ANNUAL RATES OF SUBSCRIPTION.—Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling,** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

Vol. L 1 NOVEMBER, 1938 Part 5

Event and Comment

State Transport Co-ordination.

CO-ORDINATION in the public interest of all forms of transport is the object of a new measure which was submitted to the State Parliament in the course of the month. In a large, sparsely populated country like Queensland, transport services are, obviously, of major importance. In moving the second reading of the Bill, the Premier, Hon. W. Forgan Smith, sketched briefly the development of mechanised communications within the State, with particular reference to the revolution in transport which followed the coming into general use of the internal combustion engine. He emphasised the importance of railways, however, to the extension of land settlement and their influence on the general progress and wealth of Queensland, and expressed the view that Queenslanders must at all times depend on rail carriage for many of their material needs. He said, for example, that under no conditions to be visualised to-day could heavy haulage be transferred from the railways to some other means of transport.

Continuing, the Premier said that the wise policy of building railways from natural ports to the interior had produced in Queensland a better distribution of population than exists in any other State of Australia.

The miles of railway open for traffic in Queensland are 6,500 and 45 per cent. of that mileage is within territory containing only 15 per cent. of the population. The importance of those facts cannot be lightly regarded when transport problems and the financial position of railways generally are being considered.

The average goods revenue of the railways per ton mile last financial year was 1·68d. For every ton of goods hauled 100 miles the Railway Department received 14s., and empty haulage involved approximately 33⅓ per cent. of the total haulage, wagons being loaded to only 70 per cent. of their capacity.

Having regard to these important facts the difficulty of running State-owned railways on a strictly profitable basis, using the term "profitable" in the sense that the accountant of a joint stock company would use it, could be perceived, the Premier added. It was a good thing that the railways were owned by the State, because in no circumstances "would any private company, which seeks profits first, be likely to have built so much railway mileage in Queensland. From the point of view of the real development of the State, taking Queensland as a whole, who could urge that a loss has been sustained? The building of those long lines from seaports and the building of branch lines has enabled us to open up for the people, settle, and bring under production, lands that would otherwise still be in a virgin state to-day. Obviously, we have to regard the economy of a country as a whole and not in separate parts."

Mr. Forgan Smith went on to say—

> "In the Estimates the consideration of which we have just concluded each department is outlined in detail, but to obtain a proper bird's-eye view of the economy of the State we must pool all our resources and see the picture as one complete whole. Obviously, for instance, land revenue must be taken in conjunction with railways. If those railways had not been constructed and settlement had not followed, that land revenue would not be available. So that to take but one instance, the revenues of the railways and those of the land, from the point of view of Queensland's economy, have paid this country handsomely . . . . . "
>
> "If we want to arrive at a true balance of the assets and liabilities of our railway system, and the part that it plays in national economy, then land settlement, land revenue, agricultural development and population must all be added to the credit side. Viewed from that standpoint we realise that the Railway Department has played, and will continue to play, a very important part in the development of this country."

Development of Motor Transport.

DEALING with the development of motor transport, the Premier stated that no one could dogmatise as to what might happen in the next fifty years, but whatever path of development road transport might take with the internal combustion engine, it was extremely unlikely that heavy transport on roads would ever replace the railways.

The Premier then went on to describe the general expansion of motor transport which led to the establishment of the Main Roads Commission. The Commissioner of Main Roads and his engineers, he said, did not look at the building of a road merely from the point of view of constructing a roadway from one given point to another. They did not look at it from the engineering point of view alone, although that was of major importance. They made a very extensive contour survey of the country that the road was to serve. They found out the class of crop that the land was expected to grow and the use to which that land would be put, and the final survey provided for the road that would be most suitable for the settlers whom it was intended to serve.

The activities of the Commission had grown very extensively since it was established, and last year it spent £1,455,752 on road construction, and that figure excluded the amount spent by the Public Estates Improvement Branch of the Department of Public Lands and the amount spent under various schemes by the local authorities.

Since the inception of the Main Roads Commission it had spent £14,203,050 on its own activities, excluding the activities of the other authorities mentioned, and its annual expenditure was growing with the needs of the population and the demands for better facilities. The wear and tear on main and developmental roads by heavy vehicles was considerable.

In some quarters, the Premier remarked, there had been a tendency to deprecate railways and to approve of road transport, but much of that controversy was propaganda. Each form of transport had its rightful place in a well-organised community.

The principle had been laid down, however, that users of public highways as an instrument of business should pay a service fee for the facilities and advantages provided. Anyone who objected to that principle obviously wanted a private gain at community cost. The type of vehicle and the load of the vehicle were important considerations in fixing the value of that highway service. Some types of vehicle wore the roads more than others. For example, a motor lorry with flat, hard tyres, carrying a heavy load, damaged the road more than a similar vehicle shod with pneumatic tyres carrying a similar load.

Motor transport to-day was capable of supplying and was supplying a community need. Competition among the transport services, however, must be regulated. Just as they had to regulate railways, so a similar problem was presented in road transport. Just as a railway company or a railway department did not allow any more trains on a line than were required to give an effective service, so the principle applied to heavy vehicles running on a traffic road.

There was a provision in the Bill enabling drivers of heavy vehicles to obtain Industrial Court awards. There was also an important provision regulating the time—and this applied to both owner-drivers and employees—that anyone might drive a heavy vehicle continuously.

In the past there had been very gross cases of overloading. In policing the existing Act it had been found that 2½-ton vehicles had been loaded with as much as seven tons. Motor vehicles loaded to their capacity had been observed going up the Toll Bar road to Toowoomba in reverse gear. That indicated the extent to which overloading was taking place, and such overloading was a danger to the public and all others concerned, and must be stopped in the public interest. The rigid policing of the Act had almost wiped out that type of offence, but continued vigilance would be maintained to preserve reasonable loading on road transport vehicles.

The Premier stated further that the principles contained in the Bill were in accordance with his policy speech at Mackay, when he said:—"Labour is anxious to promote co-ordination and a friendly spirit of co-operation among all transport agencies for the best service of the public. Labour's proposals aim at alloting to each form of transport its appropriate function and so avoiding wasteful competition, but at the same time securing equitable conditions to all. In all matters affecting transport, as in public policy generally, Queensland's interests will be paramount."

The Control of Banana Rust Thrips.

N. E. H. CALDWELL, B.Sc.Agr., Assistant Research Officer.

(*Continued from p. 449, Part 4, Vol. L.—Oct.*, 1938.)

XI. THE CONTROL OF RUST.

(1) Legislation.

The present policy of the Queensland Banana Industry Protection Board is to discourage the transference of planting material from thrips-infested districts or localities to districts or localities thought to be free from the pest, or from localities heavily infested to localities only slightly infested. There can be little doubt that a factor in the spread of thrips throughout the banana-growing areas of the State has been the transference of infested planting material from one area to another. At the same time there must be a gradual natural spread of the insect. Though there are now no large districts in southern Queensland free from the pest, there are within these districts many localities thought to be free or known to be only slightly infested. Therefore, the present policy of the Banana Industry Protection Board in respect of the transference of planting material should be continued, at least until some efficient method of destroying thrips on infested planting material has been devised.

(2) Use of Clean Planting Material.

Growers establishing new plantations should make every effort to obtain clean planting material, even for new plantations in infested localities. By so doing, severe rust may be avoided in the first and possibly the subsequent cuts.

At present, clean planting material can only be obtained from a plantation which is absolutely free from thrips. It must be remembered, however, that many plantations thought to be thrips-free on account of the lack of rust development on the fruit may be harbouring a small thrips population which would be quite sufficient to initiate infestation in a new area.

If material from a clean plantation is not obtainable, it should be sought from an area which has experienced only slight rust incidence. At all costs, heavily infested plantations should be avoided. The smaller the number of insects transferred to a new area, the greater will be the chance of avoiding severe rust for any given period. If the need for the application of control measures to bunches of only the first cut can be completely or even partially obviated by adequate precautions, any additional expense incurred in obtaining thrips-free, or lightly infested, planting material will be amply justified.

(3) Treatment of Planting Material.

All types of planting material from infested plantations should be pared and trimmed as severely as possible without injuring the growing tissue. Such treatment will remove adhering earth, plant debris, etc., and free the plants from a great part of the thrips population.

The usual method of paring and trimming suckers, involving the removal of the outer tissues of the corm to expose banana weevil borer channels, stripping the outer leaf sheaths from the pseudostem and

cutting off the top of the plant near the juncture of leaf petioles with pseudostem, does not completely eliminate the thrips population. Furthermore, the dipping of such pared and trimmed suckers in a nicotine sulphate bath will not ensure thrips-free planting material.

A more drastic treatment of suckers, which is practised by some growers, does not appear to be prejudicial to the subsequent growth of the plant. It entails cutting off the pseudostem not more than three inches above ground level (relative to the sucker's original position), coupled with heavy paring of both the corm and the remaining portion of the pseudostem. This treatment, followed by dipping in a nicotine sulphate bath, should destroy any thrips present on the suckers, but no experimental data on this point is available.

The use of "bits" has been brought into prominence recently for cultural reasons. This type of planting material, either with or without dipping, appears to offer the best chance of establishing a thrips-free plantation, provided, of course, that the corms from which they have been cut have been properly pared. Again, experimental evidence is not available.

The same applies to "butts," or whole corms, though cultural considerations probably preclude the wide use of this type of planting material.

Any treatment of planting material which, at a reasonable cost, considerably reduces the initial thrips population of a newly-established plantation, will probably be justified unless the plantation is situated adjacent or in very close proximity to heavily-infested bananas. As the cost is small, the dipping of both "bits" and heavily pared and trimmed suckers in a nicotine sulphate bath (nicotine sulphate 1 pint, water 60 gallons, soft soap 3 lb.) would be well worth adopting on a commercial scale by growers, even though the treatment may not completely eliminate the pest.

(4) Recommended Control Measures on Bearing Plantations.

Bagging and dusting are strongly recommended for banana rust thrips control in the plantation and the following details in connection with this method of control must be stressed.

The bag must be made of good quality "sugar" hessian, i.e., 11 oz. hessian. Bags 45 inches deep and 27 inches wide are large enough to accommodate most bunches.

Nicotine dusts should be used in which the nicotine may be present either in the free state or as nicotine sulphate, but the actual content of nicotine should not be less than 2 per cent. The physical properties are most important. A light "fluffy" kind of dust is necessary to secure adequate penetration into all parts of the bunch. Heavy, quick-settling dusts are less effective. For this reason, nicotine dusts in which some other insecticidal materials, such as sulphur, have been incorporated, are usually unsatisfactory for the control of the banana rust thrips.

The bunch must be bagged as soon as practicable after emergence from the throat of the plant. The mouth of the bag can be fastened securely round the bunch stalk above the top hand by means of string, wire or a nail. About a fortnight later the bag should be taken off, fallen bracts emptied out, adhering bracts removed, the flower bud broken off and the bag then replaced. This operation is necessary to minimise the risk of fungal infection of the fruit.

During the thrips-active season, the dust should be applied to the bagged bunches at fortnightly intervals throughout the life of the bunch, or, as an alternative, at weekly intervals for a month after the bunch is thrown, dusting then being discontinued. The former method has given satisfactory results under all conditions experienced in southern Queensland in four seasons. The second has been tried for only one season under conditions of moderate rust incidence, when it was completely satisfactory, and this treatment may, for all practical purposes, prove to be as efficacious as the first.

The first dusting should be applied either before or just after the bag is first fitted to the bunch. In the former case the bunch and the bunch stalk above the top hand can be dusted thoroughly. Quite good results, however, can be obtained by applying the initial dusting through a small hole in the bottom of the bag. All subsequent dustings are given through this aperture. When dusting through the bag, the mouth of the duster should be pointed more or less directly upwards to ensure that the dust is blown right through the bunch from bottom to top.

In all readily available makes of dust gun, it is necessary to reduce very considerably the flow of dust from the machine. Without some modification, dusters are liable to deposit excessive amounts of the insecticide on the fruit which may then require cleaning before packing.

With small hand dusters of the plunger pump type, holding about one-half pound of dust, the aperture of the hopper outlet is usually about three-eighths of an inch in diameter. The dust flow of these machines can be reduced effectively by inserting into the outlet a cork from which a V-shaped section has been cut so that the area of the aperture is one-eighth that originally provided. About six full strokes of the pump are then sufficient for the average bunch. Ideally the bunch within the bag should be enveloped in a cloud of dust, sufficient to kill the insects without leaving more than a film of dust on the fruit. With care and a little practice growers should have no difficulty in performing this operation.

Two other methods of treatment give a fair measure of control. Though not so efficient in the control of rust as bagging with dusting, they have the merit of much smaller cost and thus may sometimes be useful. For instance, they could be used early in the season as a precautionary measure until the trend of thrips activity is sufficiently clear to indicate the need or otherwise for more effective measures.

In the first of these alternative methods, the bags are dispensed with and the bunches are dusted with a nicotine dust at weekly intervals. Longer intervals between dustings are much less efficient. Treatment must be thorough. The dust must be blown into the bunch from all angles, particular attention being paid to the top hands, where the thrips infestation is heaviest, especially if the bunch is at all choked. At the same time the dust residue must be kept down to a minimum.

The second alternative method requires the use of a cloak and the application of a nicotine dust at fortnightly intervals. The cloak—a piece of hessian—is wrapped round the bunch as soon as possible after it is thrown. Thereafter the procedure is the same as with bagging and dusting, the insecticide being blown on to the bunch from the bottom and the exposed side, if any. The cloak must be of the good quality hessian and large enough to envelop the bunch fairly completely.

It is necessary to stress the fact that open mesh, inferior quality hessian, when used either as bags or cloaks, has not proved satisfactory in rust control experiments.

Dusts, either alone or under bags or cloaks, should not be applied when the bunches are wet, as heavy dust residues may accumulate on the fruit under these conditions. Owing to the protective action of the sugar hessian, bunches enclosed in bags can be dusted with much less interference from rain than uncovered bunches. Only during heavy and prolonged rain, which, of course, is fairly common during the thrips season in most of Queensland's banana-growing districts, do bunches in the bags become wet enough to prevent dusting.

Whatever control measure is adopted by the grower, every stool in the plantation should be inspected at weekly intervals, or as near thereto as practicable. Thus, even in the case of bagging with fortnightly dustings, the selection of newly thrown bunches for treatment should be carried out each week. If this is not done, some bunches will be nearly a fortnight old before control measures are applied and they may have developed a certain amount of rust and, what is more serious, acquired a dangerously large thrips population, the complete extermination of which will not be effected by the first application of dust owing to the survival of the eggs and some of the insects in more sheltered situations.

Normally, growers should be prepared to start control operations during November but a close watch should be kept on the situation from early October. When bunches less than a month old show appreciable amounts of rust, or are harbouring a large thrips population, control operations should be started immediately. Treatment should not be deferred until rusty fruit is being harvested. When control measures are first applied to newly thrown bunches those already hanging should not be neglected. November "dumps," though they may remain practically clean for some weeks, are very liable to become rusted rather badly by the time they are harvested, and it is not uncommon for October-thrown fruit to be affected similarly.

Dusting may be safely terminated at the end of April, or perhaps a little earlier in some seasons, but the incidental benefits due to bagging the fruit, and to a somewhat lesser extent to cloaking, are so great that growers should, where practicable, continue covering the bunches right through the winter.

The selection of the right time to start control work will depend on the judgment of the grower. Much time and money can be lost by faulty decisions and growers should, therefore, familiarise themselves with the appearance and habits of the pest. The insects in the adult and larval stages, the only stages with which the grower need be concerned, are readily visible to the naked eye, and the results of their work are only too obvious. Finally, it cannot be emphasised too strongly that the appearance of the young bunches in the plantation, and not the cut fruit in the shed, is the key to properly applied control measures.

(5) Related Factors to be Considered in Rust Control.

(*a*) *The Effect of General Cultural Methods on Rust Control.*—It has been clearly demonstrated that "choked" bunches tend to develop more severe rust than well-thrown ones. In addition, owing to the

compaction of the fruit in some of the hands and the consequent relative inaccessibility of the contact surfaces of fruits to dust penetration, the efficiency of all recommended methods of control is markedly reduced, particularly in respect of top hands which usually contain the best fruit on the bunch. Growers should, therefore, adopt methods of cultivation, fertilizing and suckering which promote vigorous plant growth and hence the production of loose, well thrown bunches. Vigorous growth is also associated with early fruit maturity, which is highly desirable in that it results in the exposure of the fruit to the depredations of the pest for a shorter time.

In some cases the rust control programme can be curtailed considerably by regulating the growth of the plants so that the majority of bunches will be thrown at a period which does not coincide with that of maximum thrips activity. Under present conditions, this can be done only by the regulation of sucker growth and is practicable only in the second and subsequent crops. Cultural difficulties play a dominant part in any such programme and probable market conditions must also be considered. Spring-thrown bunches escape rust to a large extent but are marketed in the summer when prices are usually low. Winter bunches are generally not of satisfactory quality. On suitable plantations, bunching should be timed for the autumn. Bunch treatment for rust control should then be unnecessary for all but March and early April bunches but, as all autumn bunches hang through the winter, they should be bagged or cloaked, irrespective of rust incidence. Despite winter conditions this treatment will ensure the development of well-filled, good quality fruit which will be ready for cutting in the spring when the market is normally buoyant.

Cutting up spent stems is essential for the purpose of controlling the banana weevil borer (*Cosmopolites sordida* Boisd.). This must have some effect, however small, in reducing the thrips population. Flower buds must, of course, be removed from bagged bunches. It is improbable that their removal has any significant effect on thrips population as it is only in the case of very severe infestations that the insects breed in these parts.

(*b*) *The Effect of Recommended Control Measures on General Plantation Operations.*—The application of the bagging and dusting method of treatment introduces certain practical difficulties into plantation operations which can be overcome by a little intelligent organisation of labour and materials on the part of the grower.

Some method of distinguishing bunches bagged each week is necessary. The bags should be numbered with a different numeral for each week, the numbers being placed on both sides of the bag in large script to facilitate recognition at a distance. The use of Roman notation would reduce printing difficulties. The ordinary blacking used in stencilling should be found quite satisfactory.

Such a method of numbering will eliminate any confusion as to which bunches require treatment in any week. It will also greatly assist in indicating the state of maturity of the bunch. In practice a knowledge of the exact age of the bunch, as shown by the number of the bag, and the feel of the fruit through the bag will enable the experienced grower to judge accurately the state of maturity of the fruit without removing the cover.

In the case of cloaked bunches no difficulty arises in readily determining the state of maturity of the fruit. However, as dusting is required only at fortnightly intervals, it is still necessary to adopt a system of marking the cloaks to distinguish those due for treatment in any week.

(*c*) *Incidental Effects of Recommended Control Measures.*—The highly beneficial effects of bagging, and to a lesser extent cloaking, on the quality of fruit and in the control of sundry pests and diseases have been stressed elsewhere. Covers have the further advantage that, if left on the bunch after cutting, the fruit is thoroughly protected on its way to the packing shed. The colour of bagged and cloaked fruit is rather pale but this does not prejudice marketing. There is, therefore, no need to remove the bag for the last week or two before cutting the bunch in an attempt to darken the colour, a practice which frequently causes severe scalding.

(*d*) *Marketing Rusty Fruit.*—In the southern States rusty fruit is more severely penalised than in many Queensland markets, where consumers are more familiar with it. No matter how efficiently control measures are applied, growers will still have some blemished fruit, especially in bad rust years. If this fruit is marketed locally at a slight discount, the clean fruit can be reserved for markets in the southern States. In this way each grower could do much towards maintaining a good reputation for his brand in the south and thus avoid the risk of depreciated prices.

(6) The Special Problem of Control in Tall-growing Varieties.

The control measures outlined have, of course, been developed for the dwarf Cavendish variety which is overwhelmingly the most important in Queensland, particularly in the severe rust areas.

Tall-growing varieties such as Lady Fingers and Sugars are grown chiefly in southern Queensland, though, for the most part, beyond the limits of severe rust infestation. Mons Marie, a variety which is tall-growing under favourable conditions, is at present being more extensively planted throughout the southern portions of the State. None of these varieties is immune from rust. As the bunch in all these varieties is normally out of reach, rust control presents a special problem. The labour involved in bagging and dusting the bunches might render the method uneconomic. Cloaking and dusting offers somewhat better possibilities since bract and bell removal can be dispensed with. Dusting operations would necessitate a large duster of the knapsack type provided with a greatly extended feed arm.

In the event of severe rust infestation in areas of tall-growing varieties, it seems obvious that further enquiries into the matter of control will be necessary.

(7) Geographical Limitations of Control Recommendations.

The control measures detailed above have been designed for conditions in the south of the State. They have not been tested in Central and North Queensland where conditions are very different in many respects. Their value in these regions still requires investigation.

(8) The Economics of Control.

The cost of the various control measures is admittedly rather high. Bagging and dusting is estimated to cost rather less than 6d. per bunch

and dusting alone in the vicinity of 2d. The cost of cloaking and dusting will depend on the price of the material used for cloaks but should be intermediate between the other two methods.

These costs are based on wages at the rate of 15s. per diem, the ruling market rates for dusters and dust, the price of bags purchased in lots of one hundred and the assumption that one bag will serve for two bunches. By strict attention to detail growers should be able to operate under commercial conditions at costs below these estimates. The price of bags would probably be reduced appreciably if large quantities were purchased. In addition, if the bags are thoroughly dried and stored in a dry place free from vermin when not in use, the majority will last for at least three bunches. Efficient organisation will keep labour costs down to a minimum. One man should be able to dust four to six acres on the average plantation in a working day of eight hours. The time required for marking bags, placing them in position and their subsequent attention must, of course, also be taken into consideration. The cost of dust and dusters is relatively insignificant compared with the two main items of cost—viz., bags and labour.

The minimum profit which can be expected from the efficient application of rust control measures is represented by the return obtained for the fruit which would otherwise be unmarketable. The cost of control will usually be amply covered by the enhanced prices for the remainder of the fruit, due to the absence of rust and improved general quality. As the wastage in a bad thrips year may represent from 10 to 50 per cent. of the season's total crop, there is no doubt that rust control will pay handsomely, except perhaps under extremely depressed market conditions.

XII. SUMMARY.

(1) The history of *Scirtothrips signipennis* Bagnall as a pest of bananas in Queensland and its occurrence in other parts of the world are briefly reviewed.

(2) The importance of banana rust thrips to the industry is discussed, and it is concluded that the pest has played only a minor part in the recent diminished production.

(3) A summarised account is given of the bionomics of *S. signipennis*, based on previous investigations and observations made during recent work.

(4) Originally of economic importance only in North Queensland, the pest is now established in most banana-growing districts. Two major outbreaks in 1923-5 and 1930-33 caused widespread losses. More recently the pest has been relatively unimportant, but individual plantations may suffer each year.

(5) The available information on population fluctuation and epidemic outbreaks of the pest in Queensland is reviewed. Topography of the plantation has a definite bearing on the population, probably as a result of temperature effects. Meteorological data sheds little light on the phenomenon of epidemics. Widely held views on the irregular distribution of the pest are examined, but none can be accepted without question as valid explanations of the phenomenon. The lessened susceptibility of aged plantations to attack also remains unexplained.

(6) A detailed account is given of the injury caused to the banana plant.

(7) Extensive control experiments conducted in the field during four consecutive seasons are described. The most satisfactory results were obtained from repeated treatment of the bunch with nicotine dusts either alone or in conjunction with hessian bags or cloaks. The best control was obtained by using bags made of 11-oz. sugar hessian in conjunction with fortnightly applications of a nicotine dust throughout the life of the bunch, though the restriction of the dustings to three at weekly intervals in the early stages of bunch development gave comparable results in the single experiment of this type carried out. Bags or cloaks of an inferior quality hessian (10-oz.) were less satisfactory, but, in combination with certain dusting schedules may give reasonable commercial control of rust under plantation conditions. Other dusts tested, including derris, pyrethrum, sulphur and calcium cyanide, singly or in various combinations, were less efficient than nicotine dusts, either when used alone or with bags or cloaks. Good quality bags and cloaks without supplementary dusting gave fair control in some experiments but proved unreliable. The treatment of the whole plant with nicotine dust proved both uneconomical and inefficient.

(8) The possibilities of several other methods of bunch treatment were examined but did not warrant large-scale field trials.

(9) Plants grown under glasshouse conditions from suckers pared, trimmed and dipped in a nicotine sulphate bath before removal from the plantation acquired a banana rust thrips population. Such treatment cannot, therefore, be relied upon to give thrips-free planting material.

(10) Control measures based on these experimental results are formulated and shown to be both practical and effective. The principal control recommendation necessitates bagging the bunches as soon as practicable and dusting with a nicotine dust fortnightly during the whole growth period of the bunch. Alternatively, the bagged bunches may be dusted weekly for the first month only.

XIII. ACKNOWLEDGMENTS.

During the course of these rather extensive investigations the author has been rendered valuable assistance by many persons. Free access to their plantations for experimental work was afforded by nine banana growers. Messrs. Buzacotts (Qld.) Ltd. provided free samples of dust in one season. Of fellow officers of the Department of Agriculture and Stock, Messrs J. A. Weddell, A. R. Brimblecombe, and C. W. Winders assisted in the field work in 1933-34; many officers of the Fruit Branch provided transport facilities and helped in other ways, especially Mr. J. R. Horsley, Banana Agent, Pomona, in whose district the bulk of the experimental work was carried out; various other officers consulted from time to time were ever ready to assist with information and advice. To all these the author's sincere thanks are tendered. Finally, it is desired to acknowledge the help of Mr. J. Harold Smith in the preparation of the manuscript and in other matters, and of Mr. Robert Veitch, firstly as Chief Entomologist and latterly as Director of Plant Industry (Research), who provided the facilities for the work and whose encouragement and advice were greatly appreciated in its performance.

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THE PLOUGH.

The plough is still the most important implement in agriculture, in spite of all the engineering progress which has been made. Over and over again it has been claimed that our modern cultivators have reached the stage of development when they are considered capable of doing the whole work of preparing the soil without the use of the plough. But time has proved that the plough still remains indispensable. The rototiller, or some other implement, may one day push the plough on to the farm scrap heap, but that time has not come yet.

To obtain the best results from a plough, the discs or mouldboards should never be allowed to rust. It is only a small job to clean and grease them immediately after use, and particularly when the implement is to remain out of use for any length of time. Mouldboards or discs which have become pitted as a result of rust do not work as smoothly when working in moist or heavy soil as those with a bright smooth surface.

Most of the bad ploughing seen on a day's run through farming lands can be traced to the faulty setting of the plough. Apart from other points, the influence of "set" on the draught of the plough is very great. Another serious result of faulty setting is the wear and tear on the plough itself.

Again, disc ploughs with badly-worn discs are frequently seen in use. Provided the plough is otherwise mechanically sound, the obvious remedy for faulty ploughing in such cases is to fit a new disc.

After all, it is not a hard job to set a plough properly. There is no magic or mystery about it. No special skill is called for. All that is required is a fundamental knowledge of the purpose of each part of the implement, and the ability to use that knowledge, so as to make each part work in harmony with the whole, and thus preserve what is known as the "balance" of the plough. Any experienced ploughman will show the new hand how to set the implement, and, while on the job, there is nothing better than a sweetly running plough.

The Acidification of Alkaline Nursery Soils for the Production of Exotic Pines.

H. E. YOUNG, M.Sc.Agr., Assistant Research Officer.

THE most important softwood planted in Southern Queensland is the hoop pine, *Araucaria cunninghamii*. In the early years of its development this tree will not stand heavy frosts, and it is essential to avoid affected areas when planting with this species. It has therefore been found necessary to provide a "filler" species for the localised areas which are subject to frosting. The proportion of these areas in the Brisbane Valley rises to from 10 to 20 per cent., and the quantity of planting stock of the species required is considerable. Experiments are current to determine the possibility of using indigenous forest trees on frosted sites, but in the meantime recourse is made to exotic species, principally *Pinus caribæa*. The use of these species in conjunction with hoop pine gives rise to the necessity for making the production of exotics a subsidiary function of hoop-pine nurseries. Attempts at producing exotics in the Yarraman nursery in sufficient quantities to meet the requirements of part of the Brisbane Valley area were not attended with very satisfactory results, and necessitated the importation of the required nursery stock from coastal nurseries—a procedure involving considerable expense. This led to an inquiry into the reason for the failure experienced in the area concerned.

Preliminary investigations at the Yarraman nursery revealed the frequent absence of mycorrhizal structures on exotic seedlings in the nursery beds, and the unthrifty growth was considered to be bound up with this phenomenon. The seed on sowing was found to germinate successfully, and the seedlings grew to a height of 3 to 4 inches, but then became chlorotic and spindly, and growth ceased. This was usually followed by death of the plants. The introduction of vigorous plants with well-developed mycorrhizal root systems, with the object of infecting the nursery soil with the symbiotic fungus, together with the addition of organic manure to the beds, was tried without success. Hydrogen ion concentration determinations revealed the alkaline state of the nursery beds. This alkalinity is presumably due to the relatively low rainfall, the light frequent waterings and high evaporation rate causing an upward movement of the soil bases. It seemed likely that, although the nursery soils were for the most part suitable for raising the native species, their alkalinity might be a limiting factor in the case of exotics. Experiments on the effectiveness of increasing the acidity of the nursery beds at Yarraman were consequently initiated.

Soil Acidification in General.

Usual practical methods of soil acidification are by means of treatment with aluminium sulphate, sulphuric acid, or ground sulphur. Sulphur was used in France in viticultural and other work in the nineteenth century, and in 1877 Panknin, of Charleston, South Carolina, suggested that sulphur mixed with ground bone or mineral phosphates produced sulphuric acid when incorporated with the soil, thus making the phosphorus available. He patented his process in 1878, and a similar patent was taken out by B. Chisholm, of the same town, in 1904. Lipman

in 1916 observed that sulphur applications were successful in the treatment of potato scab, and suggested that sulphur applications in agricultural practice would make the soil phosphates available by acidifying the soil, and he commenced experiments which demonstrated this. Hibbard (1921) also showed that the application of sulphur could be used to acidify alkaline soils. Joffe and McLean (1924) came to the conclusion that the value of the sulphur was in providing hydrogen ions which replaced the calcium and sodium cations in the exchangeable bases of the soil. The salts formed are in the form of alkaline or alkaline earth sulphates. By means of this breakdown there is brought about a solvent action towards a number of essential plant foods which were formerly present in insoluble and unavailable forms. The principal solvent effect of sulphur oxidation is on the calcium carbonate of the soil (McGeorge and Greene, 1935), and sulphur therefore increases the availability of calcium as a plant food in alkaline calcareous soils. The size of the sulphur particles appears, from the work of these authors, to have little effect upon the rate of oxidation or its effects, and therefore ordinary agricultural ground sulphur is suitable for soil applications.

Although the oxidation of sulphur to sulphuric acid by bacteria in the soil, on which the above reactions depend, is a process which has been well known for many years, it is only comparatively recently that the phenomenon has been investigated in detail. Liebig was perhaps the first to suspect that the oxidation was a biological process (Lipman, 1916). The nature of the true sulphur bacteria was shown by Lipman, Waksman, and Joffe (1921), by Joffe (1922), and by Waksman (1922). The bacterial oxidation of elementary sulphur in soil is brought about chiefly by the genus *Thiobacillus,* which Bergey (1930) describes as "small, rod-shaped organisms deriving their energy from the oxidation of sulphides, thiosulphates or elementary sulphur, forming sulphur, persulphates, and sulphates under acid or alkaline conditions and deriving their carbon from carbon dioxide or from bicarbonates and carbonates in solution; some are obligate, and some facultative autotrophic; one species is anærobic."

The chemical oxidation of sulphur to sulphuric acid in the soil also occurs, but it is unimportant compared with the biological process. It has been shown by Kappen and Quensell (1915) that flowers of sulphur is not appreciably affected in a sterile soil, but that milk of sulphur undergoes oxidation. There is evidence that the chemical oxidation of sulphur in the soil decreases with the increasing size of the sulphur particles.

Work in Australia on soil amelioration by means of sulphur application has been carried out by Rountree (1933) on an alkaline South Australian soil—namely, the Renmark clay loam. This author studied the effect of soil temperature and soil moisture on the rate of sulphur oxidation, and isolated an organism from the soil in question and studied its reactions in sterilized soil. Sulphur had also been used by Sideris and Krauss in 1933 for soil acidification purposes in Hawaii in connection with pineapples, and Lewcock (1935) in Queensland has used it in connection with the control of pineapple wilt.

Investigations in Queensland.

In the preliminary trials carried out with the object of correcting the alkalinity at the Yarraman forest nursery, sulphur and aluminium

sulphate were used as acidifying agents. The results indicated that aluminium sulphate, although successful in increasing soil acidity, was toxic to the pine seedlings when used in quantities sufficient to produce the required pH value. The results obtained from the sulphur treatments justified further investigation.

Nursery trials were therefore established using a series of four nursery beds, each 4 feet wide. The experiment was laid out as a randomised block of seven treatments with four replications. Each unit plot was 4 feet square, with isolation strips 15 inches wide between each two plots. The treatments used were as follows:—

(*a*) Ground sulphur at the rate of ½ lb. per plot (1,400 lb. per acre).
(*b*) Ground sulphur at the rate of 1 lb. per plot (2,800 lb. per acre).
(*c*) Ground sulphur at the rate of 1½ lb. per plot (4,200 lb. per acre).
(*d*) Ground sulphur at the rate of 2 lb. per plot (5,600 lb. per acre).
(*e*) Ground sulphur at the rate of 3 lb. per plot (8,400 lb. per acre).
(*f*) 0.6 cubic feet of rotted cowdung per plot (10 tons per acre).
(*g*) Untreated control.

Soil samples were taken from each plot before treatment, and pH determinations were made. A complete analysis of the untreated soil was also made. The treatments were applied to the plots on 13th June, 1934, the dressings being well mixed with the top 6 inches of soil in each plot. There was a very noticeable smell of hydrogen sulphide in the neighbourhood of the sulphur-treated soil for a number of weeks after treatment. Monthly pH determinations were made by means of an antimony electrode by the Agricultural Chemist on samples obtained from each plot until 15th February, 1936. The readings taken were made from composite soil samples taken to a depth of 8 inches.

After the sowing of the seed, the beds were kept moist until the seedlings were established, and then were allowed water at the rate of 20 points per week until the conclusion of the experiment, except where higher rainfalls made this impossible. Moist, cold-stored seed of *Pinus caribæa* was sown in all the beds at the rate of sixteen seeds per linear foot of drill on 15th February, 1935, when the pH levels had become approximately constant. The drills were made 8 inches apart, thus allowing five drills per plot.

Records were kept concerning the monthly condition of the plants in each plot, and at lifting on 15th February, 1936, specimens of the root systems of plants growing in each plot were preserved and later examined microscopically. Weather data were recorded. The pH results obtained each month for each plot were averaged for each treatment at the conclusion of the experiments and the results plotted against time (Plate 183). The monthly rainfall was plotted on the same graph for purposes of comparison. In the case of the graph illustrating the relationship of pH and time, semi-logarithmic paper was, perforce, used. The sulphur dressings were worked out in pounds per acre to correspond to the treatments as noted at the commencement of the experiment. Rainfall data were given in inches per diem.

On referring to the graph, it will first be noted that there was a general fluctuation in pH throughout the period, even in the control. These fluctuations followed the trend of the rainfall, the pH rising after

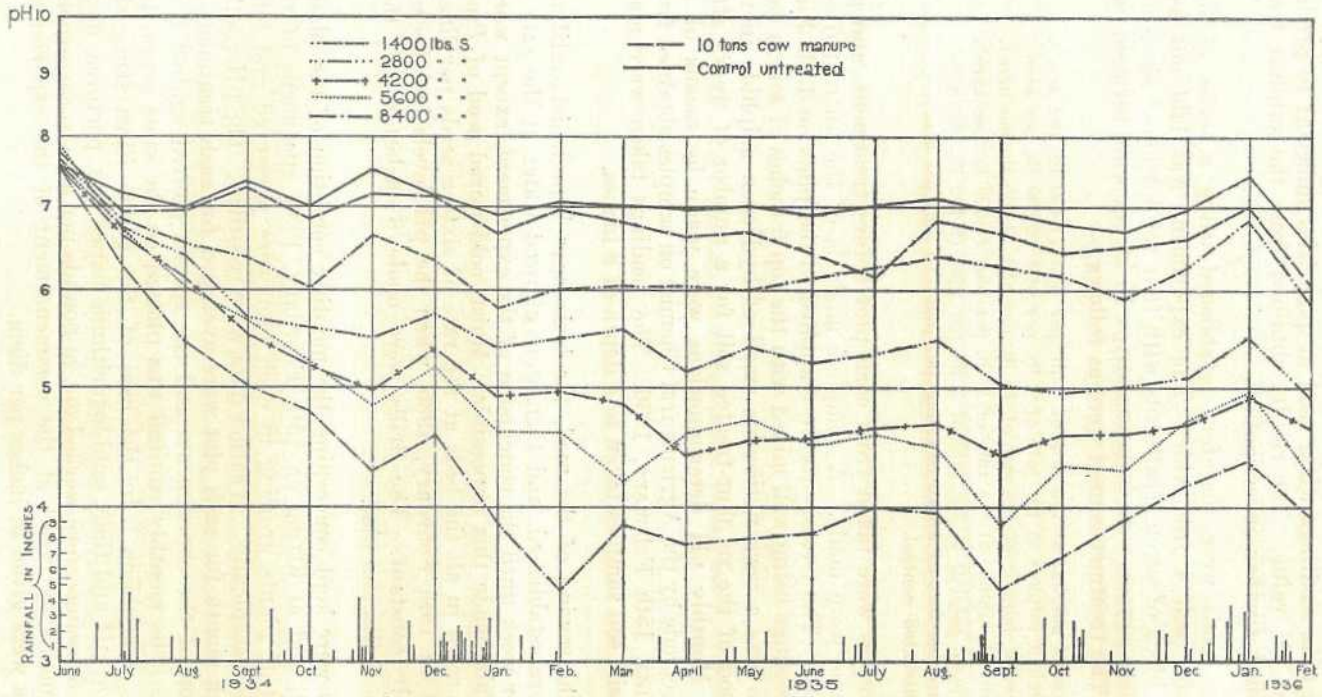

Plate 183.
Effect of Treatment on pH.

any appreciable fall of rain. This effect was also noted by Sideris and Krauss (1934), who thought it was due to the dissolved H_2CO_3 in the wet soil causing the higher acidity, and that it was helped by the washing down to the deeper layers of the soil of the basic salts. On examining each individual curve, it will first be noted that there is a close agreement between the results for the untreated control plots and those for the plots treated with cowdung, showing that the addition of cowdung in the quantities used made no appreciable difference to the pH value of the plots thus treated. The results obtained by treating the soil with any of the quantities of sulphur used show a definite drop in pH values as compared with the control, the heavier treatments affecting the results proportionately. The time taken to reach a constant pH, disregarding such other factors as rainfall, varied with the intensity of the sulphur application.

