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

QUEENSLAND AGRICULTURAL JOURNAL

Volume 64 1 APRIL, 1947 Part 4

Event and Comment.

Soil Conservation.

AS already announced by the Minister, Hon. H. H. Collins, a comprehensive programme of investigation and demonstration to ascertain the best methods of conserving soil has been entered upon by the Department of Agriculture and Stock. As part of the investigational section of this programme, work has commenced at the Hermitage Regional Experiment Station in the Swan Valley on the Eastern Darling Downs. Ascertaining suitable cropping rotations for use on various types of slopes to conserve soil and to indicate the need of terraces, and the best types and methods of constructing them, are part of the general plan.

For terrace formation, various types of equipment have been purchased and it is intended to supplement this machinery with a series of installations which will enable soil losses and run-off of storm rains to be accurately measured under a range of cropping rotations. Similar work is also planned for the Kairi Regional Experiment Station on the Atherton Tableland. It is anticipated that the data obtained from these field investigations will form the basis for the laying down of a sound system of soil conservation which will involve correct land use practices and improvement of soil fertility and productivity. Plans for extending similar activities to selected demonstration areas in other places on the

Darling Downs are well in hand. Elsewhere, notably in the South Burnett, a considerable number of demonstration areas have already been established.

Mr. Collins has also announced the establishment of a new position within the Department of Agriculture and Stock, that of Soil Conservationist, to which an experienced and fully-qualified officer has been appointed.

Market Price Reporting Service.

Another new development in the Department of Agriculture and Stock has been announced by the Minister, Hon. H. H. Collins, and that is the inauguration of the Market Price Reporting Service within the Division of Marketing, which is designed to provide primary producers and others interested with authentic daily reports of market movements and values. An officer who has had many years of experience of price reporting in the Sydney markets is in charge of this additional service to all engaged in the land industries. As a commencement, daily price reports are prepared and disseminated to fruit and vegetable growers; this benefit will be extended to other primary producers as trained staff and facilities become available.

Tobacco Irrigation.

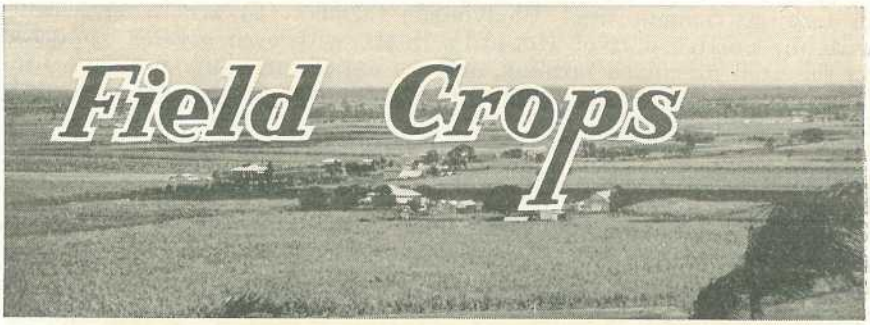
Outlining a water conservation scheme for irrigating tobacco lands at Dimbulah and Mareeba, the Minister for Public Lands, Hon. A. Jones, has announced that early developments in the project would include a weir on the Walsh River 3 miles upstream from Dimbulah; and a weir on Granite Creek, a tributary of the Barron River, 4 miles above Mareeba.

Experience had shown that stability of the tobacco industry depended on the availability of water, said Mr. Jones. The Walsh River project provided for a series of weirs, and the one near Dimbulah would back up the water for at least 2½ miles and impound 800 acre feet or 220,000,000 gallons. The most important part of this scheme, however, would be a storage dam 21 miles above the new weir, which would have a height of at least 60 feet and form a lake 5 miles long and 5 miles broad.

A series of smaller weirs was planned for the tributaries of the Barron River, added Mr. Jones. One weir had already been built on Emerald Creek, and others would be constructed on other tributaries in Granite, Atherton, Rocky and Tinaroo Creeks.

Last month the first sod of the Walsh River weir was turned by the Minister for Public Works, Hon. H. A. Bruce; a similar function at the Granite Creek site was performed by the Minister for Agriculture and Stock, Hon. H. H. Collins.

Mr. Jones also stated that work would begin on the big border streams project as soon as men and materials were available. The water stored would supply 70,000 acres of irrigable land along the Macintyre and Dumaresq Rivers. The scheme would involve a big barrage at Mingoola, with twelve weirs and five regulators down-stream.



Soil Management.*

W. J. S. SLOAN.

Introduction.

DURING recent years the problems of soil erosion and loss of soil fertility have received increased attention, and publicity has been given to criticism of modern methods of cultivation and the extensive use of artificial fertilizers. In general, would-be agricultural reformers claim that the salvation of agriculture lies in the adoption of "back to nature" methods, the abandonment of inorganic fertilizers, and a revision of methods of soil preparation and crop cultivation. There is no monoculture in nature, that is, the growing of single crops in pure culture; mixed culture is the rule. Cultivation tends to destroy the fertility reserve in the soil which under natural conditions is built up in the form of humus in the upper layers of the soil by the activities of micro-organisms, earthworms, and the like, from the residues of plant and animal life. Therefore, critics assert that stable agriculture and successful food production can only be secured by imitating as closely as possible the processes which operate in nature. However, the improvement and maintenance of the soil humus content is not an easy problem and this paper is presented for the purpose of briefly examining methods advocated as substitutes for present-day practices by several writers.

Maintenance of Soil Humus in Cultivated Land.

Howard (2) believes that the ideal method is to make humus in specially prepared compost heaps from plant residues and the dung and urine of farm animals and then return it to the fields. Ploughing, thorough drainage and sub-soiling, he says, are all essential for aeration of the soil, but he condemns the continued expansion of the machine in agriculture because manure from animals is necessary for correct humus production. Apart from improvement in the soil structure and the addition of plant nutrients, the benefits of specially prepared humus are claimed to include the creation of a favourable soil environment for the development of mycorrhizas on the roots of crop plants. This fungal root association is suggested as the basis of healthy plant growth and resistance to pests and disease. Howard (3) and Sykes (7) claim further that the health of stock is improved when they are grazed and fed on crops produced by the use of humus. Moreover, Howard believes that the health of the populace generally would be raised if a keener appreciation of the use of properly prepared humus could be developed

* Paper presented at the Bundaberg Conference, Q.S.S.C.T., April, 1946, and reprinted from *The Cane Growers' Quarterly Bulletin* (Bur. Sug. Expt. Stns., Dept. Agris. & Stk., Q.), Jan., 1947.

in farming communities. Biodynamic farmers (6) are in agreement with the greater part of Howard's thesis, with even greater emphasis on the need for mixed farming, and the use of farm animal manures in humus production. The basis of their argument is that the soil must be fed, not the plant. A fertile soil is rich in organic matter and is alive by virtue of the fact that it contains enormous populations of micro-organisms. If the latter are fed with properly prepared humus, healthy plant growth and high quality produce are a natural sequence. Biodynamic farmers hold extremist views with regard to humus preparation, and believe that manure and compost heaps should be treated with certain mysterious starters prepared by fermenting at specific depths in the soil special herbs and plants in close contact with certain parts of animals. Emphasis is laid particularly on the value of humus prepared from animal manure and urine in the belief that such humus contains special growth-promoting substances.

A variation has been introduced by Faulkner (1) in a popular, but unscientific, book which has received considerable publicity. Humus production and the imitation of nature's methods are the main theme, but the use of the mouldboard plough is violently opposed because the complete burial of organic matter is in sharp contrast to the rotting down of organic matter on the soil surface which takes place under natural conditions. Soil preparation and crop cultivation therefore should be limited to the top few inches of the soil. Faulkner believes that the drainage problem is accentuated by the deep burial of organic matter, because rain water would be absorbed by the soil and not accumulate in hollows if the soil surface was maintained in an open granular condition by the incorporation of plant wastes in the top few inches only. Unlike the writers previously mentioned, he does not define any method for preparing humus under special conditions off the field, the emphasis being laid on sheet composting in the field itself by chopping up green manure crops and plant residues with disc harrows or similar implements in a manner comparable to the operation known as stubble mulching.

Although it has received greater prominence in recent years, the value of soil humus has long been recognized. No modern agriculturist of repute has failed to appreciate the merits of organic matter in soil conservation and crop production and to advocate consistently the maintenance and improvement of the humus content of cultivated soil. However, the artificiality of agriculture is a problem which cannot be overcome. While the need for rotations is recognized, there is no alternative to monoculture over large areas of arable land. Under natural conditions the law is survival of the fittest, but under cultivation the aim is to prevent the growth of all plants other than the main crop. Sowing fields with mixed cultures of crop plants would create chaotic conditions in cultivation and harvesting. Clearing and fencing land, row cropping, the development of new strains of crop plants, and so on, are obviously unnatural, but very necessary to maintain the volume of primary production.

The need for maintaining humus at an adequate level in cultivated soil is undeniable, but methods must be both practical and economic. Preparation of compost heaps under special conditions would require a considerable expense in labour and add to costs of production. Moreover, the machine has come to stay in agriculture and the number of farm animals will steadily decline in the future on farms mainly devoted to the cultivation of a single crop. The claim that well prepared humus

confers on the soil special properties of significance to growth of crops, apart from its mineral nutrient content and the beneficial effect on soil structure, has not been satisfactorily proved. There is strong evidence that mycorrhizas are associated with vigorous growth of certain forest trees, but Laycock (4) investigating the effects of endotrophic mycorrhizas on cacao found that they tended to be more prolfic on unthrifty trees, indicating that they were not of importance in the nutrition of the cacao tree. Prepared plant hormones are used for improving the rooting of cuttings, but there is no evidence that vitamins or other specific growth-promoting substances which may be present in organic manures increase crop yields or have any special nutrient effect.

The intelligent application of green manuring, trash conservation, and grassland rotation where possible, offer the best solution to the cane farmer in maintaining and improving the soil humus content. Green manuring, although it does not add greatly to the humus content, does supply valuable nitrogen and in addition protects the soil from unfavourable weather conditions and arrests the loss of humus. Crop residues provide the best source from which the cane farmer can make an appreciable addition to soil organic matter. Trash conservation is probably of more importance on some soils than others.

Unfortunately, the war years have brought about an increase in the burning of cane before harvesting and large quantities of organic matter which might otherwise have been utilized for soil improvement have been lost. However, the cane roots and the trash which survives burning, particularly from well fertilized crops, do add an appreciable amount of organic matter when ploughed in. Molasses and mud or press cake are other excellent sources of organic matter where they are available to farmers. The grassing of idle land for a few years is undoubtedly one of the most important methods of raising the organic matter status of the soil. The grass roots also promote a desirable crumb structure favouring the formation of good tilth and, moreover, the grassland rotation assists to lower the weed population.

The Role of Inorganic Fertilizers.

Antagonism to the use of so-called "artificial inorganic fertilizers" is unscientific and not based on sound experimental data. Fertilizers like potash, guano, lime and sodium nitrate, are derived from natural deposits and are no more artificial than the mineral particles of the soil. Inorganic fertilizers in general are not harmful to the physical and chemical condition of the soil if applied intelligently. It is true that the continued use of sulphate of ammonia may increase soil acidity, but this is readily checked by periodic applications of lime. Sodium nitrate may also have an adverse effect on heavy soils, but this can be avoided by using other nitrogenous fertilizers for this type of soil. Indiscriminate use of fertilizers without correct soil management to maintain good physical condition may give disappointing results, but on the other hand additions of organic matter low in plant nutrients may be equally unsatisfactory unless supplemented with inorganic fertilizers. The population of micro-organisms is higher in soils treated with organic manures, but the normal rates of application of inorganic fertilizers have not been proved to be harmful to these organisms. Nor has it been shown that the resistance of plants to pests and diseases and the quality of produce are lowered by the use of balanced inorganic fertilizers.

There is no doubt that organic matter is of great value in arresting soil erosion, but there is no evidence that the correct use of balanced fertilizers has directly caused it on a large scale. In the case of some unskilled farmers, artificial fertilizers may have been a contributory cause insofar as they influenced neglect of soil management. However, inorganic fertilizers have been very useful on eroded soils in helping the establishment of soil stabilizing plants and thus preventing further erosion. Their use in cane produces larger crops and makes available a greater quantity of trash and roots for incorporation in the soil. However, there is no question that inorganic fertilizers must be used intelligently, otherwise results may be disappointing. Balanced fertilizing is required and there is definitely a limit to rate of application, above which gains are not economic. Consistent success is only achieved when fertilizing is combined with soil management to maintain a good structural condition of the soil.

Soil Preparation in Relation to Crop Residue Management.

Criticism of modern agricultural methods is essentially based on the question whether land should be cultivated deeply and the organic matter turned under, or whether soil preparation should be limited to chopping up weeds and crop residues in the top two or three inches of the soil without any disturbance of the lower layers. Burial of the greater portion of the organic matter in land preparation is necessary to provide a good seed bed, help weed control, enable efficient planting, cultivation, irrigation, and harvesting in rows with machines, and to facilitate the decomposition of organic matter to humus. Moreover, deep ploughing to leave a lumpy surface promotes penetration of rain and thus reduces erosion. If organic matter fails to rot down before planting, the growing crop will often exhibit nitrogen starvation which, unless corrected, may adversely affect yields. This possibility is increased where the organic matter is merely incorporated in a shallow layer of surface soil. The elimination of ploughing would cheapen seed bed preparation but cultivation costs would be higher. Practice has shown that inadequate preparation aggravates the weed problem. Nutgrass, couch, and summer grasses are more difficult to control unless the land is well cultivated, particularly if rain should occur at or just after ploughing. Rotary tillage is claimed by some as the solution to the problem of eliminating the need for ploughing, but it is doubtful if consistently good results can be obtained by this means alone. Alternation with deeper ploughing or grubbing or subsoiling would be required periodically to break up the hard pan which continued use of rotary tillers will produce in cultivated land. A recent paper by Matthews (5) gives interesting information on the value of various ways of incorporating crop residues in the soil for dry land crop production. This constitutes a summary of results obtained over a number of years in experiments at field stations in the Great Plains and Columbia River basin of U.S.A. Small grain crops, chiefly wheat, were grown and the soil treatments included leaving all the residues on the surface, leaving a portion of the residues on the surface, and completely burying the residues. Yields were much the same for all soil treatments. The conclusion was that the need for leaving crop residues on the surface was largely dependent on a long-term view of erosion rather than the expectation of materially influencing current yields.

Conclusion.

Dogmatic opinions in agriculture are unwise and usually not in the best interests of the farmers and the community generally. Experience has taught that most soils and farms need their own individual treatment. Given certain well-founded principles, the farmer's own knowledge must supply the details for the management of his land to the best advantage. Nevertheless, the views discussed above, while lacking evidence from sound experimental work to support their extravagant claims, do contain a useful warning to farmers. It is a matter of everyday observation that where trash is left on the surface rainfall absorption by the soil is better, run-off is thereby reduced, and the rate of erosion slowed down. Uncovered, bare soils are liable to serious deterioration in tropical and sub-tropical areas of high rainfall. It is true that some farmers powder the soil unnecessarily by over-cultivation, and some tend to rely too much on inorganic fertilizers without due regard for the structural condition of the soil. The commonsense view is to combine the use of inorganic fertilizers, properly balanced for the soil under consideration, with soil conservation by the use of green manuring and the return of organic matter to the soil. Fortunately, the cane farmer is using a crop which has many advantages. There is a prolific growth of roots, the soil is protected by a leafy canopy during the period of high temperatures and heavy rains, and run-off and erosion are checked by the fibrous roots and stools.

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THE KEEPING OF FARM ACCOUNTS.

In the business of farming, as in any other commercial enterprise, the keeping of accounts is a necessity.

An accurate system of bookkeeping, besides showing the results of trading operations, will enable a farmer to see his exact financial position and to say definitely what he is worth at a particular date; what he owes; what is owing to him; and whether he is gaining or losing.

To meet the need of a simple system of keeping farm accounts, the Department of Agriculture and Stock has published a handy brochure on farm bookkeeping. A copy may be had free of charge on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Some New Agricultural Implements.

Subjoined is an extract from a comprehensive report by Mr. E. R. Behne, Assistant Director and Chief Mill Technologist of the Bureau of Sugar Experiment Stations, on his mission to the United States, Cuba and Hawaii to study recent developments in mechanized agriculture, and which was published in extenso in the Cane Growers' Quarterly Bulletin (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for October, 1946.

IN contrast to common practice in Queensland, growers in Louisiana hill the land into 18-inch ridges six feet apart, and then plant the cane at an average depth of six inches at the top of these ridges. In Hawaii the reverse is the case in the irrigated areas, viz., the cane is grown along the bottom of deep irrigation trenches. The latter practice is followed in irrigated districts of Queensland, but these of course represent only a small part of the Queensland cane areas. Naturally different methods of cultivation in many cases call for special implements, many of which are unlikely to have immediate application under Queensland conditions. Moreover, under the plantation system in Hawaii large heavy units are generally used and these, in any case, would be impracticable for the average Queensland grower.

When at Chicago the delegation visited the International Harvester Company. Here discussions around farming equipment were had and films illustrating new equipment were seen. In past years this Company maintained an implement showroom,, but during the war years, from lack of space, this had to be discontinued. Consequently, it was not possible to see a selection of implements for cane cultivation. A visit was paid to the tractor factory of this Company.

