about 50 minutes earlier.

On the 21st the Moon will accompany Jupiter. When darkness falls both will have crossed the meridian.

Saturn and the Moon will travel together across the sky from 3.54 p.m. on the 24th to 2.44 a.m. on the 25th, Saturn rising 20 minutes earlier and setting half an hour later than the Moon. When the planet is on the meridian—about 9.30 p.m.—the Great Square will be seen to the north-west of it.

Mercury will be a morning star at the beginning of December, and on the 17th attain its greatest distance—21 deg. west of the Sun.

When twilight fades on 13th December Venus will be seen in conjunction with a fine crescent of the Moon above the western horizon. Both will set at the same time—about 8.30 p.m.

Mercury rises at 6.11 a.m., 1 hour 8 minutes after the Sun, and sets at 7.53 p.m., 1 hour 44 minutes after it, on the 1st; on the 15th it rises at 6.7 a.m., 1 hour 14 minutes after the Sun, and sets at 8.2 p.m., 1 hour 42 minutes after it.

Venus rises at 5.53 a.m., 50 minutes after the Sun, and sets at 7.17 p.m., 1 hour 8 minutes after it, on the 1st; on the 15th it rises at 5.59 a.m., 1 hour 6 minutes after the Sun, and sets at 7.44 p.m., 1 hour 24 minutes after it.

Mars rises at 12.3 p.m. on the 1st, and sets at 1.21 a.m. on the 2nd; on the 15th it rises at 11.45 p.m., and sets at 12.54 a.m. on the 16th.

Jupiter rises at 3.11 p.m. on the 1st, and sets at 3.23 a.m. on the 2nd; on the 15th it rises at 2.10 p.m., and sets at 2.27 a.m. on the 16th.

Saturn rises at 5.16 p.m. on the 1st, and sets at 4.42 a.m. on the 2nd; on the 15th it rises at 4.13 p.m., and sets at 3.46 a.m. on the 16th.

4th	Dec.	☾ Last Quarter	6	40 a.m.
11th	,,	● New Moon	7	45 a.m.
19th	,,	☽ First Quarter	7	4 a.m.
26th	,,	○ Full Moon	9	28 p.m.

Perigee, 3rd December, at 5.0 p.m.
Apogee, 18th December, at 2.0 a.m.
Perigee, 29th December, at 9.0 p.m.

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

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

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