Effect of Treatment on Plant Growth.

For the purposes of the experiment, the three middle rows of each plot were used for observation purposes, thus leaving the two outside rows as extra isolation space. In all plots germination was successful, but succeeding events considerably modified the final appearances of each treatment. The subsequent results in the plots treated with cowdung were very poor on account of the seedlings' damping off after appearing above ground. In the treatment receiving sulphur at the rate of 3 lb. per plot the seedlings in many cases died soon after reaching a height of approximately 3 inches. The mean number of plants surviving per plot of three rows for each treatment at the end of the experiment is shown in Table 1.

TABLE 1.

Number of Plants Surviving per Mean Plot.

Treatment per Plot.	Number Surviving Plants per Mean Plot.
½ lb. sulphur	95·7
1 lb. sulphur	70·5
1½ lb. sulphur	114·25
2 lb. sulphur	87·5
3 lb. sulphur	39·75
Cowdung	13·25
Control	78·75

After the germination of the seed the plots were inoculated by planting between every two rows in each plot at the southern ends of the drills a twelve-months-old plant of *Pinus caribœa* with its roots infected with *Boletus granulatus,* which is one of the chief mycorrhiza-forming fungi, in the case of *Pinus,* in Queensland. Periodic checks were made of the distance of spread of the mycorrhizal fungus along the rows, together with observations on the general appearance of the seedlings and of the plants used as a source of *Boletus granulatus* infection. At the end of the experiment the state of the plants in each treatment was summarised (Table 2).

TABLE 2.

THE FINAL CONDITION OF PLANTS IN EACH TREATMENT.

Treatment per Plot.	Vigour.	Type of Growth.	Colour.	% Plants Infected.	Average Height Infected Plants.
					Inches.
A. ½ lb. sulphur ..	Fair ..	Fair to spindly	Good ..	30·5	9
B. 1 lb. sulphur ..	Fair ..	Fair	Good ..	41·1	9
C. 1½ lb. sulphur ..	Good ..	Good	Good ..	30·0	11
D. 2 lb. sulphur ..	Fair ..	Spindly.. ..	Light ..	28·4	8
E. 3 lb. sulphur ..	Poor ..	Spindly.. ..	Chlorotic ..	6·9	6½
F. Cowdung	Poor ..	Spindly.. ..	Chlorotic ..	0·6	6
G. Check	Poor ..	Spindly.. ..	Chlorotic ..	23·4	8

It would appear from this table that the efficiency of the mycorrhizas are increased with increasing acidity up to pH 4·7, and thereafter are adversely affected. The survival of seedlings in the control plot was good, but the vigour was low and the growth poor. The general appearance of the plants indicated that the 1½ lb. of sulphur treatment was the most satisfactory, with a trend to lessening in quality of the plants both with heavier and with lighter treatments. The surviving plants in the cowdung treatment were of equal quality to those in the control.

The effect on the transplanted plants, which were put in the various plots for mycorrhiza infection purposes, of their twelve months' sojourn in the treatments was as shown in Table 3. This data indicates that the

TABLE 3.

EFFECTS OF TREATMENTS ON TRANSPLANTS.

Treatments per Plot.	Condition of Transplant.
½ lb. sulphur	Chlorotic colour, fair plants
1 lb. sulphur	Fair, some growth
1½ lb. sulphur	Good, growing well
2 lb. sulphur	Good, growing well
3 lb. sulphur	Chlorotic colour, no growth
Cowdung	Dead
Control	Some chlorosis, fair

transplanted stock, although apparently able to stand greater extremes than the seedlings, followed the same trend as regards desirable pH values. The death in the cowdung plots appeared to be due to root rots.

Effect of Treatment on Mycorrhiza Development.

The development of mycorrhizas in each treatment was noted by means of counting the number of plants with externally observable infection. According to Table 2, the results in the plots having ½ lb., 1 lb., and 1½ lb. sulphur each were very similar when the irregular

distribution of plants in the plots was allowed for. There were slightly fewer in the 2-lb. plots and a very small number in the 3-lb. plots, and practically none were observable in the cowdung treatment. The number in the control treatments was less than that in the 2-lb. plots.

In the more acid plots—namely, those treated with sulphur at the rate of 1½ lb. per plot and more—crystals of calcium oxalate were always found on and in the soil immediately surrounding the roots of the plants in increasing amounts, and to a much larger extent in non-mycorrhizal than in mycorrhizal plants. In the 1½-lb. plot the deposit was only present on non-mycorrhizal plants. The significance of this phenomenon is not known, but it is suggested that the appearance of this crystalline deposit outside the roots is due to the relatively large amount of calcium sulphate formed in the soil by the action of the sulphuric acid, formed from the added sulphur, on the calcium carbonate normally present. The oxalic acid would be produced as an excretory product by the pine roots. The less frequent appearance of these crystals on mycorrhizal roots could be due to the controlling effect on pH in the immediate environment by the ectotrophic mycorrhizal fungi on the surface of the roots. These normally tend to produce a substratum of constant acidity. This degree of acidity would apparently be somewhat less than that appertaining in regions outside their sphere of influence. Much more calcium oxalate was formed in those plots which were too acid for the fungal development. The optimum pH value for growth of the mycorrhiza-forming fungi in question is pH 5-6. In hoop pine, *Araucaria cunninghamii*, where the mycorrhizal fungus is endotrophic as in *Sciadopitys*, no such limiting effect on the formation of calcium oxalate occurs. In this case the deposit is freely formed on the roots of infected hoop-pine plants in sulphur-treated nursery beds at Yarraman, when no such deposit is formed on infected *Pinus caribæa* at the same pH value. It is thought possible that the calcium oxalate formation may be a temporary character in a treated soil of this nature and that the effect may disappear in time with the gradual disappearance of the calcium sulphate.

The fact that all the plants in the best plots were not infected by the mycorrhizal fungus is thought to be due to the time factor and the spacing of the plants in the beds. The fungus appears to require, for quick dissemination, actual contact with the pine roots, and therefore complete infection of a nursery bed would take some considerable time if natural growth were depended upon. Artificial dissemination, by means of distributing infected soil throughout the nursery beds, and subsequent cultivation ensures good infection when the requisite soil conditions of acidity, moisture, and organic content are provided.

Effect of Acidification on Type of Mycorrhiza.

Microtome sections of root specimens obtained from plants in all the treatments involved in the nursery experiment were cut, stained, and mounted, and examined microscopically in order to obtain some idea of the effect of the various treatments on the mycorrhizal complex. The relative effects are tabulated in Table 4. These differ somewhat from the microscopic observations shown in Table 4 in the case of the cowdung treatment, in which no ectotrophic mycelium was visible to the naked eye, though obviously present in the mounted sections.

TABLE 4.

The Effect of Sulphur Application on Mycorrhiza Formation.

Treatment per Plot.	Mantle.	Hartig Network.	Intracellular Hyphae.	Cell Contents.
Control ..	Well developed	None ..	None ..	Non-granular
½ lb. Sulphur	Well developed	Well developed	Fair	Many digestion products
1 lb. Sulphur ..	Well developed	Well developed	Fair	Many digestion products
1½ lb. Sulphur	Well developed	Well developed	Fair	Many digestion products
2 lb. Sulphur ..	Very thick ..	Well developed	Very occasional	Few digestion products
3 lb. Sulphur ..	Thin	None	Some.. ..	No digestion products
Cowdung ..	Well developed	Medium ..	None ..	Few granules

From this it will be seen that the mycorrhizal development varies from strictly ectotrophic in the case of the untreated controls, through the typical ectendotrophic in the 1½ lb. of sulphur treatment to the almost purely endotrophic in the 3 lb. of sulphur treatment. In the case of the control treatment the fungus did not penetrate into the root and appeared to be living more or less independently on the root surface. This was closely simulated by the cowdung treatment, in which case, however, the cells had more granular contents. The ½ lb. of sulphur type is ectendotrophic, with the presence of an external mantle, a Hartig network, intracellular hyphæ and broken-down mycelial products due to digestion of the fungus in the cells by the root. The types produced by 1 lb. and 1½ lb. sulphur treatments (Plate 184) are similar, and represent a well-balanced root-fungus relationship in which the fungus is being adequately controlled; whereas in the case of the 2 lb. of sulphur treatment the mantle has become thicker with a well-developed Hartig network but little intracellular invasion and few digestion products. In the case of the 3 lb. of sulphur treatment, however, the fungus appears to have developed a parasitic habit with a well-developed inter- and intra-cellular mycelium without any evidence of hyphal digestion by the invaded cells. The mantle in this case is extremely thin. These microscopic findings are, from the symbiotic point of view, directly correlated with the general appearance of the plants. In the observations it was noted (Tables 2 and 3), that the treatments with ½, 1, and 1½ lb. of sulphur per 16 square feet gave the most satisfactory planting stock, with the 1½-lb. treatment being generally the best. This same relationship is reflected in the root association with the mycorrhizal fungus where the true mutualistic relationship is developed in these treatments.

Practical Applications.

The nursery beds at Yarraman form a good example of sulphur treatment in practice. Following on the results obtained from the experiment described above, the section of the nursery which was to be sown with *Pinus caribœa* seed was treated with sulphur at the rate of 1½ lb. of ground sulphur to each 16 square feet of bed space, and was then well dug over to mix the soil. In addition, the beds were given a

dressing of cowdung to augment the organic content of the soil, it having been found that with a suitable acidity such an application is advantageous when the soil organic matter is low. The first crop of seedlings produced was infected by the mycorrhizal-forming fungus only in patches, but these areas extended as the season progressed. The original infection was introduced from Beerwah. After lifting this stock, the soil in the

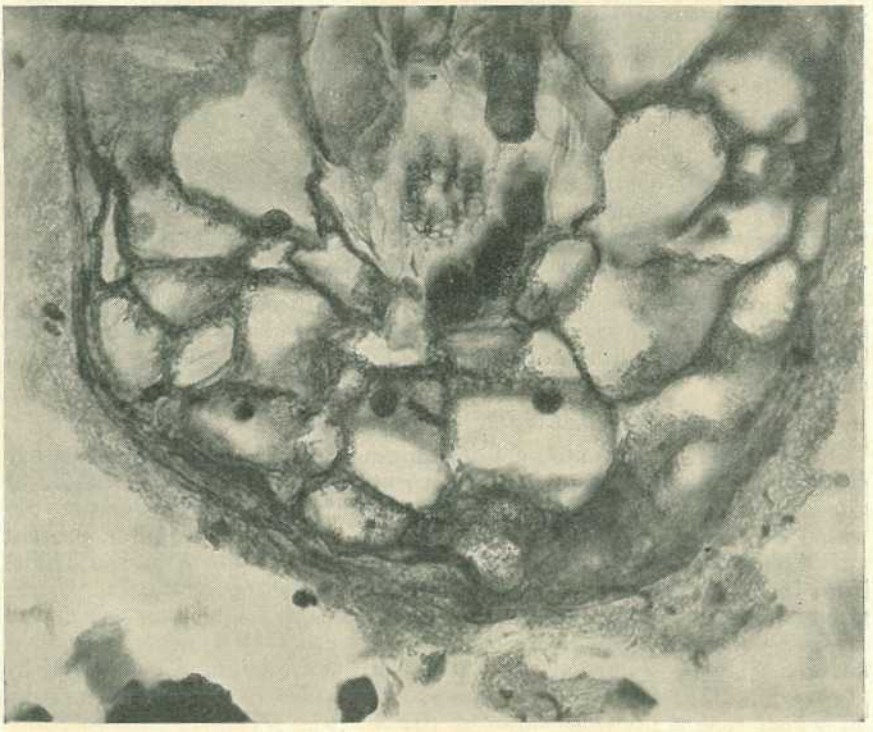

Plate 184.

Photomicrograph illustrating healthy mycorrhizal root tip in plot dressed with 1½ lb. of sulphur.

beds was again well mixed, with the result that the succeeding crop was well infected throughout and produced good vigorous planting stock. In this manner the simple treatment of the beds with a requisite quantity of sulphur resulted in the successful production of vigorous plants of the species of *Pinus* required, thus enabling the nursery to complete its planting programme without the necessity of obtaining supplies from another district.

In another instance it was found necessary to determine the sulphur requirements of soil from the Jimna nursery for the production of exotic conifers. Laboratory tests were made involving the application of various amounts of sulphur to the nursery soil in question. The soil was weighed out in equal quantities into glass jars 8 inches deep and sulphur applied to each jar and well mixed in the soil. The rates of application of the sulphur was worked out to correspond to dressings as shown in Table 5.

TABLE 5.

Effect of Sulphur Dressings on Jimna Nursery Soil.

Treatment per Jar.	Resultant pH Value.
½ lb. sulphur per 16 sq. feet surface area	6·4
1 lb. sulphur per 16 sq. feet surface area	5·7
1½ lb. sulphur per 16 sq. feet surface area	5·4
2 lb. sulphur per 16 sq. feet surface area	4·9
3 lb. sulphur per 16 sq. feet surface area	4·3
4 lb. sulphur per 16 sq. feet surface area	3·8
Control	8·0

The jars were kept at room temperature for eleven weeks and moistened periodically with equal amounts of distilled water. From the pH determinations made it was found that 1½ of sulphur would be a safe dressing for the soil in question. The nursery space devoted to the production of exotic pines was then treated accordingly.

In a case where a condition of lime-induced chlorosis developed in hoop pine seedlings owing to the nursery beds in localised patches becoming very alkaline, applications of sulphur caused a cessation of the trouble.

Maximum Acidity Obtainable in the Soil.

The absolute maximum acidity obtainable in the Yarraman nursery soil after application of excess sulphur at any time during the period of the experiment corresponds to a pH value of 3·56. The average pH value over the period of the experiment with excess sulphur present was 4·03. In the soil of the Wongabel nursery on the Atherton Tableland in North Queensland, the minimum pH reading obtainable, in the presence of excess sulphur and the same sulphur bacterium, was found to be 2·4 in the top 3 inches of the soil and 4·4 at 6 inches below the surface. This is somewhat different from the minimum pH recorded by Lewcock (1935) for the poor coastal sandy soils in South Queensland, in which case a limiting value of pH 4·5 was reached. No isolations were made in the last mentioned case, but it is considered probable that the same organism is involved. If, as appears to be the case in Queensland soils, the same organism is responsible for the acidity changes after sulphur application, then the minimum pH value obtainable would be dependent on the particular soil treated. It is considered likely that with a change in reaction a different group of soil organisms, apart from the sulphur bacteria, gains the ascendant, and that, in different soils with different amounts and types of nutrient available, competition with the sulphur bacteria becomes more severe at different pH values. Thus at a lower pH value competition in the poorer soils would be keener on account of the smaller amounts of nutrients available, and the development of sulphur bacteria less active. Hence, the possible minimum pH value producible by sulphur bacteria would vary with the quantities present of the particular nutrients governing the growth of the sulphur bacteria and the other competing organisms.

Effect of Application of Sulphur on Soil Fauna.

After the application of sulphur to nursery beds it was noted that the white grubs (Scarabæid larvæ) present in the treated beds emerged

from the soil and perished in the sun. This effect has also been noted by other observers in Queensland in the case of pineapple soils, when these are treated with sulphur. A somewhat more spectacular effect was obtained in the Yarraman nursery in the hoop pine, *Araucaria cunninghamii*, beds. These beds are normally subject to damage by the white grubs, which attack the roots of the hoop pine seedlings, devouring the cortex, and, unless checked by fumigation, cause a

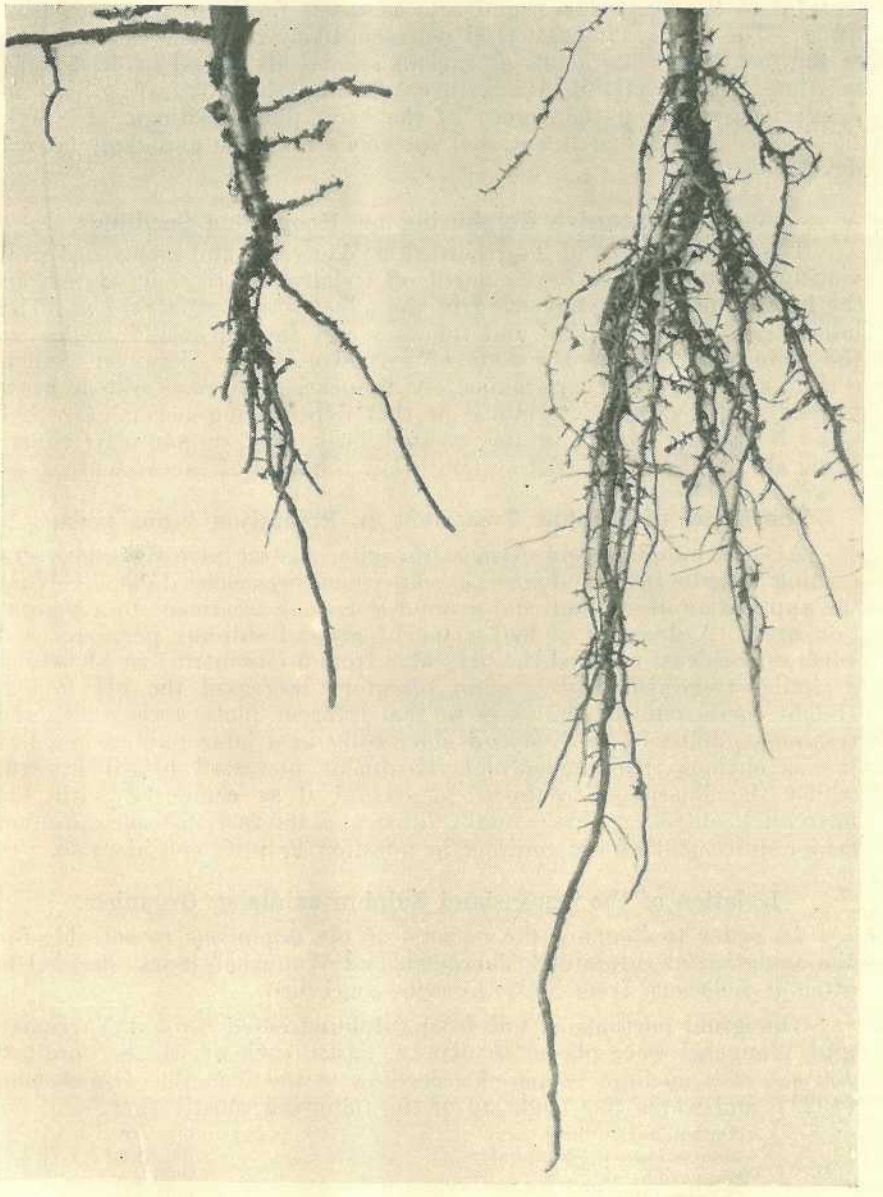

Plate 185.

Left.—Root system of hoop pine seedling growing in soil of pH 2.4.
Right.—Normal root system.

number of deaths. In an experiment designed to find out the effect of sulphur on the hoop pine seedlings, it was found that there was no white grub damage in the treated plots, whilst untreated plots adjacent to these had suffered badly, the losses exceeding 50 per cent.

It has been suggested that the effect is due to the hydrogen sulphide which is generated in the soil after the application of sulphur and which is present for a number of weeks. The gas is presumably distasteful to the beetle larvæ and acts as a soil fumigant, driving them away. The acidity change would not seem likely to be the cause, owing to the fact that white grubs of various species are found in most soils, whether acid or alkaline in nature. The sulphur dressings had no deleterious effect on the vigour of the hoop pine seedlings. In fact, the treated plants had better root systems with more abundant lateral development.

Effect of Excessive Sulphuring on Hoop Pine Seedlings.

The low pH value of 2·4 recorded at Wongabel and mentioned previously resulted in the development of a characteristic root system on the hoop pine seedlings growing in the affected soil (Plate 185). The lateral roots were dwarfed and tuberous and formed small nodules on the main root. Below the zone of excessive acidity, however, which ceased at a depth of approximately 6 inches, the root system grew normally, pH values determined at that depth being normal for that soil. Numerous plants in the treated beds died, apparently before being able to develop a root system below the zone of excess acidity.

The Effect of Sulphur Treatment on Plantation Pinus tæda.

At Beerwah, in connection with experimental investigations concerning "needle fusion" disease, an experiment was carried out involving the application of sulphur and ground limestone treatment to a plantation area. A dressing of half a ton of ground sulphur per acre as a surface broadcast reduced the pH value from 5·7 (control) to 4·9, whilst a similar treatment with ground limestone increased the pH to 6·2. Height increments of the trees in the different plots varied with the treatment, and will be discussed more fully in a later publication, but it was obvious that the sulphur treatment increased height growth, whilst the limestone treatment depressed it as compared with the untreated controls. This case also illustrates the fact that the optimum acid requirement of the conifers in question is quite considerable.

Isolation of the Queensland Sulphur-oxidizing Organism.

In order to compare the natures of the organisms responsible for the oxidation of sulphur at Yarraman and Wongabel, it was decided to attempt isolations from both nurseries concerned.

One-gram portions of soil from sulphur-treated beds at Yarraman and Wongabel were placed in 300-c.c. flasks, each of which contained 100 c.c. of a medium prepared according to the formula of Waksman (1922), and which was made up of the following constituents:—

Ammonium sulphate	0·2 gm.
Monopotassium phosphate	3·0 gm.
Magnesium sulphate	0·25 gm.
Calcium chloride	0·25 gm.
Ferrous sulphate	Trace.
Sulphur (powdered)	10·0 gm.
Distilled water	1,000 c.c.

The sulphur was weighed out into the individual containers at the rate of one gram to each flask. The flasks were steam-sterilised on each of three successive days at atmospheric pressure. The reaction of the medium was adjusted to a pH value of 4·0.

After inoculation, the flasks were incubated at 26°C. for seven days, when each flask was subcultured by transferring a platinum loop full of medium into a fresh culture flask. The cultures were examined microscopically and were found to contain a variety of organisms. Acidity determinations were made on each flask before subculturing in order to ensure that only flasks in which the sulphur bacteria were active were being dealt with. The process of subculturing was continued each week for five weeks when relatively pure cultures of organisms which increased the acidity of the medium were obtained.

The cultures were then plated out on thiosulphate agar and individual colonies subcultured again into fresh liquid media. In this way pure cultures of a sulphur-oxidising organism from each of the localities in question were obtained.

The two isolations were similar in appearance microscopically, and had the following characteristics:—

A short bacillus with rounded ends.

Length 0·5–0·8 microns.

Thickness 0·25–0·4 microns.

Motile with a single polar flagellum.

Gram negative.

The organism appears to be more closely related to *Thiobacillus trautweinii* than to any other named organism, and is definitely different from the species isolated in the Southern States (Rountree, 1933). For comparative purposes, this organism and other more closely related species are compared in Table 6.

TABLE 6.

CHARACTERS OF SOME THIOBACILLI.

Species.	*Thiobacillus* n.sp. Queensland.	*Thiobacillus trautweinii.*	*Thiobacillus thiooxidans.*	*Thiobacillus* sp. (Rountree).
Dimensions	0·5 — 0·8 × 0·25 — 0·4u	1·3u × 0·4u	1u × 0·5u	2·3u × 0·4u
Staining	Gram — ve	Gram — ve	Gram + ve	Gram — ve
Motility	++	++	±	
Limiting pH values	1·9 — 9·0	5·7 — 11·5	2·8 — 4·0	4·5 — 8·6

From the differences observed, it would appear that the organism isolated from the Yarraman and Wongabel soils is distinct from that found by Rountree in the Renmark area in the Southern States of Australia, and also from other previously described species, and is accordingly thought to be a new species.

In pure culture in a liquid medium it was found that the Queensland organism reduced the pH value to a minimum of 1·9, which is approximately equal to that brought about by *Thiobacillus thiooxidans*, and it

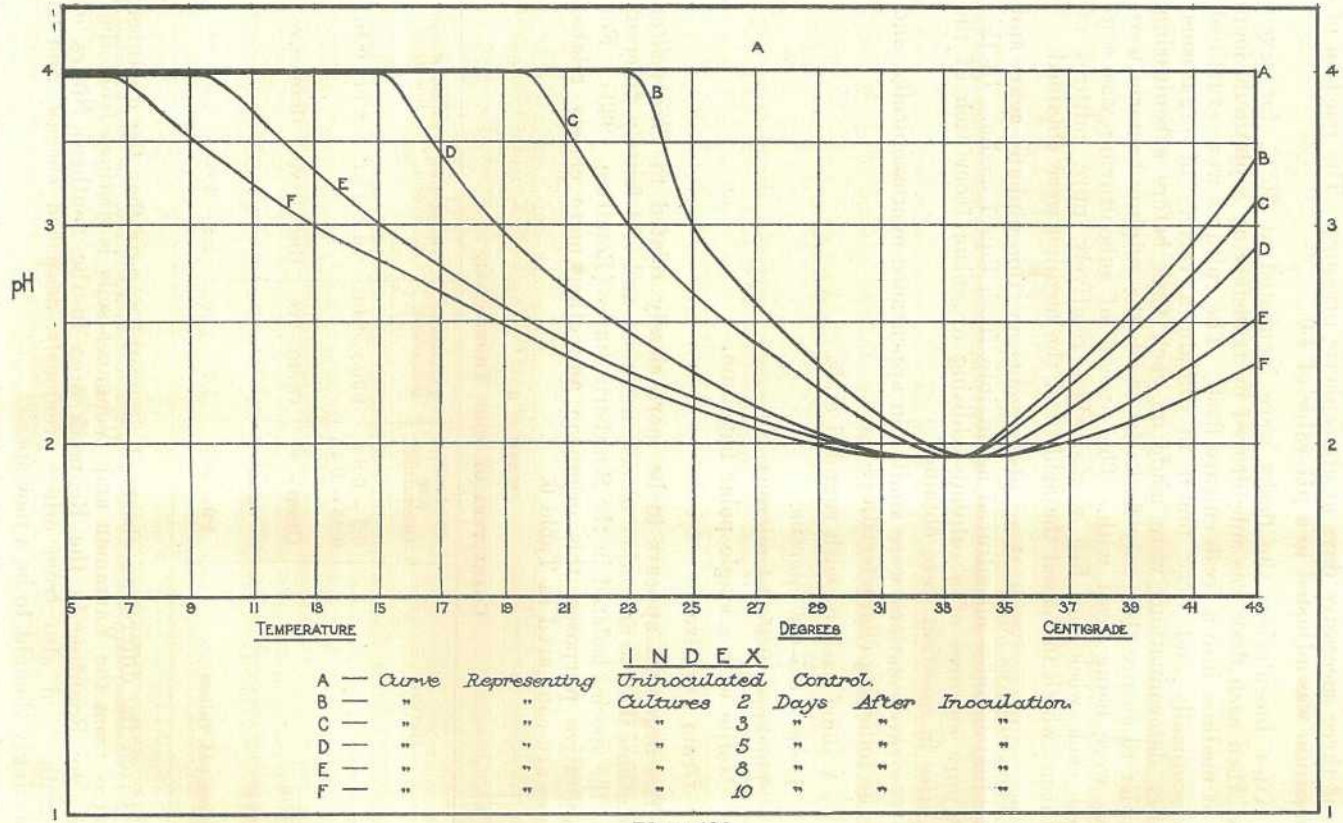

Plate 186.

Graph illustrating the relationship of pH time and temperature for *Thiobacillus* sp.

was found that the species could exist at pH values up to 9·0, which is higher than that for other species except *Thiobacillus trautweinii,* which can tolerate pH values up to 11·5.

The Effect of Temperature on the Activity of the Queensland Thiobacillus.

The temperature relationships of the Queensland organism were worked out, using pure cultures in the liquid medium of Waksman mentioned above. Cultures were placed in a multiple temperature incubator which provided a range from 5°C. to 43°C. distributed over twenty chambers. Daily pH determinations were made and the results plotted to form the graph shown in Plate 186. In the graph each curve represents the pH value found at all of the temperatures in the range at that particular time after inoculation, for which the curve has been drawn. There was no action at any temperature in the first twenty-four hours after inoculation, as is shown in the curve marked A; but after two days a definite increase in acidity had taken place at some temperatures, as indicated by the curve marked B. It will be noted that the acidity had reached a minimum pH value of 1·9 in the two days, and that this minimum was reached most quickly at a temperature of 33·6°C., which therefore corresponds to the optimum temperature requirement for the organism.

At longer periods after inoculation—as, for example, at 2, 3, 5, 8, and 10 day intervals—it will be seen that the same minimum pH value of 1·9 was reached at lower and higher temperatures than 33·6°C. It is shown that within the limits of the experiment the lower the temperature the longer the interval after inoculation at which activity of the sulphur bacteria commenced. For example, two days after inoculation activity had just started at 23·0°C., and ten days after inoculation activity had started at as low a temperature as 6·4°C.

From the trend of the curve at 43°C. it would appear probable that the organism is capable of activity at a temperature higher than that allowed for in this experiment. Thus it will be seen that *Thiobacillus* n. sp. is able to actively exist at comparatively high temperatures such as often occur in the surface layer of the soil, and that it is also active at lower temperatures such as occur in the winter, but that quicker action takes place the nearer the temperature of 33·6°C. is approached.

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The Spread of Ephemeral Fever (Three-Day Sickness) in Australia in 1936-37.

H. R. SEDDON, D.V.Sc.

Following is an abridgement of a paper presented by Professor H. R. Seddon, D.V.Sc., of the Faculty of Veterinary Science, University of Queensland, and Veterinary Adviser to the Department of Agriculture and Stock, Queensland, to the annual general meeting of the Australian Veterinary Association, May,* 1938:—

UNTIL the events recorded in this paper, there was no evidence of the existence of ephemeral fever in Australia. For this reason and because the malady spread widely through Queensland, it is of some interest to record its progress, particularly as nowadays cases of introduction of an exotic disease are rare, and, when they do occur, the natural spread is limited by the application of quarantine or other control measures.

It is known that the disease occurs in many countries of Africa, Palestine, India, Japan, and Sumatra.

The disease was probably introduced to Australia by infected insects.

Whilst incoming aeroplanes are sprayed for the destruction of insect life, usually at their last place of call before crosing the Timor Sea and landing at Darwin, they must be considered a posible means of introduction. The disease, however, does not seem to have spread from Darwin or other aerodromes in North Australia, and what now seems likely to have been its starting point was a considerable distance from any aerodrome.

The other possibility seems to have been accidental insect introduction from some boat trading between these northern islands and the Australian coast. This sea traffic is fairly extensive and varied in character—*e.g.*, mail steamers, cargo boats, pearling and trochus-shell luggers and sampans.

Location of First Outbreak.

The location of the first outbreak cannot be stated. The first official records are for three widely separated centres, one being in Western Australia, another in the Northern Territory, and the third in Queensland. The districts where these centres are located and the dates of the outbreaks are:—

Western Australia—Kimberley district, 15th March, 1936.

Northern Territory—Humbert River district, February, 1936.

Queensland—Gulf country, early in March, 1936.

The actual date of the commencement of the disease in each of these areas also cannot be stated definitely, and from such evidence as is available it would appear that these three outbreaks were not very widely separated in point of time.

It may be wondered why the earliest appearance of the disease would not necessarily be discoverable, but in this connection there are

* This paper was published *in extenso* in *The Australian Veterinary Journal*, Vol. XIV., No. 3 (June), 1938.

several important features to consider, some of these being bound up with the system of cattle husbandry which, because of the incidence of the rainfall, has to be practised in Northern Australia.

The system of animal husbandry practised in these northern cattle areas does not call for close supervision, and as a general rule cattle are seen only about twice a year, once for mustering fat and store animals for southern markets, and later in order that the young may be branded, and the musters are far from complete. More important, perhaps, is the fact that no cattle operations are undertaken in the "wet" season—only in the "dry."

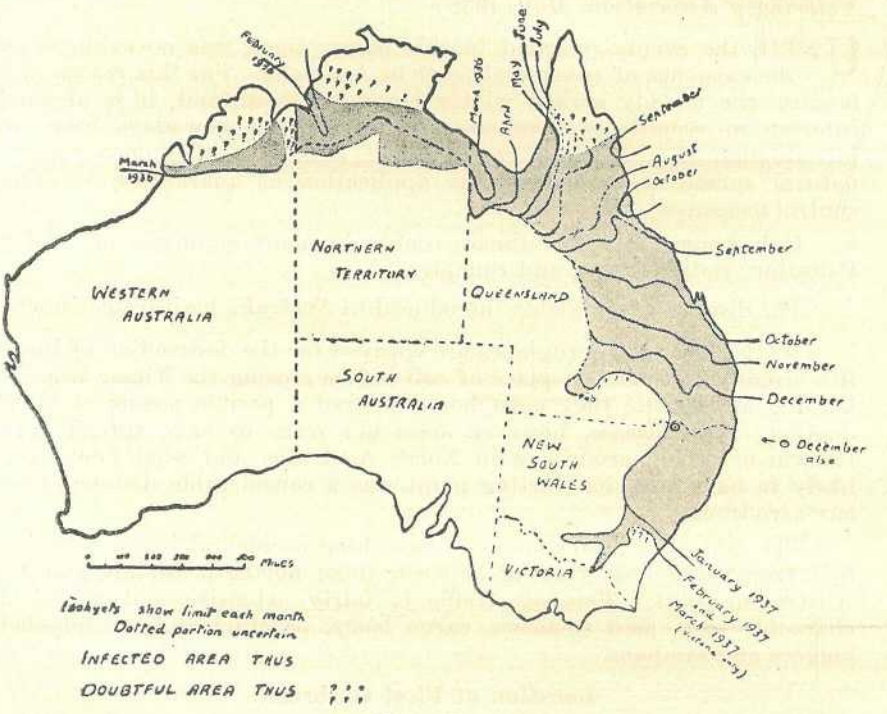

Plate 187.

Distribution of Ephemeral Fever in Australia to March, 1937 (end of primary invasion). NOTE.—Not all places within monthly limit lines became affected during that month.

Small wonder that a disease hitherto non-existent there and therefore of a type not known to stockmen should escape notice, particularly in view of the facts that it is evanescent in character, its duration in a herd being merely a matter of a few weeks, and that, as it causes practically no mortality in station cattle, there would be no serious shortage at a subsequent muster and few carcases to mark its path. Even so, the chance of early detection was considerably lessened by reason of the probability that it first occurred during the wet season.

The evidence suggests that the disease appeared early in February, 1936, in the north-western portion of the Northern Territory, near the mouth of the Victoria River, and that it spread in both easterly and south-westerly directions to the Queensland and Western Australian borders respectively.

During 1937 only a few cases of the disease were reported from the Northern Territory, all in the Gulf country, and immediately following the wet season.

Distribution of the Disease.

The earliest reported cases (in Queensland) were in what is known as the Gulf country—*i.e.*, the lands to the south of the Gulf of Carpentaria—this being held in large cattle stations, sparsely stocked and very sparsely populated. As a result of extensive inquiries made later by Mr. C. R. Mulhearn, Acting Director, Animal Health Station, Townsville, and field officers working under his direction, it would appear that the first observed cases occurred during the month of March on three separate stations—two within 30 miles of the Northern Territory border and the third a little further east. The date of the appearance on the most easterly one of these stations is given as 18th March, 1936, and of a station to the west of it as "beginning of March."

The following month (April) the disease was seen on stations to the east, and one to the south, of those previously affected, extending further east and north-east, through the country on the eastern shore of the Gulf, during the ensuing month (May).

In June and July cases occurred on other properties, but only five outbreaks are recorded for these months, the disease disappearing from areas previously affected. This extension was to the east and south-east, and by then the disease had spread half-way to the eastern coast of Queensland, so that it was no wonder it reached there at the nearest point (Cairns) during August. The disease now spread more rapidly and extended south-east, each succeeding month finding it in more southerly districts until in January, 1937, it reached the southern border of Queensland.

During the latter part of 1936 sporadic cases occurred in North Queensland, chiefly affecting herds or animals which had escaped the visitation earlier in the year.

The number of cases increased somewhat in January and February, 1937, in North Queensland. The disease apparently died out during mid-winter, but sporadic cases occurred in various parts in the following spring.