There were, however, in general use several implements which it is felt might be of interest to Queensland cane farmers.

Implement for Ploughing out Stools.

This implement (Plate 68) is used extensively in Louisiana, and was referred to by Mr. N. J. King in his report to the Queensland Society of Sugar Cane Technologists, 1939. It consists of a heavy rectangular frame with a straight coulter at the front. Behind this is a double mouldboard plough or middle buster—the implement itself is frequently referred to as a middle buster. At the rear are two gangs of scalloped discs, one on each side of the middle buster. As this implement is drawn along a row of stubble behind a tractor, the straight coulter splits the stool, which is then rooted out by the middle buster, half to each side, into the paths of the two gangs of scalloped discs.

The operation of this implement was later discussed with the executives of the International Harvester Company in Chicago, who agreed to the suggestion that such an implement be brought to Queensland for trial purposes. Some modifications may be necessary for Queensland conditions, when the ratoon fields are reasonably level before plough-out, since the middle buster would then leave a furrow along the line of the cane row.

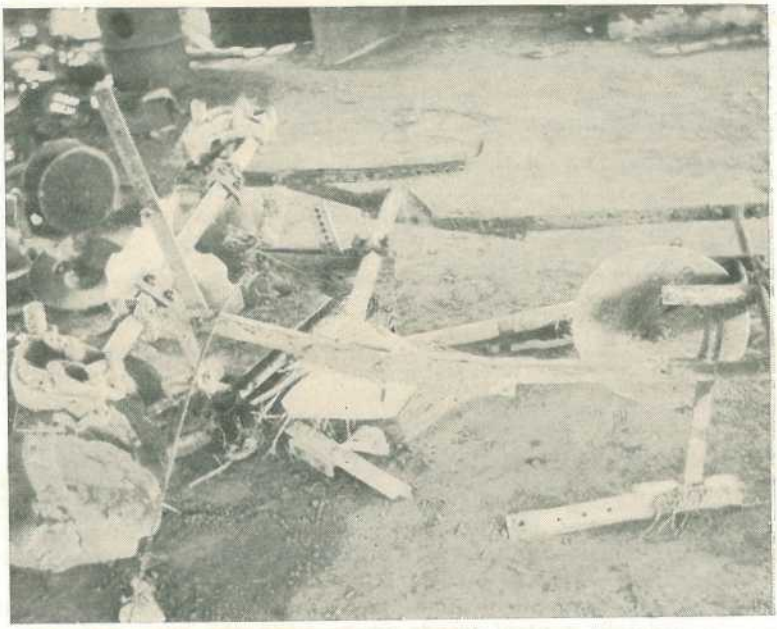


Plate 68.
Implement Used in Louisiana for Ploughing Out Stools.

Manure Spreader.

At Albania Delgado, in Louisiana, a new International Harvester Manure Spreader was inspected and later, in Chicago, a film showing the machine in operation was seen at the headquarters of the Harvester Company.

The implement consists of a two-wheeled pneumatically shod cart drawn by a tractor. Operated by chains from the axle of the cart is a conveyor delivering towards the rear of the cart, where a scroll-type spinner is mounted. The cart is loaded with farmyard manure and then taken to the field. Here, by moving a lever, the chain drive is connected to the sprocket on the axle so that when the cart is moved forward the conveyor operates and carries the manure to the distributor, which is said to fling it a distance of 18 feet to either side. Such a machine might find application in handling filter cake and for spreading lime.

Disc Weeder.

This implement, which is a tractor attachment, was seen in Hawaii, where, it is gathered, it was developed from the Churchill irrigation-furrow reshaper. It is now referred to as the Ford Disc Weeder. It consists of two toothed discs drawn behind a tractor. The axes of the discs are in the same vertical plane, but are inclined towards each other at the top. This angle is adjustable so that the slope of the discs may be varied to suit the sides of the furrows down which they are drawn. The discs rotate by friction on the ground and the teeth acting in the manner of a cultivator remove the weeds. A typical construction is as follows:—

The discs, which are 36 inches in diameter, are made of ¼-inch plate and are dished about 1½ inches. A ½-inch by 1-inch circular reinforcing

plate is welded in the centre of the disc and to this plate is welded a piece of 2½-inch heavy pipe 18 inches long. This pipe serves as a standard, and, by passing it through a bushing on the tool bar bracket, it also acts as a journal for the disc. Adjustable collars are placed above and below the bushing so that the discs may be regulated for height.

The cutting rim on the disc is made from ¼-inch by 4-inch spring steel. Some rims are notched, some are used plain, and some have a row of 3-inch long harrow teeth around the edge at about 3-inch intervals. The type of disc used depends on the amount of—and type of—grass that is to be removed.

In another type seen at the Oahu Plantation the solid disc is replaced by a six-armed spider (Plate 69).

One man driving the tractor is reported to be able to cultivate from 4·5 to 6 acres per day.

FLAME AND SPRAY CULTIVATION.

The elimination of weeds from canefields is one of the chief problems confronting the farmer and has been so ever since the crop was systematically cultivated. Hand chipping or hoeing was for long the only method and, as long as cheap labour was available, was eminently satisfactory. Mechanical methods have now been introduced, but these do not completely control weeds in or near the cane row, and few farmers are able to carry on without occasional chipping. Moreover, recent investigations have indicated that repeated mechanical disturbance of the soil causes a breakdown in soil structure, depletes fertility, and damages the root system of the cane.

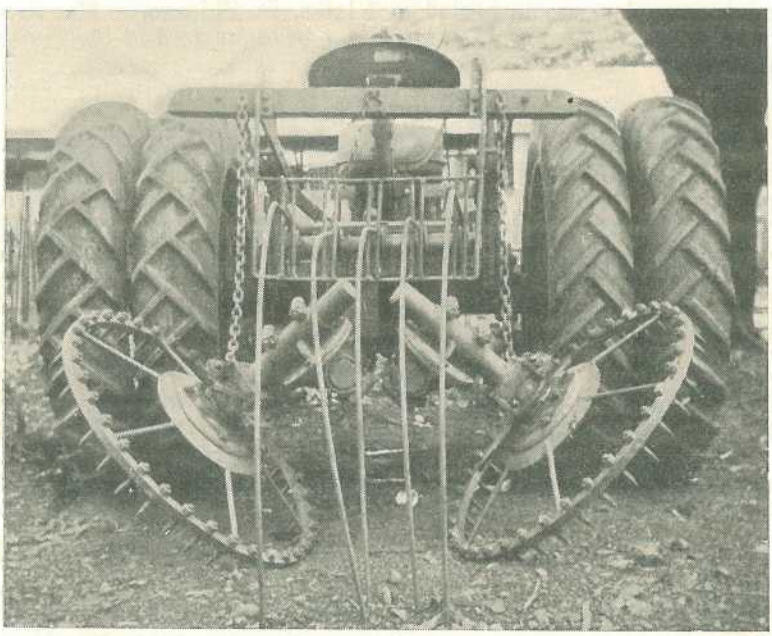


Plate 69.
DISC WEEDER USED IN HAWAII.

In those countries where labour costs are high, it is natural that efforts have not been spared to develop other methods of weed control and the two most promising so far are: (1) the use of flame to burn the weeds, and (2) the use of weedicides to kill the weeds. The former has been used on quite a large scale in U.S.A., particularly in the cotton areas, whilst its application to sugar fields is said to be spreading rapidly. The poisoning method has been used in the cane areas of Hawaii for many years, whilst at present a new type (or rather a modification of an old type of poison) is being tested extensively.

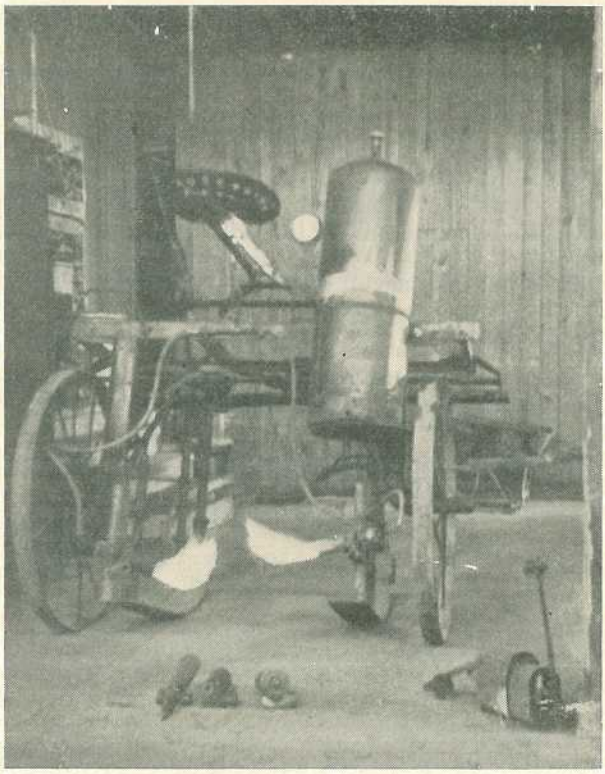


Plate 70.
Sulky Type of Flame Weeder Used in Louisiana.

Flame Cultivation.

This is also described as selective burning, since the procedure is to apply a hot flame along the entire row of plants when the weeds are small and to rely on the greater resistance of the cane (in the case of canefields) to the scorching effect.

Several types of apparatus and fuel are used and a number of reports have been prepared by Dr. Barr, of the Louisiana State University, on their operation.

The flame cultivator is used to destroy young weeds in the row of cane from the time the cane is 9 inches above the ground until it is 3 to 4 feet high. In the case of Johnson grass (*Sorghum halepense*)

results have been variable—some tests having been successful and others doubtful. It is believed, however, that improvements in technique may result in effective control of this grass.

There are two main types of cultivator in use: (*a*) the sulky type (Plate 70) and (*b*) the tractor type. The same principles are employed in both, but in the latter type the entire equipment is mounted on the tractor and operated from the power take-off. The sulky type is the more common and consists of a two-wheeled vehicle carrying a reservoir of fuel, compressor and burners. For keeping the burners correctly placed over the row a skid arrangement is provided. Two burners operating on the Bunsen principle are provided and are attached near the ground facing each other. They are mounted flexibly and adjusted so that the flames do not meet, since this would cause considerable upscorch.

The machine is of very simple construction and similar ones could be built in Queensland at a very low cost.

At a later date the delegation visited the Fijelan Research and Development Co., Washington, D.C., which Company holds the U.S. patent rights for the "Sizz Weeder." The managing director of this Company stated that 500 machines were operating in the United States, of which 200 were in the sugar cane areas of Louisiana, the remainder being mostly in cotton.

The acreage handled naturally varies with the kind, thickness, and growth of the weeds to be treated. A single-row machine would handle from 40 to 100 acres per week; the usual practice is to cover each field once per week. This principle is also used to some extent in Louisiana for keeping permanent railway lines free of weeds. In this case the burners are mounted on a small truck drawn behind a locomotive.

Spray Cultivation.

The killing of weeds by poisons is not a new idea. For many years arsenical sprays have been used, but these have certain drawbacks, although it may be mentioned that opinions regarding these are somewhat controversial. It is claimed in some quarters that the constant application of arsenic to the soil results eventually in an accumulation of this element which may be detrimental to root development, and so reduce production, particularly in light textured soils. Others point out that the concentration of arsenic to produce this effect in the soil is never likely to be reached with the rates of application normally employed. The hazards of handling this material have also received their share of over- and under-statement. Admittedly the use of arsenic is not to be preferred if some other "non-poisonous" but equally efficacious weedicide can be developed.

To this end the Experiment Station of the Hawaiian Sugar Planters' Association has been experimenting with diesel oil emulsions, since diesel oil is a well-known weedicide. Numerous mixtures have been made and tested and at present what is known as "Cade 24" has proved the most promising. This is a mixture of diesel oil, water, an activator and a spreader or wetting agent. A concentrated emulsion is first prepared using diesel oil and water in the proportion of two to one. Incorporated in this concentrate are the wetting agent and part of the activator. If all the activator were added here it would break the

emulsion. Magnesium in the water has the same detrimental effect so that magnesium-free water is essential. Fairly high concentrations of sodium chloride may be tolerated.

This emulsion must be absolutely stable so that special care must be given to its preparation. Any of the standard types of equipment may be used for this purpose, but that selected by the Experiment Station of the H.S.P.A. is a high pressure pump which circulates the oil and water mixture through a small orifice under very high pressure (2,500 lb. per sq. inch). A high speed agitator or disc colloid mill may also be used, but all are expensive pieces of equipment and capacities are low.

Before application, this concentrate ("Cade") is diluted with water containing the remainder of the activator, the degree of dilution varying from 1 to 10 to 1 to 40, depending on the size of the weeds to be treated. The diluted mixture is then sprayed on to the weeds by any of the usual types of spray. It was stated that for weeds one inch high the higher dilution was satisfactory, and about 175 gallons per acre in each of two applications was sufficient to give a complete kill.

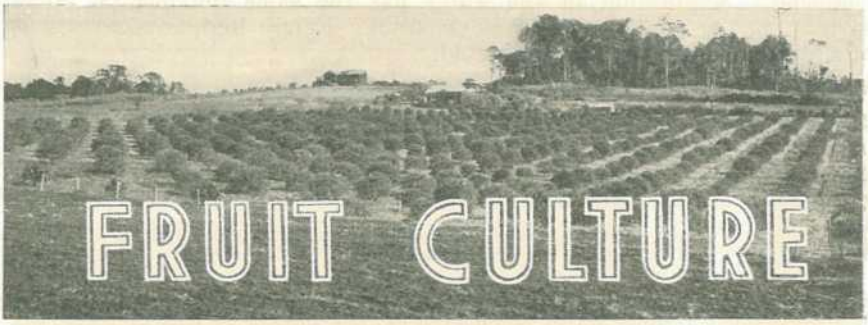
With a tractor drawn tank with pump and hose attachments and operated by three men, three acres per day may be sprayed.

No cost data were available, but a request for complete information was made to the Director of the Experiment Station, since this development may prove of considerable value to certain areas of Queensland, e.g., the heavy rainfall areas, and the irrigated areas, where it is undesirable to interfere with the expensive irrigation set ups by cultivation. Naturally it will be necessary for well conducted trials to be performed here before the value of this weedicide may be generally assessed.

It is interesting to report that tests have been started to determine whether this weedicide may be effective in killing cane before the pre-harvest burn in order to improve the effectiveness of the burn. No results have yet been obtained but it was stated that from the appearance of the trash on treated cane some improvement was anticipated.

Plate 71.

THE BEACH NEAR PORT DOUGLAS, MOSSMAN DISTRICT, NORTH QUEENSLAND.



Citrus Pruning.

R. L. PREST, Horticulture Branch.

WHILST citrus trees do not, in most instances, require drastic pruning, nevertheless a certain amount is essential in all varieties and with some, particularly mandarins and lemons, correct thinning can mean the difference between a very good crop and a very poor one.

The following is an outline of the essential points to be observed with the main varieties.

ORANGES.

Young Trees.—The pruning of young trees should be confined to the removal of adventitious shoots from the stem and the checking of excessively vigorous growths from the main arms. Two secondary arms may be permitted to grow from the ends of each of these main arms so as to develop a strong and well-shaped top. Other secondary arms will grow but should be removed. Undesirable shoots which grow all along the main arms, and which are obviously out of place and would by their continued growth weaken the framework of the tree, should be cut away. In instances where awkwardly-shaped trees are received from the nursery, it is often possible to train a shoot, which ordinarily would be out of place, to develop and fill up a gap. Such training involves shortening back the required shoot at some dormant period of growth to a bud pointing in the direction it is desired the shoot should grow. Long, weak limbs that do not show a tendency to branch should be headed back generally to the limit of other growths, so that the tree will grow strong, compact and symmetrical. The top should not be allowed to become too dense; on the other hand, it should not be kept so open as to permit scalding of the main limbs and branches by the sun.

Bearing Trees.—Provided that a well-developed framework has been maintained, young, well-grown trees should come into profitable bearing at between four and six years. During the first years of bearing, pruning should be directed towards the removal of sucker growths from the main branches and of weak fruiting shoots. Where pruning operations have been diligently carried out on young trees, they actually require very little pruning during the first fruiting years, except that they should be gone over occasionally and suckers removed. Sucker growths may, as a general rule, be considered parasitic, but they do not necessarily remain so, for in many instances they later produce bloom and fruit of normal fullness. This fact can be made use of when necessary in replacing broken and damaged limbs.

There is no doubt that the low production in the case of many older but well-cared for orchards is due to the lack of vigorous, healthy fruiting wood. This condition points to the necessity for a periodical renewal of fruiting wood, which can best be accomplished by thinning out and at the same time shortening back terminal growths and twigs. The cuts should be made right back to strong new growths, removing weak shoots and those that have borne fruit. The thinning leaves room for the necessary subdivision, whilst the shortening back tends to force into growth dormant buds from behind, stops the excessive growth of any branches, and at the same time renews supplies of fruiting wood. Where crowding of growth becomes evident, the removal of an entire branch is at times desirable. The entry of plenty of light and air assists the growth of healthy and vigorous shoots behind the outer ring of foliage. These new shoots make new fruiting wood; at the same time any excessive growth of suckers or water shoots which arise from well inside the tree following heavy pruning require to be cut away or they will absorb a lot of vigour and crowd the centre.