The first appearance of the disease in New South Wales was apparently in the middle of December, 1936, on a property near the Queensland border and nearly 200 miles from the coast. Curiously enough, the nearest centre in Queensland at which the disease was recorded during that month was some 90 miles further north, and it was believed that it did not reach the border near the New South Wales outbreak until January, 1937.

In January, 1937, the disease appeared in various parts of the eastern third of the State, as far south as Sydney, being present on north and central coast, northern and central tablelands, north-west and western slopes and part of the north-west plains.

The following month (February) it extended southwards and was recorded from several centres in the eastern half of the southern portion of the State, with the exception of the far south coast and portion of the southern tablelands, and in a northern district where cases had not occurred during the previous month.

Its incidence in the northern coastal districts seems to have been much the same as in the neighbouring parts of Queensland, but as it extended southwards this became progressively lower.

In Victoria the incidence on affected properties was even lower, and not more than three animals were affected on any one holding.

The first case occurred in the Wodonga district on 11th February, the disease then being present across the New South Wales border at this point. Subsequently it was definitely diagnosed on eleven properties between Wodonga and Wangaratta, all in a relatively small area, the last case occurring on 22nd March, less than six weeks after the discovery of the first case in this State.

It will thus be seen that the disease never assumed serious proportions in Victoria, and it is significant that on the first property involved only three animals became affected although there were some hundred head on the holding.

The earliest recorded outbreaks were in the Northern Territory (February, 1936), but as the disease occurred then at two places over 100 miles apart, it is probable that the first cases in the Northern Territory were actually earlier. It was probably present in Western Australia also during February and possibly may have been present in Queensland also, though careful inquiries have failed to establish its presence during that month.

Reviewing its spread in Queensland, which is in general now known, it would seem most probable, seeing that it travelled east or south-east in the Gulf country, that it came in from the Northern Territory.

If ephemeral fever moved in the same way in the Northern Territory, it seems reasonable to assume that it traversed the Territory from west to east, with probably a south-easterly trend.

A very important observation by Mulhearn has been the occurrence of the disease on islands off the coast of Queensland. In the cases investigated, the islands have been distant one, several, and in one case 20 miles from the nearest part of the mainland, with no introduction of cattle or other farm animals for many months—*i.e.*, only prior to the first recognition of the disease in that part of the State. These cases have occurred at the same time as, or a little later than, the disease was present on the neighbouring mainland. In some cases regular tourist launches have been plying between the islands and the mainland, but in other cases there has been no such regular service. As the disease moved south all islands off the Queensland coast on which cattle were depastured became affected.

The disease has occurred on many isolated *inland* properties in Australia—*i.e.*, farms situated deep in valleys in mountainous country or clearings surrounded by forests where the immediately surrounding country for several miles has not been stocked. Such cases have occurred, however, only immediately following the occurrence of the disease in the nearest pastoral country.

Probable Natural Method of Transmission.

Investigations in Australia and abroad have shown clearly that ephemeral fever is not spread by simple contact. It is, however, readily conveyed by inoculation, even minute amounts of blood from an affected animal setting up the disease (Mackerras).

These facts suggest that the common mode of transmission is by some insect vector, and the spread of the disease to animals isolated by water suggests that it is some insect vector capable of travelling by air, —*i.e.*, some flying insect.

The spread of the disease across several miles of water, its introduction into herds miles away from other stock, and the fact that the disease "jumps" rather than spreads, appearing here to-day and 10 miles away in a day or so, without affecting intervening stock, suggests that such an insect may be spread by other than natural flight—*i.e.*, by wind.

The question of an insect transmitter has been the subject of investigations by Roberts in this State and by Mackerras and his co-workers at Canberra, but up to the present it has been possible neither by ecological studies to suggest the actual insect that may be involved nor by experiment to show that any of the insects tested are capable of transmitting the disease.

Nevertheless, there are grounds for believing that some type of biting fly is responsible for the transmission of the disease.

The Spread of Ephemeral Fever.

Even though one accepts insect transmission as the natural means of spread, there are certain other features which at least merit mention, if not discussion.

(*a*) *Spread of the disease by travelling cattle.*

Two possibilities exist:—

(i.) Spread by cattle then affected with the disease.

(ii.) Spread by recovered cattle.

There is considerable evidence that the disease spread in the entire absence of cattle movement. During February and early March it would be the wet season in the Northern Territory and droving of cattle would be impossible. Yet the disease spread just at that time.

A little later—*i.e.*, with the onset of the dry season—there were extensive movements of cattle west, south, and east from the Territory and south, south-east, and east from the Gulf country of Queensland. Actually, in the latter locality the disease was first recognised when stock were being mustered for dispatch to market; it was the lameness of such cattle, causing inability to travel, which first led to its detection. Though these movements in April, May, and June were extensive, and many cattle must have been sent from areas where the disease had recently occurred, careful inquiry showed that it was not thus spread to areas which these cattle finally reached. Many of these cattle were sent by rail and so would reach destinations on the eastern seaboard of Queensland in a matter of a few days; yet the disease did not occur there until months later.

There remains, however, the possibility that movement of cattle in which the disease was then present may have facilitated the spread of the disease. This is considered to have occurred in at least one instance in Queensland, but only when they were taken to an area where conditions otherwise were such that the disease was capable of then spreading there.

A consideration of the evidence therefore leads to the conclusion that whilst cattle movement may facilitate spread of ephemeral fever, it was not the prime factor in the dispersal of the disease.

(*b*) *Cattle population and distribution of the disease.*

Reference to the map on page 602 and what has previously been written regarding the occurrence in the several States which became infected shows that the disease occurred only in portions of these States.

In Northern Australia much of the unaffected area is not stocked, but a large part carries a cattle population equal to, and in some cases denser than, that in the affected areas. In southern New South Wales and in Victoria there is a large cattle population in districts contiguous to those affected, and in the more southerly portion, moreover, the disease apparently failed to attack more than a small percentage of the animals in a herd, as against from 75 to 100 per cent. in the north.

For these reasons, it may be concluded that the mere presence of cattle in areas contiguous to an infected area, even when the incidence in that affected area was high, was not sufficient to ensure the spread of the disease, and that the distribution of the disease was limited by some factor other than absence of the susceptible host—viz., cattle.

(*c*) *Other factors which may have limited the spread of the disease.*

A consideration of all affected areas where the incidence of the disease as to properties and as to individuals of the herd was high—*i.e.*, all parts except southern New South Wales and Victoria—shows that the non-affected areas abutting on them have a lower rainfall, except in the case of certain unstocked country on the northern coast.

It appears certain, however, that in no part of Northern Australia did it occur in one area and not in a contiguous stocked area when the *recent* rainfall in the latter had been greater than in the former, unless that area was so placed that the disease had to pass over the lower rainfall area before it could get to the higher rainfall area.

The limit of the affected area in Queensland in general approximates that of the 20-inch line of rainfall for 1936. No particular significance can be assigned to this figure, however, for the disease has appeared in parts of Northern Australia in which the rainfall for that year was only 10 inches.

Fuller consideration suggests that the determining factor is quite probably what might be termed "effective" rainfall. This might well be only *recent* rains, when probably 2 or 3 inches would suffice. Further, other climatic factors such as temperature probably exert considerable influence.

Such evidence as is obtainable suggests that the relative lack of surface water may have been a limiting factor in the distribution of the disease, and climatic influences associated with onset of winter responsible for its gradual decline, and even its disappearance, temporarily if not permanently. These conditions support the suggestion of an insect vector.

(*d*) *Is the vector an introduced one?*

The fact that the disease occurred for the first time in Australia early in 1936 might suggest that the vector was one introduced about that time.

There is no evidence, however, of the appearance and rapid spread of any hitherto unrecorded biting fly, particularly an exotic one, appearing first in the north and then spreading through the area to which the disease subsequently gained access. In all probability the initial entry was by some introduced *infected* vector, but it would seem that thereafter its spread was by an insect indigenous to Australia. It is understood that there are several types of indigenous biting, winged insects (particularly mosquitoes and sandflies) which have a wide distribution in Australia, some, in fact, a distribution akin to that taken by ephemeral fever, and, further, that some of these occur also in islands north of Australia.

The southerly spread of the disease along the eastern coastal portion of Queensland, commencing in the north during the early spring (September), suggests the action of some vector breeding locally and emerging in more southerly latitudes as the weather became warmer. This is supported by the relative quiescence of the disease in the north during the colder months there (June to August) and its final disappearance in Victoria with the onset of autumn.

(*e*) *Absence of vector the limiting factor in distribution.*

On such an assumption the absence of the disease from the more inland parts of North Australia, south-western Queensland, western New South Wales and most of Victoria becomes understandable, for it may well be that climatic conditions in these areas would be unfavourable to such insect life. We know that such factors limit the occurrence in Northern Australia of piroplasmosis (tick-transmitted) and onchocerciasis (probably conveyed by a sandfly).

Support for such a suggestion comes from a report by Mr. Mulhearn that on one station in the Winton district, Central Queensland, the disease did not appear until after a flood in a river passing through the property, and that mosquitoes, rare prior to the flood, became very numerous following it.

(*f*) *Is any other factor involved?*

Assuming that ephemeral fever is spread by a local insect vector and that cattle movement plays no constant part, can one assume that the spread was entirely by insects transported by their own powers of flight? Against this we have:—

(1) Its apparently simultaneous appearance at two centres nearly a thousand miles apart, the disease having apparently been in Australia only a few weeks and almost certainly not more than two months.

(2) Its known rapid spread (*e.g.*, in Queensland, from 200 to 300 miles a month).

(3) The fact that, in general, an insect, even a flying one, does not tend to roam extensively from its local breeding ground.

(4) The spread across the sea to islands up to 20 miles off shore.

(5) The spread of the disease by a series of "bounds" or "jumps" rather than a progressive invasion from farm to farm.

For these reasons, and from the well-known fact that certain types of flying insects are liable to be wind-driven, it has seemed profitable to consider how far the prevailing winds may have assisted the spread of

ephemeral fever and whether these would have lead the disease to take the directions it did.

To attempt to trace this influence on its whole line of spread would be tedious, and consideration will therefore be confined to:—

(*a*) Its dissemination in Northern Australia in February-March, 1936, and

(*b*) Its later spread southward along the Queensland coast during October-December, 1936.

February-March Spread.

During this period of the year the northern coast is subject to the north-west monsoon; according to information supplied by the State Meteorologist for Queensland (Mr. A. S. Richards), between Wyndham and Cape York the prevailing wind on 70 per cent. of days would be from the north-west, and that on reaching Australia this would be broken by local storms and cyclonic influences. Further, from an area to the north-west of Daly Waters this wind would be directed to the *west*, blowing from the Victoria River district (where the disease first appeared) across the Kimberleys to Broome (*i.e.*, traversing the district in Western Australia where the disease occurred). A north-west wind also prevailed during February and the first four days of March along the southern shores of the Gulf of Carpentaria, and towards the south-eastern corner of the Gulf this wind would tend to turn south. From one of the three properties in Queensland first affected it is recorded that the disease coincided with the prevalence of northerly winds and that it spread south over the property.

If, therefore, the disease did first appear in the northern part of the Northern Territory and its dissemination were in any way dependent on wind movements, its spread to the west (to Western Australia) and to the east (to the Gulf country of Queensland) would be in accordance with these wind movements.

October-December Spread.

During this period the coast, from Townsville southwards, received a regular north-easterly afternoon wind and further inland northerly winds in general prevailed. Several officers have reported that the appearance of the disease has followed strong winds from the direction in which the disease was earlier present.

It is felt that whilst proof is lacking these wind movements are at least suggestive.

How far such an insect vector could be entirely wind-borne one does not know, but though the north-westerly monsoon blows strongly from the islands to the north of Australia, it would seem unlikely that it alone could be responsible for the transport of infected insect vectors to Australia. Much more likely they reached the shores of Australia in some craft, either sea or air vessel, in which they had sought shelter.

Conclusions Regarding Manner of Spread.

These may be summarised as follows:—

1. The disease is not spread by contact *per se* (experimentally it can be transmitted only by blood inoculation).

2. Whilst the disease may spread from holding to holding in contact, it frequently "jumps," and may next appear some miles away.

Nevertheless, the progress of the disease in eastern Australia was in the nature of a steady southerly advance each month, the forefront of this being well defined and so capable of being represented geographically except in one instance (New South Wales, December, 1936). This New South Wales outbreak, confined to a single property, may have been an excessive "jump," or, perhaps, due to rail transit of affected stock from Queensland.

In two cases in North Queensland, the disease did not reach certain coastal districts until after coastal regions on either side of them; hence the "loops" for September (Daintree) and October (Ingham).

3. The disease is ordinarily spread, not by movement of affected cattle, but by some other agency capable of crossing several miles of water.

4. Although affected cattle cannot ordinarily travel by road because of the weakness induced, the fact that inapparent infections are now known to occur would suggest that the disease may "smoulder" in a mob, so that on reaching another district a new centre of infection may be set up. A centre of infection might also result from affected cattle being travelled by rail.

Since only rarely has infection been spread from such a centre, the conclusion is that such movements are dangerous only when some other agency is present at that centre to disseminate the disease.

5. Aerial conveyance of the virus itself is improbable for the following reasons:—

(*a*) There is no knowledge of the escape of the virus from an infected animal into the atmosphere;

(*b*) The non-infectivity of simple contact; and

(*c*) The non-spreading of the disease to cattle in certain contiguous districts.

6. The above strongly suggest the necessity for some insect vector capable of flight.

7. There is no evidence of the introduction into and the dispersal in Australia of such an exotic vector; in all probability, some local insect was responsible for the spread of the disease.

8. The southerly spread of the disease during spring, 1936, and summer, 1936-37, suggests that this coincided with the emergence of insects breeding locally.

9. The failure of the disease to spread to certain inland areas of lower rainfall than neighbouring districts at that time affected, and to certain southern districts, suggests that climatic conditions in these parts were not adequate for the insect vector.

10. The lessened incidence and gradual disappearance of ephemeral fever in southern Australia also suggests that climatic influences determined its limitation.

11. In view of the propensity of the disease to "jump," and in the light of its very rapid spread in North Australia and the direction of that spread, it is suggested that the insect may be wind-driven by prevailing winds.

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Soil and Plant Interrelationships as Demonstrated by Soil Analysis.*

C. R. VON STIEGLITZ.

THE term "soil analysis" is heard so frequently, in reference to fertility investigations, that the uninitiated may be pardoned for concluding that this represents a certain fixed technical examination to which all soils are subjected, whatever the problem. It is also frequently assumed that such treatment will supply the complete answer to all soil problems, however complex. Unfortunately no method capable of yielding such spectacular results has yet been evolved, and the method to be adopted must be chosen to fit the problem. A soil analysis designed to give the "total" amounts of the various chemical substances comprising the soil complex, whilst of interest and help to a soil chemist in specialised investigations, tells nothing necessarily of the fertilizer requirements of the soil under investigation.

Special methods have been devised from time to time to determine what are called the "available" soil plantfoods, but although such methods in the past furnished results which separated soils of very high from those of very low fertility, little success attended the efforts to base fertilizer advice on the analytical findings.

This failure can be attributed to two main causes—

1. The fertilizer field trials, with which the analytical results were compared, were themselves unreliable, and
2. The sample submitted to the soil chemist for analysis was frequently not a true representation of the field under examination.

With the advent of statistical methods and their application to fertilizer field trials the outlook was completely changed, and it is now possible to carry out such trials confident in the knowledge that the results obtained will accurately assess the plantfood needs of the field under examination. Such an advance in field experimentation has supplied the chemist with that reliable information of the soil's reaction to fertilizer treatment which he previously lacked, and has paved the way to establishing a definite relationship between laboratory methods designed to show quantities of "available" plantfoods and the results of fertilizer field trials.

It has been possible also to devise new and less time-consuming laboratory methods, and to assess correctly their usefulness as a guide to fertilizer applications. During the past ten years the Bureau of Sugar Experiment Stations has been conducting scientifically designed field trials on selected farms on all the major soil types of the sugar areas. Such trials, however, are time-consuming and expensive, so that the desirability of obtaining similar results by reference to a soil analysis is obvious.

With this object in view, soil samples were taken from the "no fertilizer" plots of all experiments and analyses for plantfood availability carried out in the Brisbane laboratory by methods developed by the Bureau. By this means it has become possible to establish a good

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for October, 1938.

working relationship between the results from the field trials and the laboratory methods.*

Such a relationship, however, only exists when the sample for analysis is truly representative of the field under consideration and is taken during a definite period of the crop rotation. This correlation which has been established is based on the analysis of *samples taken just prior to or immediately after the harvesting of the plant crops of cane.*

A sample obtained at this period approximates most closely to the average state of the available plantfoods during the rotation.

It is a generally accepted fact that during fallow fresh soil particles disintegrate and decompose, and the supply of available plantfood, which has become depleted through the demands made upon it by the growing crop, is partially restored. Particularly is this so where a green manure crop has been ploughed under and allowed to decompose, thus helping to aerate the soil and supply the soil bacteria with the necessary energy to fulfil their function in building up anew the nutrient supply. The supply of nutrients, however, which is built up in this way, may be only transitory in nature and will largely disappear when the growing crop exerts its full influence. It will therefore be readily appreciated that soil samples for analysis taken immediately after a fallow period, are likely to give an exaggerated idea of the fertility of the soil, whereas one taken at the end of the first big growth period will express more nearly the power of the soil to supply plantfoods continuously.

Experiments on sampling carried out by the Bureau during the last three years have demonstrated that fields which appear uniform to the observer may vary very considerably from point to point in available plantfoods; and they have also shown how essential it is to exert the utmost care in sampling if the subsequent analysis is to mean anything. The Bureau will test soils for cane farmers free of charge, but any person submitting samples for analysis and fertilizer advice must endeavour to supply a sample which is as nearly as possible a true representation of the field in question.

It must be stressed that the instructions given below for the number of sub-samples which should be taken to form one composite is the minimum necessary; only good would result from increasing the number two or three times.

Procedure for Taking Soil Samples.

A post hole digger is one of the most convenient implements with which to sample the soil, as this removes a complete portion in one operation. An ordinary 1½-in. auger is good, provided the soil is sufficiently moist to cling to it firmly. If these implements are not available, a square hole should be dug to a depth of 10 in. (plough depth) and after cleaning out the loose earth, a slice about 2 in. to 3 in. thick taken down one side from top to bottom. Such a sub-sample should then be placed on a clean bag or piece of canvas. Other sub-samples (of approximately similar weights) should be taken from other portions of the field and added to the first one on the canvas; all should be mixed thoroughly before making the final sample, which should approximate

* These results have now been compiled by Dr. H. W. Kerr and the writer, and have been published as a Technical Communication of the Bureau.

2 lb. The number of sub-samples which should be taken and mixed in order to obtain such a representative sample will depend on the apparent variability of the soil and size of the field. At least three samples should be taken and composited for the smallest area. For large areas at least one sub-sample per acre is required.

Soils which appear markedly different must never be mixed, but each sampled for separate examination. Slight differences in colour, however, may be disregarded. *Fallow land should not be sampled except for special investigations.*

Notes should be recorded as to the type of sub-soil—e.g., sand, clay, &c.—and whether the area in question would be likely to benefit by artificial drainage, and these notes despatched, when the soil sample is forwarded to the—

Director,
Bureau of Sugar Experiment Stations,
Department of Agriculture,
Brisbane.

Samples should be taken from the middle of the interspaces just prior to or immediately after harvesting the plant crop but before fertilization for the ratoon crop.

A HANDY TROUGH FOR PIGS.

A very handy trough for feeding pigs or calves can be made out of a kerosene tin. The tin should be cut diagonally (as shown in Fig. 1), leaving the edge AB uncut, and then opened out, forming two wedge-shaped troughs side by side. A box frame should be made of the right dimensions to hold these troughs, and a centre piece let in on the upper edge CD (Fig. 2). The uncut edge of the tin must be placed over CD, the troughs lying on each side of the box frame. By cutting a nick at each corner the edge of the tin is bent over the edge of the box and tacked down.

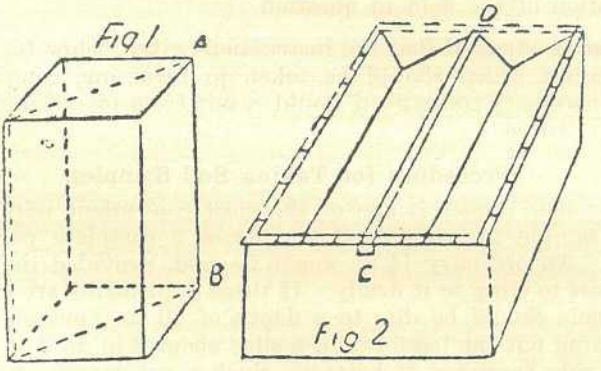

Plate 188.

This class of trough is much to be preferred to wooden or small log troughs or old fruit-case or butter-box troughs, for the reason that it is more permanent and can be scalded out daily, and thus be kept in a clean sanitary condition. If the trough is affixed to a wide board or floor, say, 3 ft. square, it will be impossible for young pigs to upset its contents, and if moved on to a fresh site occasionally will be found exceptionally handy, particularly in wet weather.—E. J. SHELTON, Instructor in Pig Raising.

Some Factors influencing Cane Production.*

H. W. KERR.

Introduction.

IF we could provide those conditions of soil plantfood and moisture which would maintain continuous cane growth at its maximum rate, it would be possible to produce crops very much in excess of the best Queensland production levels at present recorded. In a small experiment in North Queensland which received almost continuous irrigation and frequent fertilizer applications, a plant crop at 18 months old yielded over 140 tons of cane per acre; even in the southern areas, where the "growing" season is much shorter, it is possible to grow 100 tons of cane per acre, under similar conditions. Whilst admitting that no cane grower desires to produce on a field scale crops of this magnitude, which would probably become hopelessly lodged and rotted, it is well to remember that a 45-ton crop of cane, though pleasing to the farmer, by no means represents anything like a *maximum* yield; and the farmer who cannot average better than 20 tons per acre should be certain that there probably exist serious limiting factors, in his farming system, which it may be possible to overcome or eliminate, with consequent benefit to himself.

It is then of interest to record the several major factors which are involved in plant growth and to indicate briefly the steps a farmer should take both to investigate causes of crop limitation, and to eliminate them.

Factors in Crop Growth.

The following are the most important soil factors affecting plant growth:—

1. Water supply.
2. Air supply.
3. Temperature.
4. Supply of plantfoods or nutrients.
5. Various injurious factors.

1. Water Supply.—

It has frequently been emphasised—and indeed, it is quite obvious to every canegrower—that sugar cane is a water-loving plant. Water is absorbed by the crop roots, and is evaporated by the leaves of the cane. It has been estimated that in the production of 1 lb. of *dry* material, the cane plant absorbs and evaporates, on an average, about 30 gallons of water. The production of a 30-ton crop of cane therefore necessitates access to about 45 acre-inches of water. If the crop is denied ample soil moisture, growth ceases, and in extreme cases, it may actually perish from drought. It will be evident, therefore, that during rainless periods, the cane crop is able to grow only so long as the soil moisture supply lasts. This will be governed largely by the nature and amount of the rainfall, in replenishing the soil water supply; but it is well known that a "heavy" soil (clay or clay loam) holds moisture better than a "light" or sandy soil, and therefore crop growth is more regular

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for October, 1938.

on the heavier type, because of the superior moisture supply. Moreover, crops growing on heavy soils make more economical use of water than do those on sandy soils.

Where the normal incidence of rainfall is such as to cause serious checks to cane growth, the only satisfactory method of overcoming the trouble is by the artificial application of water. Irrigation practice has expanded rapidly in many of the drier areas of the State in recent years: and wherever good quality water can be brought to the field at reasonable cost, costs of cane production have been reduced very materially.

It has been pointed out from time to time that the humus content of the soil is an important factor governing the moisture retentive power of the soil. Therefore the farmer can attempt to effect some improvement in a droughty soil by ploughing in all crop residues—trash and tops—and green manuring the land when in fallow. Deep working of the land by means of the subsoiler or grubber will also assure the maximum absorption of moisture in time of heavy rainfall, and also permit deep penetration by crop roots to get access to the moisture so stored.

It is also possible to minimise the loss of moisture by evaporation from the moist land surface by conserving trash as a surface mulch in ratoon crops. In a dry year particularly, this has frequently been attended by striking results.

2. Air Supply.—

Though the cane crop roots require an abundant water supply, they must also have air for their healthy growth and development. Without air the roots cannot "breathe," and are unable to perform their normal function of water and plantfood absorption.

It is therefore essential that the farmer pay special attention to the question of land drainage. During heavy rainfalls, the air is temporarily driven out of the soil, and all interspaces between soil particles become filled with water. When the rain ceases, however, it is essential that the surplus water drain freely, so as to restore the desirable condition of an aerated, moist soil.

It is a fact that many of the Queensland cane soils which cause the crop to suffer most in rainless periods, also become water-logged in times of heavy rain. The situation may be improved in a number of ways. An adequate system of surface drainage will enable excess water to be removed from the surface of the land, and relieve the burden of sub-drainage in the soil. But this is only partially effective if the subsoil strata are of such a character as to be impervious to water; under such conditions, the only means by which the excess can be eliminated is by evaporation from the land surface, and this is not satisfactory. The breaking up of hard pan layers and the installation of a system of tile drains is the only satisfactory means of guarding against long periods of waterlogging in such a soil. They are costly, but effective. The mole-drainer may be helpful, but it gives satisfactory results only where the subsoil clay is of suitable character. Deep grubbing or subsoiling has given good results on certain soils, notably where the existence of a compact plough pan is the cause of excessive water retention by the soil.

The farmer should make a careful examination of any fields in which waterlogging occurs, and apply the appropriate remedy, if at all possible.

An over-wet soil may be responsible for just as great crop losses as one which is droughty.

3. Temperature.—

The temperature of the soil (and air) are of importance to cane growth. It has been demonstrated that crop growth is virtually at a standstill, so long as the average daily atmospheric temperature is less than 65°F. This is true, no matter how favourable all other growth

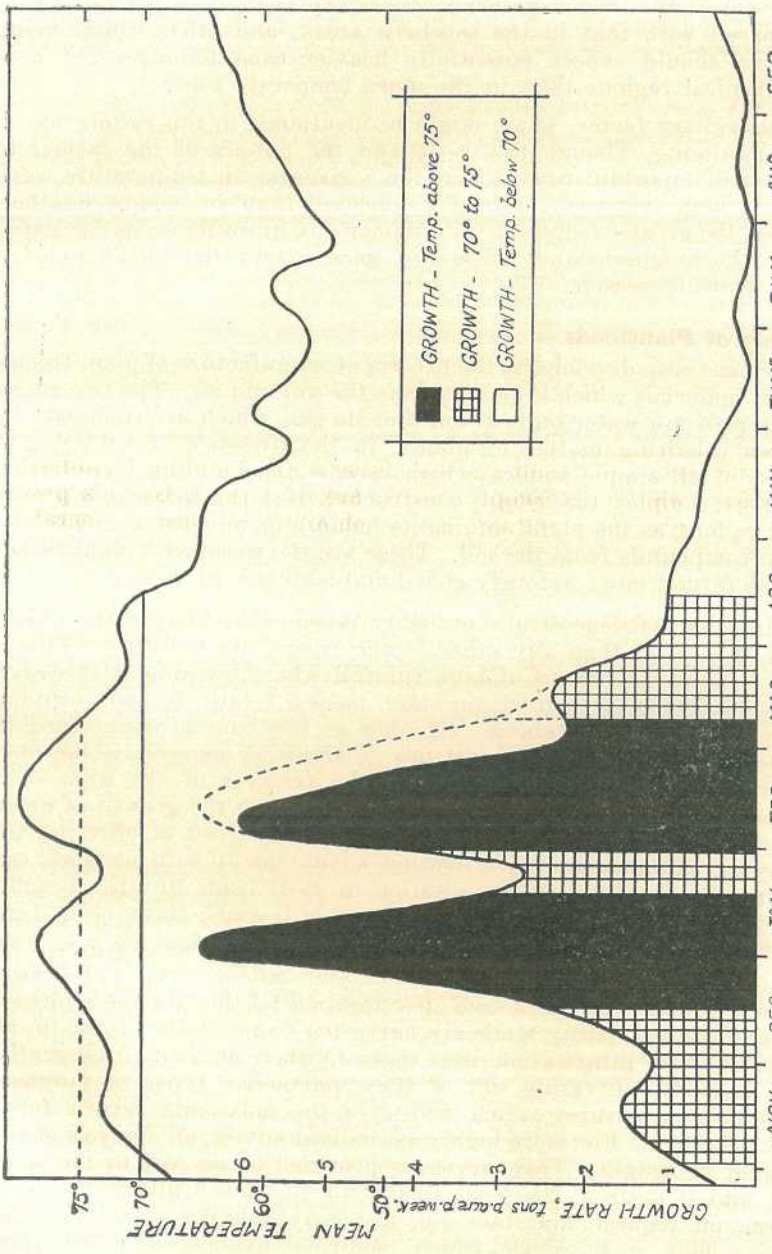

Plate 189.

Illustrating the close relationship between cane growth and mean atmospheric temperature; irrigated cane.

conditions may be. When the mean temperature rises to 70°F., vigorous growth becomes possible, while for temperatures from 75° to 80°F., crop growth can proceed at a very rapid rate. Of course, other factors incidental to temperature enter to modify this generality. Excessively hot, dry winds would result in a high average temperature, but it is known that they tend to distress the crop, rather than favour its development.

On the basis of soil and atmospheric temperature, then, stands the explanation of the longer growing season experienced in the far north, as compared with that in the southern areas; and other things being equal, one should expect potentially heavier cane tonnages per acre in the tropical regions than in the more temperate zone.

A subsidiary factor, which might be mentioned in this connection, is that of sunlight. Though this is beyond the powers of the farmer to modify, it is important to note that for a given mean temperature, cane growth is more vigorous in bright sunshine than in cloudy weather. Moreover, the greater length of the summer day in southern, as compared with northern Queensland, offsets to some extent the handicap of a shorter growing season.

4. Supply of Plantfoods.—

The cane crop develops by the process of manufacture of plant tissues from raw materials which it obtains from the soil and air. The two major raw materials are water and carbon dioxide gas, which are combined by the green colouring matter of plants, in the presence of sunlight, to give first of all simple sugars, which become the building stones from which more complex tissues are constructed. But this process can only proceed so long as the plant obtains its balance of mineral elements and nitrogen compounds from the soil. These are the so-called "plantfoods" which the farmer must jealously guard and maintain in the soil.

Plantfood deficiencies are probably responsible for greater reductions in crop yield than any other factor except soil moisture. This is notably true in the regions of high rainfall where leaching is excessive, and the soils, even in their virgin state, possess relatively poor supplies of these important substances. So long as the land is maintained in permanent cultivation, the liberal use of artificial manures is the only means of maintaining or building up the reserves of the soil. The policy of long fallowing under grass, combined with the growth of green manure crops, is a slower but more economical method of effecting the same result. Doubtless it is a distinct advantage if both methods can be combined judiciously. Crop rotation in itself leads to other benefits which cannot be discussed in detail here, but which have been dealt with previously.

The plantfood requirements of the major cane soil types of Queensland are the subject of continuous investigation by the Bureau, and each year a number of fertility trials are harvested from selected farms in all cane areas. The information thus gained, when applied intelligently, enables farmers cultivating soil of these particular types to purchase those fertilizer mixtures which will give the maximum return for a given expenditure. For more highly specialized advice, an analysis of the soil should be sought. This service is provided at no cost to the cane-grower, and if desired, the local Instructor in Cane Culture will visit the farm, on request, and take the necessary samples of soil for the purpose. This is a service which could be availed of much more

completely than it is at the present time. Fertilizers are costly, and the purchase of the wrong balance of foods may lead the farmer into much unnecessary expenditure.

5. Various Injurious Factors.—

There often exist in the soil substances which are actually harmful to the cane crop. One of the chief of these is soil acidity. Due to excessive leaching of lime and similar substances, there develop in certain soils concentrations of acidity which are definitely harmful to the crop roots. Cane normally thrives in a soil with a slight intensity of acidity; but when a certain maximum value is exceeded, the falling off in crop growth proceeds at a rapid rate, while extreme instances have been recorded where cane growth was not possible. The remedy for this trouble is the application of suitable amounts of liming materials—either crushed limestone, earth lime, or burnt lime. The need or otherwise for this treatment can rapidly be determined by a simple test, and growers desirous of advice in this connection should consult the local Instructor, or forward a sample of soil for the purpose to the Head Office of the Bureau, or to one of the experiment stations. This knowledge is important, for it is well recognised that fertilizer applications do not produce the full possible benefits on soils which need liming to destroy acidity.

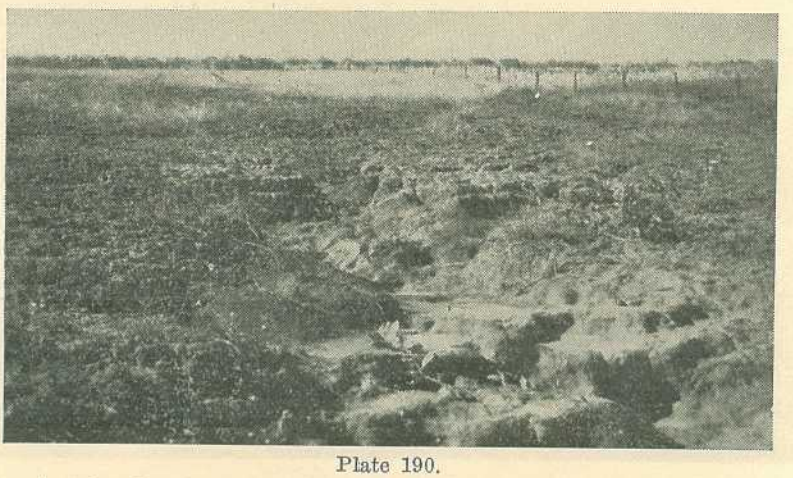

Plate 190.

Illustrating the effects of soil erosion; ten years previously this field produced good crops of cane.

Where irrigation is practised, soils and crops are sometimes damaged due to the presence of harmful salts dissolved in the water. Brackish waters may lead to an accumulation in the soil of common salt, which builds up to such an extent that crop growth is seriously affected. This occurs most frequently on soils which do not possess adequate subsoil drainage. The obvious remedy is either to promote better drainage conditions, or to avoid using waters of excessive salinity. No water should be used for irrigation purposes until it has been analysed by the Bureau, and declared safe. A more dangerous salt which often occurs in the sub-artesian waters of the Burdekin district is carbonate of soda, or "free alkali." This substance is much more troublesome than ordinary salt, and its effects on both soil and crop may be very serious. Water

analysis readily demonstrates the presence of soda, and if the grower is unable to fined a supply free from this ingredient, he should at least guard against permanent damage to the soil by taking the necessary precautions. The use of lime is often helpful in this regard, while applications of gypsum (occurring also in superphosphate), sulphate of ammonia or sulphur will readily overcome the effects of moderate amounts of free alkali.

In certain areas adjacent to the coast, canelands are inundated by high tides, and the salt which remains in the land after the tide has receded and the soil water evaporated, may reach injurious proportions. In such cases, an attempt should be made to prevent ingress of salt water, while lands so damaged may again be restored to a state of fertility when the salt has been washed out by rains. Sub-drainage is, of course, essential if the salt is to be removed effectively, and supplementary treatment with gypsum, lime, or sulphur may be necessary to improve the physical conditions of the soil.

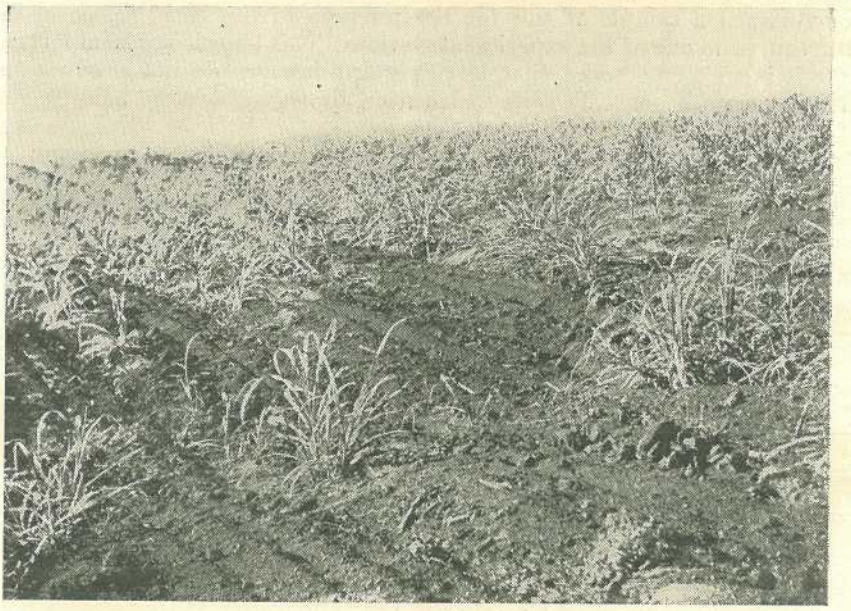

Plate 191.
The poor stand of young cane was due to the removal of surface soil from the hillside, by erosion.

Amongst "injurious factors" might be classed pests and diseases of sugar cane. The farmer should be continually on his guard against the presence of these factors; and although it is not expected that he will be able to recognise and identify all of these, or even diagnose the trouble when it occurs, he should at least be able to detect that the trouble is due to some such biological cause, and invoke the aid of the experiment station officer to assist him.