Old Trees.—In older trees, where growth has become stagnant, provision will be required to be made for the removal of old-crowded and dead limbs. In such instances, pruning is of a much heavier nature, requiring at times the removal of large branches. Such branches should be cut right back to their source of origin so that the sap is readily diverted to the remaining limbs, encouraging the growth of new wood. Under no circumstances should stubbing be resorted to. In instances where it is necessary to replace a number of large limbs, it is preferable to do the work gradually over two or more years to avoid excessive suckering.

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

In Queensland the regular thinning and pruning of bearing trees is definitely necessary and should be carried out during the winter months, and, where possible, completed before spring growths occur—particularly where regular pruning has been neglected and heavy cutting is necessary. Frequent and regular treatment tends to preserve as nearly as possible the balance between the root system and aerial portions of the tree, assists in economical pest control and cultural requirements, and counteracts adverse climatic conditions.

MANDARINS.

The majority of mandarins, when not systematically trained and pruned, are often merely shrubs—not trees. They naturally grow very densely, and unless regularly thinned out and shortened back after the fruit has been harvested, the massed twigs become so dense that many perish and the remainder are so weakened that only small inferior fruit are produced.

The treatment at planting is identical with that of the orange. After the first season from planting, numerous vigorous upright shoots arise from the head of the tree. While small, these should be thinned, leaving only those which will assist in building a desirable framework.

These should be carefully watched, and where the growth becomes too lengthy they should be shortened back to the limits of other growths. Heading back and thinning may be done when growths have hardened, not when they are soft and growing rapidly. It is possible to check excessive growths by pinching out an inch or so of the tips.

The densely growing habit of the mandarin, particularly such varieties as the Beauty of Glen Retreat, Scarlet, Thorny, and similar types, leading to a profusion of weak shoots, is responsible for overbearing and resultant small and inferior fruits at an early age. Providing that a well-developed framework has been maintained, young, well-grown mandarin trees may be permitted to bear at four years of age. The annual pruning of bearing mandarin trees requires the same regular and close attention as in training and forming young trees. The dense growths and crowded branches require to be well thinned out and shortened back to vigorous laterals of current season growth; weak twigs and, where possible, shoots that have borne fruits, should be removed. In the case of types similar to the Beauty of Glen Retreat, Thorny and Scarlet, the thinning and shortening back may be described as heavy; modifications should be practised according to the habits of the tree growth of the various types of mandarins. Types such as Fewtrells Early and Ellendale Beauty resemble the orange tree in growth and should be treated accordingly.

The annual pruning, permitting ample light and the ready circulation of air throughout—

(1) Greatly increases the vigour of the tree;

(2) Removes surplus growths and twigs;

(3) Improves the size and quality of the fruit; and

(4) Provides for the renewal of ample, young, and vigorous fruiting wood.

LEMONS.

With lemons, the general practice with growers has been to prune severely while the trees are young in an effort to control the growth and so produce a strong framework. In some instances, such treatment has retarded growth, and certainly it has retarded the early fruiting of the trees. Apart from the necessary trimming at planting, which, similarly to oranges, consists of shortening back and removing broken and bruised roots, and a corresponding shortening back of the head of the tree in such a manner as to produce a strong, straight stem with three or four well-placed arms radiating therefrom, little pruning should be done during the first two or three years. All that is necessary is a light thinning to remove any undesirable shoots that are out of place and would later upset the balance of the tree, and, perhaps, a shortening of excessively vigorous shoots. Main, upright growing limbs, evenly spaced, should be selected as main leaders. As the tree grows older these limbs become weighed down at the ends by further branching and the weight of fruit; strong side shoots will develop from them. These side shoots should be thinned out, but not all removed. Those left, when hardened, should be shortened back to three or four buds to form spurs, which will produce the best fruit. Suitably placed growths may be left to grow and take the place of the first leaders which have been weighed down.

In time, it will be found that the tree is built up of series of tiered branches radiating from the main framework. The object of building up the tree in this manner and spurring is to encourage a fruit-bearing habit. This is explained as follows:—As the fruit weighs the vertical branches down to a more horizontal position, the vigour of the branches is reduced and side shoots arising from such branches are, when spurred as outlined above, conducive to fruit production.

When shortening side shoots, the cuts should be made well back into ripe wood, thus throwing the sap into dormant buds. Light wood issuing from inside the more erect permanent arms may be retained, shortened for spurring, and from time to time renewed. No rank growth should be tolerated, unless it is required to continue the work of some displaced leader.

As the limbs drag down, it will be necessary from time to time to lift them by removing some of the lower limbs.

TREE PLANTING.

In many Tableland districts of New South Wales there is a serious timber deficiency for shade, shelter, fuel, fencing and other requirements. Mr. T. E. Hood, Tantaleon, Orange (N.S.W.), has outlined regeneration methods he has successfully employed. Writing in the January issue of *The Soil Conservation Service Journal*, Mr. Hood explains how he replanted much of his timber-bare land.

The propagation of trees from the seed of eucalypts is not beyond every landowner. It is a fascinating and economic project. Fresh seed gathered on the farm when the fruits are ripening and turning from green to brown, or just bursting and losing their seed, will germinate readily. Small branches carrying fruits can be broken off trees, carried home and stripped at leisure. The fruit can then be placed in an oatmeal bag and hung in the sun to dry. In a fortnight the seed can be beaten out by striking the bag against a wall.

A seed box containing half pure sand and half sieved leaf mould, or light soil, should be prepared in which to sow the seed. It must have good drainage. Before sowing, the soil should be thoroughly saturated with water and then the seed broadcast on the surface. No soil need be placed on top of the seed but a single thickness of light bagging should be laid on it to retain moisture. The box should be kept damp with light waterings.

Under warm spring or summer conditions, fresh seed treated thus will be up in five days. The bag should be lifted each day and with the first sign of germination it should be taken off at once and the box put in semi-shade. One watering per day will probably be ample from then on, as the seedlings are likely to damp off if given too much water.

Mr. Hood recommends that as soon as the seedlings have reached about half an inch in height they should be transplanted into pots, tubes or jam tins immediately. This move from the seed box should take place before the seedlings develop beyond the first juvenile two-leaf stage. The pots or tins should be filled with the same mixture of soil and sand as the seedbox and the same attention paid to drainage.

The area to be planted should have been fallowed and worked beforehand to retain all possible moisture. It should be securely fenced to exclude rabbits and hares which are most destructive. Weed growth must also be kept down for a year or two.

It must be remembered that we are handling a tree whose natural habitat is the open forest and that we are probably putting it into a paddock where it has no adult neighbors to shelter it from the fierce sun or drying wind. Also, let it be remembered, our soils now lack the humus contained in the original litter of the forest which meant so much to natural regeneration.

Consequently every means must be adopted to assist the seedling in its strange environment. In extreme cases a limited amount of watering may be necessary, but proper care will reduce this to a minimum.

Sizes and Specifications of Fruit and Vegetable Cases.

C. G. WILLIAMS, Supervisor, Preparation and Transport.

FREQUENT enquiry relative to the size and specifications of the various types of fruit and vegetable cases indicates that information on this subject is required by the grower and the case miller.

The information set out as follows is in accordance with "*The Fruit and Vegetables Acts,* 1927 *to* 1939," and the "Exports (Fresh Fruit) Regulations."

Case.	Inside Measurements.	Capacity.	Timber Specifications.	Remarks.
	Inches.	Cub. Ins.		
Tropical Fruit Case	24 3/4 long 12 wide 12 deep	3,564	Ends: 2 pieces, 6 x 3/4 x 12 inches Sides: 11 x 5/16 x 26 1/4 inches Tops and bottoms: 12 x 5/16 x 26 1/4 inches Four cleats: 2 x 5/16 x 12 inches	No piece to be under 3 inches in width Two 6 inches or three 4 inches pieces Used for marketing pineapples, papaws, granadillas, vegetable marrows, and carrots
Standard Banana Case	21 long 12 wide 12 deep	3,024	Apart from altered dimensions, construction to be identical with Tropical Fruit Case as above	Used for marketing bananas in Queensland and New South Wales
One Bushel Dump Case	18 long 8 2/3 wide 14 1/4 deep	2,223	Ends: 8 2/3 x 5/8 x 14 1/4 inches Sides: 13 1/2 x 1/4 x 19 1/4 inches Tops and bottoms: 1 each, 8 1/2 x 1/4 x 19 1/4 inches	Apple Export Case Used for marketing apples, pears, citrus, papaws, custard apples, mangoes, rosellas, cucumbers, beans, lettuce, and carrots
Canadian Standard Bushel Case	18 long 11 1/2 wide 10 1/2 deep	2,173 1/2	Ends: 11 1/2 x 5/8 x 10 1/2 inches Sides: Four—5 1/4 x 1/4 x 19 1/4 inches Tops and bottoms: Two each—5 1/2 x 3/16 x 19 1/4 inches Four cleats: 3/4 x 3/8 x 11 1/2 inches	Apple Export Case Used for marketing apples and citrus
*Long Bushel (Pear Flat)	26 long 6 wide 14 1/4 deep	2,223	Ends: 6 x 5/8 x 14 1/4 inches Sides: 13 1/2 x 1/4 x 27 7/8 inches Tops and bottoms: 6 x 1/4 x 27 7/8 inches	Export Pear Case No piece to be under 3 inches in width Except for pear export not recommended
Half Bushel Dump Case	18 long 8 2/3 wide 7 1/8 deep	1,111 1/2	Ends: 7 1/8 x 5/8 x 8 2/3 inches Sides: 7 x 1/4 x 19 1/4 inches Tops and bottoms: 8 x 1/4 x 19 1/4 inches	Export Case for apples and stone fruits Used for marketing tomatoes, passion fruit, grapes (made on the narrow side); citrus, custard apples, strawberry punnets, and persimmons
*Long Half Bushel	26 long 6 wide 7 1/8 deep	1,111 1/2	Ends: 6 x 5/8 x 7 1/8 inches Sides: 6 3/4 x 1/4 x 27 7/8 inches Tops and bottoms: 6 x 1/4 x 27 7/8 inches	Standard packing is difficult in this case due to the very narrow width Used for marketing tomatoes and passion fruit

* This case has a central division of the same dimensions as the end pieces.

Case.	Inside Measurements.	Capacity.	Timber Specifications.	Remarks.
	Inches.	Cub. Ins.		
Flat Half Bushel	18 long 11 3/4 wide 5 1/4 deep	1,110 3/8	Ends: 5 1/4 x 5/8 x 11 3/4 inches Sides: 5 1/4 x 1/4 x 19 1/4 inches Tops and bottoms: 12 x 1/4 x 19 1/4 inches Two lid battens: 2 x 3/8 x 12 inches	Very suitable for grapes, but not for grape export Used for marketing apricots, plums, peaches, passion fruit, and tomatoes
*Californian Citrus Case	24 long 11 1/2 wide 11 1/2 deep	3,174	Ends: 11 1/2 x 11/16 x 11 1/2 inches Sides and bottoms: Two boards—5 1/4 x 1/4 x 26 1/16 inches Tops: Two boards—5 1/4 x 3/16 x 26 5/16 inches Cleats: 3/4 x 3/16 x 11 1/2 inches	Citrus Export Case
Tray	18 long 14 1/4 or 11 1/2 wide Any depth not exceeding 4 inches	..	Thickness of timber may be similar to flat half bushel	Export, all fruits
One Quarter Bushel	13 3/4 long 10 1/8 wide 4 deep	556 7/8	Ends: 4 x 1/2 x 10 1/8 inches Sides: 4 x 1/4 x 14 3/4 inches Tops and bottoms: 10 x 1/4 x 14 3/4 inches	Used for marketing cherries, apricots, and cape gooseberries
Strawberry Punnet	8 long 4 wide 1 1/4 deep	40	16 oz. cardboard or chip (wood)	Used for marketing strawberries and cape gooseberries
Fig Box	8 1/4 long 6 wide 1 1/2 deep	76 1/2	Chip (wood)	Used for marketing figs

* This case has a central division of the same dimensions as the end pieces. An aperture 1/2 inch wide shall be allowed between boards, comprising the sides, bottom, and top. The inside top edges of the sides, end, and centre boards, shall be chamfered. The boxes shall be wired at each end against the inside edge of the cleat with the twitch on the side of the box and shall be centre strapped.

Vegetable Containers.

For vegetables such as cabbage, cauliflowers, peas, beans, potatoes, turnips, beetroot, carrots, and onions, etc., jute bag containers are commonly used.

Cabbage and cauliflowers have, in the past, been forwarded in chaff bags, but it is more desirable to forward these vegetables in open mesh bags, slightly shorter than the chaff bag. Chaff bags are too heavy and bulky in loading on and off high transport vehicles. A bag which would contain 10 to 15 cabbage or cauliflowers according to size is more suitable. Such a bag would be 40 inches deep by 30 inches wide and when packed contains approximately 110 pounds.

The Chapman sack is used for potatoes, and, to some extent, turnips and carrots.

Onions should be forwarded in open mesh onion bags, which are also used for the carriage of carrots, but it will be found that peas and beans have a tendency to sweat and rot in sugar bags in hot, humid weather.

Although the vegetables abovenamed are usually marketed in jute bags, they should be forwarded in fruit cases of suitable capacity over long distances.

For peas and beans a thin hessian bag of the same dimensions as a sugar bag is used.

Some Notes on Construction.

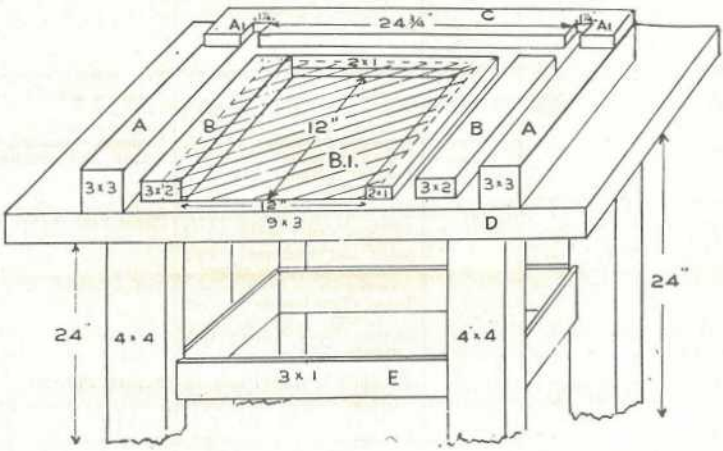


Plate 72.

TROPICAL CASE-MAKING BENCH, SHOWING METHOD OF ATTACHING CASE END, TEMPLATE AND NAIL CLINCHER.

SPECIFICATIONS:

Length.—42.50 inches;
Height:—(Underside of top), 24 inches;
Width:—24 inches;
Template:—As described.
Timber:—Legs, 4 inches x 4 inches;
Stops:—(A) Outside, 3 inches x 3 inches x 13½ inches;
(B) Inside, 3 inches x 2 inches x 12 inches;
(C) Back, 3 inches x 1 inch x 34 inches;
Top:—(D) 3 pieces 8 inches x 3 inches x desired length;
Stays:—(E) 3 inches x 1 inch.

DESCRIPTION:

The stops (A) and (B) are placed approximately 1½ inches apart, with the back stop (C) placed across the back ends of (A) and (B). A cut 1 inch deep and 1½ inches wide is made in the back stop to correspond with the slot between (A) and (B). The back end of this cut should be 12 inches from the front of the bench. The inside stop (B) is placed ½ inch from the front edge.

Template and Nail Clincher.

Many growers find difficulty in making up two-piece ends for fruit cases into correct widths owing, often, to the badly-cut timber. This can be easily overcome by attaching a template, in the form of a three-sided wooden frame, to the shed bench (Plates 72 and 74). A piece of flat sheet iron is placed to cover the space enclosed by the sides of the template. This acts as a nail clincher, turning the ends of the nails when the cleats used for joining the two pieces making the end are hammered on (Plate 73).

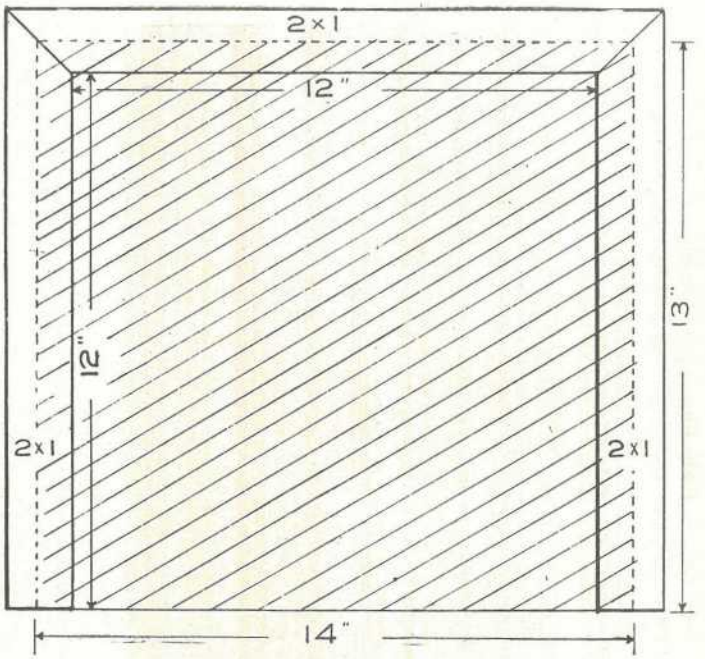


Plate 73.