This is particularly important in the case of cane diseases; at the present time the Southern cane districts are seriously threatened by Fiji disease, and the chief difficulty with which the Bureau has to contend in eradicating this trouble is to find out where the disease

occurs, so that steps may be taken to prevent its spread. The wisest course for the farmer to follow in matters of this nature is, then, to report immediately to the nearest experiment station anything whatsoever of a suspicious nature. An early visit from an officer will then reassure him, or advise what must be done to correct the situation.

Other Causes of Depleted Yields.

It would be possible to list and discuss a number of causes of local soil troubles, but this cannot be attempted in detail. There are, however, two important factors which growers may completely over-look. The first is *Soil Erosion*, leading to loss of plantfoods and general fertility, and the second is *Faulty Subsoil Conditions* which result in extreme droughtiness of the land.

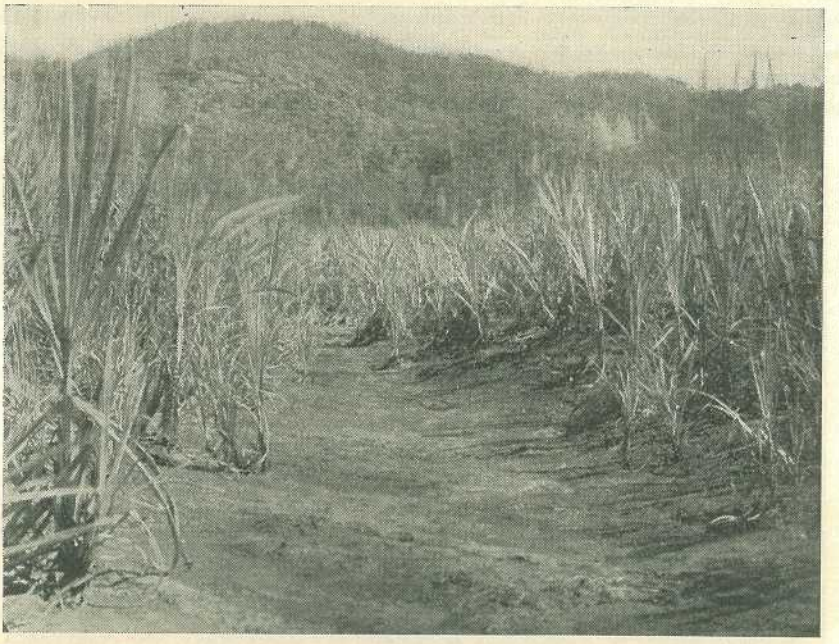

Plate 192.
Showing a badly "washed" area on which the cane cannot survive, due to the removal of the surface soil.

Soil erosion is, fortunately, not a matter of serious general occurrence in the cane districts of Queensland, but on certain hillside areas in regions of high rainfall, it has been responsible for substantial losses. In parts of the Innisfail district, farmers on red volcanic soils often find that the productive capacity of the soil falls off at a rapid rate for no very obvious cause. They will agree that "soil washing" occurs, but as the subsoil in such areas is generally very similar in colour and appearance to the surface soil, the loss of the richer surface layer is not detected, and the mischief is done before its true significance is realised.

Measures for overcoming soil erosion have been discussed in earlier issues of this Bulletin. At this time will be recorded only those measures which have been found most effective in dealing with the trouble.

Ordinary applications of artificial manures are of no avail in restoring fertility in such circumstances, and the only effective and economical method is to apply heavy dressings of mill by-products—mud, molasses, and ashes. This practice is now being followed with excellent results in the South Johnstone area. Green manuring, and trash conservation (as a surface mulch) in ratoons, are also two factors which will assist the farmer.

A case was recently reported where cane on an apparently fertile area suffered very severely during dry weather, for no obvious reason. An examination by the instructor in cane culture showed that at a depth of two feet the soil was underlain by a deposit of water-worn stones and gravel, indicating the earlier existence of a watercourse in this locality. The cause of crop distress was thus made evident; such a layer of coarse material possesses little powers of water retention, even after the heaviest rains, and the crop was obliged to subsist on just so much moisture as the surface soil was able to hold. Unfortunately, there are no practical means of correcting such a difficulty.

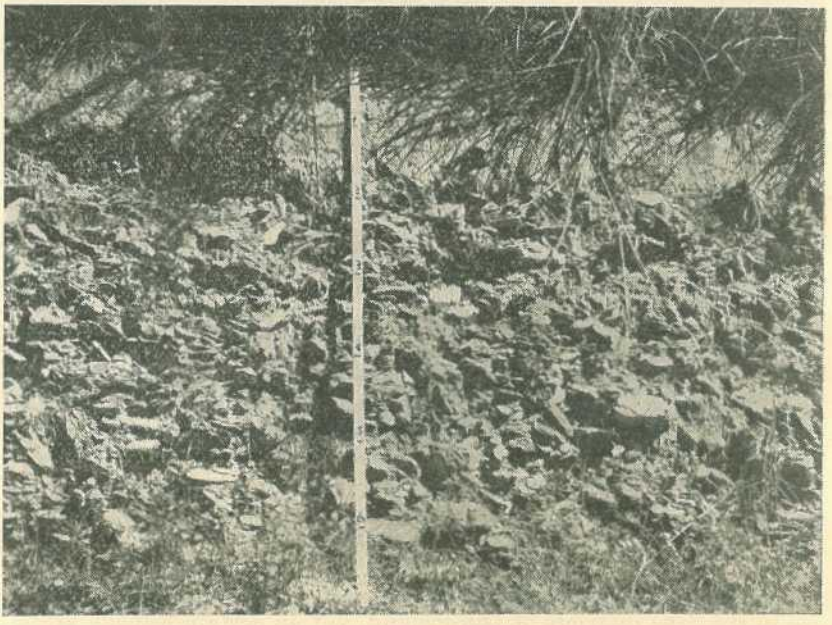

Plate 193.
Illustrating a bed of water-worn stone and gravel below 2 feet of soil.

Conclusion.

It is hoped that this discussion may stimulate cane farmers to make a more detailed study of the factors operating in their locality to make or reduce crop yields. The farmer should know his own conditions intimately, and it is generally unwise to blame any one cause for growth failure, until all possible causes have been investigated.

Introduction of Cane Varieties from Overseas.*

ARTHUR F. BELL.

IN common with most other crops there has been a great deal of interchange of varieties of sugar-cane between the different cane sugar producing countries of the world. At first, of course, this was entirely an unco-ordinated exchange of varieties as between growers in different countries. However, as time went by, it became apparent that this uncontrolled interchange of varieties also meant interchanging diseases, and of later years the responsibility for importing new varieties has been vested in the various Experiment Stations, which have facilities for guarding against the consequent importation of diseases. Those countries which went somewhat slowly in the matter of variety introduction in the early days, and which early adopted a system of strictly controlled introductions, now have their reward in a comparative freedom from serious diseases of sugar-cane.

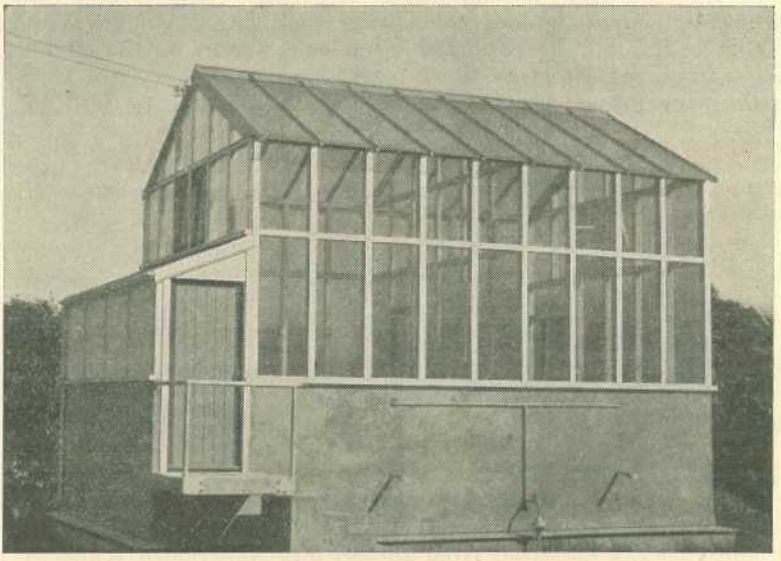

Plate 194.
Showing the quarantine glasshouse in which all newly-received canes are grown for a year.

Unfortunately, Queensland was very late in regulating variety importation with the result that we now have the world's richest collection of cane diseases. In this case, however, such control is much better late than never. There are still some diseases which do not exist in Queensland and also certain strains of some of the diseases we already have. Therefore it is very desirable that all reasonable precautions should continue to be taken when importing new varieties, and this can

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for October, 1938.

best be done under the aegis of the Bureau of Sugar Experiment Stations. The Bureau maintains an insect-proof quarantine house in Brisbane; all varieties received from abroad are fumigated on arrival and then grown in the quarantine house, under constant supervision, for a year. By the adoption of these precautions it is highly unlikely that any disease would be spread into cane-growing areas.

Incidentally, it might be advantageously pointed out that this quarantine house has well justified its existence. In 1936 Fiji disease was detected in two varieties which had been imported from New South Wales. If we had had no quarantine facilities and these cuttings had been sent to one of our field stations for propagation, then Fiji disease might have been introduced into Central or Northern Queensland. Naturally all varieties growing in the quarantine house at that time had to be condemned; the apparently healthy canes were planted again and grown under observation for a further year before being distributed. This occurrence also explains why some varieties—Q. 2 for example—have been a year late in reaching certain of the districts in Queensland.

For some reason, obscure to us, there exists in some quarters a belief that since the re-organisation of the Bureau, ten years ago, the importation of varieties from abroad has been greatly reduced and that the present administration does not favour such importations. We trust that this belief will be exploded by a comparison of the number of varieties imported direct by the Bureau during the ten years 1928-1938 with the previous ten-year period of 1918-1928 (June to June in each case):—

Country of Origin.	Varieties Imported, 1918-1928.	Varieties Imported, 1928-1938.
Hawaii	6	68
Java	8	13
Mauritius	13	0
India	6	12
United States	0	9
West Indies	3	2
New Guinea	1	1
Philippine Islands	4	0
Totals	41	105

During the last ten-year period some dozens of seedlings raised by the Colonial Sugar Refining Company in New South Wales and Fiji, and varieties imported from abroad into New South Wales by that organisation, have been introduced into Queensland for trial purposes either by the Bureau or by the company itself. In addition, in 1928 an American Sugar Cane Expedition visited New Guinea and collected over one hundred varieties which were placed at the disposal of the Bureau. In actual fact therefore it will be seen that the last ten-year period has been a very active period in the matter of foreign variety introduction.

It is true that the existence of these varieties has not been brought so prominently before the public in later years as previously. In former years newly imported varieties were often distributed for farm trial as soon as sufficient stocks were available; they were not tested for disease resistance and were allowed to find their own level by trial and error test. Nowadays, however, we have both the staff and the facilities

for carrying out disease resistance trials on an adequate scale, and new varieties must satisfy the disease resistance requirements of a district before they are placed in yield trials in that district. Most other sugar-cane producing countries have very few major diseases, and the varieties we obtain from them have naturally not been tried out against more than one or two of our diseases. Consequently, when we subject them to disease-resistance trials the majority are found wanting and are quietly discarded; naturally, then, the general public hears nothing of them.

In Hawaii, for example, the only major diseases common to our two countries, and for which resistance trials are carried out, are leaf-scald and chlorotic streak diseases. When we subject their varieties to test we find the vast majority of them susceptible to gumming, downy mildew, or Fiji disease, or all three of them, and very few have ever reached farm yield trials. This system is obviously a much better one than that of planting the varieties out to considerable areas and then finding that they are highly susceptible to one of the particular diseases present in that district.

Actually, the number of countries from which we can import varieties is very restricted since a number of the cane-producing countries carry out little or no cane breeding. The important sugar-cane country of Cuba, for example, has never greatly interested itself in cane breeding, while some countries, such as South Africa, are situated too far from the tropics to permit of cross pollination of cane varieties. Java, once a valuable souce of new canes, now prohibits the export of canes, therefore its newer seedlings are not available to us.

A discussion of the question of variety importation from overseas must necessarily include reference to the neighbouring island of New Guinea. Owing to the remarkable success of Badila in this country there is quite naturally a feeling on the part of farmers generally that we should continue to seek new varieties in that country. With that viewpoint we agree to a certain extent, but there are several factors to be considered. In the last fifty years several hundred varieties (probably many of them duplicated) have been brought from New Guinea to Australia, but with the exception of Badila and Korpi, there is not a single one of all these varieties which amounts to 1 per cent. of our crop (Korpi constitutes about 1·25 per cent.). Thus it would seem that the importation of Badila has been a very large slice of luck and, had that variety not been introduced, New Guinea varieties would have been regarded as very second rate.

New Guinea is one of the original homes of sugar-cane, and we also know it to be the original home of a number of the important sugar-cane diseases. In those places where the cane and certain diseases have existed together for centuries, we might expect that the cane must have acquired a certain amount of resistance in order to survive. It does not appear to us that New Guinea is likely to prove a promising hunting ground for new commercial varieties but it does attract us from the standpoint of a suitable place from which to obtain lines from which to breed. It is logical to assume, for example, that the place to look for canes for use in breeding for Fiji disease resistance is a section of New Guinea where Fiji disease is found. Unfortunately, it would be necessary to send an expedition to New Guinea to observe the diseases

and collect such canes, since the organisation of that country is not such as to obtain a satisfactory collection otherwise. Should such an expedition ever visit New Guinea it would also be of great interest for it to examine the type of cane which was found by the late J. G. Hides, and which was growing at an elevation of over 6,000 feet.

We trust that in the foregoing discussion sufficient has been said to dispel any false ideas that the importation of varieties from abroad has been curtailed, or that there is an intention of curtailing it. On the other hand, it is wise not to expect too much of imported varieties. Yields are increasing in most sugar-cane countries, due in part to the development of varieties which suit local conditions better than the varieties they displace. It therefore becomes more and more the case that an outstanding variety in any country is outstanding because it dovetails closely with the particular requirements of that country, and hence is not particularly likely to be a pronounced success in any other country. It is interesting to note that Badila, the outstanding cane of Queensland and Fiji, is scarcely grown elsewhere. H. 109, the "wonder" cane of Hawaii, is seldom worth a second look in other countries; P.O.J. 2878 has not found outstanding favour outside Java (although of great value in parts of Southern Queensland and New South Wales). B.H. 10/12 and S.C. 12/4, the leading canes of the West Indies, are a failure elsewhere, and so on. It seems to be very much a matter of hit and miss, and it would appear that the needs of a country are best served by developing its own cane-breeding services to the utmost. To this end the Bureau is now raising seedlings at its three field stations, and the resultant seedlings, after full test, are commencing to reach commercial scale plantings.

At the present time one of our officers, Mr. N. J. King, is visiting Hawaii and the United States, and he has been instructed to make enquiries regarding varieties suitable for importation into Queensland. It will be readily appreciated that the man on the spot has a much better basis for judging the possibilities of a variety than is obtainable from reading reports, and we look forward with interest to receiving his selections.

A New Species of Legume.

In the April issue of the "Quarterly Bulletin" brief reference was made to experiments with a new leguminous species, bearing the formidable name *Crotalaria goreensis*. Arrangements have been made for further trial areas to be planted at our Experiment Stations and on selected farms throughout the cane districts, and in all probability more will be heard of this legume.

It is therefore desirable that it be endowed with a name which will be more readily pronounced and remembered by farmers. As it was imported from Gambia, Africa, it is proposed to call it the "Gambia Pea," and it will therefore be referred to as such in all future publications of the Bureau.

—H. W. K., in The Cane Growers' Quarterly Bulletin.

Notes on Rat Baits, Rat Poisons, and Rat Population.*

W. A. McDOUGALL.

PROBLEMS connected with poison baits for rats can be conveniently placed in two groups; (1) those dealing with rats as *average* individuals, (2) those concerning rats as *a population*. It is proposed to deal chiefly with some aspects of group (1), viz., "median lethal doses" of the common rat poisons, bait bases, bait strength, and intake. Knowledge gained from a study of these portions of group (1) is one of the fundamentals for dealing with the second group, which actually covers possible control of rats in the field by poisoning. Unfortunately, the subject of rat populations, that is, the numbers of rats, kinds and ages of rats, condition and behaviour of rats in the field, is also of fundamental importance for a proper understanding of group (2). At the present time conclusions resulting from the early progress in our study of rat populations, and their application to the economic problem of rat control, must in some degree be a matter of opinion. They are given here as such.

Rat Bait Bases.

It is necessary that the few semi-technical terms used above should be explained at this stage. A "bait base" is a rat food into or on which a poison is placed. Bait strength denotes the proportion of poison to food in the bait. "Intake" means the amount of bait or food that an average rat may eat or can be expected to eat. We should distinguish between intake and take: intake is a true index of the palatability of a bait or food, whereas take, which could be called a field term, usually denotes the amount of material which is taken in the field. Obviously "take" depends upon a number of factors including bait or food palatability and the proportion of material offered to the number and weight of rats present. The "median lethal dose," or M.L.D. for short, is a term used for comparing the "deadliness" of different poisons. An M.L.D. of 250 means that a dose of 250 milligrammes of poison per kilogramme body weight of rat will kill 50 per cent. of the rats which eat it. It follows that a poison with an M.L.D. of 30 is ten times more deadly than one with an M.L.D of 300.

The field rat (*R. culmorum*) is predominantly a vegetarian, and foods which have been or may be used for bait bases could be listed in order of preference as follows:—rolled oats, a prepared food, cracked corn, corn, wheatmeal, whole wheat, barley, and bread. Rolled oats stands out above the others; barley is not a food particularly desired by the field rat, and there is always a poor intake of bread. For general purposes, the average field rat can be expected to eat approximately ¼ oz. per night of an unpoisoned food such as wheat, and in the winter time as much as ½ of an oz. The climbing rats (*Melomys littoralis* and *M. cervinipes*) which are smaller species, eat less. The actual palatability of baits is not improved, so far as the economic aspect

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of baiting is concerned, by the addition of linseed or corn oil. These oils are excellent attractants, but they are not appetisers. It seems as if the fundamental fact governing intake is the palatability of the base bait as a food. Such intake is, in different degrees, modified by the several rat poisons at different bait strengths. We do not know of a material (called an "appetiser") which, when added to a poor bait base or a bait of poor intake, such as phosphorus on bread, will increase the intake.

Rat Poisons.

Having briefly discussed bait bases, &c., we shall now turn to the poisons. It has been found that, for our conditions, most of them can be dismissed very briefly. Red squills is variable in quality; the M.L.D.'s of samples used by us varied from 350 to 1,000. Arsenic (the sample used by us gave an M.L.D. of 200) gives very variable results. Zinc phosphide has an M.L.D. between arsenic and thallous sulphate, and of all the reputed rat poisons used by us, barium carbonate is the most useless from the point of view of its deadliness (M.L.D. about 1,000 at bait strength of 1 in 5). From a practical standpoint, all the above poisons together with the strychnines (probably the alkaloid is the best) and yellow phosphorus, tend to reduce bait intakes. The strychnines and phosphorus, however, are very deadly poisons. The effect of the strychnines on different rats is variable, but in general this poison is much more deadly than thallium. Phosphorus is easily the most deadly rat poison with which we have dealt. The small M.L.D.'s or extreme deadliness of these two poisons make up to a considerable extent for the small intake of baits containing them: this is particularly true for phosphorus. The successful administration of all rat poisons other than phosphorus, depends upon the intake of comparatively considerable, but variable, amounts of desirable foods. Phosphorus, on the other hand, is usually used on a cheap bait base (bread) with a very poor intake. Actually any successes with phosphorus and bread are due to heavy overdoses, accepted by the rats in very small intakes. Thallous sulphate, with an M.L.D. of approximately 35, is a very reliable poison. It is considered that, in the light of our present knowledge, and taking into account the numerous factors concerned, a bait strength approximating closely to 1 in 300 would be the best for thallium sulphate treated wheat in our cane fields.

Last year we had for our use a fairly uniform field infested by rats. We were able to obtain considerable information about the rat population in this field without reducing it in any way. There was very little migration, only one species of rat was present, and the relative sizes of the rats were such that similar behaviour could be expected from them all. It was found that a 62·4 per cent. take of ¼ oz. packetted, paraffin-coated, linseed oil sprayed, 1 : 500 thallous sulphate treated wheat, at the rate of 200 baits per acre, laid at ten yard intervals, had the same effect on reducing the rat population as a take of freshly prepared bread-phosphorus baits so small that it could not be calculated. It is not intended that this experiment be used to compare these two baits as rat controls. These baits are extremes in so far as intakes are concerned, but it is evident that it is futile to compare, on field takes, the actual effectiveness of baits of different intakes. The reduction of the rat population to a degree sufficient to prohibit damage to cane is the chief criterion for the success of poisoning. A certain bait may give valuable results in the field. When it is known that the particular bait can do good work, its failures are not necessarily due to a shortcoming

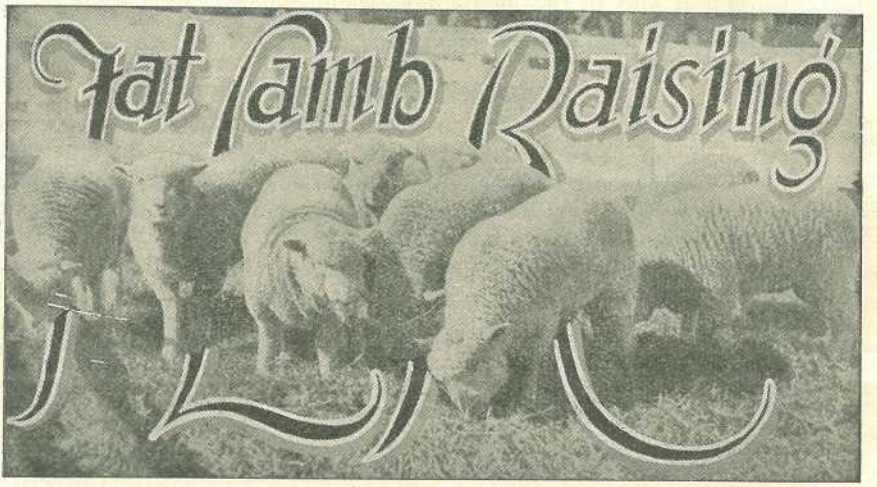
of the bait itself, which can be rectified. Very probably other good baits would fail also in the particular circumstances. This leads us to a consideration of rat populations.

Rat Populations.

Very often the popular conception of the subject of rat populations is limited to the question of how many rats per acre do we have to deal with to stop damage in our cane fields. No doubt the answer to this question is important, but we should be interested also in the kinds or states of population. For example: the destruction of a rat population consisting of non-migrating, reasonably even-sized rats at the rate of 100 per acre is much easier than attacking successfully a similar-sized population made up of small and large rats. Again, the damage to cane by a rat population of, say, 100 per acre is more easily prevented by poisoning in a field where this population has been born and bred, than in a field to which it has migrated.

In years when damage to cane by rats is most severe and wide spread in Queensland large rat populations are present. These are often called "plague" years, and during these years the rat population exhibits, besides "quantity," most of the difficulties associated with "quality" which could be encountered in rat control. At the present time, when there are not sufficient data available to help in forecasting rat plagues in cane fields, no recommendation can be made as to the best and most economic method of preventing or combating rat plagues.

In normal years nature takes a severe toll of rat populations between October and January. During this period large numbers of the heavier and older rats die off. With this in mind, and taking into account several other factors, including the small amount of rat damage in normal years and the remarkable recuperative powers of rat populations, it is considered that continuous and general all-the-year-round poisoning of cane fields and adjacent rat environments may not be economically sound. At least during normal years, attacks on the rats themselves or other direct methods of control, if necessary, might best be applied to localities where it is obvious that damage is occurring.



Farmers' Breeding Flocks.

The want of the right type of ewe in the breeding flock is often the fat lamb raisers' difficulty. As a straight-out breed, the Corriedales should meet the requirements to the greatest extent. The sheep selected for the purpose should be of the true Corriedale type, possessing large, deep, well-formed frames, and producing a long fleece of 56s 58s spinning quality. Should these not be available, then an English long wool crossed on the large-framed, plain-bodied merino will be found satisfactory. The trouble with this type, however, is that if conditions are suitable for fattening lambs when they are on the ewe, the temptation to sell them as lambs is too great. Well-grown crossbreds at five months can be sold usually to such advantage that it pays the man on good—and, therefore, expensive—country to sell them as lambs and buy ewes at the breeding age. Practically the only ewe at breeding age that is available in Queensland is the merino.

The only way out of the difficulty is for sheep farmers on suitable country further west to breed either pure-bred Corriedales or English long wool crosses, and sell the ewe progeny when about 2-tooth to the fat lamb raisers. The advantage of breeding to the pure-bred Corriedale is that only one breed is necessary; and, as they are suitable as a farmer's flock for both wool and mutton, they serve the dual purpose with the breeder, and the surplus ewes should meet with a good demand from fat lamb raisers. Much of the brigalow lands in the medium rainfall areas, when sufficiently developed and improved, can be used to advantage for sheep breeding, and the Corriedale is, it is considered, more suited to these areas than the merino.

—J. Carew.

THE CORRIEDALE.

The qualities of the Corriedale as a general utility sheep are not sufficiently appreciated in Queensland. The Corriedale was founded on the Lincoln-Merino cross, from which was evolved this distinct breed which possesses the most valuable characteristics of the best type of dual purpose crossbred. That is to say that when the Corriedale ewe is joined with a Downs ram the breed produces a fleece of high quality as well as a lamb of outstanding merit.

In Queensland, a tendency to produce a sheep too fine in the fleece has been observed in some Corriedale studs. It should be recognised, however, that this tendency if allowed to persist will eventually defeat the object for which the Corriedale was evolved.

—J. L. Hodge.

THE CULLING OF FLOCKS.

Faulty fleeces, malformation, lack of conformation, constitution, and size, and a general unthrifty appearance are all indications of the necessity of culling the flock.

The covering of wool should be governed, to a great extent, by the conditions of the locality in which sheep are to be depastured. In Western and Central districts of the State, where climatic conditions have a fining influence on the fleece, a fibre on the strong side of medium is advocated. Colour, length of staple, character—all combine to make a quality fleece.

With the culling of the ewe flock should go the selection of better rams. With rams, the type selected should be at least somewhat stronger in the desirable characteristics than that of the ewes. Prepotent power —that is of like begetting like—is of great importance, and is generally indicated in the ram's head. Having achieved a type, the quickest way to fix and retain it is to continue with the same strain of rams. It takes the breeder of long experience to chop and change successfully from stud to stud when introducing new blood.

—J. L. Hodge.

UNIFORMITY IN FAT LAMBS.

One of the greatest hampering factors in the fat-lamb raising industry is the lack of the right type of crossbred ewe. In fat-lamb raising in Queensland, a beginning has often to be made with the Merino ewe. The type chosen should be of the large-framed, strong-woolled kind. On ewes of this type, long-woolled rams—such as the Romney Marsh, Border Leicester, or Lincoln—should be used. The ewe progeny of this mating should be reserved as future breeders in the fat-lamb producing flock. To produce the most desirable lamb at an early age, the use of Southdown, Dorset Horn, or Shropshire rams on these crosses is advised.

Pure Corriedale ewes make excellent mothers for the early fat lamb.

Time is saved and impetus is given to the fat-lamb industry when farmers acquire ewe weaners of the right crosses. It is always a pity to see these potentially valuable breeders slaughtered.

—J. L. Hodge.

BUYING FLOCK RAMS.

Even in these more or less enlightened days too many graziers still hold the opinion that practically any flock rams will do, so long as they are pure merino and cheap enough. No greater mistake could be made in the breeding of sheep. The ill-effects of such a policy are lasting.

In the selection of rams for a certain line of ewes, familiarity with the type and qualities of the latter are essential.

A grower without the necessary knowledge to successfully "nick" the sexes would be well advised to employ a man fully qualified for this important work.

Violent contrasts in the types of ewes and rams should be avoided. For instance, if a grazier has a medium flock of say 64's quality, and it is desired to strengthen the clip somewhat, it is not advisable to join the strongest of merino rams. This is an attempt to do in one year something which should take not less than four years. Breeding for an alteration of type should be gradual.

Rams selected for a certain line of ewes should be slightly stronger in fibre than the ewes with which they are to be joined, and, further, should be specially selected to rectify any pronounced fault in the ewe flock.

A guinea or two is neither here nor there in the acquisition of suitable flock rams.

—*J. L. Hodge.*

IMPROVEMENTS ON THE GRAZING SELECTION.

Improvements on newly acquired sheep lands are important from two points of view—firstly, their place in economic management, and, secondly, the necessity of avoiding the making of improvements likely to over-capitalise the property. A horse paddock is a prime necessity, and should be sufficiently large to run working horses and house milking cows.

If the lie of the land allows it, the horse paddock should be situated as near as possible to the centre of the property. The advantage of this will be found when the selection is stocked. The shorter distances to ride will be appreciated by both man and beast. The fencing should be sheep-proof, and the paddock cleared of unnecessary timber. Fencing the boundary is the next important job. The nature of this fence depends on the conditions under which the land has been selected. It may be that rabbit netting has been specified, and a dog-proof fence may be necessary. In any case, the boundary fence should be the best of its kind. If an addition to the natural water supply is necessary, this should be attended to at once. In this connection, the selector would be well advised to observe the methods adopted in the district. Bores, wells, and surface tanks all have their advantages, according to local circumstances. If the country is naturally watered, the subdivision fences should be so planned, as far as practicable, that permanent water will be in every paddock. Substantial yards—preferably of post and rail construction—are necessary at the homestead. The yards may be used for both horses and cows. A sheltered calf pen

should be attached. If conditions make it necessary, judicious ring-barking is the next job. Consideration should, however, be given to the reservation of tree belts for shade and shelter.

A woolshed and drafting yards on a small property should be close together and conveniently situated. The homestead, and its lay-out, is important, but its cost should be in keeping with the capital value of the holding.

—*J. L. Hodge.*

THE BEST TYPE OF LAMB FOR EXPORT.

To meet the demands of both the home and the export trade, a true sucker lamb must be prime fat, irrespective of weight.

To produce the right lamb for export, at an age profitable to the grower, breeding is a prime essential. It follows naturally that different graziers have preferences for certain breeds of English sheep, but it may be laid down broadly that the best lamb for export is produced by a Downs sire—such as the Southdown or Dorset Horn—from a ewe of one of the long-woolled breeds—such as the Romney Marsh, Border Leicester, or Lincoln crosses. The foundation merino ewe should be of a large-framed strong-woolled type. Corriedales make excellent breeders. Ewes in lamb should be maintained in good, strong condition, and no feed is too good for them after dropping.

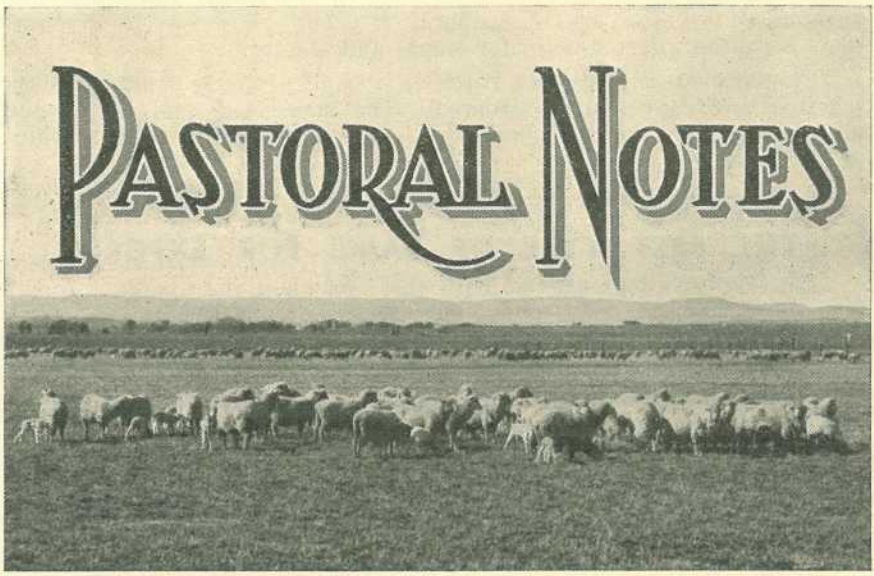
From 30 to 33 lb. is the proper weight of a fat lamb, and this weight should be attained when it is about four months old.

—*J. L. Hodge.*

SHEEP-DIPPING.

The only known method to combat lice and ticks (ked) in sheep successfully is to dip. A preparation of proved efficiency should be used. If a powder dip is chosen, great care should be taken in the mixing. The powder in small proportions should be mixed with water and stirred until the consistency of an ordinary mustard mixture is attained. When the whole of the powder necessary to charge the bath is so mixed it may be added to the full quantity of water in the dip. This should be done overnight.

It is necessary to follow carefully the directions as to quantities given by the manufacturers. Sheep get most benefit from dipping when a month to six weeks off shears. Never dip sheep when they are hot or thirsty. For the job, avoid, if possible, extremes of heat and cold. Let the sheep drain thoroughly in the shade, if practicable. Treat the dipped sheep gently and avoid driving them for any considerable distance.



Irregularities in the Teeth of Horses.

The horse has two dentitions—a milk dentition, and a permanent dentition. The incisors and premolars are milk teeth, and are replaced in due course by permanent teeth.

The centre permanent incisors appear from two and a-half to three years old, the lateral from three and a-half to four years old, and the corner ones from four and a-half to five years old when the animal is said to have a full mouth. The tushes seldom appear before the age of four years, are well up at four and a-half years, and are level with the corner incisors at five years. In mares, these canines seldom appear.

Occasionally the milk teeth are not shed before the appearance of the permanent ones, and they may interfere with their normal growth, pushing them out of position. Removal of these milk teeth sometimes is necessary, and this is done with small forceps, or even by levering them sideways with a strong knife blade. Never break them off. After their removal the permanent tooth soon straightens up.

Many horses, particularly aged horses, lose condition because of pinnacles and sharp edges on the molars, and which may prevent the proper mastication of food. These irregular projections are found on the outside of the upper and the inside of the lower molars, sometimes cutting into the cheeks and tongue, causing painful sores; or, one molar may be found to have grown too long through decay of the opposite one, and consequent lack of wear, that it prevents the other molars from meeting, and the horse is unable to grind its food.

An affected animal shows distress in chewing by holding its head on one side to chew, and eventually dropping the half-masticated bolus from its mouth.

Other evidences of distress are an objection to the bit being put into its mouth by tossing the head, or by "running away from the bit" when pressure is applied to the reins.

Indigestion and colic are usually the consequence of this condition.

The remedy lies in the careful and patient use of the tooth rasp, which is used in conjunction with a mouth gag, care being taken not to destroy the natural bevel of the teeth, for it must beremembered that mastication is performed by movement of the bottom jaw, the bevel of the teeth providing the resistance, so that food may be properly ground. After the teeth have been levelled, the mouth should be swabbed out with a solution of borax and water, and a suitable tonic given with feed—such as gentian root powdered, four parts; sulphate of iron powdered, two parts; nux vomica powdered, one part. Two heaped tablespoons of the mixture should be given twice daily in a small quantity of dry feed.

TETANUS IN HORSES.

From time to time valuable horses die from tetanus (lockjaw), and, in some instances, early attention might mean the saving of the animals. The financial loss to the owner is serious, especially when the loss is not covered by insurance. The loss in the case of the death of a valuable draught or thoroughbred stallion is a matter of community as well as of individual concern.

Once tetanus develops and symptoms become evident, it is almost impossible to save an animal. The symptoms are dilated nostrils, head poked forward and neck stiff, movements slow and hesitant, tail elevated and held straight out, and the third eyelid (haw) swinging backwards and forwards across the eye at the slightest noise. Clapping of the hands or opening of the stable door may produce the last mentioned symptom. In short, the animal appears stiff all over, is unable to bend the body normally, and is described as "swinging about in one piece like a ship at sea."

In horses, tetanus usually occurs as a result of some small injury, such as a punctured wound in the foot or any other part of the body. Stable manure is a most suitable medium for tetanus germs.

The incubation period in most cases, especially in horses, is one to two weeks. However, cases have occurred where symptoms have been observed twenty-four hours after infection. Preventive measures should always be adopted by thoroughly cleansing the wound and treating it with tincture of iodine or some other antiseptic. In cases of punctured sole or bruises, after cleansing the wound thoroughly and treating it with antiseptic dressings, plug the wound with tow soaked in tincture of iodine and bandage the foot to prevent the entrance of dirt. In all cases tetanus anti-toxic serum should be injected. It is not claimed that the inoculation protects the animal for any length of time, but the use of anti-toxic serum immunises the animal over the period in which infection might be gathered through an open wound.

—Dr. F. H. S. Roberts.

Cutworms in Seedling Cotton.

During the spring and early summer months, one of the most serious pests of seedling cotton with which the farmer has to contend is the common cutworm.

Cutworm outbreaks may necessitate replanting, which is successful only when the soil contains adequate moisture. In any case, some time may elapse before resowing is practicable, and the replant crops are rarely so successful as those sown early. For that reason, precautions should be taken against cutworms to ensure a commercial stand of cotton with the first seeding.

The winter of 1938 has been more or less favourable for the insect, and good spring rains may be followed by a widespread emergence of moths. Farmers therefore should be familiar with the habits of the pest and the methods used for its control.

Cutworms, the larvæ of a dark-brown moth, are stout, soft-bodied, greyish-brown to greyish-green caterpillars, growing up to 1½ in. in length. They feed principally on low-growing weeds, but if these food supplies are disturbed in any way the caterpillars may migrate to nearby cotton fields or, if already in the cultivation, may damage the germinated cotton. The pest feeds at night and normally attacks the stem just above the ground level.