NAIL CLINCHER AND TEMPLATE can be made separately or fitted to the case-making bench. The dotted line enclosing the shaded portion shows the shape of the piece of sheet iron. Invaluable for joining two piece ends.

The materials required are—

2 pieces wood 2 inches x 1 inch, 14 inches long;
1 piece wood 2 inches x 1 inch, 16 inches long;
1 piece sheet iron 14 inches x 13 inches x $\frac{1}{8}$ inch;
and necessary nails.

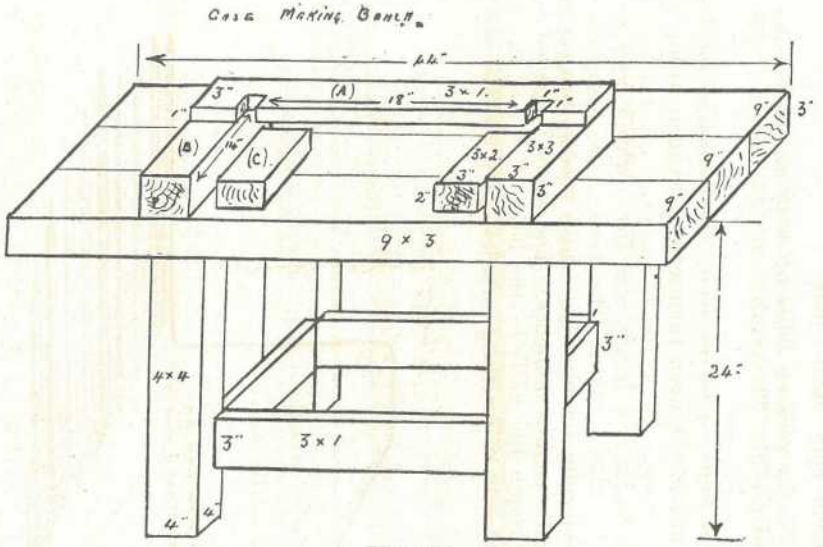


Plate 74.

CASEMAKING BENCH FOR MAKING AUSTRALIAN DUMP, CANADIAN STANDARD, BUSHEL AND HALF-BUSHEL CASES, AND OTHER FRUIT CASES, 18 INCHES IN LENGTH, INSIDE DIMENSIONS.

Specifications.

Height .. 24 inches from floor
Width .. 27 inches
Length .. 44 inches

Timber.—Legs .. .. 4" x 4"
Inside .. 3" x 2" (C)
Stops—outside .. 3" x 3" (B)
Back .. 3" x 1" (A)
Top .. 9" x 3"
Stays .. 3" x 1"

Casemakers' Nail Comb.

A nail comb (Plate 75) for picking nails up with all the heads in one direction will be found useful. The comb is made of a heavy piece of galvanized iron turned to clip on to the end of the nail box with a number of knitting needles soldered to the iron. The knitting needles are placed so that nails will slide between them easily, without dropping through, and remaining suspended by their heads in the comb. A comb with up to sixteen needles is a handy size for working, and will hold enough to make ten to fifteen cases. The needles are best placed with the ends shaped in a circular manner, the centre needles projecting about 6 inches and the side needles 5 inches. The comb is loaded by scraping or pushing it through the nails in the box. The cost of the comb is the price of four sets of knitting needles, and the necessary solder.

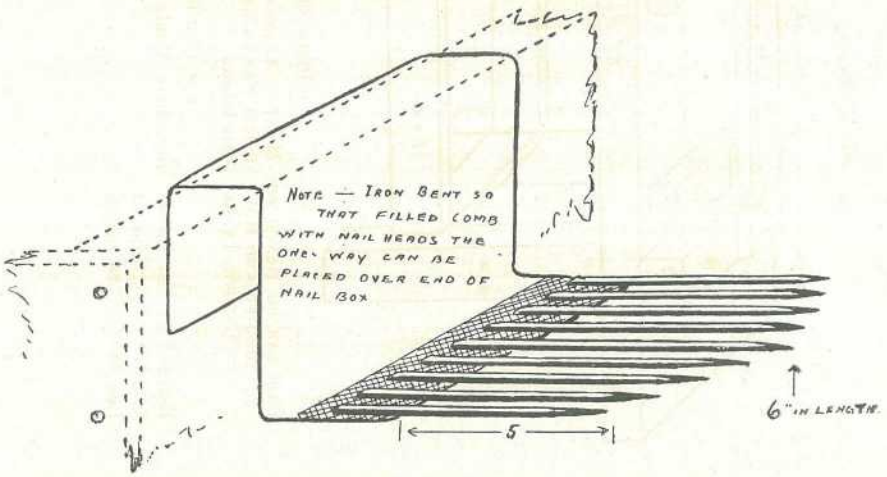


Plate 75.

CASEMAKER'S COMB.—Made of galvanised iron and knitting needles.

Plate 76.

HARVESTING SORGHUM FOR SILAGE ON CONDAMINE PLAINS.

Cucumber Growing.

C. N. MORGAN, Horticulture Branch.

CUCUMBERS grow very well in Queensland. The vines like warm growing conditions though very hot weather tends to burn and consequently defoliate the plants, exposing the cucumber fruits and thereby rendering them liable to sunburn. Frost will kill the vines and they should therefore not be grown during winter on low-lying land.

The main planting is carried out in southern coastal districts during the months of July, August and September, and a further sowing is made during February and March in areas not subject to frost. On the Tablelands, such as at Stanthorpe, seed may be sown from September to January, whilst in northern coastal districts seed may be sown throughout the year except during the very hot months.

Planting.

Cucumbers require to be grown quickly in order to obtain good crops of crisp tender fruit. On land which is not particularly fertile, 5-6 cwt. of a quick-acting commercial mixture should be used as a base dressing, followed by a side dressing at the rate of 2 or 3 cwt. of a similar quick-acting fertilizer just before the plants commence to run. If using land which has just grown a winter crop, say of cabbage, which has been heavily fertilized, then it is only necessary to use half the quantity of fertilizer. All that would be necessary in this case would be to apply fertilizer along the rows where the cabbages have been removed, scuffle the area well a couple of times, open shallow drills and sow the seed. Seeds should be sown sufficiently thickly in the drills to provide for the thinning out of the young plants to one about every 18-24 inches. When established closely together in this manner, the vines cover the ground quickly, affording protection, and they also usually fruit earlier. When grown in rows approximately 3 feet apart, and spacing the plants as above, 2 lb. of seed should be sufficient to plant an acre.

Another method of planting is in what are known as "pits" or "hills." These terms are used to represent groups of three or four plants. At one time, the seed was sown always on small hills of soil formed by throwing together two or three shovelsful of soil, hence the name "hills." However, unless the land is inclined to be wet, there is no need to follow this practice. The method of planting in "pits" or "hills" is to fertilize small patches of ground about 4 feet apart, and to sow several seeds in each, about an inch below the surface. About four plants are allowed to grow in each "hill."

Should the vines send out their runners to a distance of two or three feet without setting any cucumbers, fruiting may often be assisted by pinching off the tips of the runners.

Protection from Winds.

Vines of all descriptions are particularly subject to damage from heavy winds. If the site is exposed, therefore, it is well to provide a breakwind of some kind. This applies more especially with an early crop sown say in July, which might be exposed to the westerlies that are usually experienced in August. A little thought on the part of the grower will soon overcome this problem. For example, thickly sown rows of a quick-growing crop such as Saccaline sorghum grown early in the year at say half a chain intervals, and allowed to remain for the cucumber crop, will afford a surprising amount of shelter from winds. If the breakwind tends to grow too high, and to shade the vines, it can easily be lopped back with a reaping hook to a height of about 30 inches. It is desirable to have rows running north and south for the early crop to obtain maximum sunshine and protection.

Harvesting.

Cucumbers usually take about three months from seed sowing to harvesting. The fruit should be picked when nearly full grown, before the seeds harden, and the skin begins to turn yellow.

Varieties.

Varieties recommended are Early Fortune, Kirby's Stay Green, Black Diamond and White Spine.

QUEENSLAND SHOW DATES FOR 1947.

May.

Kingaroy	1st, 2nd, and 3rd
Beaudesert	7th, 8th, 9th, and 10th
Blackall	13th and 14th
Kilkivan	16th and 17th
Ipswich	13th to 16th
Wondai	15th, 16th, and 17th
Charleville	21st and 22nd
Gayndah	21st and 22nd
Murgon	22nd, 23rd, and 24th
Esk	22nd, 23rd, and 24th
Warrilview	23rd
Goomeri	27th and 28th
Biggenden	29th and 30th
Gympie	29th, 30th, and 31st
Kalbar	30th
Blackbutt	30th and 31st

June.

Maryborough	5th, 6th, and 7th
Boonah	6th and 7th
Childers	9th and 10th
Gladstone	16th and 17th
Bundaberg	12th, 13th, and 14th
Lowood	13th, 14th, and 16th
Gin Gin	16th and 17th
Rockhampton	18th to 21st
Toogoolawah	20th and 21st
Mackay	24th, 25th, and 26th
Proserpine	27th and 28th

July.

Charters Towers	1st, 2nd, and 3rd
Kilcoy	3rd and 4th
Ayr	4th and 5th
Townsville	8th, 9th, and 10th
Rosewood	11th and 12th
Nambour	17th, 18th, and 19th
Gatton	18th and 19th
Cairns	22nd, 23rd, and 24th
Crow's Nest	30th and 31st
Laidley	25th and 26th
Innisfail	31st, and 1st and 2nd Aug.

August.

Lawnton	2nd
R.N.A., Brisbane	9th to 16th

September.

Rocklea	13th
Beenleigh	19th and 20th

PLANT PROTECTION

Seasonal Notes on Tomato Diseases.

J. E. C. ABERDEEN, Plant Pathologist, Science Branch.

Bacterial Spot.

THIS disease has been very prevalent over recent rainy months and will be apparent for some weeks after the present rainy season finishes. It is usually noticed by the grower at two stages in the history of a crop. The earliest appearance is in the seed-bed and in the field for the first week or so after transplanting. Spotting appears on both leaves and stems and is usually distinguished from target spot by the comparatively small size of the spots and the greater number of spots per leaf. It may be confused with the early stages of Septoria leaf spot, but the latter develops a grayish centre bearing dark pinpoint size fruiting bodies. The probable reason for bacterial spot being so often severe after transplanting is that the plant makes little growth for a week or so, while if rain is prevalent the bacteria spread freely.

With good growing conditions the plant outstrips the rate of infection and the disease will disappear unless further rain coincides with the period of fruit setting. This time the grower will not notice the disease until he is harvesting, but the damage is actually done when the fruit is very young and still showing a hairy skin. Once the skin of the fruit becomes smooth and waxy the bacteria cannot attack it. On the fruit the disease appears as a small, black, raised scab-like spot, which may increase in size to approximately one-eighth of an inch in diameter. The earlier the fruit is infected the larger the spot is finally. It ceases to increase in size after the fruit has matured and does not penetrate past the tissue immediately under the skin, and if any extensive rotting does occur it is due to other organisms entering the bacterial spot injury. As a result, fruit that is not too badly scabbed can still be marketed without fear of further rot developing.

The control of this disease during the rainy conditions favouring its spread appears to be impracticable with the sprays at present available. Copper sprays may check a mild infection only. Field evidence suggests that the chief sources of infection are the soil and seed. Consequently the most definite control recommendations are seed treatment with corrosive sublimate and sterilization of the seed-bed.

Irish Blight.

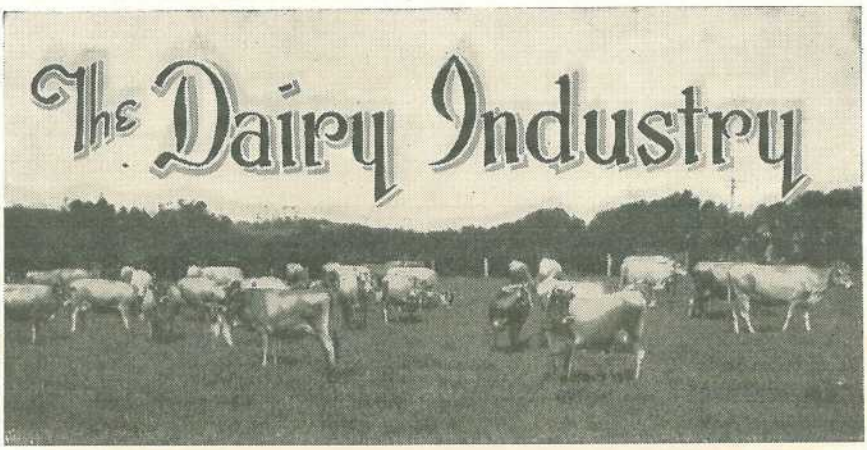
This is a disease likely to appear on tomatoes at any time from April onwards. It is some years since seasonal conditions were really favourable for the development of this disease, and as a result growers who did not experience some of the epidemics which occurred during

the period of the early thirties and years previous to that may have become a little casual in their use of copper sprays and dusts. Last winter being particularly dry also fostered this attitude. The ever-present target spot has served in a measure to keep growers aware of the necessity of copper treatments, but has not demanded the intensity of application that is necessary during a period of weather really favourable to Irish blight.

Either copper sprays or dust may be utilised to control this disease. Thoroughness of application is the most important factor, and a definite effort must be made to cover all the plant. If using dusts during the winter months it is wise not to use weaker strengths than 7 per cent. copper, and in the event of continued showers the grower should change over to a 10 per cent. dust. In comparing spray mixtures a 4-4-40 Bordeaux mixture or home-made cuprous oxide (1–10) is equivalent to 2 lb. to 40 gallons of any proprietary mixture containing 50 per cent. copper, or 8 lb. to 40 gallons of those mixtures containing 12½ per cent. copper. Commercial recommendations are usually at slightly weaker strengths than those mentioned above, e.g., 1⅓ lb. of a 50 per cent. compound to 40 gallons, but such are still within the range of suitable strengths providing the application is thorough.

A further important point for control of Irish blight is to start control measures before the disease appears. In fact, routine application of copper compounds should have been commenced already.

Plate 77.
A FIELD OF DWARF GRAIN SORGHUM NEAR GOONDIWINDI.



The Composition of Milk.

L. A. BURGESS, A.A.C.I.

MILK may be defined as the white fluid secreted by the mammary glands of female mammals for the nourishment of their young. The fluid which is most commonly called "milk" is that obtained from the cow. This animal, by a process of selection, has been developed to such an extent that certain types secrete much more milk than is required by its calf and this is utilised by man for his own nourishment. Milk obtained from the goat, camel, buffalo, ewe, mare, reindeer, and certain other animals is used in certain countries for the same purpose.

As a food, milk and its products are gaining favour. This is not surprising as each of the solid constituents has a definite food value. In fact milk has a greater food value than many of the common solid foods, as shown in Table 1.

TABLE 1.

COMPOSITION OF COMMON FOODS.

Foodstuff.	Protein.	Fat.	Carbo-hydrate.	Water Content.	Calories per 100 g.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Cabbage	1·6	0·3	4·5	94	27
Tomato	0·9	0·4	3·3	94	20
String Bean	2·3	0·3	5·5	90	34
Beet (Cooked)	2·3	0·1	7·4	89	40
Carrot	1·1	0·4	8·2	89	41
Milk	3·2	3·9	5·1	87·1	67–70
Apple	0·4	0·5	13·0	85	58
Potato	2·2	0·1	18·0	78	82
Egg	13·4	10·5	0	74	148

TABLE 2.

COMPOSITION OF MILK.

							Per cent.					
				Olein								
				Palmitin	Glycerides of insoluble							
				Stearin	and non-volatile							
			Per cent.	Myristin	fatty acids	3·4						
		Fat	3·9	Butyrin					Fat ..	3·9		
				Caproin	Glycerides of soluble							
				Caprylin	and volatile fatty							
				Caprin	acids	0·5						
				Laurin								
	Per cent.											Per cent.
							Per cent.				Total Solids	12·9.
Milk ..	100			Casein	2·5							
				Albumin ..	0·5	Total Proteins ..	3·2					
				Other Proteins ..	0·2							
				Lactose	or	Milk Sugar	5·1					
		Milk Serum ..	96·1						S.N.F. ..	9·0		
				Potassium Oxide ..					(Solids not fat)			
				Sodium Oxide								
				Calcium Oxide								
				Magnesium Oxide ..		Ash	0·7					
				Iron Oxide								
				Sulphur Trioxide ..								
				Phosphorus Pentoxide								
				Chlorine							..	
				Others in Traces ..								
				Water								87·1
												100·0

The average composition of cow's milk is as follows:—

	Per cent.
Water	87·1
Fat	3·9
Proteins	3·2
Lactose	5·1
Mineral ash	0·7

It is shown in greater detail in Table 2.