Cutworm losses in cotton may be considerably reduced by good cultural methods. Thorough ploughing, in which weeds are destroyed completely, is necessary. Patches of weeds missed during ploughing are frequently the centres from which extensive cutworm damage radiates. Ploughed land should be kept free of weeds for at least a month before planting, which, if the rains are suitable, will be carried out between mid-September and mid-October. Early ploughing is therefore required. After planting, weeds should be kept in check.

If weeds are ploughed under immediately prior to planting, the risk of cutworm injury is increased greatly, for many of the eggs and larvæ on the weeds will survive and attack the cotton seedlings.

Virgin land, or Rhodes grass paddocks which are being prepared for cotton, usually contain little weed growth, and this, to a great extent, minimises the risk of cutworm injury. Nevertheless, early ploughing is still preferable, in order to ensure the preparation of a good seed-bed, and to allow adequate time for the organic matter to break down.

Where direct control of the cutworms is required, insecticides must be used. The poisoned bran bait method has been tested thoroughly, and is recommended as a reliable control measure.

To prevent the entry of invading swarms, the bait should be distributed along one or two ploughed furrows across and in front of the line of attack. When the pest is within the field, the bait may be broadcast or applied in lines along the rows of cotton seedlings. If broadcast, about 50 lb. dry weight of bran will be required per acre; if distributed along the rows, 25 to 30 lb. dry weight of bran per acre should be sufficient for baiting purposes. The formula of the poison bran bait is as follows:—25 lb. bran, 1 lb. Paris green, 2 quarts of molasses, and enough water (2 to 2½ gallons) to make a friable, crumbly mash which can be broadcast without difficulty. The bran and Paris green are first mixed dry; the molasses is dissolved in the water, and after being mixed the whole is well stirred up to make the mash as required. As the cutworms are night feeders, the bait should be applied in the late afternoon and evening. The use of insecticides for cutworms is a remedial measure only, and is not normally necessary if efficient cultural practices are applied on the farm.

—W. J. S. Sloan.

TRIALS WITH MAIZE TRAPS IN COTTON.

Maize in the tasselling and earing stage is much more attractive to corn ear worm moths for egg-laying purposes than cotton, and by utilizing this attraction attacks may be concentrated on maize, and the cotton crop protected from severe injury.

During the 1936-37 season, successional plantings of maize rows were made at regularly-spaced intervals through a selected cotton field. The maize was periodically treated with a poison swabbing mixture, consisting of 1 lb. of lead arsenate, 1 gallon of molasses, and 1 gallon of water, to destroy the larvæ. Results from this trial were promising enough to warrant an extension of the area on which the maize trap crop method of controlling the corn ear worm in cotton was used. In the following season, sufficient space was left in 370 acres of cotton, distributed over six farms, to permit the interplanting of strips of six rows of maize at regular intervals through each field. Each of these spaces was sown two rows at a time, the first two rows being sown three weeks after the cotton was planted and an additional two rows at three-weekly intervals thereafter.

Observations during the peak of the corn ear worm attack in late January and early February showed that a certain amount of egg-laying had taken place on the cotton, and that complete protection of

the cotton crop was not provided by the maize plantings. Nevertheless, the tasselling and earing maize traps at this period were very heavily infested with corn ear worm eggs which, in the absence of maize, would almost certainly have been laid in the cotton.

Unfortunately, severe losses of squares and bolls due to dry hot weather in February and March completely overshadowed any losses from corn ear worm attacks. Since all selected farms returned poor yields, because of drought reasons alone, the evaluation of the maize trap crop as a means of protecting the cotton crop was not possible.

However, four conclusions from the season's work require stressing:—

(1) When planting rains are delayed beyond mid-October, the first maize planting should be made at the same time as that of the cotton, instead of three weeks later, as required for September and early October plantings. When planting rains are delayed beyond November, only two maize plantings are required, the first of which coincides with that of the cotton. Only one planting of maize is considered necessary in cotton crops soon after December, and both the maize and the cotton should be planted at the same time.

(2) Maize plantings should be made as scheduled, regardless of the amount of soil moisture available. Dry planting may be a failure, but it is worth doing in the hope of obtaining an early strike of maize. Even if replanting is necessary, loss of time and seed in making the first planting is a comparatively small item.

(3) Land intended for the maize should be maintained free of weeds, and in a good state of cultivation prior to planting and during the growth of the maize. Proper cultural treatment is just as essential for the success of the maize as for the cotton.

(4) A swabbing mixture of a 1-1-3 formula (1 lb. lead arsenate, 1 gallon molasses, 3 gallons water) is suggested for use instead of the 1-1-1 mixture. The former runs more easily into maize silks and plant terminals, is cheaper and has given satisfactory results.

The maize trap crop method of controlling corn ear worm in cotton is inexpensive and easy to manipulate. Properly carried out, it decreases corn ear worm attacks in the cotton, and is therefore well worthy of trial. The maize must on no account be cut and fed to stock—the swabbing residues are poisonous. The shelled grain is, however, quite safe for feeding purposes. Farmers who contemplate using maize trap crops in the coming season are advised to make contact with the Entomologist at either the Cotton Research Station, Biloela, or the Department of Agriculture and Stock, Rockhampton.

—W. J. S. Sloan.

Treatment of Milk Fever.

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

SINCE the discovery of udder inflation for the treatment of milk fever, this disease has had few worries for the dairy farmer, but it is considered that a few notes on it, describing the precautions to be observed in udder inflation, some of the undesirable consequences that may follow, and recent advances in treatment, may be useful.

Usually the condition has been present some time before treatment is applied, and the affected beast will be down and more or less unconscious.

The udder should be wiped clean with a clean damp rag, and then a clean towel should be placed under the udder to prevent contamination from the soil. The beast should then be propped up on its breast bone in as natural a position as possible, taking care that the hind legs are in a normal position and not causing undue pressure on the udder. In very advanced cases, this may not always be possible, but it should be attempted.

Strip the udder of any milk present and then commence inflation with a teat syphon. Each quarter is inflated firmly and the teats are tied off at the bottom with clean tapes to prevent the escape of air. The udder should then be massaged gently to distribute the air throughout the organ. The tapes should be untied about half an hour after they were put on. If no improvement is noted after three hours, inflation should be repeated. The most undesirable after-effect that may follow treatment by udder inflation is mammitis. To avoid this the following precautions should be observed:—

(1) The teat syphon used should be sterilized thoroughly before use by boiling.

(2) Take every precaution during inflation that the teat syphon does not come in contact with any contamination; should that happen, immerse the syphon in boiling water before continuing its use.

These precautions are against the possibility of introducing any infection into the healthy udder.

(3) If a quarter of the udder of a cow being treated with milk fever is affected with mammitis, or has been so affected at any time, that quarter should be the last inflated; and, following use on that quarter, the teat syphon must be sterilized thoroughly by boiling before being used again.

The necessity for such a precaution is obvious.

Despite the fact that most cows treated for milk fever by udder inflation record an uneventful recovery, it has been found that better results are obtained by the subcutaneous (under the skin) injections of a substance known as calcium boro gluconate. It is well known that in milk fever the calcium content of the bood drops considerably, and the injection of calcium boro gluconate aims at restoring the lost calcium balance. In addition to being a more convenient treatment, other advantages it possesses over udder inflation are that there is no risk of introducing or spreading mammitis, recovery is more rapid, relapses are less likely to occur; and also the method may be used as a preventive. The drug is put up in convenient form commercially, and the local chemist will be able to advise where to get it.

The drug is usually issued in cartons containing 2½ oz., the contents are dissolved in 10 oz. of hot water recently boiled and then allowed to cool to body temperature before use.

The dose given is sufficient for one treatment, and should be injected under the skin at various parts of the body—do not inject all the solution in one place. The usual precautions are taken regarding sterilization of the syringe and needles and antiseptic precautions at injection.

It has been found that repetition of the dose is rarely necessary.

Some cows are known to be more subject to milk fever than others, and in such cases it has been found advisable to give an injection immediately after calving, followed by a second injection about twenty hours later. For these injections, the dose should be half that used for curative treatment.

Whatever the method of treatment adopted, it is advisable to cover the animal with a rug and in no circumstances should the beast be drenched as, because of the paralysis extending to the throat, the cow is unable to swallow, and any liquid forcibly given may enter the lungs and set up pneumonia which almost invariably proves fatal.

When the treated cow gets to her feet, it is advisable that some definite form of after treatment should be adopted. The udder should not be touched for at least twelve hours after the cow has risen, and milking "dry" must be avoided. Small quantities of milk should be drawn off at frequent intervals on the following day, and the diet should be restricted.

FAT LOSSES IN SEPARATED MILK.

When milk is passed through a separator there is always a certain proportion of the fat left with the separated milk. The extent of this loss depends on the condition of the milk and the efficiency of the separator. Cold milk is more difficult to separate than warm milk, because the latter is more fluid and the fat globules reach the centre of the bowl quicker.

The separator is a delicately balanced machine which is likely to lose its efficiency without any significant outward indication. Roughening or denting of the discs, vibration of the machine because of insecure foundations and an over supply of milk to the bowl as a result of a damaged float are among the causes of increased fat losses.

The matters with which the farmer is mainly concerned are the percentage of fat in separated milk, and the proportion of the total fat thus lost.

Some farmers may be amazed to learn that separated milk from an efficient separator seldom contains less than 0·06 per cent. of fat. Results of separator trials carried out by a well-known separator manufacturing firm show fat percentages ranging from 0·06 to 0·07, and accurate analyses in other countries indicate that, under normal working conditions, a percentage of 0·12 is quite common. Numerous analyses have shown an average of 0·08 per cent. of fat. The reasons for this loss is that all milks contain a certain proportion of very minute fat globules and only a comparatively small proportion of these are separated with the cream, the major portion being lost in the separated milk. This loss is unavoidable and cannot be appreciably reduced by adjustments to the separator.

Reports of analyses showing percentages of 0·01 to 0·03 should be discounted as worthless, as in all probability such tests were obtained by using the ordinary Babcock test. When applied to such products as separated milk and buttermilk the Babcock test is unreliable. Regulations under the Dairy Product Acts require that separated milk shall be tested by the normal butyl alcohol modification of the Babcock test. This method gives results comparing favourably with standard analytical methods.

An efficient separator removes about 98 per cent. of the total fat in the milk as cream, the remaining 2 per cent. of the fat being lost in the separated milk. A loss of 1·5 per cent. of the total fat is about the lowest that can be expected under normal working conditions.

—L. A. Burgess.

HYGIENIC MILKING METHODS.

To avoid contamination of milk, the milking yard and surroundings should be kept free from any accumulation of dust and dung by their removal after each milking. For the same reason, it is imperative to wash over the udders, teats and flanks of each cow before commencing to milk. Each bail should be provided with a separate bucket and clean cloth for this purpose, and the water should be changed as frequently as necessary. A basin or small bucket of clean water in which the milker should rinse his hands before milking each cow should be provided in every bail. A towel also should be provided for drying the hands, and this should be washed out daily in order to keep it perfectly sweet and clean. There is not yet sufficient appreciation of the actual monetary loss caused by neglect or carelessness in these all-important preliminaries. The extra comfort derived from milking a clean udder with clean hands should in itself compel their observance. A further essential is the donning of clean overalls before commencing to milk.

The straining of milk is another very important point in dairy practice, but a dirty strainer (cloth or gauze) is worse than none. It is sometimes noticeable after a bucket of milk has been emptied into a can that certain foreign substances have been intercepted by the strainer. These are left there, and the next bucket of milk is poured over them. When this has been done a few times the substance dissolves, and washes into the milk. It is obviously of very little advantage to use a strainer in such a way. As provided by the Queensland Dairy Regulations, cotton wads are specified for use in straining milk. As the wads are very cheap and readily obtainable, there is no reason why the wad should not be changed when necessary during milking.

SIMPLE SHEEP FENCE.

At the present prices of wire, anything that will economise in material is acceptable to landowners. The fence illustrated, which was noticed by a frequent contributor in Western Australia, will be found an effective fence for merinos and easily repaired. Only one wire is used, the posts being 100 feet apart, and the secret of success is to keep this wire tightly strained, with wire droppers from it to the netting selvedge. The netting is let into the ground, but is not fastened in any way to the posts. Fig. 1 shows the general arrangement of the fence. Fig. 2 shows the device for making the wire droppers, consisting of a piece of batten with a screw, A, a spike, B, and a

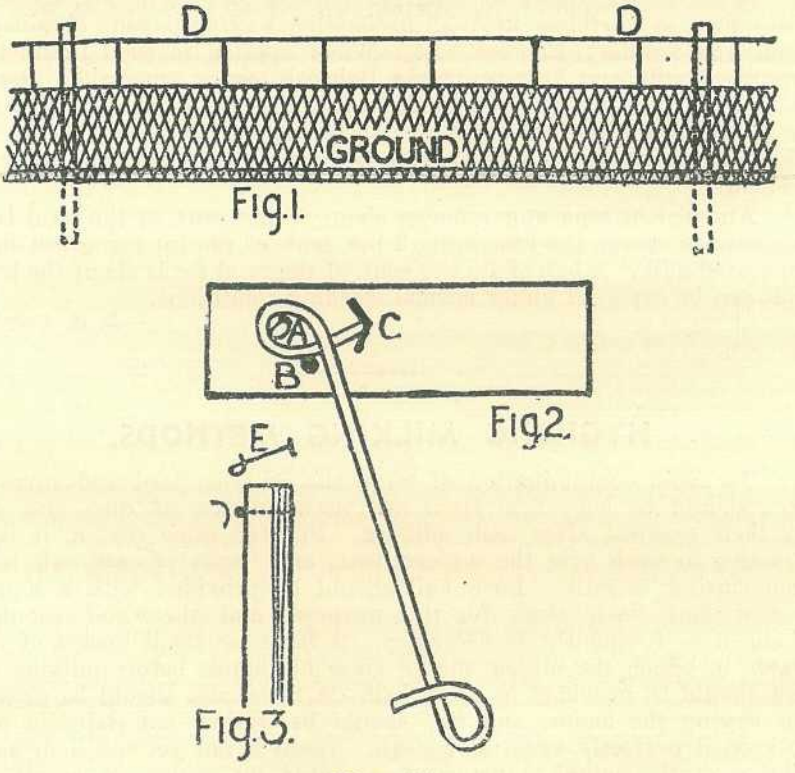


Plate 195.

stop, C, all projecting about half an inch out of the batten. The ends of the droppers must be turned in opposite directions, and on opposite sides. Fig. 3 shows how the top wire of the fence is fastened to the posts by a piece of wire, E, running through the post at right angles, with a twist about the size of a halfpenny at the back to hold it, and an ordinary hitch round the top fence wire to hold that wire in position at D.—*Australasian.*

Some Points in Pig-feeding.

E. J. SHELTON, Senior Instructor in Pig Raising.

THE following points on the feeding of bacon pigs have a particular interest for farmers in the districts southwards from Rockhampton:—

Soft, Oily Pork.—Although several foods may be responsible for this soft condition, all the evidence points to the fact that the chief cause of the trouble is the feeding of peanuts or meal manufactured from peanuts to pigs which are being finished or topped up for the market. When maize and other grain foods are relatively scarce and high-priced, and farmers are naturally tempted to use peanuts and peanut meal in place of grain, especially as peanuts produce particularly fast growth in young pigs, the position could be relieved if pig raisers would concentrate their peanut-feeding on the breeding stock and pigs to weaning age, which will make very good use of surplus peanuts, and then other foods available could be kept for the pigs from the weaner stage until they reach bacon weights. Separated milk, root crops, pumpkins, lucerne (either as green fodder, hay, or chaff), and small quantities of pollard, meat meal, and pasture can be used to make up good rations in the absence of maize.

Yellowish-coloured Pork.—It is known that the cause of this condition is an excess of carotin, a colouring matter in plant life, and which is present especially during the early life of the plant and at the stage when (as in the case of pumpkins) the crop is fully ripe or over-ripe. The feeding of an excess of green wheat, oats, or barley, in the absence of, or short supply of milk may also be responsible; so also may the continuous use of grass or of lucerne as the principal food.

Low-conditioned Pigs.—Lack of condition is, of course, invariably due to lack of sufficient nutritious food. When pigs are in such a condition they become more liable to infestation by internal and external parasites, which irritate the animal and cause much restlessness, especially at night.

It is better to keep fewer animals and to feed them properly than to attempt the keeping of more than the number for which food is available. It is better, too, to market the pigs when light and prime than to carry them on to heavier weights with loss of condition. Where milk is in short supply, meat meal may be used as a substitute. In all cases, the pigs should have clean drinking water and mineral matter, also charcoal.

Bruised and Damaged Pigs.—Where pigs are weakened as a result of lack of condition and where they are soft in texture—the result of improper food—they bruise much more readily, and tend to be more discontented. The only way to avoid bruising is to have the animals in the primest condition (not overfat) and to treat them kindly and not force or beat them when loading or unloading. Avoid kicking them or forcing them through narrow gateways or over rough stony yards.

Overfat Pigs.—Despite high-priced foods, there is still an appreciable proportion of overfat and very heavy weight stock coming forward. Pigs should not be fed too heavily on grain, but should be kept growing and given abundant exercise in grassy pastures. It is a mistake to keep pigs penned up continuously in small sties and bare yards. The use of flesh-forming foods like milk, meat meal, lucerne, greenstuffs, &c., and mineral matters will tend to overcome any tendency to over-fatness.

Use of Skimmed Milk and Other Liquids.—There is a widespread belief among dairy farmers that because at certain seasons of the year skimmed milk is plentiful, that milk costs them nothing. It is only during periods of short supply and during the colder months of the year that they really appreciate the fact that skimmed milk has a definite commercial value and actually does cost them something to produce, even though it may be difficult to show the amount in figures.

Milk may be regarded as the principal basic pig food, and is of such value that it should be used economically and with a full knowledge of its chemical content. It would not be right, however, to expect good results from rancid or impure milk, or from milk heavily diluted with water or other liquids.

It is uneconomical to attempt to force a pig to consume more than a normal allowance of milk or other fluid food. To do so causes gluttony without giving in return a proportionate growth value. The pig normally has a very hearty appetite and will eat almost any class of food. This appetite should be considered in feeding practice, especially as the digestion and assimilation of food proceeds at a rapid rate in a well-fed, healthy pig.

Foods vary in chemical content; they are intended for different purposes. With the unborn pig, all its food is naturally in fluid form. This form of nourishment continues until birth, and after, until the sucker reaches the weaning stage. This is the critical stage in the pig's growth, for up to the age when the pig begins to fend for itself, nature sees to it that the food is suited to bodily requirements. The change from sow's milk to other foods should not be too sudden. A gradual change is made by allowing the young pigs extra food while still sucking the sow. No pig's food is complete without water. It is not, however, desirable, as stated already, to attempt to compel the pig to consume a large quantity of fluid, but rather to provide plenty of fresh, clean water, so that the young pigs may drink as often as they want to.

Balance in the Ration.—A study of the chemical make-up of foodstuffs and of the way in which they should be balanced in the preparation of rations for pigs will be well repaid. The principal items are proteins (flesh-formers), carbohydrates (fat-formers), minerals essential in the building up of a strong bony system, and vitamins, without which the pig cannot develop as it should. Vitamins increase the pig's powers of resistance to disease.

Proteins may be added through the use of green foods like succulent green lucerne, grasses, herbage, and green crops, and by the use of concentrated meals such as meat meal. Carbohydrates are usually fed in the form of grain—maize, wheat, or barley—and cereal meals.

Minerals may be added as required through the use of mineral mixtures; they are also present in meat and bone meals. Vitamins are provided in succulent green foods, and, of course, completely balanced rations.

Cleanliness is essential in a piggery; and the animals should be allowed plenty of paddock room for grazing.

CASTRATION OF PIGS.

Male pigs must be castrated while they are very young, so that they may be fit for slaughter on attainment of the correct weights. The age recommended for the operation is six weeks, or two weeks before they are weaned.

As many beginners do not know how to perform the simple operation of castration, the Department of Agriculture and Stock has made available, free of cost, a very useful and well-illustrated pamphlet—"Castration of Pigs"—which gives detailed instructions in convenient form and in everyday language.

Demonstrations may be arranged, on application, in the course of the instructors' itineraries, either at gatherings where facilities exist for performing the operation, or at a slaughter-yard where young pigs are available. In the latter case it is preferable to demonstrate on a pig carrying more age—say, up to four months—and which can be killed and dressed beforehand. Demonstrating on a dressed porker simplifies procedure, and enables the instructor to explain it without the inconvenience of handling a live pig.

That a better knowledge of the operation of castration is essential is emphasised frequently by bacon factory officials, meat exporters, and slaughtering inspectors, who often come across carcases of male pigs which have been castrated improperly. Partial, if not total, condemnation of the hindquarters—the result of abscess formation—the formation of tumours in the scrotum, callous or improperly healed tissue, or some other abnormality—is the inevitable result.

Castration should be performed during cool dry weather and before flies—blowflies in particular—become numerous. Absolute cleanliness in all details, proper equipment, healthy growing pigs, and a correct knowledge of the job are necessary for success in the performance of the operation.

—*E. J. Shelton.*

PASTURES FOR PIGS.

Although young pigs will not grow rapidly if given only bulky foods—such as pasture—because of the limited capacity of their digestive tract, approximately one-third of their diet may consist of good pasture. In the case of dry sows, four-fifths of the diet may be provided as pasture.

Pasture, being relatively cheap fodder, should be used to the greatest economic capacity in pig feeding. Not only does grazing provide pigs with cheap food, but it provides a measure of insurance against deficiencies of minerals and vitamins which are likely to occur when pigs are intensively housed and hand-fed.

Pigs require a relatively high proportion of protein in their food, and they are unable to cope with large amounts of fibre; it is, therefore, desirable to graze pigs on pasture or forage crops when they are young and succulent.

Annual forage crops have the advantage of yielding large quantities of green feed in a short time; also, the practice of ploughing and planting pig paddocks twice a year is a satisfactory method of providing sanitation and control of parasites in the piggery. However, some permanent pasture is usually desirable in the piggery, but it should be stocked lightly and given frequent rests to preserve the stand and to prevent fouling of the paddock.

Wherever it can be grown, lucerne provides the best permanent pasture for pigs, but to prevent the pigs from rooting and spoiling the lucerne plants their snouts should be either cut or ringed. When lucerne cannot be used, Kikuyu grass is a very good substitute. Kikuyu has the advantage of being able to withstand severe grazing and rooting, and will quickly recover from drastic treatment by the pigs. It is a palatable and nutritious grass, and will thrive under a wide range of climatic and soil conditions.

—L. A. Downey.

LOSSES AMONG YOUNG PIGS.

Of all the difficulties with which the pig raiser has to contend, none involves such heavy financial loss as that associated with mortality in young pigs prior to the stage, and age, at which they are ready for market. Probably 25 per cent. of the average litter of pigs is lost before the weaning age (eight weeks).

The commonest cause of death before weaning is lack of attention at the time of farrowing, a number of pigs being suffocated at birth or killed by the sow. Premature birth also causes considerable loss.

It must be remembered that pregnant sows may be underfed and improperly prepared for farrowing in several ways. Lack of succulent green food, drinking water, mineral matter, readily digestible food, and also want of exercise, are frequent causes of trouble at farrowing time.

The remedy on many farms lies in providing necessary supplements to the food supply.

Strict limitation of the food supply a day or two before farrowing is necessary. Careful feeding, a clean, dry, nicely-bedded pen with suitable farrowing guards, and quiet surroundings in which the sow can settle down are very important.

Losses after weaning also are unusually heavy where management is slack. The period dating from the eighth to the twelfth week after birth is one of the most susceptible in the life of a pig. The system adopted should aim at feeding the young pig in such a way that there will be no check in growth before, at the time of, or after weaning. Care should always be taken to minimise the "shock" of the change over from the sow's milk to other foods by providing, for instance, a separate pen in which the young pigs can feed apart from the sow.

The greatest check in growth results from the young pigs having to contend with older pigs at the feeding trough. Additional hindrances are overcrowding, filth, dampness, parasite infestation, and lack of clean drinking water.

—E. J. Shelton.

BRANDING OF PIGS.

Under the Queensland Pig Industry Act, the identification of all pigs sold, offered for sale, barter, or exchange, is compulsory. This is essential to satisfactory marketing of this class of stock, and where marking is carried out as a regular routine job, it presents little difficulty. Identification facilitates investigation into disease, whether epidemic or otherwise.

The Act provides particularly for the marking of all pigs consigned to factories, and there has been widespread appreciation of its value. There may be differences of opinion in regard to the advantages of various systems of identification; but, from a factory point of view, it is a very great advantage to have the carcases plainly identified.

Exporters prefer the body tattoo as a means of identification, and bacon-curers almost without exception are more than satisfied if the carcases are tattooed efficiently. The use of the firebrand is being superseded generally by the more efficient method of tattooing, in which a body-tattooing instrument and marking paste or ink are used.

The marking of sucker, weaner, and store pigs presents greater difficulty, because neither the body tattoo nor the firebrand are sufficiently permanent where the pigs are to be retained on the farm for periods varying for two to five months. In the case of these young pigs, two systems are especially adaptable, viz., earmarking and ear-tattooing, the latter being suitable only in the case of white or red coloured pigs.

The departmental pamphlet, "Identification of Pigs," is available free on application to the Department of Agriculture and Stock, Brisbane.

OBJECT OF REGISTRATION.

THE registration of hatcheries has for an object the distribution of healthy chickens, the progeny of parent stock of good type and production ability.

The following clauses of Regulation 29 of "*The Diseases in Poultry Acts,* 1923 *to* 1937," will indicate the obligations of owners of Registered Hatcheries:—

(iv.) He shall have all poultry at or upon or kept at or upon such hatchery tested for pullorum disease at the times and in the manner from time to time required by the Chief Poultry Expert. He shall pay to the Minister the cost of every such test.

(v.) He shall not place, permit, suffer, or allow to be placed in any incubator at such hatchery for the purpose of incubation, any egg which shall be less than 2 oz. in weight.

(vi.) He shall not sell or offer for sale any chickens other than chickens which are healthy and normal and shall not sell or offer for sale any chickens which are deformed or injured in any way, or which have weak navels.

(vii.) He shall at all reasonable times permit the Chief Poultry Expert, any Inspector, or any officer to enter into or upon such hatchery and inspect the same.

Following is a list, giving the names of the owners of hatcheries registered up to and including 30th June, 1938:—

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana..	Nevertire ..	White Leghorns, Australorps, Rhode Island Reds, and White Wyandottes
F. J. Akers, Eight-mile Plains ..	Elmsdale ..	White Leghorns and Australorps
J. Cameron, Oxley Central ..	Cameron's ..	Australorps and White Leghorns

Name and Address.	Name of Hatchery.	Breeds Kept.
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
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	..	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros. ..	White Leghorns
J. W. Grice, Loch Lomond ..	Quarrington ..	White Leghorns
C. & C. E. Gustafson, Tannymorel	Bellevue ..	Australorps and White Leghorns
F. J. Lambert, Acacia Vale, Townsville	Lamberts ..	Australorps and White Leghorns
J. McCulloch, White's road, Manly	Hindes Stud Poultry Farm	White Leghorns, Australorps, and Brown Leghorns
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 Black Leghorns
J. A. Miller, Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, Brown Leghorns, and White Leghorns
F. J. Mottram, Ibis avenue, Deagon	Kenwood Electric Hatcheries	White Leghorns
J. W. Moule, Kureen	Kureen ..	White Leghorns and Australorps
E. K. Pennefather, Oxley Central	..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Australorps, Sussex, Rhode Island Reds, and Brown Leghorns
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
E. E. Smith, Beerwah	Endcliffe ..	Australorps and White Leghorns
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's Poultry Farm	White Leghorns and Australorps
T. Westerman, Handford road, Zillmere	Zillmere ..	Australorps and White Leghorns
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

INCREASE EGG VALUES.

The well-fed hen produces an egg of maximum food value, and it rests with the farmer to maintain this quality in order to obtain the maximum value.

Quality and size govern price, quality being the more important. The lack of size is something easily determined, and by using for breeding only birds that lay large eggs, small eggs can almost be eliminated from the market.

Cleanliness of shell is the first essential in the satisfactory marketing of eggs. There is only one degree of cleanliness, although there may be several degrees of dirtiness. Cleanliness can be ensured by providing nests in which clean litter or nesting material is kept, and by gathering the eggs at least twice a day.

Water is usually used for cleaning eggs. It should be changed from time to time, and the cloth used rinsed at frequent intervals. Before the eggs are packed they should be dried thoroughly to prevent deterioration. Packing should be done in cases and fillers, as the use of materials, such as chaff, soils the eggs; there is also the risk of infection of the egg content by moulds. This infection gains entrance through the pores of the shell.

At the bottom and top of the case, pads of wood-wool or other suitable material should be placed to act as a cushion. Exceptionally large eggs should always be packed on the top layer to avoid breakages, and if petrol cases are used only five layers packed per case.

As the quality of an egg deteriorates with age, frequent despatch to market is necessary to obtain the highest values. During summer, eggs should be railed twice weekly, and during winter at least once weekly.

Pending despatch, eggs should be stored in a cool place free from odours, for taints are readily absorbed by the egg.

Many poultry farmers may not have a sufficient quantity to forward case lots twice weekly. To them, it is suggested that consideration be given to the possibility of combining with neighbouring farmers who are in a similar position.

The increased returns that will follow as the result of a little care bestowed on the egg to maintain quality will repay any farmer.

—P. Rumball.

CARE OF GROWING CHICKENS.

The age at which chickens should leave the brooder is largely dependent on weather conditions. Although artificial heat and brooding may be dispensed with when the chickens are four weeks old, it is not desirable to remove them from the brooder house until they are about six weeks old. Poultry of any class do not take kindly to strange quarters, and as there is a wide difference between conditions in the brooder houses and the rearing pens, it is well to teach the chickens to perch before removing them, thereby minimising, to some extent, the effect of a change in conditions.

As the brooding of chickens of mixed ages is undesirable, so is the rearing—particularly during their early life period. When chickens are being shifted from the brooder house to the rearing pens, it is desirable to separate the males from the females, and rear them in separate quarters. This applies particularly to light breeds, such as Leghorns and Anconas. The heavy or dual-purpose breeds may be allowed to run together until they are eight or nine weeks old. Although heavy breeds do not develop reproductive characteristics early, because of the disparity in size between males and females, separation of the sexes is desirable for obvious reasons when the chickens are at the age of nine or ten weeks.

—P. Rumball.

REARING OF CHICKENS.

The successful rearing of chickens is one of the most important points in poultry farming. Any setback which chickens receive, especially during the brooding stage, will be reflected in their development. Too much trouble cannot be taken to ensure that the chickens are reared under the most satisfactory conditions that circumstances will permit.

A reliable brooder is one of the first considerations—one that will generate sufficient warmth in the coldest weather to prevent the chickens packing together to get warm; and, at the same time, provide for plenty of fresh air. The brooder should be so constructed that the chickens can move away from the heat if the temperature is too high, and get back again without any obstruction. Much of the wastage of chicken life could be avoided if due regard were paid to these fundamental factors in brooding.

—*J. J. McLachlan.*

FOWL MANURE.

Poultry are usually fed a ration rich in protein, and consequently their excrement is rich in nitrogen. The arrangement by which intestinal and kidney waste products are voided together makes the nitrogenous products of fowl manure largely soluble.

It follows that care must be taken in storing fowl manure to see that no loss by leaching occurs. This may be done by storing it under cover in peaked heaps, or by mixing it with sand or friable earth which will absorb the soluble plant food.

Its high nitrogen content makes fowl manure a forcing fertilizer—usually termed "strong"—so that while its use for rapidly growing vegetables and strawberries is advocated, admixture with superphosphate and potash is advisable for most other crops.

GREEN FEED FOR CHICKENS.

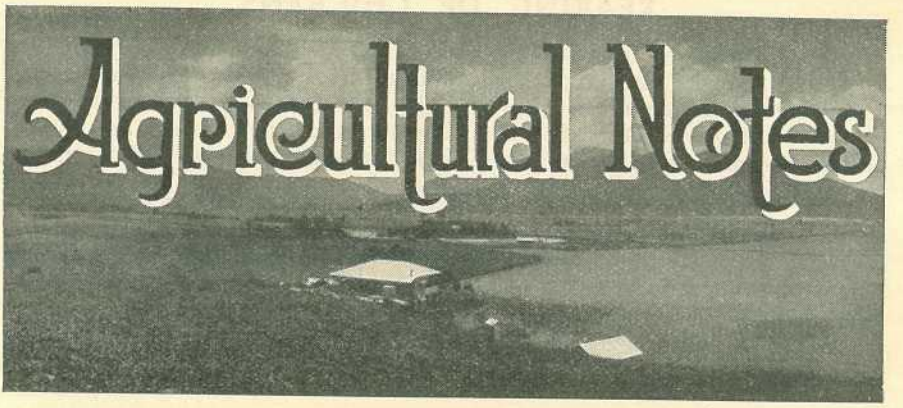
An abundance of succulent green feed from the time chickens are a week old onwards will keep the birds healthy and help in their development. Stalky crops—like lucerne and barley—should be cut finely, but rape, kale, and similar types of green feed can be given without being chaffed.

Green stuff can be fed twice daily between other feeds, and when the chickens are accustomed to it they should be given as much as they will eat, without leaving any of it to wilt.

—*P. Rumball.*

WASTED LAND.

There is a good thought in what an English farmer said recently. "Fortunately for us in England," he remarked, "we have no such titanic problem of combating the results of farming for immediate profits and taking absolutely no thought for the morrow. Our land was always too limited in relation to the number of the population to allow us to be so extravagant, although now and then foolish attempts have been made to cash the accumulated fertility of the soil and leave the future in the hands of destiny." The quotation is from *The Farmer and Stockbreeder* (England).



Rubber Tyres for Farm Machinery.*

H. W. KERR.

FARM TRACTORS.

THE use of rubber tyres for farm tractors is rather a new development which would appear to have prospect of substantial expansion in the near future. Low-pressure tyres of this class were introduced to Australian agriculture in 1934; they usually carry 10 to 12 lb. of air pressure in the rear and 24 lb. in the front-wheel tyres.

This equipment has been extensively studied by certain of the Agricultural Experiment Stations of the United States, and it may be of interest to Queensland canegrowers to review some of the conclusions reached at Ohio.

Rolling Resistance—Steel Wheels with Lugs *v* Pneumatic Tyres.

The tyres used in the tests were 11·25 × 24 rear and 6·00 × 16 front. The significance of this test is that the lower the rolling resistance, the less power will be required to move its own weight over the ground, thus resulting in fuel economy. On both ploughed land and on sod, the rubber-tyred tractor required substantially less power to move it than did the same tractor with steel wheels. The reduction in power was of the order of one-half, and it is interesting to note that the rolling resistance of the rubber-tyred tractor on ploughed ground was less than that of the steel-wheel tractor on sod.

One of the major reasons for the differences lies in the fact that power is consumed in forcing the lugs into the ground and removing them as the tractor moves onwards. The force required is, of course, greater on grass land than on ploughed land.

Fuel Consumption—Steel Wheels with Lugs *v* Pneumatic Tyres.

The tractor was in this case required to pull a subsoiler at different depths and various rates of travel. The rubber-tyred tractor showed a lower fuel consumption in practically all tests. Only on ploughed land,

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for October, 1938.

at light draw-bar pull, was the steel-wheel tractor superior. Moreover, the rubber-tyred tractor operating in third gear had greater fuel economy than the steel-wheel tractor in second gear. The greater draw-bar pull of the former was due to the much reduced slippage which was experienced.

Summarising all tests (with tractor operating uniformly in second gear, on sod and ploughed land), the average fuel consumption for the two units was—

Rubber-tyred .. 1·84 lb. per hour per H.P. at draw-bar.
Steel-tyred .. 2·02 lb. per hour per H.P. at draw-bar.

When the rubber-tyred tractor was operated in third gear, the disparity in fuel used was even greater.

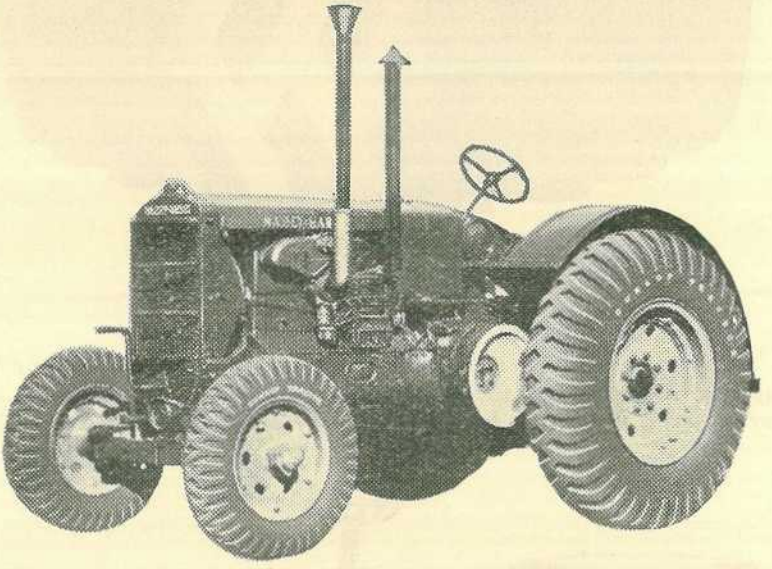


Plate 196.
Showing a tractor equipped with pneumatic tyres.

Ploughing Test—Steel Wheels with Lugs *v* Pneumatic Tyres.

The results of this test are summarised in the following table:—

—	Steel wheels.	Ruboer tyres.
Area ploughed	0·79 acre	0·79 acre
Depth of ploughing	6·89 in.	6·82 in.
Time taken	45·1 mins.	35·3 mins.
Rate of travel, miles per hour	3·53	4·50
Fuel used—pounds	12·8	9·7
Fuel used—pounds per acre	16·3	12·3

The ploughing was carried out on a field of mixed lucerne and grass sod. Very little trouble was experienced in securing sufficient traction with the rubber tyres, even in the mornings when the grass was wet and the soil somewhat slippery. It was, however, necessary to change the hitch on the plough to cut the desired width of furrow.

It was also found that a greater maximum draw-bar pull was provided by the tractor with rubber tyres than with steel wheels and lugs. The superiority of the rubber-tyred tractor was more pronounced at higher speeds.

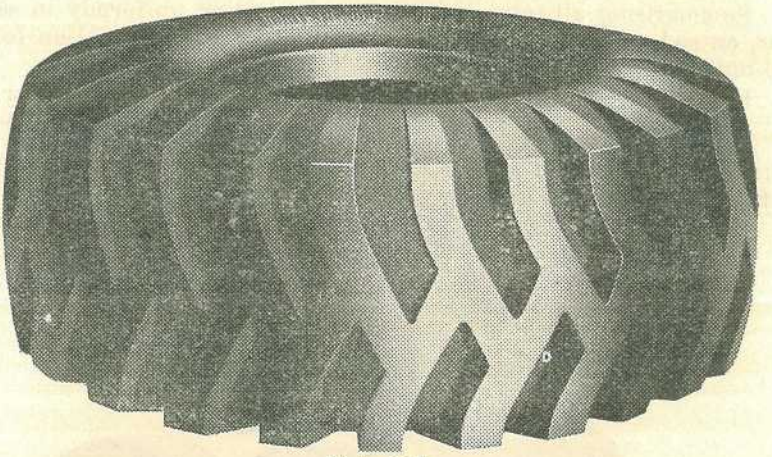


Plate 197.
Illustrating a tractor rear rubber tyre.

LIFE OF RUBBER TYRES.

Observations made on a tractor which had been operated for 1,349 hours, on all manner of farm work, showed little sign of abrasive wear. They suffered most wear by chipping, though this was not serious, and

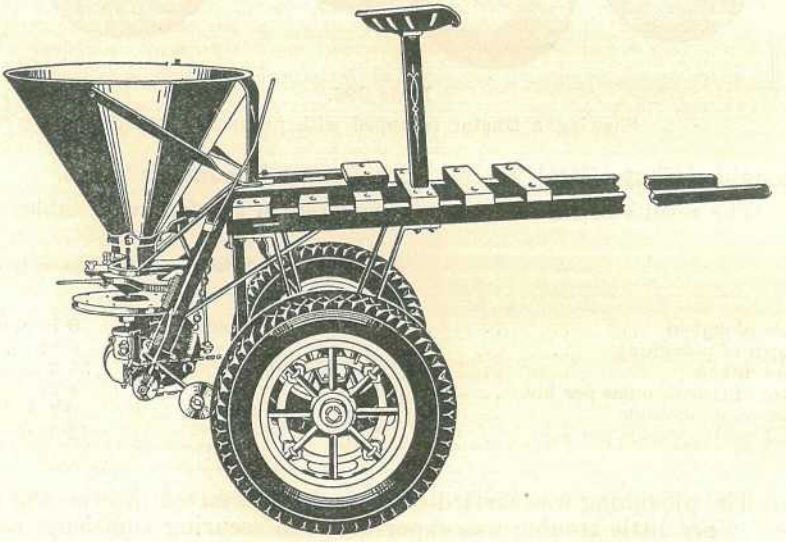


Plate 198.
Illustrating a lime distributor equipped with rubber tyres.

was due to contact with sharp stones. During the period, the rear tyre decreased in weight from 98·3 to 94·3 lb.; the front tyre decreased in weight only ½ lb. Only two punctures were experienced.

GENERAL OBSERVATIONS.

The amount of dust raised in dry soil is much less with the rubber-tyred tractor. Under most conditions it also rides easier, though in badly ridged land it "bounces" considerably. This can be overcome by inflating the rear tyres slightly. Rubber tyres also pick up less material than do the steel wheels with lugs.

It is concluded that for most farm operations rubber tyres are very satisfactory. They are especially desirable for transportation work (or travelling over roads where grips must be removed from steel wheels). Where land is wet or sticky, chains may prove of some assistance to the rubber tyres, but it is better to stay off such land.

To get the best results with pneumatic tyres, it is necessary to add weight to the rear tyres; this had actually been done in the tests discussed above. For a tyre 11·25 × 24, for example, the weight per wheel should be not less than 750 lb. A very useful and convenient means of effecting this is to apply weight in the tyre by means of water. This is done by filling the tube up to half-full of water, and inflating the remaining space to normal operating air pressure.

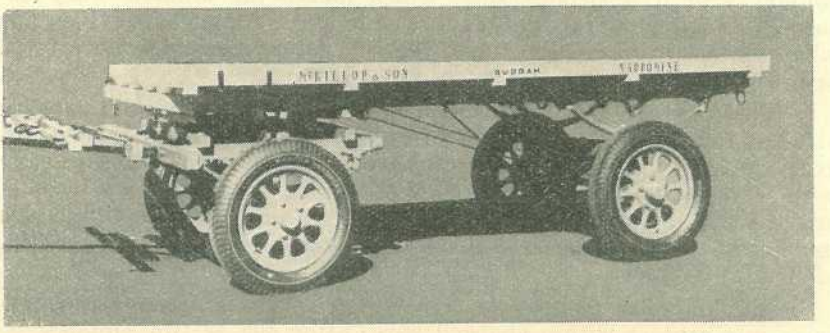


Plate 199.
Showing a waggon fitted with pneumatic rubber tyres.

FARM WAGGONS AND TRAILERS.

Though many horse-drawn commercial delivery vans equipped with rubber tyres have been in use in North Queensland for many years, the idea has not been adopted to any extent by canegrowers. Combined with the use of rubber-tyred tractors, it is probable that such waggons and trailers will be more widely employed in the future for such purposes as cane carting, when the need for a motor truck may be largely displaced.

It has been found that, due to the larger bearing surface of rubber tyres over the steel tyres of the ordinary farm dray, there is less penetration of the surface and hence a lower tractive power required. On

carefully conducted tests, the following tractive power was required for comparative loads:—

	Power required—	
	Over grass.	Over soft ground.
	H.P.	H.P.
Wheel with iron tyres	1·1	1·9
Wheel with pneumatic tyres	0·6	1·4

The rubber tyre also causes less damage to pasture land than does the iron rim.

An important feature of the rubber-tyred vehicle is its low construction, due to the smaller wheels. This greatly facilitates loading and discharging. It is interesting to note, also, that in the tests made, roller bearings did not offer much advantage as regards tractive power—the rubber tyre was the most important factor.

The "Electric" Fencer.

A DEVICE which was recently brought on to the market, and which is attracting considerable attention from farmers, is the so-called "electric fencer." It consists of a small, compact unit, operated by a dry-cell or storage battery, which maintains sufficient pulsating voltage in the insulated wire of the fence to give any farm animal coming into contact with it a strong sting, which makes the animals wary of it thereafter. It is pointed out that the amount of electricity which flows, when contact is made, is so small that it cannot cause any harm to man or beast.

It is claimed that fencing costs can therefore be reduced substantially, as a single wire is sufficient to restrain all classes of farm animal, even the most persistent fence breakers. Moreover, ordinary barbed wire is suitable, supported by light stakes at intervals of 40 or 50 ft. apart. The wires are fastened to the stakes through small porcelain insulators, and it is stated that one unit will effectively charge 20 miles of insulated fence..

The stock are trained to respect the fence, by tempting them to come into contact with a charged wire; after one or two contacts, they will "leave it alone." Horses, cattle, and pigs are readily trained; it takes a little longer with sheep.

A dry-cell battery will remain effective for about two months, while a 6-volt storage battery would require recharging at about four to six week intervals.

The possibilities of this scheme have already attracted the attention of Cane Pests Boards, one of which is considering its value in keeping wild pigs out of cane paddocks. It is certainly an experiment which can be carried out very cheaply, and offers prospects of success. It may also prove useful in areas where wallabies are pests, and where netting would prove too expensive.

The cost of the unit without battery, is a few pounds, and we will be pleased to arrange for full particulars of the device to be forwarded to any interested canegrowers or organisations.

—H. W. K., in The Cane Growers' Quarterly Bulletin.

New Zealand Blue Lupin as a Winter Legume.*

N. J. KING and D. R. L. STEINDL.

IN the October, 1937, issue of the Quarterly Bulletin were reported the results of a trial with New Zealand Blue Lupin as a winter cover crop at the Bundaberg Station. So successful was this first experiment that a further planting was made during the past winter. The seed was planted on the 7th April, 1938, on an experimental block which was undergoing a long fallow.

Plate 200.

Illustrating the heavy crop of Blue Lupin on the Sugar Experiment Station, Bundaberg.

On this occasion, 2 bushels of seed per acre were sown, with the object of obtaining a heavier crop. The field was harrowed in two directions after broadcasting the seed, and an excellent germination resulted. The double harrowing appears to be necessary to ensure coverage of the large seeds. The ideal winter rainfall of this year resulted in unchecked growth right through to time of flowering of the crop, which commenced about the end of August. By this time the crop was 5 feet 6 inches high, and had produced a heavy, erect growth of succulent material. Ploughing in presented no difficulties, and with a single-disc plough a good, clean cover was obtained (*see* Plate 200). The crop was in full flower and some young seed pods had already formed, but the plants were still remarkably soft and succulent, with no sign of woodiness in the stem.

When the crop was being turned in the plants were found to have numerous large bacterial nodules along the tap root. The bacteria in these nodules would naturally be expected to "fix" large quantities

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for October, 1938.

of atmospheric nitrogen, making it available to the plant, and thus increasing the store of nitrogen in the soil when the crop has decomposed.

At the time of ploughing in (7th September), small areas of the crop in different sections of the field were cut off at ground level and weighed. These weights, when calculated to tonnage, gave the very good average figure of just over 20 tons per acre of green matter, with no allowance for the underground portion of the plants. The farmer will recognise the humus-forming value of such a mass of succulent material, and at the present time there is available no other winter-growing crop which will produce such a large body of growth, and which will decompose so rapidly, while at the same time enriching the soil in nitrogen.

Plate 201.
Showing a portion of the crop of Blue Lupin grown on Windermere Plantation.

In order to determine the dry weight of the crop, and the amount of nitrogen added to the soil by it, several plants were cut and weighed green, then dried out and nitrogen determinations made. These showed the following highly satisfactory values:—

Weight of green crop	20 tons per acre.
Weight of dry crop	4·1 tons per acre.
Nitrogen in dry material	1·05 per cent.
Nitrogen contained in crop	97 lbs. per acre.

The quantity of nitrogen in the crop is, therefore, equivalent to an application of sulphate of ammonia at the rate of 485 lb. per acre. Moreover, it is in a form which would become available to the cane crop at a gradual rate during the ensuing few months after the rotting is complete.

A prolific crop of New Zealand Blue Lupin was also grown this year by Mr. C. Colquhoun, manager of Windermere Plantation (*see* Plate 201). The seed was broadcast at the rate of 2 bushels per acre, then harrowed in and rolled. Planting was carried out on the 26th April, and the crop was ploughed under during the first week in September. By the time it was in flower it had reached an average

height of 4 feet 6 inches, but was over 5 feet high in places. The growth was very dense and succulent, and no trouble was experienced in ploughing in.

Although the seeds were not inoculated the roots were found to be bearing large Rhizobium nodules similar to those found on the crop grown on the station. This would indicate that a suitable strain of the bacterium was present in the soil.

Another crop grown on a nearby property, however, was a comparative failure. An examination of the young crop showed that a large proportion of the plants were yellowed and wilting, and many had died. The roots and lower portion of the stems of these plants were found to be attacked by a fungus which was killing the tissues. This fungus was apparently very plentiful in this particular soil, or was favoured by the heavy rains during the autumn, but it is unlikely that it would become a general menace to lupin crops; it is thought advisable, however, to mention the occurrence of the wilt in this particular planting.

This crop appears to be particularly suitable for inclusion in a long-fallow system, but the ploughing in of a winter-grown leguminous crop naturally dries out the soil, and the use of such crops in dry areas is not advocated unless it is intended to delay planting until autumn, or at least very late spring.

FARMING IN THE MARANOA.

In the Maranoa district dry farming methods entailing summer fallowing are necessary for success with winter fodder. A more extensive use of the plough and harrows would do much to prevent heavy flock losses that may otherwise become an annual experience on small properties where native pastures are usually relied on. On these small holdings, if the conditions are suitable, mixed farming is recommended. This applies especially to the reclaimed prickly-pear country where a change from cattle to sheep is contemplated.

There is plenty of light, sandy loam and friable brigalow and belah scrub soil very suitable for dry-farming throughout the Maranoa district. In view of the progress already made, the time is now opportune for the utilisation of more of these types of soil for growing fodders, both for green feed and conservation as hay or silage.

Wheat, barley, and, on some of the better soils, lucerne grown during the winter give some insurance against the frequent dry springs; and 50 to 100 acres of land under these crops may well be the means of saving a large amount of money—the equivalent of the value of ewes and lambs that, otherwise, would be lost irretrievably. Summer-grown crops—such as Sudan grass, grain sorghums, cowpeas, and Japanese millet—will give a green bite for the flock when pastures dry off during summer; any surplus can be conserved as hay, stover, or silage.

—*C. F. Defries.*

Peanut Seed Treatment.

The difficulty encountered in obtaining a good stand of Virginia Bunch peanuts is well known to all engaged in this industry in the South Burnett district. The germination of the kernels after sowing is dependent on a large number of factors such as the moisture content of the soil, depth of sowing, tilth, and physical condition of the land. For example, with the same seed sample a poorer strike will be obtained on old land than on that recently broken up for cultivation which has better physical properties, largely because of a higher humus content. However, failures to obtain a good stand occur frequently, even when the conditions are quite good. In these cases, germination tests indicate that the seed is at fault.

Experiments have shown that this faulty germination of peanut kernels is dependent on two main factors—the method of shelling and the presence of fungus contamination. Hand-shelled kernels have given good germination when that of machine-shelled kernels has been poor. Also, the protection of the kernels from the injurious effects of invading fungi by treatment with fungicidal dusts has resulted in marked improvement in germination. The most reasonable explanation than can be advanced is that a certain amount of fine cracking and other injury occurs to the seed coat of the kernal during machine shelling, and that this injury permits the entry of fungi. The subsequent rot can be observed in the cotyledons or seed leaves of many of the seeds after germination occurs. When the rot spreads to the main stem the plant perishes. This occurs frequently before the plant emerges from the soil, but may also take place at any subsequent time.

The main purpose of these notes is to discuss the most practicable method of overcoming the difficulty. Satisfactory germination can be obtained by hand shelling the nuts or by the use of soaked whole nuts for planting. Both these methods have been used on a fairly large scale by a few growers at various times, but they are neither likely to be generally adopted because of the increased planting costs.

Using machine-shelled kernels, a reliable strike is only obtained after treatment with fungicidal dust. For this purpose the copper dusts are not nearly as effective as the mercury dusts. Of the latter, the two at present being marketed in Queensland—Ceresan and Agrosan—have both been tested with good results. In experimental work the dust has been applied at the rate of 1 oz. of dust to 20 lb. of kernels. The cost of treatment is low compared with the advantages. In fact, because of the lower planting rate which may be adopted, it will probably be found cheaper to sow with treated than with untreated seed. No definite ruling can be given as to the best planting rate, but the grower can work on the basis that he can use one-third less seed when it is treated. In recent experiments rates from 22 to 44 lb. per acre of treated kernels all gave satisfactory stands, but this has been tested in one season only. On the grounds of economy the grower will probably prefer a rate towards the lower end of this range. The experiments referred to proved a small but definite increase in yield from plots planted with treated seed.

In treating seed with mercury dusts, certain precautions need to be observed. The dusts are poisonous and should be handled with care.

They vapourise to a certain extent so they should be handled in a well-ventilated place—preferably out of doors. They also have a tendency to blister tender skin, and a little discomfort may be caused if the dust is allowed to accumulate between the fingers, particularly when the hands are moist. Treated kernels should all be sown and not be left where they are likely to be eaten by man or domestic animals.

However, the percentage of mercury in the dust is quite low and, with reasonable care, there should be no untoward results from its use on kernels for planting purposes.

Seed treatment can be confidently expected to improve the germination of Virginia Bunch peanut kernels. It cannot, however, improve the inherited qualities of the seed which, given good growing conditions, govern the cropping power of the plants. Seed treatment then while being highly desirable should not replace seed selection and the elimination of undesirable types from the seed plot—practices which are necessary for the maintenance of a high producing strain of seed.

—R. B. Morwood.

SEASONAL SOWINGS.

Land prepared for summer growing crops can be sown now with a variety of fodder, hay, and grain crops—such as maize, sorghum, millet, Sudan grass, and cowpeas. The majority of farmers recognise fully the necessity for making provision for recurring dry spells, and also for the winter months, when the growth of natural pastures is retarded considerably. In favourable seasons good results can be obtained by the cultivation of winter cereals and legumes; but it is to the more vigorous growing summer crops that stockowners must look for the provision of their chief requirements in hay, fodder, and silage.

Maize can be grown successfuly on a great variety of soils within the 30-inch rainfall region, deep alluvial soils being particularly suitable for its full development. Land ploughed deeply during the winter should be in good condition just now as a result of cross ploughing and harrowing; and it is well to remember that no amount of inter-row cultivation will undo the effects of sowing on hastily prepared land.

Maize crops are usually termed early or late, but as sowings may take place from August to late December, no definite sowing period can be recommended, weather conditions being the governing factor.

For grain purposes, the chief essential is to assure adequate moisture during the tasselling stage. Nine to ten pounds of sound seed to the acre will be found sufficient, sowing in rows 3 feet 6 inches to 4 feet apart; but for fodder or silage purposes double this quantity may be used, choosing a leafy variety such as Reid's Yellow Dent.

The sweet or saccharine sorghums also are widely grown throughout the dairying districts, as they provide a large bulk of nutritious and palatable fodder.

Although slightly less nutritious than maize, the sorghums will withstand dry conditions much better, while they also retain their succulence for a period after maturity, making them specially valuable as early winter feed. In cultural requirements the crop is somewhat akin to maize, sowing being done in rows 3 feet to 3 feet 6 inches

apart, which will be found to utilise approximately 5 lb. seed per acre. Sorghums frequently are sown broadcast; but although a finer stalk is produced, the total yield is reduced often by this method, besides which, weed growth is apt to be troublesome during the early stages of growth.

For silage purposes sorghum should be cut when the grain is well formed yet still in the soft dough stage. Saccaline imphee and White African are popular varieties.

Where a quick-growing summer grazing or hay crop is desired the millets can be recommended confidently, as they will produce fair crops even on the poorer soils.

The seed usually is drilled or sown broadcast, at the rate of 12 to 15 lb. per acre, and under favourable conditions the resulting crop will provide good grazing within five or six weeks. However, it is preferable to exclude stock until the plants are 8 inches to 12 inches high, when the roots will have a sufficiently strong hold to withstand grazing.

For hay purposes millets should be cut when the grain is in the soft, doughy stage; and, if a binder is used, small sheaves should be made and stooked in windrows. The varieties known as Japanese millet and white panicum have given the best results.

Sudan grass also is excellent for grazing or silage purposes, and is considered to be the best possible summer crop for the drier farming area, such as the Western Downs and Maranoa.

It is better to drill in the seed, using approximately 7 lb. per acre; but for broadcasting double the quantity will be required. The risk incurred in allowing stock access to Sudan grass prior to the flowering stage has been stressed often; however, the risk is taken by many experienced stockowners who have fed the crop during all stages of growth without ill-effects.

The cowpea now is widely recognised as a valuable green manure crop, resulting in the development of a good trade in locally grown seed. Its profitable utilisation as a fodder crop is also receiving attention by progressive dairymen, as it is highly nutritious, provides a good bulk of fodder, and is valuable as a rotation crop. Stock can be readily accustomed to green cowpea by sowing in conjunction with maize, either in the maize drills or in alternate rows. The seed varies greatly in size according to variety, so that, when sown in drills 3 feet apart, from 5 to 15 lb. seed per acre will be necessary. Poona, groit, and black are popular varieties.

With all spring-sown crops much better results are obtained when inter-row cultivation is carried out thoroughly, although, as previously pointed out, the initial preparation of the land, involving winter fallow, is of primary importance.

SEED WHEAT.

All crops of grain are not suitable for seed. To be fit for this purpose, grain should be true to variety, free from barley, black oats, and weed seeds, with an absence of flag, ball, and flying smut—particularly the lastmentioned, which is much more difficult to deal with successfully than ball or flag smut. If a careful inspection reveals that a crop will be suitable for seed, after a little roguing or the

removal of strange wheats, barleys, oats, or other foreign growths, before being harvested, selection should be made from an area in the middle of a paddock sufficiently large to provide the quantity of grain required. By making the seed reservations from the position in a field of wheat—the last sown, as well as the last to be harvested—the risk of contamination by the introduction of other varieties through the medium of the seed drill and harvesting machinery is reduced to a minimum.

Although a seed reservation cannot be protected from hail, the risk of loss by fire can be reduced very considerably by cutting for hay, say, a swathe half a chain in width round each paddock and ploughing or undercutting the cut-over ground. Where the areas are large, they should be cut into sections—say, from 100 to 200 acres in extent—as a precautionary measure, thus facilitating harvesting and providing a valuable reserve of wheaten hay.

JERUSALEM ARTICHOKE.

Like the sweet potato, the Jerusalem artichoke should attract much more attention as a crop than it does at present, more particularly by pig raisers in the drier farming districts, for not only is it drought-resistant, but its tubers are highly nutritious as well. The yield, which is controlled by the soil and seasonal conditions, may range from 6 to 8 tons or more per acre; and although the plant does best on good friable loams, it will thrive on sandy, gravelly, or clayey soils, which enables the poorer patches of soil on the farm to be put to a profitable use.

The area intended for Jerusalem artichokes should be prepared in much the same way as for potatoes. The crop may be planted in early spring in furrows 3 feet apart, with the sets 2 feet apart. This spacing with medium-sized tubers will entail the use of between 4 and 5 cwt. per acre.

As with maize and potatoes, until the crop is 4 inches high, all cultivation can be done with tined harrows working across the drills. Afterwards, the cultivator will have to be used as the condition of the soil and weed growth necessitates.

—R. E. Soutter.

MELILOT OR HEXHAM SCENT.

Every spring numerous specimens of this plant are received from farmers in different parts of Queensland for identification, and a few notes on its properties may not be out of place. It is most abundant on the Darling Downs, but during the present season specimens have been received from the central West and from the coastal North. It is a native of Southern Europe, but is now widely spread as a naturalised weed in most warm-temperate and sub-tropical countries.

It was boomed as a fodder under the name of King Island Melilot some years ago, but our experience in Queensland has been that stock do not take readily to it, and have to become accustomed to the peculiar odour and flavour. It has the great disadvantage of tainting milk and cream rather badly. It is short-lived, being at its best during the spring months, dying off at the approach of hot weather towards the end of

October or early November. As a fodder plant for Queensland for winter and spring months it is poor compared with some of the annual trefoils and clovers, such as the common burr trefoil and cluster clover.

It is a common weed of wheatfields, and if reaped with the wheat and stored for any period the peculiar penetrating odour is communicated to the flour and bread subsequently made.

It is an apright plant, something like lucerne in appearance, but with small yellow flowers born in slender spikes. The seed pod is small, round, and encloses a single seed.

—*C. T. White.*

THE WORK OF SCHOOL PROJECT CLUBS.

THE Bureau* has always warmly endorsed those aspects of Project Club work in rural schools which centre on simple fertility trials, as a means of demonstrating the value of special plantfood materials in cane production. There can be no better means of impressing the value of this phase of technical agricultural knowledge on the youthful minds of those who will be our future cane farmers.

An excellent demonstration is afforded by a fertility trial recently harvested at the Mossman Rural School. The area of land devoted to the purpose was sufficient to permit of 15 plots, each $\frac{1}{30}$ acre, to be pegged out, thus providing three plots each of the five standard treatments normally employed in this work.

The fertilizers were measured and spread by the pupils, who maintained close contact with the plots until they were harvested, and the cane weighed, while the calculation of the actual yields also afforded a useful exercise. The plant crop yields showed—

	Tons cane per acre.
"No fertilizer" plots	16·3
N P plots	22·6
N K plots	15·5
P K plots	21·1
N P K plots	22·8

From these figures it may be deduced that—

	Crop increase.
(N P K — P K) or (22·8 — 21·1)	= 1·7 tons due to N.
(N P K — N K) or (22·8 — 15·5)	= 7·3 tons due to P.
(N P K — N P) or (22·8 — 22·6)	= 0·2 tons due to K.

It is therefore evident that the soil is notably deficient in phosphate (P), which is remedied by applications of manures rich in superphosphate. The use of potash (K) has shown but little benefit, while the influence of sulphate of ammonia (N) has been quite definite. It should be pointed out that the area was green manured while in fallow, and therefore substantial results from sulphate of ammonia were not to be expected. It is interesting to record, however, that an application of this manure at the rate of only 60 lb. per acre seems to have improved the yield slightly.

—*G. B. and H. W. K., in The Cane Growers' Quarterly Bulletin.*

* Bureau of Sugar Experiment Stations, Department of Agriculture and Stock, Queensland.

Harvesting and Packing Cherries.

JAS. H. GREGORY, Inspector in Fruit Packing.

MOST of the cherries seen on Queensland markets come from other States, although the Stanthorpe district produces cherries which for quality compare favourably with the fruit imported from the South. Considerable improvement is possible in our marketing methods by the adoption of the 12-lb. cherry box, which is now the standard container for cherry-marketing.

The Cherry Box.

The box is commonly known as the ¼-bushel cherry case, with inside dimensions of 13¾ inches long x 10⅛ inches wide x 4 inches deep. Material required:—

Ends.—2 pieces 10⅛ in. x 4 in. x ½ in. thick (minimum).

Sides.—2 pieces 14¾ in. x 4 in. x $\frac{5}{16}$ in. thick.

Tops and Bottoms.—4 pieces 14¾ in. x 5¼ in. x ¼ in. minimum thickness.

Harvesting.

As Queensland cherries have to carry long distances, harvesting of the fruit should be done very carefully. As far as possible, all fruit should be picked from the trees in the early part of the day. As with all other stone fruits, keeping the temperature down is an important factor in successful long-distance carriage. It is far easier to keep fruit cool than to cool it down after it has become heated. Fruit should not be picked if wet by rain; otherwise fungous growths may develop. All care should be taken in the handling of the fruit, which should be reduced as much as possible. The fruit should be handled by the stalk only. If this is done with care, the fruit will be placed stalks upwards in the picking containers, and so make packing easier. Baskets or kerosene tins cut on the flat and fitted with handles make good picking equipment.

Grading.

Like all other fruits, cherries should be graded. Only well-coloured fully matured fruit should be picked and packed for the fresh fruit market. There are two types of cherries—dark and light fleshed. When picking dark-fleshed varieties, they should be fully coloured all over to a deep red. Light-fleshed varieties should be a creamy ground colour all over the skin surface, with a red flush. All cherries should be firm, and soft fruit should be rigorously rejected for market consignments.

Two grades are advised, the large fruit being separated from the small. As the use of "extra fancy" and "fancy" as grade designations are now used for most fruits, it is suggested that the large fruit be called "extra fancy" and the small "fancy. As a guide, it is suggested that fruit ¾ inches and over be called "extra fancy," and smaller fruit "fancy."

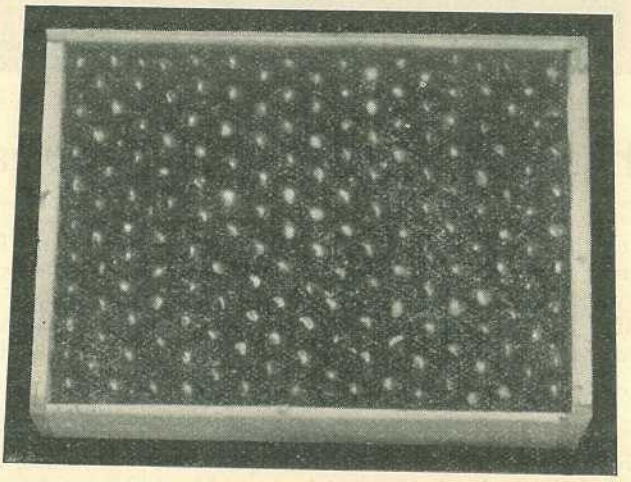


Plate 202.

A well-packed case of large cherries with the "face," packed in diagonal lines, paper lining only used.

Rejects.

It is repeated that too much care cannot be taken to exclude unsatisfactory fruit. Cherries showing the following blemishes should be excluded:—

Cracks, bird picks, fruit without stalks, fruit which has been squeezed or squashed slightly, and poorly coloured and misshapen fruit.

Packing.

After picking, the fruit should be taken as soon as possible to the packing shed and allowed to stand in the coolest part until packed. Packing the fruit is easy. One type of pack is used—the system of facing. Actually in this pack the top of the case is packed first. The case is prepared by lining with clean white or plain coloured paper or, for the best-class trade, by using a fancy thin cardboard or thick paper mask

or facing sheet. The mask is placed in the box. The cherries are then carefully placed in position with all stalks facing inwards. With the large sizes the fruit is placed in straight lines or in diagonal lines, according to the desire of the packer. When the layer is finished the case is filled with fruit layer by layer, care being taken that all stalks are placed upwards. During this operation all fruit is handled by the stalks; so it is readily understood how placing the stalks up in the basket when picking will help. The box is filled to slightly above the top, and the fruit is carefully placed into position by lightly bumping the box, which is then nailed up. When opened on the opposite side a well-packed "face" of cherries is seen, no stalks showing. The side the fruit is "faced" is always indicated to enable the salesman to

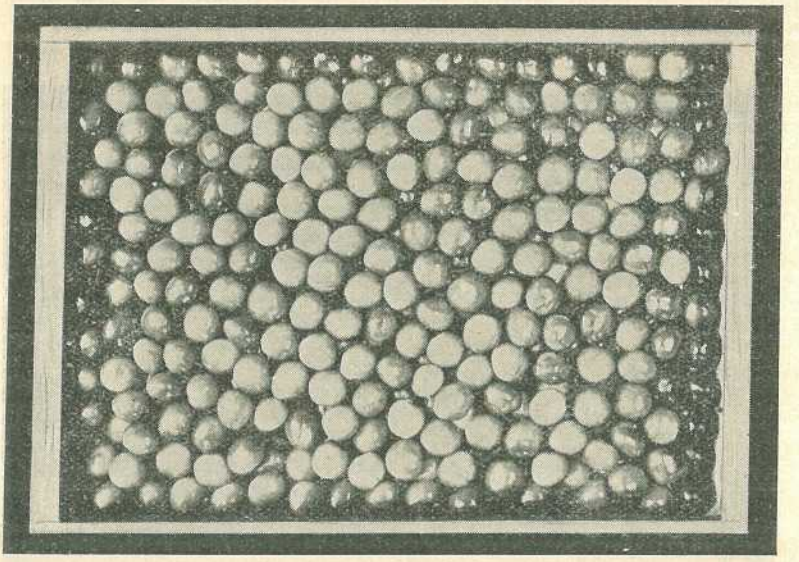


Plate 203.

Small cherries faced but not packed in straight lines.

NOTE.—This is actually the first layer of fruit to be placed in the case.

remove the correct boards for display. The same care in placing the fruit in straight lines when facing is not necessary with the small grade, although the fruit is placed in position with the stalks up (Plate 205). The following points for successful packing should be memorised by all packers:—

(1) Wet fruit should not be packed.

(2) Handle fruit by the stalks all the time.

(3) Cherries without stalks should not be packed.

(4) Blemished or damaged fruit should be rejected.

(5) Take care to indicate on the box the faced side of the fruit to enable the salesman to open for inspection in the right place.

Stencilling and Labelling.

The use of a "fancy" label is strongly recommended. It should indicate the contents of the case as cherries and have the following particulars embodied in the design:—

(Grower's name and address, name and grade of fruit.)

J. JONES,
BALLANDEAN,
QUEENSLAND.
CHERRIES. EXTRA FANCY.

The printing should be in letters not less than ¼ inch in height. In stencilling, the same particulars are required. Stencils should be made with plenty of metal around the printing to remove the risk of brush marking when applying it to the end of a case.

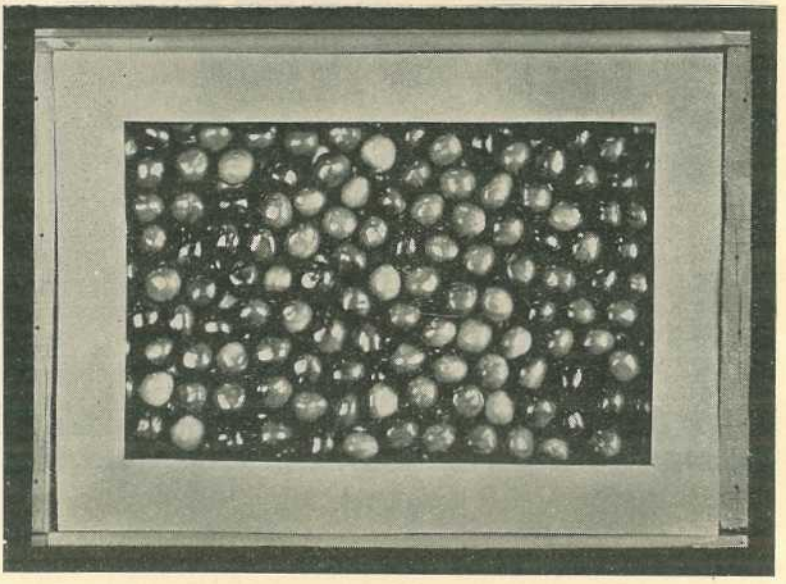


Plate 204.
A case of small-grade cherries with a thin cardboard mask used.

Label Paste.

For small quantities, ordinary flour paste is quite satisfactory. The addition of a small teaspoonful of powdered alum to each pint of paste will assist in keeping the paste from going sour.

Stencil Ink Pot.

A good stencil ink pot can be made from a handful of cotton waste placed with the stencil ink cake. The waste is kept wet while the ink is rubbed into it. The brush is dipped on the waste when using, clean stencilling being easy to do.

Stacking Packed Boxes.

After packing, the boxes should be stacked on their tops and bottoms during transit. Wood which is too thin should not be used for lids or bottoms, as it is necessary for the fruit to be protected as much as possible.

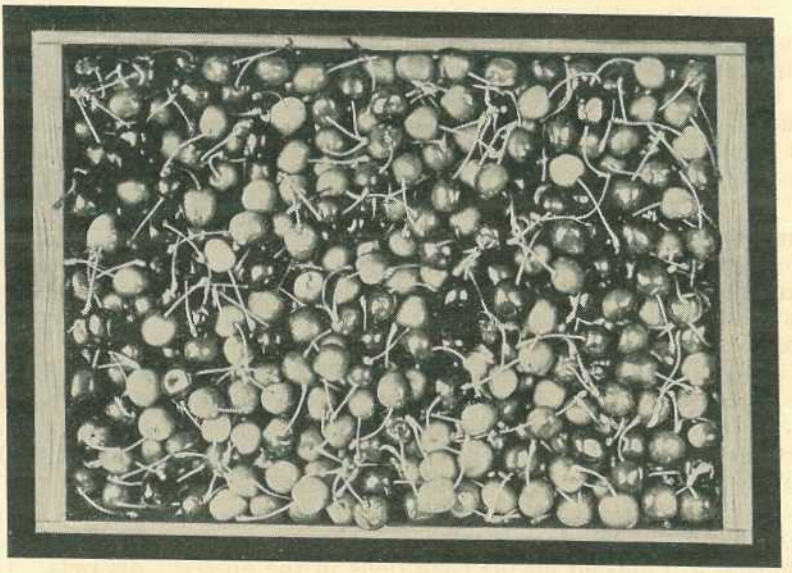


Plate 205.

The bottom layers of a case, showing how the stalks are all turned upwards when packing.

NOTE.—These layers become the bottom layers after the case is nailed down.

Maturity.

Growers will soon learn by experience the correct stage at which to harvest the fruit. The cherries must be far enough advanced to continue ripening, and, at the same time, firm enough to carry long distances. Variety has a big influence on the carrying quality of the fruit. Only the hard black or white varieties—such as the "Florence," "St. Margaret," and "Tartarian"—should be cultivated for long-distance trade.

The following salient points in marketing are stressed:—

(1) Select only hard, firm varieties for long-distance travelling.

(2) Grade into two qualities; it pays.

(3) Use the 12-lb. cherry case in preference to other boxes.

(4) Facing masks are well worth while for top quality.

(5) Keep fruit cool from tree to rail.

(6) Keep out stalkless and skin-broken fruit; it will breed brown rot.

THE PLANTING OF BANANAS.

The best aspect for banana-growing is one varying from easterly to northerly, and even north-westerly, provided that the plantation is well sheltered from strong winds. As southerly slopes are usually cold, banana plants, if grown on them, develop slowly, and the fruit is generally inferior—hence land with a southerly aspect is not worth considering if other land is available.