Other constituents which are present in smaller quantities, but which play an important physiological role include enzymes, vitamins, iodine, lecithin, and cholesterol. Dissolved gases such as oxygen, nitrogen, and carbon dioxide are also found in milk.

Water.

The water of milk is the same colourless liquid which is known to everyone.

In milk it serves two important purposes. Firstly, it holds the other constituents in suspension or in solution. The lactose and portions of the ash and proteins are dissolved, while the fat and the remainder of the proteins and ash are suspended in the form of very small particles. The food constituents are therefore in a condition capable of being immediately digested without the need of mastication.

Secondly it dilutes the solids to such a bulk that it forms the perfect food for the calf. With less water, the solids would form a too concentrated food for the delicate digestive organs of the young animal.

These are some of the reasons why milk is such a valuable food for children and invalids.

As water comprises such a large proportion of milk, and the cow in addition requires water to sustain its own life, a liberal supply of good clean drinking water should always be available. An average of fifteen gallons of water per day is required by a cow in milk.

The constituents other than water are known as milk solids. These may be divided into "fat" and "solids not fat."

Milk Fat.

Fats are complex substances and consist of a fatty acid such as palmitic acid combined with glycerol or glycerine. In the making of soap an alkali combines with the acid and glycerine is recovered as a by-product.

Milk fat is not the simple substance it appears. It is a mixture of at least nine fats, which are given in Table 3.

Some of these are liquid at ordinary temperatures; others are solid, the mixture of the liquid and solid fats forming the substance known to all as milk fat or butter fat. Various factors influence the proportions of the constitutent fats. Young succulent grass causes the proportion of the liquid fat olein to increase, and a softer fat is therefore obtained in spring and early summer following the response of the grass to rain and warm weather.

The fat exists in milk in the form of very minute globules which are in a state of suspension throughout the milk serum; this being the name given to that portion of milk other than fat. These fat globules vary in size with the breed of the cow and a number of other factors,

but the average diameter of a globule is one ten-thousandth part ($\frac{1}{10,000}$) of an inch. To give some idea of their very small size, one drop of milk may contain from 100,000,000 to 150,000,000 fat globules.

TABLE 3.

COMPOSITION OF MILK FAT.

Fat.	Per Cent.	Melting Point °F.	Condition at Ordinary Temperature.	Properties of the Fatty Acid.
1. Butyrin ..	4	about –80	Liquid ..	Soluble and volatile
2. Caproin ..	3·5	..	ditto ..	ditto
3. Caprylin ..	0·5	16	ditto ..	Partly soluble and volatile
4. Caprin ..	2	31	ditto ..	ditto
5. Laurin	7	44	ditto ..	ditto
6. Stearin ..	2	123	Solid ..	Insoluble and non-volatile
7. Myristin ..	20	88	ditto ..	ditto
8. Palmitin ..	26	145	ditto ..	ditto
9. Olein	35	41	Liquid ..	ditto

Solids not Fat.

The solids not fat consist of lactose, proteins and the mineral ash.

Lactose.

Lactose, or milk sugar, is only found in nature in mammalian milk. It contains the same elements, namely, carbon, hydrogen, and oxygen, and in the same proportion as in sucrose or cane sugar, but differs in certain of its physical and chemical properties. It is less sweet to the taste and is not so soluble in water as is cane sugar. It is one of the constituents which is entirely in solution. It is easily decomposed by lactic acid bacteria when in solution, with the formation of lactic acid. This bacterial action is the cause of the souring of milk, and is one of many changes which occur during the manufacture of cheese. Other kinds of bacteria may form other acids as well as gas and it is these products of undesirable types of bacteria which cause off flavours and other defects in milk.

Proteins.

The proteins of milk consist mainly of casein and albumin with a smaller proportion of globulin. Casein forms about 2·5 per cent. of milk. It exists in the form of an exceedingly fine colloidal suspension. There are reasons to believe that it is loosely combined with calcium or lime compounds.

The presence of casein makes the manufacture of cheese possible. As milk sours casein is coagulated, or precipitated, and this solidification of the casein traps much of the fat and lactose. Cheeses made from such sour milk curd include what is generally known as cottage cheese. When rennin, or rennet, is added to milk, the casein is again coagulated but in this case, the curd contains more of the mineral constituents of milk, notably calcium. This curd is the source of most varieties of cheese, the different varieties depending on the after treatment of the curd and the action of different types of bacteria.

In addition to its value as a foodstuff, casein has a considerable commercial value. It finds use in the plastics industry in the manufacture of artificial jewellery, imitation bone and ivory, buttons, imitation amber and ebony, and in cold water paints, leather dressings, waterproof glues, paper sizing, horticultural sprays, and in a number of other ways.

Albumin, the other main milk protein, is present to the extent of about 0·5 per cent. This protein differs from casein, being in solution in the water portion. It differs also in not being coagulated by souring or by the action of rennin. However, by heating milk above 158 degrees F., for any appreciable time, albumin is coagulated, while casein remains unchanged unless heated under pressure above 250 degrees F.

Globulin is present in considerable proportion in colostrum, the fluid first secreted after the calf is born. The percentage of globulin rapidly decreases and after five to ten days remains constant at about 0·2 per cent.

Ash.

The mineral portion of milk is generally known as ash. It is not known in what manner the mineral matter is arranged or combined in milk, but the following constituents are all present in the ash:—Sodium, potassium, calcium, magnesium, iron, phosphorus, chlorine, sulphates, carbonates, and smaller quantities of other substances.

Pigments.

Milk contains two pigments. One, called carotin or carotene, is yellow, is dissolved in the fat and causes the familiar yellow colour of butter. It is closely related to vitamin A and it has, in fact, some vitamin A activity. It is derived from green plants and is carried by the blood stream into the milk. The second pigment is found in the serum or watery portion of milk and causes whey to have its greenish-yellow colour. Previously known as lactochrome this pigment is now known to be riboflavin, one of the members of the B group of vitamins.

Vitamins.

A description of the constituents of milk would be incomplete without mentioning the vitamins known to be present in milk.

Vitamin A is present in the milk fat. This vitamin is essential for the maintenance of good health inasmuch as its absence from the diet results in a lowered power of resistance to disease, particularly diseases of the throat and lungs. Milk, cream, butter, cheese, and other milk products which contain milk fat are, therefore, of considerable value. Any excess of this vitamin which may be taken into the system is not wasted as it is stored in the liver until such times as it is required. Most vegetable oils are lacking in this particular vitamin. As stated previously carotene is related to vitamin A and is partly responsible for the vitamin A activity of milk fat.

Vitamin B was originally regarded as one substance capable of preventing a number of diseases and essential in the treatment of them. It is now well established that the original vitamin B is a complex mixture of substances which investigators are now unravelling. Members of this group already known include the following:—

Thiamin or Vitamin B1		Prevents beri-beri in humans. Somewhat affected by heat.
Riboflavin	Vit. B2 Group. Stable to heat.	Growth promoting and health stimulating.
Nicotinic acid		Prevents pellagra in humans.
Pantothenic acid		Still under investigation.
Pyridoxine		
Others		

Milk is a good source of the vitamin B complex, the constituents of which are all water soluble.

Vitamin C is also soluble in water and is essential for the prevention of scurvy. Although citrus fruits are the chief sources of this vitamin, it is also present in milk in useful amounts. It is now known to be ascorbic acid.

Vitamin D is a fat soluble vitamin known as the anti-rachitic vitamin. This vitamin prevents such complaints as rickets, provided sufficient lime and phosphoric acid are also available in the diet. Milk fat is a valuable source of this vitamin, while vegetable oils contain practically none. A number of vitamins D are probable, one already known being calciferol.

Vitamin E is also a fat soluble vitamin and a lack of this vitamin results in the sterility of certain animals. This vitamin is considered to be more widely distributed among the foods than most of the other vitamins, and milk is said to be one of the secondary sources of supply. The vitamin is now known as A (alpha)-tocopherol.

Plate 78.
SOME KINGPAH BULLOCKS.—The property of Mr. J. Faulkner.

A Non-Fat-Leaking Cheddar Cheese.

L. E. NICHOLS, Division of Dairying.

WAR conditions necessitated many modifications in food processing. Dairying is one industry which was affected. In view of the importance of cheese as a war-time foodstuff and its possible production as an alternative to butter at the time when refrigerated shipping was difficult to secure, efforts were made, in conjunction with the Queensland Butter Board, to produce a cheese which might be shipped as unrefrigerated cargo. As cheddar cheese sweats freely at high atmospheric temperatures, the possibilities too of non-fat-leaking cheese in warmer climates and the tropics could not be overlooked. In the course of the experiments approximately one hundred tons of non-fat-leaking cheese were made.

Principle of Process.

The underlying principle of the modified process is to homogenise the milk, reducing the fat globules to a size not exceeding 1/12,000th inch in diameter. The smaller the fat globules and the greater their dispersion the greater the resistance to fat leakage of the resultant cheese. Furthermore, it was found that a physical breakdown of the casein of homogenised wholemilk during cheesemaking, causing a soft curd, necessitated the separation of the milk and its reconstitution after homogenising the cream. It was also found necessary to maintain a temperature of 160°F. throughout separation, homogenisation and reconstitution to ensure complete destruction of fat-splitting enzymes.

Pasteurisation.

The milk is pasteurised at 160°F. If necessary, during the summer months, it is neutralised to 0·18 per cent. lactic acid, which increases the efficiency of separation and homogenisation.

Separation.

The heated milk is taken direct from the pasteuriser to a high-power centrifugal (preferably foamless type) separator of 1,500 gallon-an-hour capacity, where it is separated to approximately 40 per cent. fat content cream. This gives efficient skimming, the fat content of the separated milk averaging 0·02 per cent. by the normal butyl alcohol modification of the Babcock test. Although milk fat tests up to 0·08 per cent. on the separated milk do not affect fat leakage of the cheese, efficient separation is desirable.

The clarifying effect of separation removes much slime, dirt and cellular material from the milk, and benefits quality. To reduce frothing, the separated milk is gravitated into the reconstituting vat through a very fine gauze, stainless steel strainer.

At the cream outlet of the separator sodium citrate as an emulsifier is added, by means of a drip system, at the rate of 0·75 per cent. One part of emulsifier is dissolved in three parts of water. The emulsified cream is then "boosted" in temperature by passage through a tubular heater to ensure 160°F. during homogenisation, and gravitated to a stainless steel holding vat adjacent to the homogeniser.

Homogenisation.

The cream is diluted with an equal volume of hot water at 160°F. in the holding vat to reduce its fat content to 20 per cent., which was found necessary for efficient results. The diluted, emulsified cream is then homogenised in a 270 gallon-an-hour capacity, three-phase homogeniser at pressures of 2,200, 650 and 150 lb. per square inch in the first, second and third phases, respectively. The pressures are accurately checked both on the pressure gauge and electrically by means of an ammeter. By-passes ensure that all cream is subjected to uniform pressures and that there is a continuous flow of homogenised cream to the reconstituting vat.

Reconstitution.

The separated milk and homogenised cream are reconstituted at the same temperature in the stainless steel reconstituting vat near the separated milk spout of the separator. This ensures minimum frothing. After reconstitution the milk is pumped over the cooler for cooling to setting temperature, and then gravitated to the cheesemaking vat. Biologically, the milk is improved for cheese manufacture by the clarification during separation and the continuous heating throughout pasteurisation, separation, homogenisation and reconstitution. These processes are continuous.

Variations from Normal Cheddar Cheese Making.

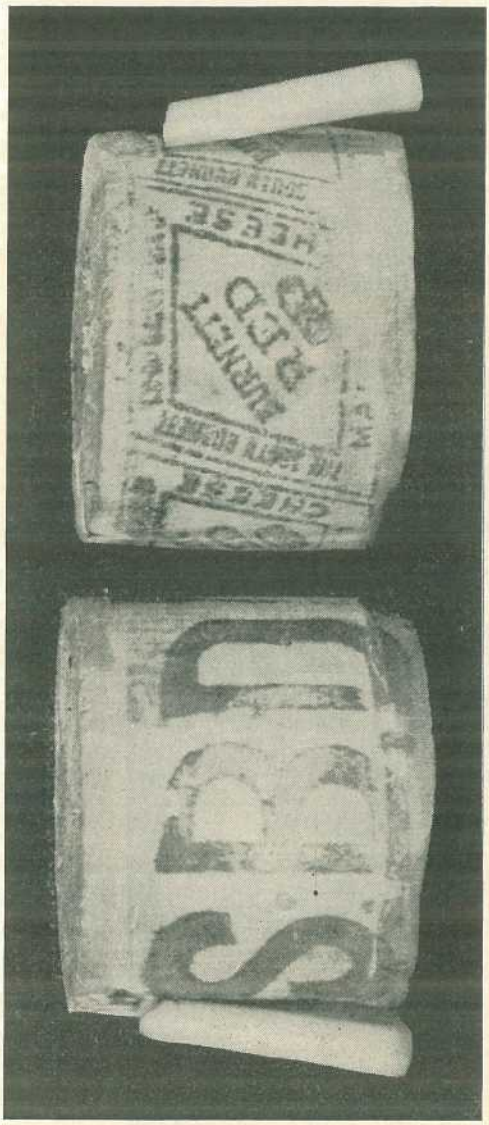
The altered physical characteristics of the reconstituted milk necessitate minor variations from normal cheddar manufacture. Lower acidities are needed at various stages than for the normal cheddar process because of the moisture retained by the curd and the longer "cooking" time. In view of the comparatively soft curd, a renneting or setting temperature 2° higher than in normal cheddar cheesemaking is recommended. Therefore the milk should normally be set at 88°F. Because of the neutralising effect in solution of sodium citrate emulsifier, as well as the neutraliser (if used), twice the normal quantity of rennet is used to set the milk.

The curd is cut finer than in normal cheddar practice and must be handled very gently. After cutting, it is stirred gently by hand for approximately ten minutes, followed by "slow gear" mechanical agitation for a further ten minutes, and finally "top gear" agitation. This prevents a cloudy whey and a flaky, crumbly curd, which would be rough after cheddaring.

The larger surface area of the fat globules gives rise to difficulties in the control of the moisture content of the curd and cooking temperatures from 2° to 4° above normal are necessary. The use of a thermoduric starter culture, in association with a normal lactic streptococcus culture, is also advised.

In "cooking" a comparatively slow "cook" to a high temperature is necessary for effective moisture control. The temperature is raised to 104°-106°F., as the casein/fat ratio demands, in approximately 40 to 50 minutes. The lower acidities during manufacture permit of a longer cooking time.

The whey is drawn when the acidity is 0·16 per cent., the curd then being firm, shotty, bright and well shrunken. One or two "breaks" can be given if the curd is inclined to be soft.



Ordinary Cheddar Cheese before Heating. Homogenised Cheese before Heating.

It will be noted that texture and condition of the homogenised cheese compares favourably with normal cheddar.

Plate 79.

In order to control the moisture content, as well as the formation of the desired texture, special attention must be given to cheddaring homogenised cheese. At the commencement of cheddaring the acidity of the whey (0·22-0·24 per cent.) is lower than for normal cheddar cheese practice; otherwise normal cheddaring is carried out. A short, rough, crumbly texture results from defective cheddaring, and the finished product is dry and crumbly.

Standard cheddar cheesemaking practices are followed beyond this stage.

HOMOGENISED CHEESE.
After heating at 120 deg. F. for 18 hours.

ORDINARY CHEDDAR CHEESE.
After heating at 120 deg. F. for 18 hours.

Plate 80.

Fat Retention in Cheese.

After prolonged incubation at temperatures ranging from 100° to 130°F. fat leakage is negligible and shape, condition and appearance are unaffected, while normal cheddar cheese exudes fat profusely at 90°F., and at 120° F. becomes misshapen, and finally a molten mass (see Plate 80).

Comparative fat losses, determined on midget (1 lb.) normal and homogenised cheeses, respectively, were:—

Temperature.	Incubation Period.	Fat Loss. Homogenised Cheese.	Normal Cheddar Cheese.
105°F.	6 hours	nil	6 per cent.
106°F.	24 hours	0·5 per cent.	10 per cent.

There is an appreciable increase in yield of cheese compared with normal methods. This is due to the higher moisture content (38-40%) and lower percentage of the milk-fat lost in the whey. The new cheese also ripens more rapidly, developing a cheddar flavour in four to six weeks, in comparison with at least four months for normal cheese. The keeping quality is satisfactory and official gradings of the cheese compare favourably with normal cheddar cheese.

The cost of manufacturing cheese from homogenised milk is somewhat greater (in these trials, 1·3d. per lb. compared with 1d. per lb. for cheddar), but higher yield per gallon of milk or pound butterfat and more rapid ripening more than compensate for the additional cost.

It is considered that this cheese also offers promise of being marketed as a rindless cheese, which, if hygienically and attractively packed, should prove palatable and popular with consumers.

Acknowledgments.

It is desired to acknowledge the facilities provided by the South Burnett Co-operative Dairy Association Limited, Murgon, and the assistance given by the Manager, Mr. P. Sing, and staff. Financial aid towards purchase of equipment was given by the Queensland Butter Board. Officers of the Division of Dairying also gave much assistance in the factory trials.

DAIRY PRODUCTION COSTS IN AMERICA.

The observations of Mr. G. C. Howey (Australian Dairy Farmers' Federation), who, in company with Mr. Chris. Sheehy (Commonwealth Dairy Produce Controller) returned recently from a mission overseas, on the conditions of dairying in the United States have a particular interest for Queensland dairy farmers. According to a Press statement, Mr. Howey said that the cost of production of butter at the farm was not less than 4s. a lb. butterfat, and, with the higher cost of living, the American dairy farmer was little, if any, better off than his Australian counterpart. Fortunately for him, he could sell his produce on the home market as the United States were barely self-supporting in dairy produce. He had not a chance on the export market against countries such as Australia and New Zealand.

Unlike America, Canada had done a good job in pegging prices, Mr. Howey said. Ten cents were gained in Canada on each American dollar changed.

Dollars went much further, while costs to the producer were not so high as the result of price pegging.

While values for produce were much higher in America so were working costs. A farm labourer received 125 dollars a month with keep (about £40 Australian currency).

A two-year-old spring grade heifer was worth 165 dollars (£A55), and a farm capable of carrying 20 cows would cost 40,000 to 50,000 dollars (almost £A700) per cow compared with Australian value of £100 per cow; American values would include herd and plant.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which qualified for entry into the advanced register of the A.I.S. and Jersey Societies' Herd Books, production records for which have been compiled during the month of March, 1947 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (STANDARD 350 LB.)				
Mountain Home Gentle 16th	M. C. Lester, Glengallan, Warwick	10,903·6	430·588	Sunny View Alert
Fairlie Favourite 33rd	Mitchell and Mulcahy, Warwick	9,341·8	421·653	Rosenthal Perfection
Fairlie Princess 38th	Mitchell and Mulcahy, Warwick	8,541·3	368·405	Fairlie Credence 2nd
SENIOR, 4 YEARS (STANDARD 330 LB.).				
Mountain Home Envy 2nd	M. C. Lester, Glengallan, Warwick	10,263·6	387·141	Fairvale Ensign
SENIOR, 2 YEARS (STANDARD 250 LB.).				
Penrhos Pansy 15th	A. Sandilands, Warwick	6,181·65	252·383	Fairlie Clubman
JERSEY.				
JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Palen Golden Lass	Prison Farm, Palen Creek	4,634·5	231·294	Banyule Silvermine Oxford

ANIMAL HEALTH

Ticks Infesting Domestic Animals in Queensland.

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

TICKS are notorious parasites of domestic animals and birds throughout the world. They are responsible for serious economic loss, which is brought about in two ways. Firstly, ticks live on blood and the loss of blood and the irritation caused by an infestation frequently result in a condition known as tick worry, which in itself can be fatal; and, secondly, many species are vectors of serious diseases. Tick-borne diseases are found wherever ticks occur but are most prevalent in tropical and sub-tropical areas. The more important include various typhus fevers, relapsing fevers, and tularaemia of man; redwater, east coast fever, and gallsickness or anaplasmosis of cattle; Nairobe disease, biliary fever, louping ill, and heartwater of sheep; biliary fever of dogs and horses; and spirochaetosis of poultry. Four of these are present in Queensland, namely tick-borne typhus or Q fever of man, redwater and anaplasmosis of cattle, and spirochaetosis of poultry. There is also a number of species which cause a condition of paralysis, frequently fatal, in domestic animals, and one of the Queensland species is of importance here.

Fifteen species of ticks are recorded as attacking domestic animals and birds in Queensland. Some are native species, whilst others have been introduced from other countries. Eight are of common occurrence. Five are found on cattle, sheep, and horses; two others are seen on dogs; and two on poultry. These ticks can be readily distinguished from one another. In this article the important distinguishing features are given and, with the aid of a good hand lens, an identification should be possible. It must be realised, however, that for the sake of accuracy and to avoid the possibility that a species not referred to in these notes is concerned, any identification so made should be checked by the laboratory.

Care must be taken when detaching ticks from their host for identification purposes. The mouthparts are essential for this purpose and ticks plucked from the skin usually leave these behind. A slow, gentle pull will usually remove the tick with its mouthparts intact. The specimens are then placed in a bottle or tin which is packed with soft paper to prevent ticks being thrown about in the post. Information accompanying specimens should include—(*a*) name of animal or bird, (*b*) date, (*c*) locality, (*d*) name of collector, (*e*) any other relevant information, such as state of health of host, degree of infestation, &c.

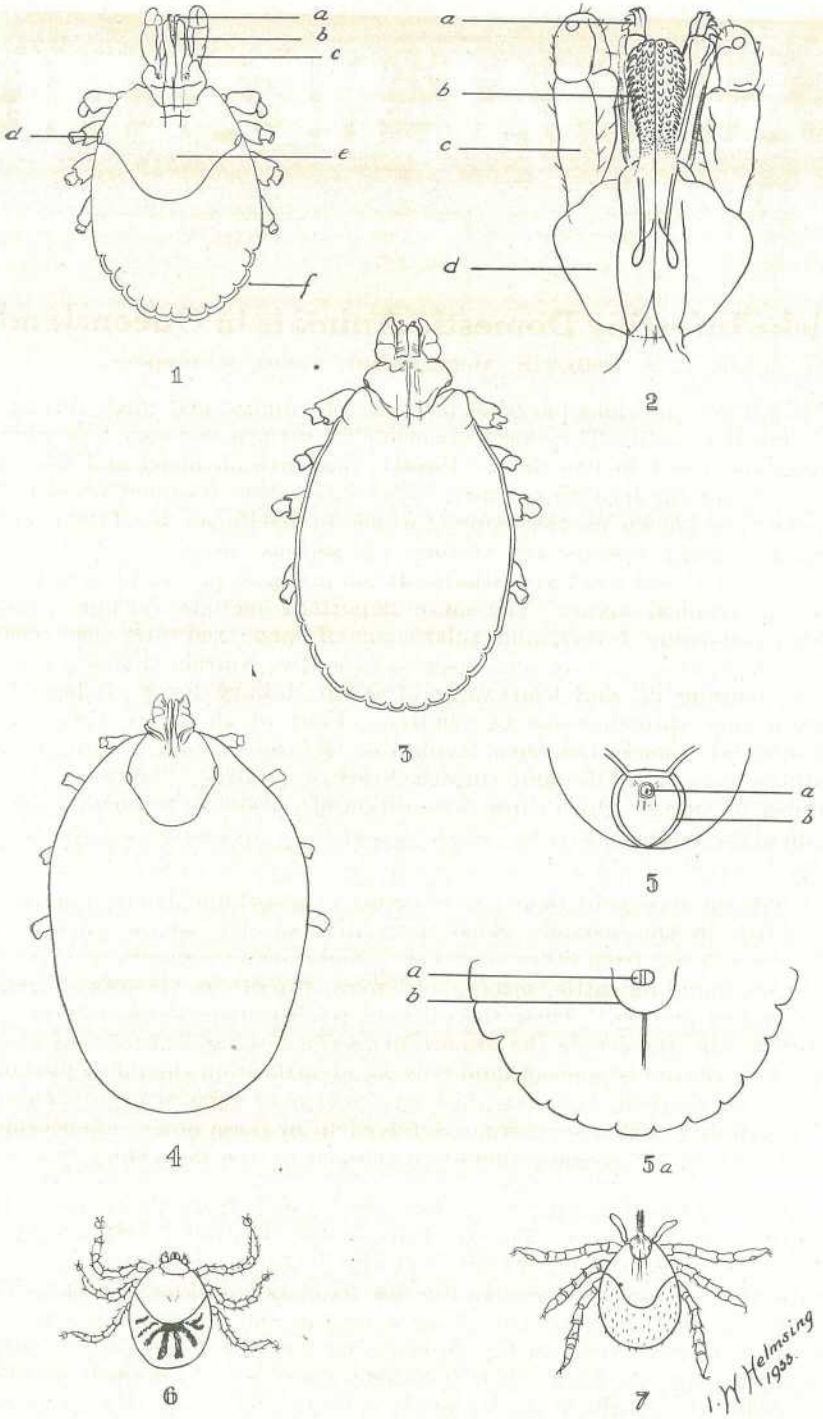


Plate 81.

STRUCTURE OF TICKS.

A tick is composed of (*a*) the body, (*b*) the mouthparts, and (*c*) the legs.

The Body.

The upper surface of the body is referred to as the dorsal surface and the under surface, to which the legs are attached, as the ventral surface. The various parts of the body which are used for identifying the species discussed here consist of the scutum, or dorsal shield, the eyes, the anal groove, the general opening, and the festoons.

The Scutum (*Dorsal Shield*):

This is a hard chitinous shield which is seen on the dorsal surface. It is present in all ticks except the fowl tick and its relatives. In unengorged females, the scutum covers about half the dorsal surface (Plate 81; fig. 1). As the female fills up with blood and the body enlarges, the scutum, whilst not diminishing in size, covers a much smaller area of the body (Plate 81; fig. 4). The male tick does not increase in size like the female and the scutum always covers practically the whole of the dorsal surface (Plate 81; fig. 3). In some species the scutum is said to be ornate when it is prettily ornamented with coloured patterns; in most of our ticks, however, it is inornate and is uniformly brownish or yellowish.

The larva and nymph also possess a scutum (Plate 81; figs. 6 and 7).

The Eyes.

Some ticks possess eyes, others are blind. The eyes are relatively small, smooth, pale, globular areas at the sides of the scutum (Plate 1; fig. 1 (*d*)). They are frequently difficult to detect and a little experience is required before it can be said whether eyes are present or absent.

The Anal Groove.

On the ventral surface of the body and towards its posterior margin, there is a small rounded opening called the anus. In some ticks a distinct semi-circular groove, the anal groove, can be seen encircling the anus from in front (Plate 81; fig. 5); in others, this groove encircles the anus from behind (Plate 81; fig 5a); whilst, in a few species, the anal groove is absent.

DESCRIPTION OF PLATE 81.

STRUCTURE OF TICKS.

FIG. 1: Dorsal view of a female tick showing (*a*) chelicerae, (*b*) mandibular sheaths which enclose the chelicerae, (*c*) palps, (*d*) eyes, (*e*) scutum, (*f*) festoons.

FIG. 2: Capitulum, ventral view, showing (*a*) chelicerae, (*b*) hypostome with rows of teeth, (*c*) palps, (*d*) basis capituli.

FIG. 3: Dorsal view of a male tick, showing scutum covering most of the back; compare scutum in the female in Fig. 1.

FIG. 4: An engorged female showing small area of back covered by scutum.

FIG. 5: The anal groove is shown encircling the anus in front; (*a*) anus (*b*) anal groove.

FIG. 5a: The anal groove is shown encircling the anus behind; (*a*) anus, (*b*) anal groove. The festoons are clearly seen.

FIG. 6: Larva of the common cattle tick, *Boophilus annulatus microplus*.

FIG. 7: Larva of the scrub tick, *Ixodes holocyclus*.

Festoons.

In many species, particularly in the males, unengorged, and semi-engorged females, the hind margin of the body is divided into a number of distinct small folds or festoons (Plate 81; fig. 1 (*f*)), less conspicuous in engorged females because of the enlargement of the body. In other species, festoons are never present.

The Genital Opening.

Situated in the mid-ventral line and towards the anterior pairs of legs is a slit-like opening, the genital opening (Plate 84; fig. 4 (*b*)). It is present only in mature males and females, and hence is a character which distinguishes the nymph from the adult.

The Mouthparts.

In one group of ticks, these are on the ventral surface and can be seen only when the tick is turned over on its back. In the second group, the mouthparts are terminal at the anterior end and readily visible. The mouthparts are part of the capitulum or head (Plate 81; fig. 2), the base of which is called the *basis capituli*, and consist of (*a*) a *hypostome*, a club-shaped structure covered with rows of recurved teeth, and (*b*) a pair of cutting organs or *chelicerae*. A pair of palps are external to the hypostome and chelicerae. In some species the palps at their bases project beyond the *basis capituli* when they are said to be salient laterally (Plate 84; figs. 1 and 3).

The length of the mouthparts and palps in comparison to the length of the body of the tick is of value in determining a species. In some ticks, the mouthparts are relatively long (Plate 83; figs. 5 and 6) and in others short (Plate 83; figs. 1-4).

The Legs.

There are four pairs of legs in the nymph and adult and three pairs in the larva. Each leg is fixed to the body by the *coxa* (Plate 84; fig. 4), and is composed of a number of moveable joints. The coxae are frequently provided with spurs or thick spines and the number and size of these is used for identifying the various species. As engorgement proceeds, the legs appear to get smaller, but this is only because the body increases in size.

LIFE HISTORY OF TICKS.

There are four stages in the life history of a tick, namely, egg, larva, nymph, and adult.

The Egg.

The eggs are small, rounded, and usually pale when first deposited, gradually darkening as the time for hatching approaches. They are deposited in heaps in the soil or debris away from the host.

The Larva.

The larva or seed tick, which hatches from the egg, has only three pairs of legs (Plate 81; figs. 6 and 7). It crawls up the vegetation and attaches to a host when opportunity offers and on finding a suitable spot settles down and commences to suck blood. When it is fully engorged, it is ready to enter the nymphal stage.

The Nymph.

The larva becomes a nymph after shedding its skin or moulting. The nymph has four pairs of legs and resembles the adult but is much smaller and has no genital opening. This stage then feeds on a host and when fully engorged prepares to enter the adult stage. In some ticks there are two nymphal stages.

The Adult.

The engorged nymph moults and gives rise to either a male or a female adult tick. The adult female attaches to a host, engorges with blood and then drops off to lay eggs. The male is smaller than the female and is an intermittent feeder, passing its lifetime wandering about the body of the host in search of females.

Three types of life history are seen among Queensland ticks:—

(1) The larva attaches, engorges, and drops off to moult to the nymph. The nymph, in turn, attaches, engorges, and drops off to give rise to the adult. Finally, the adult attaches and, if a female, engorges and drops off to lay her eggs and then dies. This life cycle requires three hosts and the tick is known as a *three-host tick*. The scrub tick, the dog tick and the New Zealand cattle tick are *three-host ticks*.

(2) In the common cattle tick, the life cycle with its moults from larva to nymph and nymph to adult takes place without the tick ever dropping from its host except as an engorged female to lay eggs, after which she dies. This is a *one-host tick*.

(3) In the poultry tick, the larva is the only stage which attaches to the host for any length of time. The adult and nymph hide away during the day in cracks and crevices and feed only at night. The female lays several batches of eggs during her lifetime.

COMMON SPECIES OF TICKS.

The Poultry Tick (*Argas persicus*) (Plate 82; figs. 7 and 8).

This is a flat, oval, leathery tick without a scutum and with ventral mouthparts. The dorsal surface is marked with numerous discs more or less arranged in radial lines. The margin of the body is always thin.

It is a cosmopolitan species and attacks fowls, ducks, pigeons, and caged birds. It is widespread throughout the State and thrives in the dry, far western areas.

It is a vector of fowl tick fever or spirochaetosis, which is a frequent cause of serious mortalities.

The Inornate Kangaroo Tick (*Ornithodoros Gurneyi*).

This species deserves mention because it is so well known to the people of Western Queensland. Its habits are very similar to those of the poultry tick in that it visits its host only to feed.

It is a brownish leathery species, with ventral mouthparts that are protected by a "hood" which on each side is divided into a number of finger-like processes.

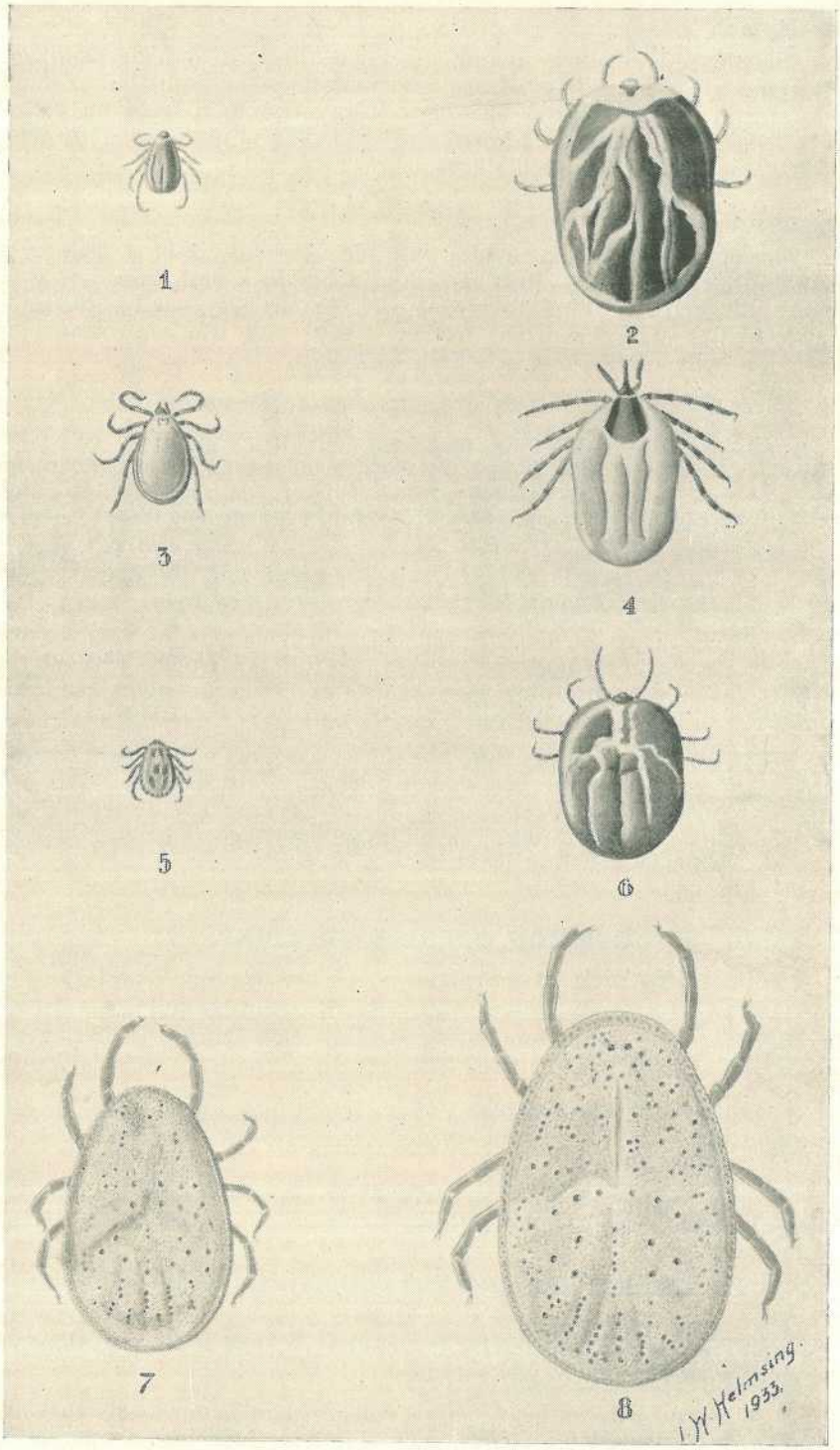


Plate 82.