Logging and hoeing operations should, if possible, be followed by a thorough grubbing. Grubbing is essential if the plantation is to be established in forest soil. It is necessary for the aeration and drainage of the soil, and the maintenance of a supply of moisture for the plants. Many growers look askance at forest soils for bananas, but plantations on such soils, if worked thoroughly and desuckered carefully, can produce fruit of first-class size and quality.

It is now possible to plant bananas in many localities. If bits or butts are being utilised, careful attention must be paid to baiting for the banana weevil borer to ensure the planting of clean material. Growers in need of advice on the selection and preparation of planting material should get in touch with the nearest fruit inspector or banana agent.

Holes for planting should be, roughly, about 15 inches square by 15 inches deep. The surface soil from the top side should be raked back into the hole and the sucker placed in the loose soil and tramped firmly all round. The top of the sucker need only be covered lightly with loose earth, and the hole should not be refilled completely.

An application of about 1 lb. of fertilizer when planting will hasten and strengthen the growth of the young plants. The actual time of planting will depend on the conditions in the different districts. On a slow-growing aspect, October planting is best, while on warmer slopes November and December may be more suitable.

Where grubbing has not been done previously a circle around each plant with a radius of approximately 3 feet should be worked. This gives the plant both sufficient sunlight and freedom from smothering weeds. Planting 10 feet by 10 feet is a good average distance.

Generally, the best method of spacing followers is that known as "one bunch one follower." This enables the grower to regulate and handle his fruit cutting and packing with convenience, as it is more or less confined to the winter months. For about the first twelve months after planting, all but one or two followers should be kept back, and thus all energy is directed into one plant and its bunch. The folly of allowing as many suckers as may appear to develop cannot be condemned too strongly.

—*J. Freeman.*

THE CAPE GOOSEBERRY.

Actually, the Cape gooseberry is not a true gooseberry, being of the same family as the tomato, potato, and tobacco. This fact suggests immediately the class of soil it requires and what would be a suitable location for its growth.

The Cape gooseberry is best propagated from seed, 1 oz. being sufficient to plant an acre. Sow the seed in a carefully prepared seedbed in the same way as tomato seed is sown. Cover the seed to a depth of

half an inch, using a rich loam, with a fair percentage of dry horse manure, if possible. Keep the bed moist, but shading is not necessary under normal conditions. The young seedlings grow rapidly and should be ready to transplant in, approximately, eight weeks from sowing. Harden the plants off by reducing the watering gradually prior to removing the plants, but give the bed a thorough soaking immediately before lifting the young plants.

Plant in a well-cultivated field in rows 4 feet by 4 feet apart. Water the plants at the time of planting. If land requires fertilizing, apply as a top dressing 1 part of sulphate of ammonia to 2 parts of superphosphate. A small amount of sulphate of potash applied just before the fruit appears is an advantage.

Harvesting may commence approximately three months after transplanting. The season lasts two to two and a-half months, regulated to a large degree by the season of the year. A fair crop would be about 3,000 lb. of fruit per acre, although much heavier yields have been recorded from time to time.

The market price ranges from 4d. to 7d. a lb. locally. The demand for this fruit is good, with little chance of a glutted market. The fruit is sold as fresh fruit, or for jam or preserves.

The chief troubles affecting the Cape gooseberry are downy mildew (control by spraying with the Bordeaux mixture 4-4-50) ; and soft, brown scale (control by spraying with white oil 1 in 56). Annual planting is recommended, but, if pruned back, the plants do quite well for two seasons.

TABLE BEETS.

The beet will grow well in most soils, but, like other root crops, it does best in a light loamy soil. The soil should be prepared thoroughly and enriched with liberal dressings of well-rotted stable manure or vegetable matter.

Commercial fertilizers may be used, and the Agricultural Chemist advises the following mixture:—

Sulphate of ammonia	1½ to 2 cwt.
Superphosphate	2 to 3 cwt.
Muriate of potash	¾ to 1 cwt.

A complete fertilizer, 2-12-6, also, may be used at the rate of from 4 to 6 cwt. to the acre.

The fertilizer should be applied at the time of thinning if the seed has been sown where the plants are to remain; or otherwise at the time of transplanting. A top-dressing about a month later with sulphate of ammonia at the rate of 1 to 2 cwt. to the acre would be beneficial.

As the seed is usually sown in the field, it is necessary to have the soil in a fine state of tilth prior to planting. The seed is customarily planted in rows about 2 feet 6 inches apart for horse cultivation, or 1 foot 6 inches apart for hand. Six to 8 lb. of seed is usually sufficient to plant an acre, or 1 oz. to every 150 feet. It should be sown to a depth of from ½ inch in heavy ground to 1 inch in light soil. The seed is usually slow in germinating. The distance between plants may vary

from 3 to 4 inches, according to variety sown. Thorough cultivation is necessary after planting out, and until the plants are a fair size care must be taken not to injure them with the implements or heavy clods of earth.

Beets should be harvested when of suitable size for market. They are usually washed and tied in bundles of about six. Varieties recommended are—Nonpareil, which has a long oval shape; and Crimson Globe —a turnip-rooted, early beet, suitable for hot districts.

PACKING SHED HYGIENE.

Growers are advised to clean and prepare their packing sheds and equipment in readiness for the next fruit-picking season.

Sizing machines should be examined and all broken parts repaired. Projecting screws, nuts, or anything likely to damage fruit in the course of handling should be removed or padded. All picking cases and equipment should be scalded or sprayed with formalin—1 part to 20 parts water. Pits for the disposal of fly-stung rejects should now be put in order.

Citrus Fruits.—At the end of the season, it is often found that there is an accumulation of old fruits which, if left to decay, may be a prolific source of blue mould and other trouble when next season's citrus crops are harvested. This rejected fruit should be destroyed. Cases which have contained mouldy citrus fruits should be scalded and cleaned thoroughly.

Bananas.—No other section of the fruit industry is worse equipped for the packing of its produce than the banana section. No attempt, as a rule, is made to make the work easier by the use of labour-saving appliances. Many growers also do not bother about the first principles of sanitation around the packing shed. Old stalks and fruit are left piled about the premises to become a source of disease infection. Growers are strongly advised to remedy this state of affairs, should it exist, by providing for the destruction of all packing-shed refuse.

Pineapples.—The same recommendations are submitted to pine-apple-growers. In addition, benches, picking baskets, and other equipment should be scalded and sprayed thoroughly at regular intervals as a measure of control of water blister and other disorders. Old tops, decayed fruit, and other litter should not be left around the packing shed.

Cleanliness in the packing shed and careful handling and packing will ensure the delivery of fruit on the market in an attractive condition. The influence of satisfactory consignments on prices is obvious.

HARVESTING TALL-GROWING BANANAS.

The "cutting" of bunches of tall-growing varieties of bananas frequently presents a difficulty to growers who have not had previous experience in growing varieties such as Mons Marie and Lady's Finger.

A very simple method that can be recommended, and one that can be operated successfully by one man is as follows:—

On the same side of the stem as that on which the bunch is hanging make two cuts with a cane knife, about 5 to 6 feet from the ground. The cuts are made one downwards and one upwards, and should meet, making an angle of about 60 degrees, approximately two-thirds of the distance through the stem, or deep enough to sever the bunch stalk in the centre of the stem. Immediately this is done, the upper portion of the stem with the bunch will not fall suddenly to the ground, but will slowly bear over, and as it gradually comes within reach the bunch is grasped and cut.

The principle of this method is that the soft fibrous tissue of the unsevered portion of the stem does not break suddenly, but because of its flexibility allows the bunch to heel over gradually. The V-shaped wedge also assists in this way: it cushions the lower and upper portions of the plant, and only gives way steadily and partly crushes under the increasing strain as the bunch nears the ground.

When cutting the stem, care should be taken to sever the bunch stalk. The tissue of this stalk is very brittle, and will snap readily. If this stalk is only partly cut, the weight of the bunch pulling the plant over will cause the unsevered portion to snap, and this sudden snapping will invariably result in the remainder of the stem also breaking and the bunch falling heavily to the ground to the detriment of the fruit.

LIME FOR THE GARDEN.

Lime is very useful in neutralising the excess acidity of the soil. It improves the physical condition of heavy acid soils, ensuring better drainage and aeration, and making cultivation easier, and it is an essential plant nutrient. When present in sufficient amount, it promotes some types of bacterial activity which convert the reserves of nitrogenous material in the soil into the soluble forms of nitrogen which plants utilise.

There is no foundation for the common belief that the exposure of acid soil to sun and air "sweetens," or reduces, its acidity. Acidity is developed through an insufficiency of lime in the original soil-forming material, or the loss of lime through leaching and absorption by plants. Acidity thus developed can only be counteracted in field or garden by the use of some form of lime. The forms of lime used for counteracting soil acidity are quicklime, hydrated or slaked lime, and ground limestone or carbonate of lime.

Slaked quicklime is formed by exposure to the air, causing it to become a very fine powder which can be spread quite easily. Ground limestone is a cheaper and more pleasant material to handle than slaked lime, provided the material is sufficiently fine and well distributed, and that equivalent dressings are applied. In the last respect, 4 lb. of ground limestone are required to supply as much "effective" lime as is contained in 3 lb. of slaked lime.

The soil to be limed should be dug over and reduced to a good tilth, after which the lime should be uniformly spread, and then lightly worked into the top soil to a depth of several inches. The amount of

lime to be used depends on the degree of acidity of the soil, its texture, organic matter content, and the type of plant to be grown. Unless all these features can be determined, suggestions on the amount of lime that it is necessary to add to a soil can be approximate only.

On loams and heavier soils, dressings may range from 1 lb. of slaked lime, or 1½ lb. of ground limestone, per square yard on loams, to double these quantities on clay loams and clays. Sandy loams or, still more, sandy soils can receive lighter dressings of approximately half the amount required for loams. Lime is lost most rapidly from sandy soils, which are usually more acid than heavier soils under the same conditions. Under garden conditions, with frequent waterings, lime is continually being lost, especially from the sandier types of soil. After the initial liming, which may need to be heavy to counteract strong acidity, it is preferable to add light dressings each season, rather than occasional heavy dressings.

It is not necessary always to add sufficient lime to neutralise soil acidity completely, as most garden plants grow well on slightly acid soils. This slightly acid condition will result only in the majority of garden soils after liming. Only for those plants listed below as very sensitive to acidity is it advisable to neutralise the acidity completely. Whilst many plants grow best on neutral soils, or on slightly alkaline soils, a considerable number of plants will tolerate fairly acid soils.

By careful planning of the garden cropping scheme, portion of the area may be set apart and only lightly limed, if at all, for certain plants (as indicated below), and the remainder limed for those crops with a higher lime requirement. Potatoes, which will grow on acid soils, do best on slightly acid soils, and in gardens where dry conditions are not experienced the danger from scab diseases in slightly acid soils is small.

The following statement shows approximately the relative sensitiveness of a number of garden and crop plants to acid soil conditions:—

Very Tolerant.—Potato, radish, strawberry, sweet potato, rhubarb, water melon, pineapple.

Tolerant.—Bean, carrot, cucumber, turnip, crimson clover, maize, oats, tomato, cowpea, cabbage.

Sensitive.—Rape, red clover, sweet clover, white clover, peas, onions, lettuce, cauliflower.

FORCING CROPS WITH ELECTRICITY.

The French Academy of Agriculture has before it particulars of new methods of forcing growth in farm crops by means of electricity. Some of them are yet in the experimental stage, but one that was introduced tentatively five or six years ago is now reported to be making headway among French market gardeners. This method is simply an adaptation of the time honoured way of utilising the heat of the midden—ex-Diggers of the A.I.F. will remember the midden in every French farmyard into which all sorts of refuse was dumped—for forcing purposes. The same thing is now done with electricity. Electric cables are placed at the bottom of the bed and over them a layer of sand distributes the heat to the soil above. Because of the fact that the bed does not lose heat very rapidly, it is said to be practicable to restrict the use of the current. This method is said to be well adapted for raising seedlings and cuttings, and for certain special crops.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

THE first of the stone fruits—cherries—has arrived on the Brisbane market from New South Wales. For early consignments prices were high for choice lines, over 1s. a lb. being paid for the best.

Some local China Flats also made their appearance.

Mangoes are now well established on the market. Some lines of this fruit have been sent to market too green. Only fully matured consignments have any chance of realising top prices. Many northern growers are making the mistake of sending fruit too green, and also badly packed. There is a good market for this fruit, but it is only by good harvesting and packing methods that agents are able to obtain top prices. The warning against sending the common type of mango to southern markets is again repeated—this time with emphasis. Papaws and smoothleaf pineapples have been in heavy supply, and prices for all but prime fruit have been low.

Quality oranges are in demand, but agents have had great difficulty in selling small-sized fruit.

Prices for bananas have eased slightly in Brisbane, but remain firm on the southern markets. Many lines of fruit have been rejected for lack of girth and growers are warned against endeavouring to place fruit of this description.

Prices during the last week of October were:—

TROPICAL FRUITS.

Bananas—Cavendish.

Brisbane.—Smalls, 5s. to 7s.; sixes, 5s. to 8s. 9d.; sevens, 8s. to 13s. 9d.; eights, 8s. to 13s.; nines, 11s. to 15s.

Sydney.—Sixes, 14s. to 16s.; sevens, 17s. to 19s.; eights and nines, 20s. to 23s.

Melbourne.—Sixes, 9s. to 12s.; sevens, 11s. to 14s.; eights and nines, 13s. to 16s.

Lady Fingers.

Lady's Finger, 1½d. to 8d. per dozen.

Pineapples.

Brisbane.—Smooths, 3s. to 5s. 6d. per case, 1s. to 4s. per dozen. Ripley, 8s. to 10s. per case, 2s. to 6s. per dozen.

Sydney.—4s. to 7s. per tropical case.

Melbourne.—6s. to 8s. per tropical case.

Papaws.

Brisbane.—Yarwun, 4s. to 7s. tropical case; Gunalda, 3s. to 4s. bushel case; Locals, 1s 6d. to 2s. bushel case.

Sydney.—2s. to 11s. tropical case. Green fruit hard of sale.

Melbourne.—6s. to 8s. tropical case.

Mangoes.

Townsville best quality, 8s. to 9s. bushel. Immature fruit hard of sale.

CITRUS FRUITS.

Oranges.

Brisbane.—6s. to 7s. bushel; few specials higher. Small grades hard of sale, 2s. 6d. to 3s. 6d.

Lemons.

Brisbane.—Gayndah, 5s. to 11s. per bushel; Locals, 3s. to 6s. per bushel.

Grapefruit.

Brisbane.—6s. to 8s. per bushel.

Mandarins.

New South Wales.—8s. to 10s per bushel.

DECIDUOUS FRUITS.

Apples (Southern).

Brisbane.—Jonathan, 8s. to 14s.; Crofton, 11s. to 14s.; Granny Smith, 15s. to 16s.; Yates, 10s. to 14s.; Cleopatra, 7s. to 14s.; Sturmer, 6s. to 11s.; Delicious, 9s. to 14s.; Rome Beauty, 8s. to 12s.

Southern shippers are again warned to select only best quality hard varieties of fruit for shipment to Brisbane.

Pears (Southern).

Brisbane.—Winter Cole, 12s. to 17s. per bushel; Winter Nelis, 10s. to 15s. per bushel; Broom Park, 8s. to 14s. per bushel.

All fruit should be wrapped. Unwrapped lines open up brown and speeky.

OTHER FRUITS.

Strawberries.

Brisbane.—9s. to 14s. per doz. boxes. Specials to 17s. per doz.

The season for this fruit has almost drawn to a close. Berries are now showing a tendency to be soft when not sold quickly.

Cape Gooseberries.

3d. to 5d. per lb.

Packers are warned against the inclusion of green berries as these very adversely affect sales.

Tomatoes.

Brisbane.—Locals, ripe, 2s. to 8s. per half bushel; green 2s. to 6s. per half bushel; choice coloured, 4s. to 10s. per half bushel; Bowen, 2s. to 6s.; Yarwun, 2s. to 7s.

Sydney.—4s. to 8s. half bushel.

Small fruit in over-supply; second-grade lines hard of sale.

Passion Fruit.

Brisbane.—10s. to 12s. per half bushel; special grade, 14s. to 16s. per half bushel.

Sydney.—8s. to 18s. half bushel.

Melbourne.—10s. to 18s. half bushel.

Few specials higher.

MISCELLANEOUS VEGETABLES, &c.

Cucumbers.—Brisbane, 3s. to 4s. per bushel. Sydney, 3s. to 5s. Melbourne, 8s. to 10s. bushel case.

Pumpkins.—8s. to 12s. per bag. Sydney, 12s. to 16s. per bag. Melbourne, £14 to £16 per ton.

Marrows.—6d. to 1s. 3d. per doz. Sydney, 5s. to 7s. Melbourne, 6s. to 8s.

Lettuce.—6d. to 1s. doz.

Cabbage.—1s. to 2s. per doz.

Beans.—3s. to 4s. sugar bag; poor quality lower. Melbourne, 2d. to 4d. lb.

Peas.—2s. to 5s. sugar bag.

Beetroot.—2d. to 6d. per bundle.

Carrots.—2d. to 8d. bundle.

Rhubarb.—6d. to 8d. bundle.

PROTECTION OF QUEENSLAND FAUNA.

Last year the Minister for Agriculture and Stock introduced a Bill to Parliament having for its object the better protection of our fauna. Mr. Bulcock obviously has a warm place in his heart for our smaller wild animals. He has prohibited for all time the destruction of our much loved koala, and has provided machinery which should put an end to some of the objectionable methods of trapping or snaring the opossum. Provisions embodied in the Bill should end the secret slaughter and disposal of pelts, as having secured the co-operation of other States, it now will be practically impossible during a close season to dispose of such pelts either in Queensland or elsewhere. Failing the complete prohibition of the slaughter of opossums, this is the next best thing. Mr. Bulcock has certainly proved to be a humane Minister. Some day, perhaps, he will see the justification for placing the opossum in the same category as the koala.—*From the Annual Report of the Queensland Society for the Prevention of Cruelty.*

TO SUBSCRIBERS.

Subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

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, the Jersey Cattle Society, the Friesian Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled during the month of September, 1938 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Valera Daphne 2nd	M. C. and A. M. Sullivan, Pittsworth	9,684·53	377·249	Blacklands Napoleon
Merridale Miss Sparrow	H. D. Giles, "Merridale," Biggenden	7,001·35	293·773	Reflection of Blacklands
Merridale Diamond	H. D. Giles, "Merridale," Biggenden	7,974	279·571	Reflection of Blacklands
SENIOR, 2 YEARS (STANDARD 250 LB.).				
Navillus Violet 5th	C. O'Sullivan, "Navillus," Ascot	7,849·75	317·493	Parkview Mars
Jamberoo Broady II.	N. Bidstrup, Ehlma, Warra	7,646·07	312·686	Brooklyn Terrace Banker
College Rascal 6th	Queensland Agricultural High School and College, Lawes	7,904·61	307·405	Duplex of Greyleigh
Navillus Mayflower	C. O' Sullivan, Ascot, Greenmount	7,426	273·559	Parkview Mars
Navillus Viola 4th	C. O'Sullivan, Ascot, Greenmount	6,557·5	259·487	Princess Sheik of Navillus
Jamberoo Topsy 6th (258 days)	N. Bidstrup, Ehlma, Warra	6,751·66	258·323	Brooklyn Terrace Banker
JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Fairvale Stately	J. H. Anderson, Southbrook	7,550·02	314·47	Blacklands Czar
Navillus Vera 7th	C. O'Sullivan, "Navillus," Ascot	8,375·25	298·675	Alfa Vale Re Nell
Navillus Daisy 5th	C. O'Sullivan, "Navillus," Ascot	7,244	276·105	Alfa Vale Re Nell
Jamberoo Reddie 4th	N. Bidstrup, Ehlma, Warra	6,512·83	248·84	Brooklyn Terrace Banker
Navillus Charm 4th	C. O'Sullivan, "Navillus," Ascot	6,423·25	243·349	Alfa Vale Re Nell

JERSEY.

Mature Cow (Standard 350 lb.).

Glenmoore Jester's Maid	G. A. Champney, Wooroolin	8,847·4	426·606	Wheatlands Jester

Senior, 2 Years (Standard 250 lb.).

Glenview Trinket	F. P. Fowler and Son, Glenview, Coalstoun Lakes	6,057·1	295·393	Trinity Governor's Hope
Oak Park Marina	Miss J. Nowlan, Lindum	6,264·4	282·223	Oakington Grassmere Plentimmon

Junior, 2 Years (Standard 230 lb.).

Glenview Royal Jubilee	F. P. Fowler and Son, Glenview, Coalstoun Lakes	6,051·8	283·659	Trinity Governor's Hope

FRIESIAN.

Junior, 2 Years (Standard 230 lb.).

Ryfield Dairymaid 8th	P. P. Falt, Wondai	8,139	369·995	Ryfield Argus 2nd

GUERNSEY.

Senior, 3 Years (Standard 270 lb.).

Lilac Pretty Polly	W. R. Smee, Peeramon	6,811·45	298·341	Lilac Masterpiece

In Memoriam.

CUTHBERT POTTS.

The death of Mr. Cuthbert Potts, B.A., a former principal of the Queensland Agricultural College, which occurred at Brisbane on 6th October, is recorded with deep regret.

Plate 206.

The late Mr. Potts graduated in Arts from the Sydney University in 1898, and for two years took the course for mining engineer.

He subsequently engaged in dairy farming at Narellan, in New South Wales, afterwards serving a term as surveyor's field assistant. He was junior demonstrator in chemistry at Sydney University in 1901, and from 1902 to 1915 was lecturer in chemistry and physics at Hawkesbury Agricultural College, of which he was sometime Acting Principal.

Coming to Gatton in 1915 as Principal of the Queensland Agricultural College, he set about reorganising the instructional system there on modern lines and brought the college to a high standard. He had remarkable success with field crops, and was an authority on fodders. Ex-students who came under his guidance speak of him with affection and with appreciation of him as an agriculturist and of his capacity as a teacher. He retired from the Headship of the Queensland Agricultural College in 1923. In recent years he was engaged in commercial and mining pursuits.

Among his published work are several important papers on the drought problem and fodder conservation. He was a valued contributor to the *Queensland Agricultural Journal*. His "Fighting Drought, an Analysis and Some Suggestions," is regarded as a notable contribution to the agricultural literature of Queensland.

Literature was with him a leisure-hour hobby and graceful verse, which at times sparkled with gems of real poetry, a favourite method of expression.

The late Mr. Potts was greatly interested in rowing and was known on the river as a sound exponent, and many winning crews had the benefit of his coaching ability. In his student days he rowed for Sydney against the other Australian Universities.

In his last illness he displayed remarkable fortitude and courage.

On learning of his death the Minister for Agriculture and Stock (Mr. F. W. Bulcock) expressed regret at his untimely passing, and paid a tribute to his work at Gatton. Similar tributes have been paid by Professor J. K. Murray, the present Principal, and Mr. Stewart Conochie, President of the Gatton Agricultural College Old Boys' Association.

The funeral service at the Brisbane Crematorium at Mount Thompson was largely attended. The Rev. S. Atherton, of St. Thomas', Toowong, officiated, and included in the congregation were Messrs. R. Wilson, Acting Under Secretary and Director of Marketing, Department of Agriculture and Stock, who also represented the Minister, Hon. Frank W. Bulcock; Professor J. K. Murray (University of Queensland), and other members of the Staff and Senior Prefects of the Queensland Agricultural High School and College; Mr. C. J. McKeon, Director of Agriculture, and other Senior Officers of the Department of Agriculture and Stock; Mr. Stewart Conochie and many other members of the Agricultural College Old Boys' Association, and a large number of citizens representative of the professional and commercial life of Brisbane, and of numerous sporting bodies.

To the bereaved relatives, deep sympathy is extended.

General Notes

Staff Changes and Appointments.

Mr. L. G. Walker, inspector under the Stock, Slaughtering, and Dairy Produce Acts, Department of Agriculture and Stock, has been transferred from Brisbane to Longreach.

Mr. J. A. Kerr, Instructor in Agriculture, Department of Agriculture and Stock, will be transferred from Brisbane to Kingaroy.

Constable A. J. Hughes, Blackall, has been appointed also an inspector under the Slaughtering Act.

Mr. T. G. Graham, Instructor in Agriculture, Townsville, has been transferred to Ayr.

Mr. R. D. Chester, Government Veterinary Surgeon, has been transferred from Maryborough to Murgon.

Constable S. J. Rigby (Tiaro) has been appointed also an inspector under the Brands and Slaughtering Acts.

Wild Life Preservation.

Mr. J. W. Green, manager of "The Plains," Boondooma, has been appointed an honorary protector under "*The Fauna Protection Act of* 1937."

Mr. C. E. Marchant (Dart street, Auchenflower) has been appointed an honorary protector under "*The Fauna Protection Act of* 1937," and an honorary ranger under "*The Native Plants Protection Act of* 1937."

Hail Insurance Regulations Suspended.

A Regulation has been issued under the Primary Producers' Organisation and Marketing Acts providing that the Canary Seed Board Hail Insurance Scheme Regulations shall have no force or effect in respect of canary seed planted during the year 1938.

Isis Central Mill.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts empowering the Isis Central Mill Suppliers' Committee to make particular levies (2) on certain sections of growers supplying cane to the mill, each levy at the rate of one half-penny per ton of cane, and to be used for administrative purposes by the Isis and Booyal Branches Committee respectively.

The levy for the Isis Branch is payable on all cane supplied from the parishes of Gregory and Childers, County Cook, and the levy for the Booyal Branch is on all cane supplied from the parishes of Booyal and Stanton, county Cook, and consigned by Government railway trucks from Booyal, Junien, and Marule Sidings.

Growers concerned may forward a petition to the Department of Agriculture and Stock, on or before 6th September, 1938, for a ballot on the question as to whether or not the levies should be made.

Butter Board.

An Order in Council issued under the Primary Producers' Organisation and Marketing Acts amends the constitution of the Butter Board to provide that elections of growers' representatives on such board shall be held triennially in the month of December, and that such representatives shall hold office for a period of three years from 1st January next following their election.

A further Order in Council gives notice of intention to extend the operations of the Butter Board for the period from 1st January, 1939, to 31st December, 1941. A petition for a poll to decide whether or not such board shall be extended may be lodged by growers on or before the 21st November, 1938.

Cheese Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts giving notice of intention to extend the operations of the Cheese Board for the period from 1st January, 1939, to 31st December, 1941.

Growers may petition for a poll on the question of whether or not the board shall be extended for such period, such petition to be lodged at the Department of Agriculture and Stock, on or before the 21st November, 1938.

Answers to Correspondents

BOTANY.

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

Sensitive Plant.

F.G.L. (Mount Perry Line)—

The sensitive plant (*Mimosa pudica*) is a common tropical weed naturalised in coastal Queensland. It is particularly abundant about Mackay. It is also very abundant in Fiji, and in that country has a good reputation as a fodder. Like other leguminous plants, it has a beneficial effect on the soil, particularly if ploughed in as a green manure. We are doubtful about the plant being a success in your locality.

Plants from Goondiwindi Named.

T.D. (Goondiwindi)—

1. Cape weed, *Cryptostemma calendulacea.*
2. Oriental mustard, *Sisymbrium orientale.*
3. Pepper cress, *Lepidium ruderale.*
4. Wild tobacco or native tobacco, *Nicotiana suaveolens.*

Feeding tests have proved that "wild tobacco" is poisonous to stock. Reports, however, have repeatedly been received from Western Queensland that graziers have noticed sheep eating this plant to a limited extent without any ill-effects following, and some feeding tests have given negative results. This is probably explained by the fact that although Seddon and McGrath, who conducted the feeding tests in New South Wales, found that 12 oz. of the dried leaves of the plant were repeatedly poisonous to sheep, repeated small doses of less than 12 oz. were not toxic. The plant is very distasteful to stock, and generally they do not eat it in quantities sufficient to cause trouble.

5. A native indigo, *Swainsona luteola.* Feeding tests proved it to have the same effects on sheep as the common indigo or Darling pea. The symptoms are stupidity, followed by stiffness, slight staggering, and trembling of the head and limbs. Unsteadiness develops, until the animal often falls down. In this stage, the action of the animal in running over small obstacles is characteristic. It jumps over a twig as if it were a foot in height. Usually symptoms are not developed until the sheep have been feeding for several weeks in paddocks in which the plant is growing.
6. Forget-me-not, *Cynoglossum suaveolens.*
7. Vervain, *Verbena officinalis.*
8. Cud weed, *Gnaphalium japonicum.*

All of the other weeds, with the exception of Nos. 4 and 5, are not known to possess any poisonous or harmful properties, although Nos. 2 and 3 taint milk rather badly.

Without knowing something more of the facts, it would be hard to state whether No. 4 or 5 was responsible, but they are the only two in any way known to possess poisonous properties.

"Wheat Thief."

R.W.B. (Amby)—

The specimen is "wheat thief" or corn Gromwell, *Lithospermum arvense,* a native of Europe, now a naturalised weed in most temperate countries. We have not seen it in any very great abundance in Queensland, although every year we receive a certain number of specimens. This year, judging from the number received, it seems to be on the increase. It is a bad weed in wheatfields, and, where possible, such as in small areas, hand-pulling is the most satisfactory method of eradication. In Europe and North America, where the weed is rather a serious pest, it has been found that sulphate of iron, 2 lb. dissolved in a gallon of water, is effectual in dealing with the weed and has very little effect on the wheat.

Eulo Plants Named.

H.W.B. (Eulo)—

1. *Trachymene australis*, one of several plants known in Western Queensland as Wild Carrot. It has been accused of poisoning stock, but nothing very definite is known about it. We are doubtful about its being very poisonous.
2. Wild Tobacco—*Nicotiana suaveolens*. The wild tobacco occurs in various forms in Western Queensland and reports regarding it are very conflicting. It is generally believed to be poisonous, but at times sheep are said to eat it without any ill effects following. In feeding tests in New South Wales by Seddon and McGrath, it was found that 12 oz. or more of the plant was poisonous to sheep, but that repeated doses of less than 12 oz. were quite harmless.
3. Caustic Weed—*Euphorbia Drummondii*. This weed is regarded as poisonous, but most of the trouble is with travelling sheep. Ordinary paddock sheep very often feed on the plant with impunity. In New South Wales it contains a prussic acid-yielding glucoside, but repeated tests with the Queensland plant have always given negative results, and the symptoms are certainly not those of prussic acid poisoning. The head and neck of affected animals swell considerably and if this swelling is pierced an amber-coloured fluid exudes and the life of the sheep may be saved.
4. *Swainsona microphylla*. The properties of this plant are not known. It is a species of indigo closely allied to the well-known Darling pea or indigo. The effects of Darling pea are probably well known to you. The sheep affected have an agonised expression, the limbs become stiff, and trembling follows. Affected animals often try to jump over imaginary objects, or small objects as if they were very high. It takes fairly large quantities consumed over several weeks for animals to become affected. We have no information, however, on the plant you send.

Plants from Oakey Named.

D.S. (Oakey)—

1. Stagger weed or mint weed, *Stachys arvenis*, causes shivers or staggers in working or travelling stock. Ordinary paddock resting stock, such as dairy cattle or poddy calves, do quite well on it and suffer no ill-effects.
2. Lamb's tongue or plantain, *Plantago varia*, a useful herb in the mixed pasture.
3. The smaller burr trefoil, *Medicago minima*. See note under No. 7.
4. Pepper cress, *Lepidium ruderale*, one of the numerous plants called mustard weeds. It is a useful fodder, but taints milk badly.
5. Crane's bill or crow foot, *Erodium cygnorum*. A useful herb in the mixed pasture.
6. A native carrot, *Apium leptophyllum*, a useful herb, but taints milk badly.
7. Burr trefoil, *Medicago denticulata*, a very valuable fodder plant. In its very green state, it is apt to bloat stock, and is generally preferred when slightly wilted or drying off. The burrs which ripen in early summer or late spring cause some trouble in the belly-wool of sheep.
8. Native carrot, *Daucus brachiatus*. This plant is more closely allied to the cultivated carrot than 6.
9. Hedge mustard, *Sisymbrium officinale*, a common farm weed, taints milk if eaten in any quantity.
10. Marshmallow, *Malva parviflora*, a very common farm weed in Queensland, particularly on the Darling Downs. In New South Wales it has been accused of causing shivers or staggers in sheep. We have had no trouble with it so far as we know in Queensland.
11. *Erodium cygnorum*—No. 5.
12. Shepherd's purse, *Capsella bursa-pastoris*, taints milk badly if eaten in any quantity.
13. *Helipterum polyphyllum*, a very common native plant for which we have heard no common name. It belongs to the Everlasting family.
14. Cudweed, *Gnaphalium purpureum*, a common farm weed. If eaten in any quantity, it is sometimes stated to cause impaction in stock.

Cooyar Plants Named.

B. McG. (Cooyar.)—

1. *Vittadinia triloba*, a common weed on the Downs for which we have not heard a local name other than "ragweed," a name applied to a number of weeds in Queensland.
2. *Solanum* sp., a potato bush. The green berries are thought to be harmful to stock, but we have little definite information on this point.
3. *Geranium dissectum*, crow-foot, also called wild carrot, although we have a true carrot on the Darling Downs. It is excellent feed for stock, particularly sheep.
4. Knot grass or Knot weed—*Polygonum aviculare*—a very common weed of cultivation during winter and spring. It is not known to possess any poisonous or harmful properties, but the long fibrous stems are said to cause impaction in stock.
5. *Rumex* sp., a dock. The docks are often troublesome weeds in cultivation.
6. Button Mallow—*Modiola multifida*—a native of North America, now a naturalised weed in many parts of the world.
7. Cudweed—*Gnaphalium purpureum*.
8. Pepper Cress—*Lepidium ruderale*—one of several weeds in Queensland called mustard weed or turnip weed. It is quite a good fodder, but taints milk rather badly.
9. Mouse-ear Chickweed—*Cerastium vulgatum*—a weed with a very wide distribution over the temperate parts of the world. It is fairly common in Queensland during the winter and spring months.
10. Bachelor's Buttons—*Craspedia uniflora*.

Plants from Redland Bay Named.

P.W. (Victoria Point)—

1. Shepherd's Purse—*Capsella bursa-pastoris*, a weed spread widely over the temperate regions of the world. It is quite a good fodder, but taints milk rather badly.
2. Mat Rush—*Xerotes multiflora*.
3. Chickweed—*Stellaria media*, a common weed spread widely over the temperate regions of the world. It is abundant in Queensland and rather a pest of cultivation during winter and early spring.
4. Fumitory—*Fumaria parviflora*.
5. Yellow Weed—*Galisoga parviflora*, generally regarded as a good fodder for stock.
6. Stagger Weed—*Stachys arvensis;* also called mintweed or wild mint, but not to be confused with the poisonous wild mint of the Darling Downs. It causes staggers or shivers in travelling stock. They recover, however, when put on to ordinary feed.
7. Pimpernel—*Anagallis arvensis*, a common weed spread widely over the temperate regions of the world. It has been accused of poisoning stock both in Australia and abroad. It has rather an objectionable taste, however, and is not often eaten in sufficient quantities to cause trouble.
8. Rib Grass—*Plantago lanceolata*. This plant is sometimes grown as a fodder. It is moderately common as a weed in Queensland and we cannot say that we have seen stock take to it very readily.
9. St. John's Wort—*Hypericum gramineum*.

Native Onion.

S.W.L. (Dalby)—

The specimen from Kaimkillenbun is the native onion, *Bulbine bulbosa*. This plant has been suspected in both Queensland and New South Wales of poisoning stock. Bailey and Gordon reported the plant as having caused the death of travelling rams, and quoted W. R. Hutchinson that sheep and horses when affected lie down, roll about, scour badly, and discharge mucous matter yellow in colour from the nose.

This plant, so far, has been tested only on a limited scale by feeding, but was not found to be poisonous. This point is being further investigated.

Rural Topics

Pasteurised Silage.

In England, grass cuttings from aerodromes are now turned into silage, which is said to keep fresh and green for as long as three weeks after it comes out of the silo.

The grass, before it goes into the silo, is passed through a hot water bath at a temperature of about 180 degrees. This has the effect of pasteurising it; that is, killing all the organisms, like bacteria, that might be present on the grass. No fermentation can then occur in the silo, so that there should be no loss in either the quantity or quality of the material put in.

The process is said to be cheap. The selling price of the silage is about £1 15s. a ton out of the silo. The quality is said to be good, some of the silage having as much as 20 per cent. protein in it, and this about the equivalent of a fairly rich concentrate.

Windmills for Electric Light on the Farm.

The wind is one of the first sources of power to be used by man, and the possibility of its additional uses is still a subject in which all are interested. The idea of "free power" (like free drinks) is attractive, and so it is difficult to appreciate that the biggest limitation to its use is not technical, but economic. It is natural to think of wind power for generating electricity, but the cost is the bugbear. In England, however, the question of reducing costs—overhead is the chief one—is being investigated thoroughly. In Germany and Russia the installation of large electricity generating plants operated by wind power has already been planned.

Competition of Margarine.

There is something like a warning in these remarks of the *London Grocer*:—"An immediate result of the recent high prices of butter is the increase of 20 per cent. in the output of margarine during the four weeks ended 28th May. The figures for May are the highest this year, but it will be interesting to see how the June average works out now that butter prices (that is, London butter prices) are many shillings lower. There is, however, no doubt that retailers will be hard put to it to recover the butter trade which they have lost to margarine."