It is not uncommon in the soil and among the debris under trees and in caves in Western Queensland and in the Gulf of Carpentaria. It is thought to be parasitic mainly on kangaroos, feeding on these marsupials when they rest under the trees, &c., where it occurs. However, it does not hesitate to attack man and dogs and would probably attempt to feed also on other domestic animals should the opportunity offer.

The bite is frequently followed by an intense local reaction in man, sometimes accompanied by temporary blindness, vomiting, and collapse. The effect on dogs is unknown.

The Scrub Tick (*Ixodes holocyclus*) (Plate 82; figs. 3 and 4).

The mouthparts of this tick are long and terminal, the palps being longer than the hypostome. There are no festoons and the anal groove encircles the anus in front, converging behind to meet at the edge of the body in the female (Plate 81; fig. 5), but remaining narrowly open in the male.

In Queensland, this tick is known as the scrub or bottle tick. In New South Wales, it is called the dog tick. The common dog tick in Queensland is *Rhipicephalus sanguineus,* which is rare in New South Wales.

The male is oval and yellowish, or yellowish-red in colour. The female is greyish with a yellow scutum. Fully engorged specimens may measure up to about three-quarters of an inch in length and are dark red, sometimes with a greenish tinge.

The scrub tick is found primarily in the moist scrubs of the coastal and sub-coastal areas, but has been recorded as far west as Warwick. Rain-forest country is a particularly suitable habitat.

The native hosts include various species of wallaby, kangaroo, opossum, bandicoot, native bear, pouched mouse, and the dingo. The bandicoot appears to be a favoured host. The scrub tick attacks man, all the domestic animals, and poultry.

Infestation of children and the domestic animals frequently gives rise to a condition of paralysis, which is usually fatal. Mortalities are especially noticeable among dogs, foals, calves, pigs, and sheep. During recent years reports have been received of deaths also among adult cattle, and in such instances a heavy infestation of ticks has been present.

The adults are most active during the spring and early summer, the period of greatest activity following the spring storms.

The Brown Dog Tick (*Rhipicephalus sanguineus*).
(Plate 83; figs. 3 and 4).

This tick, the female of which resembles the common cattle tick in size, may be recognized by its short mouthparts, the presence of eyes and festoons, a distinct anal groove encircling the anus behind, dark

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DESCRIPTION OF PLATE 82.

COMMON CATTLE TICK.—*Boophilus annulatus microplus.* Fig. 1: Male × 5. Fig. 2: Female × 5.

SCRUB TICK.—*Ixodes holocyclus.* Fig. 3: Male × 5. Fig. 4: Female × 5.

WALLABY TICK.—*Haemaphysalis bancrofti.* Fig. 5: Male × 5. Fig. 6: Female × 5.

POULTRY TICK.—*Argas persicus.* Fig. 7: Male × 7. Fig. 8: Female × 7.

brown legs, and deeply bifid first coxae (Plate 84; fig. 4 (*a*)). The male is very active and dark brown in colour. The female is greyish to dark red, depending on the state of engorgement.

It is widely distributed throughout the warmer regions of the world and is a very common tick on dogs everywhere in Queensland. It flourishes to such a degree in the western areas that cattle dogs and sheep dogs are seriously affected by the irritation caused by the gross infestations.

The dog tick is a domestic species, occurring only in the presence of dogs and in many instances has been associated with a serious infestation of dwellings. Under such circumstances, it rarely attempts to attack man and is a nuisance mainly because of its movements over the body. It has been recorded on a few occasions from cattle, sheep, horses, and cats, but is regarded as a rare parasite on these animals. This tick is a notorious vector of disease in many parts of the world and is capable of transmitting tick typhus and tulaemia to man, and anaplasmosis to cattle. It is a natural vector of biliary fever in dogs. Q fever of man, a type of tick typhus, is the only one of these diseases which occurs in Queensland. The fact that it is a three-host tick makes its control very difficult.

The Common Cattle Tick (*Boophilus annulatus microplus*)

(Plate 82; figs. 1 and 2).

This is the most important of all ticks infesting domestic animals in Queensland. It is not only capable of causing considerable tick worry among cattle, but is also a vector of piroplasmosis, babesiellosis, and anaplasmosis, three types of tick fevers which are responsible for serious economic loss.

It is an introduced tick and occurs also in Asia, South Africa, the southern United States, Central and South America, and the West Indies. In Queensland, it is the common tick of cattle and horses. It will readily attack sheep and has also been taken from the pig, dog, deer, wallaby, and kangaroo. Deer (*Cervus elephas*) may be heavily infested and will prove a problem when the eradication of this tick is seriously attempted. It has been recorded only once on the pig, dog, wallaby, and kangaroo and it seems evident that these animals must be very unusual hosts.

Other ticks frequently found on cattle are the scrub tick, *Ixodes holocyclus*, the New Zealand cattle tick, *Haemaphysalis bispinosa*, the wallaby tick, *H. bancrofti*, and the ornate kangaroo tick, *Amblyomma triguttatum*. Adult *B. annulatus microplus* may be distinguished from these by the following characters.

(*a*) Mouthparts very short. The scrub tick and ornate kangaroo tick have long mouthparts.

(*b*) Legs usually very pale. In all other species, except the scrub tick, the legs are dark brown.

(*c*) Anal groove not present. This groove is conspicuous in the other species.

(*d*) Festoons are absent. These are present in all other species except the scrub tick.

(*e*) Eyes are present. Eyes are absent in the scrub tick, the wallaby tick, and the New Zealand cattle tick.

(*f*) The scutum is uniformly brown. In the ornate kangaroo tick the scutum has coloured spots and areas.

(*g*) The body of the engorged and semi-engorged female is constricted behind the fourth pair of legs. This constriction is more noticeable when the tick is viewed from the ventral surface.

Under the system of cattle tick control in Queensland, it is frequently very important to be able to indicate how long any particular specimen has been attached. The following life cycle figures (supplied by Mr. L. F. Hitchcock, Officer in Charge, Cattle Tick Investigations, C.S.I.R.) will be of value in this respect: —

Size of Tick.	Minimum Age.	Maximum Age.	Average Age.
	Days.	Days.	Days.
Unengorged Larvae	3·5	8	4
Engorged Larvae	4·0	9	6
Unengorged Nymphs	5·0	19	13
Engorged Nymphs	11·0	20	16
Unengorged Adults	13·5	21	18
Engorged Adults	18·5	35	23

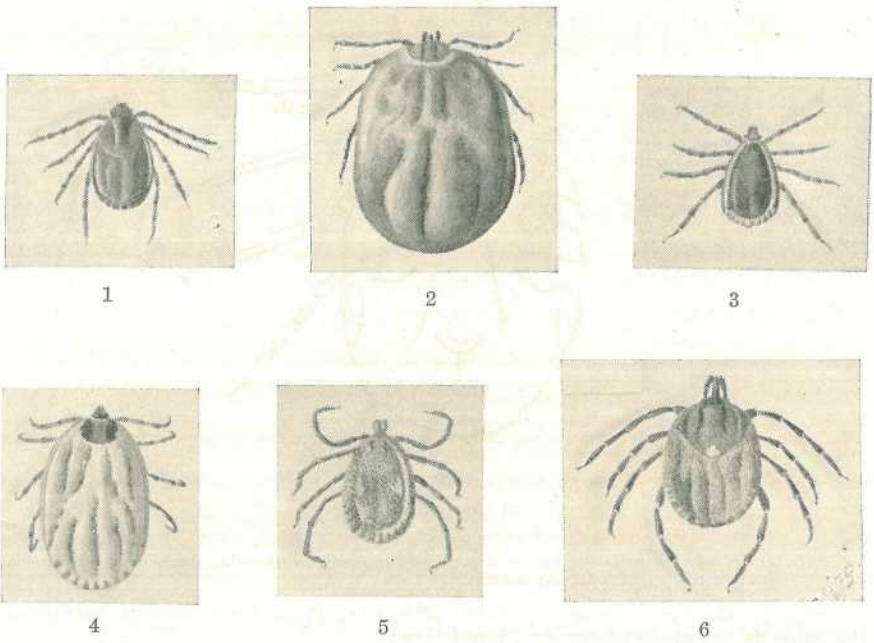


Plate 83.

NEW ZEALAND CATTLE TICK.—*Haemaphysalis bispinosa.* Fig. 1: Unengorged female × 5. Fig. 2: Engorged female × 5.

DOG TICK.—*Rhipicephalus sanguineus.* Fig. 3: Male × 5. Fig. 4: Female × 5.

ORNATE KANGAROO TICK.—*Amblyomma triguttatum.* Fig. 5: Male × 5. Fig. 6: Female × 5.

The Wallaby Tick (*Haemaphysalis bancrofti*) (Plate 82; figs. 5 and 6).

In this tick the mouthparts are short; the palps strongly project laterally at their bases (Plate 84; fig. 1); eyes are absent; festoons are present: there is a distinct anal groove behind the anus; and the legs are brown.

The wallaby tick is by no means uncommon on cattle, but is seen only in small numbers. It is a native tick and has been collected from a number of marsupials, including the wallaby, the kangaroo, the rat-kangaroo, and the opossum. It will also attack man and has been seen on the dog.

The records show that this species is distributed widely throughout south-eastern Queensland and extends as far north as Townsville.

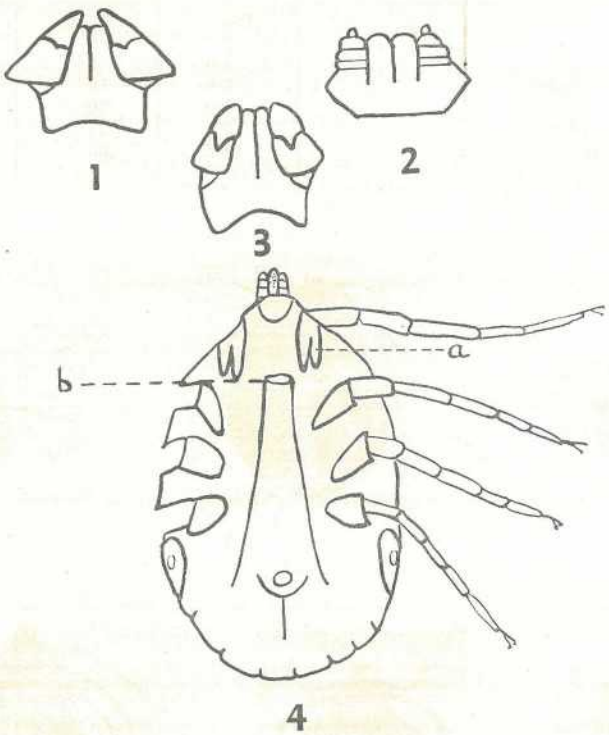


Plate 84.

Fig. 1.—Capitulum of the wallaby tick, *Haemaphysalis bancrofti*, showing laterally projecting palps (dorsal view)

Fig. 2.—Capitulum of the common cattle tick, *Boophilus annulatus microplus*. The palps do not project laterally (dorsal view).

Fig. 3.—Capitulum of the New Zealand cattle tick, *Haemaphysalis bispinosa*, showing laterally projecting palps and dorsal spine on third palpal segment (dorsal view).

Fig. 4.—Ventral view of the dog tick, *Rhipicephalus sanguineus*, showing (*a*) bifid first coxae; (*b*) genital opening.

The New Zealand Cattle Tick (*Haemaphysalis bispinosa*).

(Plate 83; figs. 1 and 2).

The mouthparts are short; the palps project laterally at their bases but not to the same degree as in the wallaby tick (Plate 84; fig. 3); there are no eyes; festoons are present; the anal groove is distinct and behind the anus; and the legs are brown. This species may be distinguished from the wallaby tick by the palps, which are not as salient at their bases and by the presence of a distinct and erect dorsal spine on the third segment.

It is an introduced species and occurs also in Asia, East Africa, and New Zealand. In the latter country it is very common on cattle and for this reason has been named the New Zealand cattle tick.

In Queensland, it is frequently seen on cattle in the south-eastern districts and heavy infestations may occur. It has also been taken on sheep, horses, and men.

The Ornate Kangaroo Tick (*Amblyomma triguttatum*).

(Plate 83; figs. 5 and 6).

The ornate kangaroo tick is so called because it is a common and widespread parasite of kangaroos in the State and is adorned with metallic whitish and greenish areas on the scutum of both male and female. The mouthparts are very long. The scutum of the female has a whitish spot at the posterior angle and sometimes whitish-green areas laterally. In the male, there are a pair of pale areas laterally and two small spots posteriorly. In some males, there is a broad pale median band, with extensive pale lateral markings. The eyes are very conspicuous. The anal groove is distinct behind the anus and festoons are present. The legs are dark brown, ringed with white at the joints.

It is an extremely common tick on cattle and has also been collected from sheep, horses, and dogs. Engorged females attain a very conspicuous size, and it is not unusual to see females almost an inch in length. Gross infestation of cattle is not recorded and, usually, one finds only a few ticks on any one beast. It is a native tick and has been taken from various species of kangaroos, wallabies, and the dingo.

TICKS OF RARE OCCURRENCE.

Occasionally ticks are found on domestic animals which are different from the species described above. These are of only very rare occurrence, however, and require expert examination for their identification. They include:—

1. The opossum tick, *Ixodes tasmani,* which infests the opossum, the native bear, and the native cat. It is recorded once from the horse.
2. The bandicoot tick, *Haemaphysalis humerosa,* a common parasite of the bandicoot, the opossum, and other native animals. It has been seen rarely on cattle and horses.
3. The snake and lizard ticks, *Amblyomma moreliae, Aponomma trachysauri,* and *Aponomma gervaisi,* and the echidna tick, *A. hydrosauri,* which on occasions may attack cattle and horses.

DIFFERENTIATING CHARACTERS OF TICKS COMMONLY FOUND ON DOMESTIC ANIMALS.

Species.	Common Name.	Mouthparts.	Anal Groove.	Festoons.	Eyes.	Palps.	Scutum.	Legs.	Domestic Animals Attacked.
Ixodes holocyclus	Scrub tick	*Long	In front of anus	Absent	Absent	Not projecting laterally	Uniformly yellowish	Yellowish	All domestic animals and poultry
Boophilus annulatus microplus	Cattle tick	Short	Absent	Absent	Present	Not projecting laterally	Uniformly brownish	Pale	Cattle, horse, and sheep; rarely dog and pig
Haemaphysalis bancrofti ..	Wallaby tick	Short	Behind anus	Present	Absent	Projecting laterally	Uniformly brownish	Dark	Cattle; rarely dog
Haemaphysalis bispinosa ..	N.Z. cattle tick	Short	Behind anus	Present	Absent	Projecting laterally	Uniformly brownish	Dark	Cattle, sheep, and horse
Rhipicephalus sanguineus ..	Dog tick	Short	Behind anus	Present	Present	Not projecting laterally	Uniformly brownish	Dark	Dog; rarely sheep, cattle, horse, and cat
Amblyomma triguttatum ..	Ornate kangaroo tick	Long	Behind anus	Present	Present	Not projecting laterally	With whitish-green areas	Dark with white rings	Cattle, sheep, horse, and dog

* In this tick the palps are longer than the hypostome.

Agricultural Chemistry

The Collection and Submission of Samples for Copper Analysis.