A Quick Business Trip.

The chairman of directors of a London butter firm, being desirous of opening business negotiations with the Australian Dairy Produce Board, came direct to Australia by air for the sole purpose of attending the annual meeting of the board which was held recently. He was welcomed by the chairman (Mr. T. M. Plunkett, M.L.A., of Beaudesert, Queensland) and, having stated his business and received the assurance that his proposal would be considered at the proper time, left the meeting to drive to the aerodrome for the return flight to London.

Dairy Instruction in New Zealand.

Farm dairy instruction on a national scale was brought into operation in New Zealand with the start of the present season. Sixty per cent. of the cost will be borne by the industry and 40 per cent. by the Government. The Dominion has been mapped out into seventy-seven districts, each of which will be served by a farm instructor working under the control of the dairy instructor of the particular district.

Australian Wheat-sowing Record.

Here is a record that will interest farmers on the Downs:—A Victorian farmer has sown 920 acres in 144 continuous hours, with fifteen hours of service, making the actual time 129 hours. Four men worked sixteen shifts night and day on one tractor and a 24-run combine at between 7½ and 8 miles an hour. It was the first high-speed tractor put into private use in the Commonwealth. The usual speed of tractors is from 4 to 5 miles an hour, and of horse teams from 2½ to 3 miles an hour. The usual sowing rate for tractors is 50 acres a day and 100 acres in twenty-four hours. Although the area was littered with mallee stumps, there was no damage to implements.

The Deadly Pea Rifle.

From the annual report of the Queensland Society for Prevention of Cruelty:—

In our last annual report we referred to the loss of life or injury to so many youths due to the pea rifle. We feel very strongly on this matter, and again this year we wish to draw attention to the tragedy which the pea rifle leaves in its wake. Since our last report we have noted twenty-eight cases reported in the daily Press of such tragedies, some being from other States. Here are brief references to a few of them:—

In a Brisbane suburb, a youth was cleaning a pea rifle, when it exploded, the bullet entering his temple and causing his death.

Youth of seventeen accidentally shot at Sandgate with a pea rifle.

Lad of sixteen accidentally shot with a pea rifle. Removed to hospital.

Lad of thirteen handling a pea rifle when it discharged accidentally, the bullet entering his body. Removed to hospital where he died.

Lad of thirteen standing by his brother, who was milking a cow, when another lad shot at some birds in a hedge. The bullet entered the thirteen-year-old lad's head and killed him.

Following the accidental discharge of a pea rifle, a lad of twelve years was conveyed to hospital in a serious condition.

Youth of seventeen out bird shooting. Put down his pea rifle whilst crossing a stream and asked another boy to throw the gun to him. In doing so, the rifle went off and killed him.

Youth aged seventeen shot and maimed a kookaburra (which is against the law). He was about to kill it when another kookaburra, probably its mate, flew by, and in swinging the weapon into line to shoot the second bird, it went off and fatally shot a young woman twenty years of age.

Schoolboys and young lads when intercepted using a pea rifle often give the answer that they "are only shooting sparrows, they are a pest and eat the seeds." We publish here an article which appeared in the *Graziers' Journal* recently, and which was written by an authority on such matters:—

"Spare the Birds that Eat the Insects.

"Air-guns in the hands of small boys, and sometimes in those of adults, who should know better, counteract the decrease of noxious insects. For it is the mossie, a preyer upon insects, which is usually the victim of human bloodthirstiness. There are other useful small birds, too, which are continually, all the year round, being killed 'for fun' . . . . Sparrows feed on grain, of course, if it is small, but they do more good than harm. . . . . Observe the sparrow and see what he does. He is continually flitting about after insects on the ground or in trees. If he pecks at a tomato or a peach he is trying to get a worm out. See what sparrows feed their nestlings—never grain, always caterpillars, moths, and flies. The green and black aphis lice which shrivel up the rose trees and appear to be fond of peach and plum leaves, and kill the buds, are the sparrows especial tit-bits. If there are no worms in your peaches or tomatoes, the sparrow will not damage them. . . . . "

Injuries to water fowl are also included amongst raids by lads. One instance was where a young duck was endeavouring to swim in amongst the reeds for protection, but made no progress, as it kept swimming in a circle; it was found that one of its legs had been shot away.

As schoolboys during school holidays are mainly responsible for the harm done to our birds, it may do a great deal of good if the teachers were to speak on the subject before the breaking-up for the holidays. . . . One of the world's great authorities on the subject has said that no system of education is complete unless the child is instructed on the principles of kindness to all created things, and that cruelty to animals will continue until the younger generation are shown what a cowardly and shameful thing it is.

Pigs Need Exercise.

Pigs kept continuously in sties or small runs spend most of their time sleeping or trying to get out of the enclosures. They are not given any chance of getting natural exercise, and when they go to the curer or pork butcher they fail to measure up to the full requirements of their class. Feeding and farm organisation may be perfect; large litter weights and early maturity may be the watchwords of management; and careful selection of breeding stock may be all that is desirable; but if the pigs have been denied opportunities for plenty of natural exercise they will be found to be unbalanced in fat and lean when they are cut up. Breeding, feeding, and open-air management are fundamentals in successful pig farming.

"Bull-dogging" Cattle at Shows.

Comment from the annual report of the Queensland Society for the Prevention of Cruelty:—

The reason put forward to justify bull-dogging at our Royal National Show is that it demonstrates to city people the methods used on cattle stations, whereas it really does not represent anything of the sort. As a matter of fact, it is not done on cattle stations to-day. The president of the Royal National Association is a cattleman of wide experience, interested in cattle all his life, and we venture the opinion that he has never seen, authorised, or permitted bull-dogging on any of his properties, and that he is well aware that it is not a practice on cattle stations. Then why represent it as such at our annual exhibition? Apart from other objectionable features of bull-dogging here are some pertinent Press comments on the subject under the heading of "Rodeo Economics":—

> "The Queensland Meat Board has not entered the controversy over steer-throwing and bull-dogging in which those who say it is cruel and unnecessary have scored most points, but we imagine its sympathy is with those who are endeavouring to eliminate this wild west touch from our Exhibition."

The latest reports from Smithfield Markets state that there is a great monetary advantage in the careful handling of cattle and that Queensland cattlemen must get it out of their heads that they are running a rodeo if they want to compete with the Argentine on the world's meat markets.

What is a Scrubber Cow?

The practice of herd-testing has been of inestimable service in New Zealand. The wonder is that it is not more universally employed. It so readily exposes those cows that cost money to keep. Perhaps the standard that would mark the scrubber cow may vary from district to district, but a safe line would perhaps be to judge one's own herd by the average production of the cows in one's immediate territory, and then to work up from that point. In the Temuka district 852 cows were in milk for 100 days or over. Of that number 211 found themselves in the class that produced between 250 and 299 lb. butterfat; 167 cows made between 200 to 249 lb. fat. Below that, one comes to the "suspect" class pretty quickly—90 were between 150 and 199 lb. fat; 41 were between 100 and 149 lb.; and 11 between 50 and 99 lb. That there is a good field for up-grading in South Canterbury is shown by the fact that 177 cows made between 300 and 349 lb. fat (this is where the real profit begins!); 93 produced between 350 and 399 lb.; 40 set a nice high standard in a class between 400 and 499 lb. fat; 16 did between 450 and 499 lb.; 5 excelled with between 500 and 549 lb.; whilst one put herself in a class by herself with 635 lb. fat—a fine record under herd conditions. If dairy farmers took the trouble to study the striking differences in the performances of the cows that are tested in their respective districts, and allowed their future policy to be guided by the lessons that the figures teach, progress towards the elimination of the unprofitable scrubber cow would be much more rapid that it is at present.—*The New Zealand Farmer.*

The Dairy Farm.

Large paddocks on a dairy farm are not economical. If practicable, the farm should be subdivided into a number of small paddocks, which allows for each to be grazed in turn, and then spelled for a period to enable the paddock to recover. Large paddocks often mean fodder wastage, as cattle roam all over the area, eating out the choice grasses and fouling the remainder, making them unfit for food.

A lot of waste results from faulty management of good pastures by stocking too heavily, which means, of course, that good grasses are eaten up quickly. If the paddock is spelled for a reasonable period, the pasture gets a chance to recover and the grasses have time to seed.

Unwise feeding methods constitute a prolific source of waste. It is necessary to balance the ration so that there will be no waste or loss in production through feeding an excess of one food constituent at the expense of another.

Free Milk for School Children.

Latest returns from the primary schools in England and Wales shows an appreciable increase in the number and percentage of children taking milk and in the number of schools operating the scheme. If parents cannot afford the penny, the milk is distributed free. The number of children receiving free milk is approaching 200,000.

An Electric Stock Fence.

The latest idea in fencing is a single wire charged with electricity. Mr. R. G. Watson is, it is believed, the first Queenslander to use electricity to keep pigs from getting out of bounds. Recently he installed an electric stock fence on his Beaudesert buttermilk piggery.

The outfit consists principally of a 6-volt battery, a transformer, and a spring-balanced flywheel which makes a regular break in the flow of current in the wires. The fence is actually a line of light stakes to which the wire is attached—with insulators, of course.

In applying the idea, Mr. Watson erected a light fence of wooden stakes across a plot of sweet potatoes with two lines of light fencing wire attached. As a try-out, about 60 small pigs were driven on to the potato patch. As soon as they spread out and contacted with the charged wires, the mild shocks received turned them back and nothing would induce the pigs to repeat the experience. Afterwards, a fence was erected along a seven-chain strip of sweet potatoes, making a narrow paddock 5 yards wide. When the pigs were driven on to this area, it was observed that those which had made contact with the wire previously kept well away from it. Within a few minutes not one of them attempted to break through the low light fence. After four days on this small area the pigs had eaten out all potatoes and other growth, leaving the whole of the narrow paddock bare to within a foot of the electrified fence. Hungry as they became, they would not eat down the feed which was close to the fence.

Already the idea of an electrically-charged stock fence has been adopted on some dairy farms in New South Wales, where cattle are kept within bounds by a single-charged wire. One shock is enough to make the cattle canny, and thereafter they keep well away.

It is claimed for the electric fence that it is cheap, easy to erect, dismantle and re-erect, and that there is no doubt about its effectiveness.

—*T. Abell.*

The Pig on the Dairy Farm.

Pig raising is an occupation with no appreciable peak load of work to clash with other jobs in dairy farming, and the by-products—skim milk, buttermilk, or whey—are converted readily into cheap and appetising pork.

On practically every dairy farm in Queensland, pigs have been and always will be a valuable side-line. Too often the pig has been regarded as merely necessary to consume milk or whey that would otherwise be wasted.

Pigs, properly housed and fed, may even rival the cows themselves as money makers.

The open-air or pasturage system, under which pigs are allowed to graze at will in a good, well-grassed paddock, enables the dairy farmer to get the full benefit of his by-products. Where crops and pasturage are available, the young pigs can be reared chiefly on those feeds—the skim milk being reserved largely for the older pigs being topped off in the sty. The young pigs will, of course, go through the topping-off process in their turn.

Cheap and effective shelter can be provided in the pig paddocks. A small shelter can be quickly knocked together by any handy man. It should be strong and easily movable (on skids for preference); and, of course, should be rain, wind, and draught proof.

No Show Umpires.

There are no umpires at Danish agricultural shows. The Danes glory in plural judging. The minimum bench comprises three judges, and there are often five judges working together. If this plural bench of judges is divided among individual entries or groups, they must give all the equal rivals an equal award of prizes—two or three firsts, as circumstances warrant, and so on.

School Children and "Grass Consciousness."

The Queensland Pasture Improvement Committee is very pleased with the report from the Department of Public Instruction on the work carried out by pupils of the State schools. Although dry weather had adversely affected the number of schools doing this project work, the interest displayed by the youngsters has been maintained at a high pitch. Last year more than 5,000 packets of grass seed were distributed and sown. The list of successful competitors covers practically all portions of the State.

Orchard Notes

DECEMBER.

THE COASTAL DISTRICTS.

THE 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 chance 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 carried out 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 sell.

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, excepting, of course, there is a good fall of rain sufficient 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.

THE COUNTRY PRESS—ITS VALUE.

"I believe every country district should have its own local paper," said the Governor (Sir Leslie Wilson), when opening the thirty-first annual conference of the Queensland Country Press Association.

"I have a great admiration for the Press," continued His Excellency. "In my life I have come in very close touch with it. Sometimes, in England, it was a little critical, but relations in the colonies have been entirely cordial. Nobody recognises the power of the Press more than I do."

In these days when aeroplanes and other means of transport were bringing Australia in close touch with the people of Europe, it was necessary that country people, as well as those in the city, should be supplied with accurate information of Imperial as well as local affairs, said Sir Leslie. Members of the Country Press Association were performing a great service. The association had been in existence for more than thirty years and had a membership of seventy.

There was one British paper—"The Times"—which had, perhaps, the best reputation of all newspapers. It represented the views of the whole Empire accurately, and its articles were reported in other papers throughout the world.

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 can be recommended as economical and profitable means of conservation where the farmer does not possess an overhead concrete silo.

However, it is the autumn-harvested crops which usually provide the greatest bulk of conserved fodder, so that December sowings of suitable bulky summer fodder crops will prove ideal 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 thereto, will be found to graze freely.

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 to be preferred.

Buckwheat can be 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 finalised during the 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.

The comparatively dry wheat seasons experienced during recent years have proved that adequately summer-fallowed land invariably produces profitable yields.

December is usually a busy month, through the successive sowing of a variety of fodder and grain crops, together with the scarifying of row crops already established.

SOME FACTORS IN DAIRY FARM MANAGEMENT.

There are certain essential factors in dairy farm management that make all the difference between success and failure. Although milking may be regarded as the main job on a modern dairying property, it is really the culmination of herd management, breeding, feeding, and attention to detail.

Why is it that on two identical farms, with only a boundary fence between them, production will show a vast variation? The answer is found in the fact that on one property constant attention is given to all the operations—from calf-rearing to the final disposal of the milk or cream—while on the other farm careless or bad management in one or two operations mars the whole effort.

It is useless to lay down good pastures and provide food, shade, shelter, and water for stock, and then keep on breeding from low-type producers.

Another important matter which should not be overlooked is the fact that modern intensive methods of dairy farming place a very high strain on the constitution of the dairy cow, and much of this constitution may be ruined by faulty methods in calf-rearing. From a practical viewpoint it is better to feed the breed than to feed the weed.

Our Babies.

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

DIARRHŒA.

IT is not many years since diarrhœa was the most frequent cause of death amongst infants. In recent years there has been a large diminution in the incidence of the disease and a great reduction in the number of deaths from this cause. Diarrhœa tends to occur during the summer months, partly because milk decomposes more rapidly during hot weather, but chiefly because milk becomes infected by disease-producing germs which are conveyed by flies during this season of the year. It is only by an intelligent use of our knowledge of the cause and spread of a disease that we can do anything to prevent it.

By diarrhœa is meant the passage of frequent, loose or watery motions. It is often caused by the presence of some irritating material in the bowel. It is due to Nature's effort to expel this that the motions become frequent. It is important to remember that the motions of breast-fed infants are never firm and solid like those of artificially fed infants. A breast-fed infant in normal health may have two or three soft motions a day. A change in the colour of the motion to a pale yellow may be the first sign of digestive upset. The passage of two or three loose motions in an artificially fed infant, particularly if they are pale or green, calls for attention. According to their cause diarrhœas may be divided into two kinds—

1. Non-infectious diarrhœa.
2. Infectious diarrhœa.

1. *Non-infectious Diarrhœa.*—This may be caused by simple over-feeding with food which is quite suitable when not given in excess. Diarrhœa due to this cause may occur at any time of the year, but it is more likely to occur in summer when babies, like older people, are more thirsty. Mothers often fail to distinguish between hunger and thirst in their babies. Thirst is satisfied by plain boiled water, of which every baby should receive a sufficient amount between his feeds. If a baby is given milk every time he is thirsty, his digestion will be upset, because milk is a food and he will be induced by his thirst to take more than he is able to digest. There are strong, vigorous, greedy babies who habitually take more than they can digest and you will be able to observe numerous large curds in their motions. Sooner or later many of these babies suffer from digestive upset, if they are allowed to continue over-feeding.

Unsuitable foods may cause diarrhœa. These are of so many kinds that it would be difficult to enumerate all of them here. Some of these are given because the mother knows no better, and in other cases, because the mother finds it easier to give the food than have the child emotionally upset by her refusing it. During the crawling stage and later many children discover for themselves and eat food of an unsuitable nature.

Treatment of Non-infectious Diarrhœa.

Diarrhœa occurring in a breast-fed baby is as a rule never as serious as diarrhœa in an artificially fed baby. When it occurs it is usually wise to give a teaspoonful of castor oil at the beginning, in order to assist Nature in expelling any irritating material which may be present in the bowel. Omit one or two breast feeds or more, depending upon the severity of the condition and the manner in which the infant responds. During this time allow him as much boiled water as he will take. On resuming breast feeding commence with short feeds, giving boiled water before each feed until an improvement is noticed in the character of the motions.

In the case of the artificially fed infant suffering from diarrhœa, all food is stopped, a dose of castor oil is given, and he is encouraged to take boiled water freely. After a few hours he is allowed as much sweetened barley water as he will take. Dried apple powder mixed with water and later with whey is found useful, particularly in the more severe cases. As the condition improves milk may be gradually added to this mixture until he is well enough to be placed on a milk mixture suitable for his age. Children who were having cereal jellies, vegetable broth and vegetable puree previous to the onset of the diarrhœa are allowed these before the milk is added.

2. *Infectious Diarrhœa.*—This is a much more serious condition which is caused by the infant or older child swallowing disease-producing germs which were present in the milk or other food which he has taken. In some cases the illness begins suddenly with high fever and vomiting, the child becoming drowsy and limp. In other cases the illness begins more gradually and the seriousness of the condition is not at first recognised. The motions are frequent and may be large, green, watery, slimy, and offensive, or they may be frequent and small containing blood and slime and having a "stale" odour. The passage of the motions may be accompanied by considerable straining and pain.

Treatment of Infectious Diarrhœa.

In every case of diarrhœa in which the child looks ill and particularly if he is feverish, or is passing blood and slime, or in which the condition has been treated by the methods recommended in the treatment of non-infectious diarrhœa and no improvement has occurred within twelve to twenty-four hours, medical advice should be sought immediately.

The Prevention of Diarrhœa.

The responsibility for the prevention of diarrhœa rests with the mother or person in charge of the feeding of the infant. Breast-fed infants have an infinitely better chance of escaping an infectious form of diarrhœa than artificially fed. As has been pointed out, they may suffer from food diarrhœa as the result of over-feeding, or of swallowing some unsuitable food. It is inadvisable to begin weaning during a spell of very hot weather. Never try to force a child to take his food, particularly during the heat, when he requires less. Secure clean and safe milk for the artificially fed infant as well as the older child. All milk should be scalded unless it can be obtained pasteurised in sealed bottles. After scalding it should be cooled rapidly, and kept cool. Scalded and pasteurised milk, as well as powdered milk mixtures, may become contaminated. In order to avoid this, care must be taken to protect them from flies, dust, and dirty fingers, and to see that teats, bottles, and other utensils are thoroughly washed and scalded immediately after use. Milk which is sweet may contain disease-producing germs. Diarrhœa may be caused by the use of stale milk. Avoid sudden changes in the quantity, quality, or composition of milk foods. If a change is necessary, make it gradually by grading baby on to the new mixture.

You may obtain information on all matters concerning child welfare by visiting the nearest baby clinic, or by writing to the sister in charge, or by communicating direct with the Baby Clinic Training Centre, Alfred street, Valley, Brisbane.

DIET PLANS REVIEWED.

(Contributed by the Queensland Nutrition Council.)

These diet plans are by no means an attempt to lay down economic standards but are merely a practical illustration of how best to secure a good nutritive value at different levels of food expenditure. They are based on intensive research carried out by nutrition scientists in America and published by the United States Department of Agriculture. The figures have been slightly modified to suit Australian conditions.

Each of the plans was based on the following twelve groups of foods:—

1. Milk in all its forms.
2. Tomatoes and citrus fruits.
3. Potatoes.
4. Green leafy and yellow vegetables.
5. Dried beans, peas and nuts.
6. Dried fruits.
7. Other vegetables and fruits.
8. Eggs.
9. Lean meat, fish and poultry.

10. Flour, bread and cereals.
11. Fatty foods, such as butter, lard, bacon.
12. Sweet foods, such as sugar, honey, jam, syrup.

In each diet, these foods were apportioned differently, nutritive value and cost being taken into consideration. In every plan, however, special emphasis was placed on milk, fruit and vegetables. In all cases, at least one-fifth of the money spent on food was used for purchasing milk. In the moderate cost diet, cereals to some extent replace the vegetables, fruit and meat, and this change is even more marked in the minimum cost and restricted diets. But even here enough vegetables, fruit, eggs, and lean meat are allowed to supply vitamins, minerals, and protein not adequately furnished by bread and by milk. The restricted diet however, is not meant to be used over an indefinite period as it does not provide sufficient quantities of the foundation foods to ensure good health over a long period.

In the low cost plans it is essential that wheatgerm or whole meal cereal and bread be used, as there is not a sufficient quantity of vegetables to supply vitamin B without it. Though the quantity of milk is somewhat lower than in the other plans, milk and cereal products together are the mainstay of these cheaper diets, because they give more nutritive value in return for the money spent than do most other foods. Enough fats and sugar are added to round out the fuel value.

The differences between the various plans show most clearly when the weekly food supplies for a definite-sized family are compared. For instance, a family of four on the liberal diet buy nearly twice as many pounds of fruit and vegetables, about two and a-half times as much lean meat and nearly twice as many eggs as the same sized family on a minimum cost adequate diet. There is a marked difference, too, in the individual foods that can be selected for each of these diets, since this choice depends largely on the total amount of money available for food. Quality, the kind of food and the season of the year influence the cost of many individual items.

It is not necessary or likely that the housewife will weigh out a supply of food exactly representing one of these diet plans week after week. However, if you wish to secure the greatest return in nutritive value for the money spent you will find it helpful to follow one of the plans for two or three weeks, making careful notes of food weights and costs. This will be especially valuable if you have only a limited amount of money to spend on food. It does not take long to get the patterns of the diet well in mind and then to make purchases that run pretty close to one or another of the plans, without continuing to keep an accurate record.

The individual housewife will undoubtedly make changes to meet the tastes and food budget of her family. Such changes always mean decreasing the quantities of some foods by increasing the amount of cereals and decreasing somewhat the quantities of some of the other foods.

A minimum-cost diet should be modified only to improve it. If the pocket allows, the food value and flavour of the suggested assortment of foods may be improved by increasing the fresh fruits and vegetables. The moderate cost plan may be the guide for such changes. The family which can barely afford an adequate diet by making food money go as far as possible should not try to adjust the assortment of foods in the

minimum cost diet. The relation of food value to food cost is so close that the easiest way to get a cheaper diet that is satisfactory (at least for a time) is to resort to the restricted plan.

Any modifications in a restricted diet should be those that will improve its nutritive value. Families who, because of some emergency, are living on a diet such as the restricted plan suggests, should look forward to increasing, as soon as possible, quantities of fresh succulent vegetables, fruit, milk, eggs, and lean meat. These changes will, of course, increase the cost. They should be made by reducing some foods and increasing the quantities of others, in order to keep the fuel value in the diet fairly consistent. Decreasing one type of food does not necessarily mean that it is less wholesome than the other foods. It simply means that some foods supply nutriment more cheaply than others, or that some are more pleasing to the individual family.

The family purchasing a diet as expensive as the liberal diet has the best choice among foods. It may modify the plan in many ways; for example, by using fewer pounds of potatoes and dried fruits, and adding more fresh vegetables and fruits. This will increase the cost. Some families may wish to use more cereals and bread, and will, in that case, probably decrease the amount of fruit, vegetables, and meat, using the moderate-cost plan as a guide.

The suggestions for a moderate cost adequate diet may also be modified up or down the scale, according to the amount of money a family has to spend on food. Increasing vegetables, fruit, eggs, and meat towards the quantities suggested for the liberal diet tends to improve protein, mineral, and vitamin values, but also brings up the cost. A diet of this type can, on the other hand, be brought down in studying the plan for the minimum cost adequate diet.

If any readers would like to work out the cost for a week of the diet that suits their particular needs, the Nutrition Council would be interested in their findings. Send them to the secretary of the Nutrition Council, Physiology School, University of Queensland, for the information of the Economic Subcommittee of the council.

Those who have read Milton's "Paradise Lost" may remember this passage, which is as true to-day as when it was first written—

"If thou wilt observe
The rule of not too much, by temp'rance taught,
In what thou eat'st and drink'st, seeking from thence
Due nourishment, not gluttonous delight,
Till many years over thy head return,
So may'st thou live till like ripe fruit thou drop
Into thy mother's lap, or be with ease
Gathered, not harshly pluck'd, for death mature."

IN THE FARM KITCHEN.

BANANAS ON THE MENU.

Banana and Cheese Savoury.

Take 3 bananas, 1 tablespoonful capers, ¼ lb. cheese, 6 fingers brown bread and butter, anchovy paste.

Spread the fingers of bread with anchovy paste. Cut the cheese into thin fingers and place one on each finger of bread. Skin the bananas and cut them in half lengthways. Put a banana flat side down on each piece of cheese, and decorate it down the centre with a row of capers. Arrange star shape on a plate. Garnish with parsley.

Banana Cheese Salad.

Take 4 bananas, 1 egg, 1 or 2 apples, 2 tomatoes, 2 oz. cheese, lemon juice.

Boil the egg for fifteen minutes until hard, then cut into slices. Peel and quarter the apple, remove the core, and cut into slices. Grate the cheese finely, slice the tomatoes, peel and slice the bananas. Arrange all these prepared slices tastefully in a dish, sprinkle with lemon juice and a little grated cheese, pile the remainder of the cheese in the centre, and serve with salad cream.

Banana Toast.

Take ¾ gill banana pulp, 5 oz. cheese, 3 oz. butter, 1 egg-yolk, 6 or 7 rounds bread, chopped parsley, seasoning to taste.

Toast the bread, then spread with butter and keep hot. Grate the cheese finely. Peel and mash up sufficient bananas to make the pulp. Melt 1 oz. of butter in a saucepan, add the grated cheese and banana pulp, and stir over a low heat until creamy. Draw aside, stir in the egg-yolk, and cook gently for a few minutes, then season with pepper, salt, and mixed mustard. Spread on the prepared toast and garnish with finely-chopped parsley.

Banana Savoury.

Take 3 bananas, 6 finger slices of bread, 1 small cream cheese, 1 hard-boiled egg-yolk, lemon juice, seasoning, fat for frying.

Split the bananas into halves and cut a small piece off the end of each half. Cut slices of bread the same length as the prepared bananas and fry in deep fat until golden brown. Then drain on paper. Spread a thick layer of cream cheese on the fried bread and season with pepper. Place a piece of banana on each, sprinkle with lemon juice and pepper, and garnish with powdered egg-yolk.

To powder the egg-yolk, just rub it through a wire sieve or strainer.

Curried Bananas.

Take 4 bananas, 3 oz. rice, ½ oz. butter, ½ oz. flour, ½ apple, ½ onion, 1 teaspoonful salt, 1 desertspoonful curry-powder, 1½ gills water, juice ½ lemon, 2 hard-boiled eggs.

Wash the rice and boil it for fifteen minutes with the salt in plenty of fast-boiling water. Boil the eggs for ten minutes, put them in cold water, and remove the shells. To make the curry sauce, peel and chop the apple and onion, and fry them in the butter for five minutes. Stir in the flour, curry-powder, lemon juice, and a pinch of salt, and add the water gradually. Stir the sauce till it boils, lay the skinned bananas in the sauce, and beat them for about five minutes. Add a little more water if necessary. Strain the rice into a colander and grate a little onion on to it. Do not mash the rice. If it is boiled for exactly the right time each grain will be separate. Heap the rice on a hot dish with the bananas and sauce round and garnish with quarters of hard-boiled egg.

Banana and Pineapple Royal.

Take 7 bananas, ¼ pint milk, ½ oz. gelatine, 1 small tin pineapple.

Peel six of the bananas and mash them to a pulp. Drain the syrup from the pineapple and put the fruit through a mincer. Dissolve the gelatine in a saucepan with half a gill of the pineapple juice, add the remainder to the banana pulp. Stir in also the minced pineapple, leaving out a little for decoration. Strain in the dissolved gelatine, then add the milk, and some castor sugar if required. Turn into a dish and leave to set. Just before you are ready to serve it, heap some minced pineapple in the centre and add the remaining banana cut in slices.

Ginger Bananas.

Take 6 bananas, 1 gill cream, 3 oz. preserved ginger, apricot jam, a few almonds, castor sugar, vanilla.

Blanch and chop some almonds. Place them on a sheet of paper on a tin, and put into the oven until a golden brown. Peel the bananas and split into halves lengthways, then scoop out a little ridge down the centre. Cut the ginger into tiny pieces and place along this centre hollow. Heat a little jam, and, if it is stiff, thin down with just a very small quantity of water, then rub through a sieve. Spread the edges of the halved bananas with this, then coat with the prepared almonds. Whisk the cream until it stiffens, sweeten and flavour to taste. Put this into an icing bag and force a line down the centre of each halved banana. Decorate with pieces of ginger.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1938 AND 1937, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of years' records.	Sept., 1938.	Sept., 1937.		Sept.	No. of years' records.	Sept., 1938.	Sept., 1937.
North Coast.	In.		In.	In.	*South Coast–contd.*	In.		In.	In.
Atherton	0·73	37	0·95	1·19	Gatton College ..	1 55	39	..	0·20
Cairns	1·69	56	0 81	1·62	Gayndah	1·56	67	0·10	0·52
Cardwell	1·53	66	0·94	1·15	Gympie	2·10	68	1·66	0·74
Cooktown ..	0·57	62	0·12	0·47	Kilkivan	1·70	59	0·11	0·70
Herberton ..	0·56	52	0·35	0·60	Maryborough ..	1·92	67	0·68	0·16
Ingham	1·59	46	0·90	1·46	Nambour	2·48	42	0·86	0·32
Innisfail	3 52	57	3·00	2·96	Nanango	1·81	56	0·95	0·53
Mossman Mill ..	1·71	25	0·47	1·26	Rockhampton ..	1·29	67	0·01	..
Townsville ..	0·76	67	..	..	Woodford ..	2·14	51	0·95	0·20
Central Coast.					*Central Highlands.*				
Ayr	1·31	51	..	0·01	Clermont ..	1·00	67	0·02	0·04
Bowen	0·80	67	0·07	..	Gindie	1·05	39	..	0·05
Charters Towers ..	0·80	56	..	..	Springsure ..	1·30	69	0·63	0·09
Mackay P.O. ..	1·55	67	0·14	0·51	*Darling Downs.*				
Mackay Sugar Experiment Station	1·48	41	0·18	0·42	Dalby	1·67	68	0·56	0·66
Proserpine ..	2·07	35	0·84	0·99	Emu Vale ..	1·76	42	0·95	0·78
St. Lawrence ..	1·25	67	0·16	0·65	Hermitage ..	1·56	32	..	0·75
South Coast.					Jimbour	1·47	50	0·37	0·35
					Miles	1·34	53	0·96	0·31
					Stanthorpe ..	2·28	65	2·18	0·17
Biggenden ..	1·54	39	0·13	0·33	Toowoomba ..	2·12	66	0·58	0·59
Bundaberg ..	1·57	55	0·31	0·07	Warwick	1 82	73	1·41	0·76
Brisbane	2·00	86	0·99	0·20					
Caboolture ..	1·83	51	0·39	0·30	*Maranoa.*				
Childers	1·79	43	0·32	0·13					
Crohamhurst ..	2·63	45	0·84	0·23	Bungeworgorai ..	0·97	24	..	0·20
Esk	2·09	51	0·63	0·35	Roma	1·41	64	0·58	0·27

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1938.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·99	85	68	84	15, 16	63	5	12	3
Herberton	..	73	54	83	15	46	1	35	3
Rockhampton	30·14	79	57	92	16	49	1, 13	1	1
Brisbane	30·19	73	53	87	16	46	4	99	4
Darling Downs.									
Dalby	30·17	76	46	85	15	33	1	56	5
Stanthorpe	..	67	39	76	28	26	1	218	9
Toowoomba	..	70	47	81	15, 17	37	1	58	6
Mid-Interior.									
Georgetown	30·10	89	61	98	16	50	6	..	..
Longreach	30·08	86	54	95	16	46	1	5	1
Mitchell	30·13	78	44	90	30	32	2	108	3
Western.									
Burketown	29·99	89	63	98	17	54	1	..	..
Boulia	30·04	87	54	100	28	47	12	..	..
Thargomindah ..	30·11	80	56	96	30	44	1	..	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	November. 1938.		December. 1938.		Nov., 1938.	Dec., 1938.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	p.m.
1	5·3	6·9	4·49	6 31	11·58	12·25
					p.m.	
2	5·2	6·10	4 49	6·32	12 51	1·21
						p.m.
3	5·1	6·11	4·49	6 33	1·45	2·16
4	5·0	6·11	4·50	6·34	2·42	3·15
5	5·0	6·12	4 50	6·35	3·35	4 17
6	4·59	6·13	4·50	6·36	4·33	5·17
7	4·58	6·13	4·50	6 37	5·34	6 24
8	4·57	6·14	4·50	6·38	6·36	7·27
9	4·57	6·15	4·51	6·38	7·40	0 23
10	4·56	6·15	4·51	6·39	8·42	9·16
11	4 56	6·16	4·51	6·39	9·40	10·4
12	4,55	6·17	4·51	6·40	10·31	10 45
13	4·55	6·18	4·52	6·40	11 21	11·26
14	4·54	6·18	4 52	6·41	..	..
					a.m.	a.m.
15	4·54	6·19	4·52	6·41	12·5	12·4
16	4·53	6·20	4·52	6·42	12·45	12·44
17	4·53	6·21	4·53	6·42	1·30	1·22
18	4·53	6·21	4·53	6·43	2·2	2·1
19	4·52	6·22	4·53	6·43	2·43	2·44
20	4·52	6·23	4·54	6 44	3·20	3·30
21	4·52	6·24	4·54	6 44	4·3	4·17
22	4·51	6·25	4·55	6·45	4·47	5·7
23	4·51	6·26	4·55	6 45	5·32	5·59
24	4·51	6·27	4·56	6 46	6·30	6·25
25	4·51	6·28	4·56	6·46	7·12	7·43
26	4·50	6·29	4·57	6·47	8·6	8·31
27	4·50	6·29	4 58	6·48	8·59	9·26
28	4·50	6·30	4·58	6·48	9·49	10·18
29	4·50	6·31	4·59	6·49	10·39	11·10
30	4·50	6·31	4·59	6·49	11·32	12·4
31			5·0	6·50		1·0

Phases of the Moon, Occultations, &c.

6th Nov.	○ Full Moon	8 23	a.m.
15th ,,	☾ Last Quarter	2 20	a.m.
23rd ,,	● New Moon	10 5	a.m.
30th ,,	☽ First Quarter	1 59	p.m.

Perigee, 11th November, at 2.0 p.m.
Apogee, 27th November, at 1.0 p.m.

A partial Eclipse of the Sun, 21st and 22nd November, will only be seen on the western coast of North America, on the eastern coast of Asia, in Japan, and some small islands in the Pacific Ocean.

On the 25th Mercury will reach its greatest distance, 22 deg., east of the Sun, after which the little planet nearest the Sun will begin to decline rapidly.

Half an hour before sunset on the 29th Jupiter will be 7 deg. south of the Moon, which will set at midnight, half an hour earlier than Jupiter.

Mercury will seem to be stationary on the 4th December and Venus on the 9th, both travelling for a few days directly towards the Earth, after which they will appear to move with retrograde motion until they reach their western elongation as a morning star.

Mercury rises at 5.43 a.m., 40 minutes after the Sun, and sets at 7.10 p.m., 1 hour 2 minutes after it on the 1st; on the 15th it rises at 6.1 a.m., 1 hour 7 minutes after the Sun, and sets at 7.53 p.m., 1 hour 33 minutes after it.

Venus rises at 6.21 a.m., 1 hour 18 minutes after the Sun, and sets at 8.20 p.m., 2 hours 12 minutes after it on the 1st; on the 15th it rises at 5.12 a.m., 18 minutes after the Sun, and sets at 7.4 p.m., 44 minutes after it.

Mars rises at 2.37 a.m. and sets at 3.34 p.m. on the 1st; on the 15th it rises at 12.56 a.m. and sets at 1.22 p.m.

Jupiter rises at 12.21 p.m. on the 1st and sets at 1.30 a.m. on the 2nd; on the 15th it rises at 11.38 a.m. and sets at 12.50 a.m. on the 16th.

Saturn rises at 4.8 p.m. on the 1st and sets at 4.1 a.m. on the 2nd; on the 15th it rises at 3.10 p.m. and sets at 3.4 a.m. on the 16th.

At the beginning of November the Great Square, which rises and sets diamond-shaped, will be four-square on the Meridian at 9 p.m. with Saturn nearly in line with its eastern side, while the Scorpion is setting south-west, Orion is rising due east, but the great northern constellations will be seen to better advantage next month.

1st Oct.	☽ First Quarter	3 6	p.m.
9th ,,	○ Full Moon	7 37	p.m.
16th ,,	☾ Last Quarter	7 24	a.m.
23rd ,,	● New Moon	6 42	p.m.

Perigee, 9th December, at 1.0 a.m.
Apogee, 25th December, at 5.0 a.m.

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

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

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