J. M. HARVEY, Chemist, Chemical Laboratory.

IT has been shown that the soils, and hence the pastures, of several areas of this State are deficient in copper. This has been noted in the field, confirmed by analysis and a response in affected stock obtained by administration of copper. A number of samples have been analysed in the Chemical Laboratory of the Department of Agriculture and Stock. In some cases contamination with copper, either in taking or in transport of the sample, has made the analysis of no value. It is felt, then, that some information on the care required in the collection and submission of these samples should be given.

The normal amount of copper in pasture and in the animal's body is small. The difference between adequate, doubtful, and deficient copper content, in the case of pasture, is in units per million. In the case of blood it is in the first decimal place of units per million. It is obvious, then, that any source of contamination must be eliminated. In the laboratory, all reagents are purified, all apparatus washed with acid and copper-free distilled water, and special care taken to avoid contamination by handling. These precautions are of no value unless contamination during collection and transport is avoided.

Pastures.

In New Zealand, it is claimed that the copper content is lower when grasses become mature and fibrous. This has not been established in this country, and it is considered advisable to collect samples at different stages of growth. The usual method is the clipping of a number of small areas about one foot square along a diagonal. The clippings are bulked and a sample taken from the bulk forms the sample from one field.

Care must be taken to avoid soil contamination both in a high rainfall area and from wind-blown dust in a dry area.

The most suitable containers for the samples are well-washed calico bags with a grease-paper bag lining.

Stainless steel scissors must be used for cutting of samples. The hands must be thoroughly washed.

Soils.

The collection of soil samples should be made with implements free from copper. A clean steel or iron spade or auger may be used. Samples should be submitted in well-washed calico bags.

Biological Material.

(i) *Liver.* The liver is the storehouse of copper in the body. A determination of the amount of copper in the liver is the most reliable means of establishing whether or not there is copper deficiency.

Wherever possible, the whole liver should be obtained and forwarded in acid-washed glass bottles without preservative. If the samples have to be sent from a long distance, pure redistilled formalin (40 per cent.) is used to preserve the organs. Only about 1 ounce of formalin is needed in a glass-topped Agee jar, which, of course, is suitably cleaned before use. Where the whole liver cannot be sent a section may be cut with stainless steel instruments.

(ii) *Blood.* The blood must be collected in all-glass syringes with stainless steel sockets. Those with plated brass sockets or plungers are useless and stainless steel ones must be made especially for this work. The blood is then transferred to pyrex tubes. These tubes are prepared by washing first with acid, then distilled water, and finally copper-free distilled water. The last should also be used to rinse the syringe between each bleeding.

FODDER CONSERVATION.

Silage making is a process whereby succulent green feed can be preserved with a minimum loss of digestible food material for quite lengthy periods of time or for as little as six weeks. Silage can be made successfully under weather conditions or from crops unsuitable for hay making. It could, if necessary be made even in light rain, while crops such as maize and sorghums, which are not suitable for hay making but yield a greater bulk of material per acre than the small grain cereals or legumes, can be used to advantage under conditions of good rainfall, or of irrigation.

Silage making increases the production possible from an area by allowing fodder to be stored when there is a surplus, against time of shortage—and also has the advantage that the product is not saleable, so that the fortunate possessor cannot dispose of it to his own ultimate disadvantage when good prices are offering for feed during drought periods. Silage is not subject to damage by fire or by mice, while generally speaking rain causes no damage to it, and provided reasonable care and attention to detail are given to the process, there is less risk of loss than in the case of hay making.

The product has a definite, though to a certain extent restricted place, in a fodder conservation programme, primarily as a drought feed in association with hay or stored grain and also as a supplement to the rations of milking stock (either dairy cows or calving stock) when the succulent pasturage required for milk production is short or only dry feed is available.

Hay has many good qualities as a conserved roughage. It has a low moisture content, and hence higher food value per ton of the final product, than silage. It has a resale value, can be handled with ease and nearly all stockowners are quite familiar with its handling and use as a feedstuff. Silage, on the other hand is not transportable and has not the wide usages of hay. It needs supplementing with hay or grain for feeding to stock and it is not a generally suitable food for horses, although up to 15 lb. per head may be fed. Its advantages as a foodstuff are its succulence and particularly, in the lower loss in food material when made under good conditions.

Silage making is, however, the only successful method of conserving the green-stuff of the heavy yielding summer cereal crops, maize and the sorghums. Because the crop is cut earlier than in the case of hay, the protein content is still high, allowing the preparation of a product high in this valuable food constituent. Provided the temperature is kept within the usual working limits the vitamin A content is preserved much more completely, which is a valuable consideration in the feeding of dairy stock.

MARKETING

General Notes for Month—March, 1947.

Market Prices Reports.

A MARKET Price Reporting Service has been inaugurated within the Marketing Division, and daily price reports for fruit and vegetables are now being supplied to the Press and the Broadcasting Services. This service will, from time to time, be extended to other primary produce.

Storage Silos for Peanut Crop.

The rapid expansion of the peanut industry during the past few years has necessitated the provision of additional storage space. The Queensland Peanut Growers' Co-operative Association Ltd. now has in hand the building of an additional 39 silos with a storage space of 8,500 tons. Nine of these are nearing completion, and it is hoped that they will be in operation for the harvest which has now commenced.

This will be the first additional storage built by the Board since 1938, when 24 silos were erected. This brought the total storage capacity up to 7,400 tons. Now that production has more than doubled as a result of the Australian demand, the provision of further storage facilities has become a matter of some urgency.

Production Trends.

Good rainfalls throughout dairying districts resulted in good growth of fodder crops and pastures. Dairy stock are in excellent condition, and a good winter production can be expected.

Fresh fruit and most vegetables will be in light supply during the current month.

On the Atherton Tableland, good conditions have enhanced the prospect of a 16,000 ton crop of maize from the 22,000 acres planted.

Grain sorghum crops are more promising and earlier estimates will be greatly increased.

Despite good rains, it is unlikely that the lag in sugar cane growth, caused by continuous dry weather, will be overtaken in many Northern mill areas. However, crops in the Southern areas have made an excellent recovery.

A yield of 20,000 tons is estimated for peanuts, harvesting of which has commenced in the South Burnett.

With the exception of the far inland areas, the pastoral industry is now assured of a secure feed supply during the winter months. Stock, generally, are in good condition.

GENERAL NOTES

Staff Changes and Appointments.

Mr. T. Douglas, Inspector of Stock, Division I., Goondiwindi, has been appointed District Inspector of Stock at Cloncurry. Mr. Douglas's successor at Goondiwindi will be Mr. L. G. Walker, Inspector, Division II., who has been appointed Inspector, Division I., Division of Animal Industry in the Department.

Farm Seed Standards.

Under new *Seeds Acts* regulations the prohibited seed list has been considerably reduced, but nevertheless contains Queensland's most objectionable weeds found in seeds for sowing, which now includes mint weed. The restricted weed schedule has been reduced to 18 species. The permitted quantity of weed seeds allowed by weight in crop seeds has been reduced. This applies also to inert matter. Germination standards in the main are unaltered.

North Queensland Citrus Sectional Group Committee.

Regulations under the *Fruit Marketing Organisation Acts* have been amended to provide additional representation for North Queensland on the Citrus Sectional Group Committee of the Committee of Direction of Fruit Marketing. The present northern electorate extends from Proserpine in the south to the Far North, and because of the difficulty experienced by the citrus delegate in contacting the associations comprising his electorate, action has been taken to divide the present electorate. Accordingly, the Cardwell, Mareeba, Dimbulah and Tully District Fruit and Vegetable Growers' Associations shall constitute the new electorate which shall elect one member, while the remaining groups of northern associations—namely, the Proserpine Fruit and Vegetable Growers' Association, The Charters Towers Primary Producers' Association, and The Banana Growers' Association at Jubilee Pocket—shall also elect a representative.

Honey Marketing Board.

An Order in Council has been issued under the *Primary Producers' Organisation and Marketing Acts* extending the operations of The Honey Marketing Board for a further period of three years from 9th March, 1947, to 8th March 1950. Members appointed for this period are Messrs. R. V. Woodrow (Woodford), R. R. Roff (Wynnum Central), H. E. Fagg (Killarney), O. N. Tanner (Mooloolaba), and H. S. Hunter (Director of Marketing).

Poultry Industry Regulations.

Regulations under *The Diseases in Poultry Acts*, 1923 to 1940, have been repealed, and new Regulations under *The Poultry Industry Act* of 1946 have been issued in lieu thereof. These Regulations cover the control of diseases in poultry, the registration of poultry stock suppliers, the slaughter of poultry for human consumption, and egg standards.

Veterinary Science Scholarships.

Following the institution of veterinary science scholarships to provide for the recruitment of future appointees to the veterinary staff of the Department of Agriculture and Stock, it has been announced that four scholarships have been allotted for 1947 to Messrs. A. A. Seawright (Townsville), D. H. Brown (Sherwood), R. R. Clem (Mayfield, via Camp Hill), and M. C. Riches (Greenslopes). The scholarships cover a period of five years, and the first two years of the course will be taken at the University of Queensland.

Cancelled Brand Fee.

An amendment of Regulations under the *Brands Acts* provides that the fee for re-registration of a cancelled horse or cattle three-piece brand shall be reduced from £3 to £1.

Wild Life Preservation.

An Order in Council has been issued under *The Fauna Protection Act* of 1937 declaring a sanctuary for the protection of fauna at Mt. Devlin Holding, near Hughenden, the property of Mr. H. H. Morell. Mr. Morell has been appointed an honorary protector for the sanctuary.

Rural Topics

Field Work of the Bureau of Sugar Experiment Stations.

While the volume of field investigational work of the Bureau of Sugar Experiment Stations was much below normal during the year 1945-46, the return of officers from national service enabled increased activity and an expanded programme of field trials now being put into operation.

A considerable proportion of the work of the Brisbane soils laboratory consisted in the analysis of soils for farmers who sought advice regarding the best use of their inadequate fertilizer supplies, and of soil samples collected in connection with district fertility surveys. The latter have been initiated in three districts and are yielding valuable results; they have aroused interest on the part of mill authorities and two mills sent chemists to the Brisbane laboratory during the last "slack" for tuition in soil sampling and analysis. It is evident that there has been a considerable decline in soil fertility levels, aggravated by the wartime shortage of fertilizer. Programmes initiated during the year include the State-wide establishment of approximately 100 liming trials to check the effect of the serious wartime shortage of this commodity, and the setting out of a number of "minor element" trials to check the adequacy of these soil constituents.

A soil conservation experiment was established on an area of relatively steep slope in the Childers district where the characteristic volcanic hills are showing the ill-effects of long-continued erosion of the soil.

A series of cultivation trials has been instituted in order to check the relative value of existing and modified field practices, including seed bed preparation. Good germination is of primary importance in cane culture and a well-prepared seed bed is essential in the drier areas of the cane belt. The value of preplanting treatment of cane setts, by dipping in fungicides, is also being investigated by the pathologists, with encouraging results.

Shortage of field labour has helped to stimulate interest in improved mechanical equipment and several new or modified implements are briefly described in the account of the work of the field staff.

Use of the standard form of variety trial necessarily restricts the number of farms on which such trials can be placed, with the result that variation in local conditions has often been insufficient to give a true assessment of a variety in a limited time. In an attempt to meet this difficulty there has now been adopted a trial system of planting dispersed trials in which a Latin square or randomised block is distributed over a number of farms of the same general soil type.

Cane Breeding Programme.—The cane breeding programme, which had been resumed on a full basis, suffered a severe check by drought. A considerable change has been effected in the varietal composition of the cane crop. Badila remains the major variety, but the position of the next two varieties (P.O.J.2878 and Co.290) is now being challenged by the rapid increase of the Macknade and Mackay seedlings, Trojan and Q.28. Trojan, bred in 1933, comprised 8.2 per cent. (372,000 tons) of the 1945 crop and is being further planted in northern areas. Q.28 was bred in 1935 and last year contributed 293,000 tons, or 6.4 of the crop; it is expected that between 600,000 and 700,000 tons of this variety will be harvested in the Mackay district this season, while it is being extended in southern mill areas.

Some new local seedlings are now begining to find favour and will increase the lead established in 1941 when Queensland-raised varieties moved to first place on the basis of country of origin. New Guinea, which held pride of place for so long, is again in second place, with 27.1 per cent., compared with Queensland's 35.1 per cent.

—*Extracted from the 46th Annual Report of the Bureau of Sugar Experiment*

GADGETS AND WRINKLES

A HANDY TORCH FOR SCRUB BURNING.

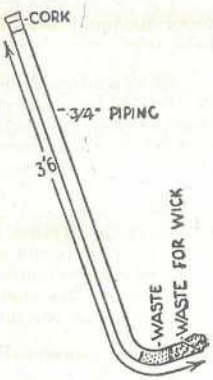
The idea illustrated here representing a handy torch for scrub burning has been successfully used by one ingenious farmer and some such implement (or a number of them) might be well worth having by some who may be in districts where such a thing is often needed.

It consists of a piece of pipe of convenient length, bent around at the end as shown (somewhat the shape of a hockey stick).

One end is plugged with old rag or cotton waste tightly enough to prevent oil soaking through in excessive quantities; a second piece at the end being left somewhat looser to act as a wick.

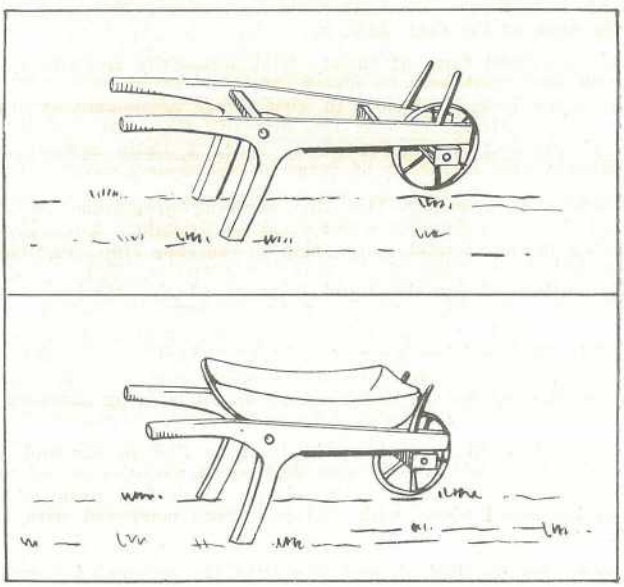
The top end is closed with a cork. The length of pipe is then filled with the kerosene, or with any waste oil that will soak through the wick and burn easily.

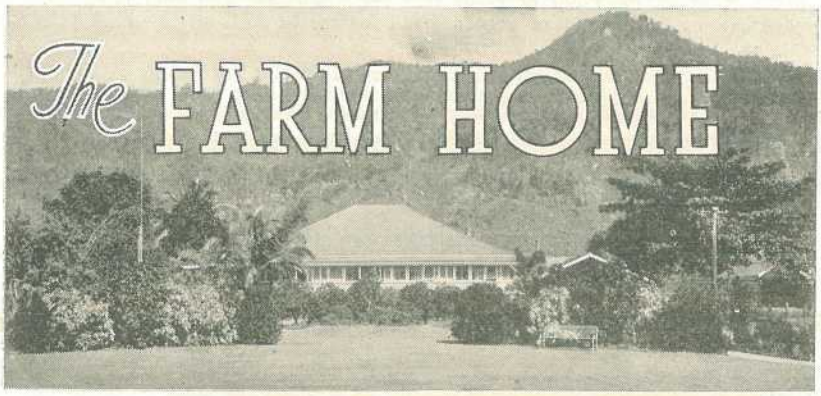
It is more convenient to use than the usual method of trailing around burning branches, and can be used for the rapid burning of firebreaks during bushfire weather.



A BUSH WHEELBARROW.

Select a forked branch of suitable size and shape and saw it down the centre, and so provide two sides of a wheelbarrow "chassis." Trim the hand grips and bore two auger holes for the cross pieces, which are wedged in position as when fitting a hammer handle. Two long bolts pass from side to side make the frame firm and solid. Two blocks of wood are bolted on to take the axle, and a bitumen drum section forms the body of the barrow.





Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

HOW MUCH DO YOU SPEND ON FOOD?

THE working out of a family or personal budget is a top topic these days, and is interesting to note that some people seem to be able to live much more economically than others. *However, the part of family budgetting that we are most concerned with is not exactly how much is spent but which items receive priority in the budget.*

Because the body is built up of the food we eat; and also because not only the height and weight, but also the health of our bodies is largely dependent on our food, this must be our first consideration. Pretty clothes and entertainments lose their charm if one does not feel well, and no amount of cosmetics will compensate for poor physique, dull eyes and hair and a muddy or blotched complexion.

Therefore, by far the largest proportion of the family income should be spent on food and to protect the family health at least one third of the income should be set aside for that purpose. If skimping has to be done it should be done among the less important items. First lay out so much money for food and then divide the remainder amongst the other things.

We realize that this is not always easy when rents are high and the cost of clothing materials almost prohibitive, but one slogan mothers and fathers should keep in front of their minds always is "it is ever so much cheaper to be well." Without the right food it is impossible to be really well.

Diet for children and the rest of the family should be planned as carefully as an architect plans a building, because the parent is the architect of the children's future and foods are the building materials.

A well-nourished child is not only the right weight for his age, but also has strong straight bones, sound teeth, good colour, firm flesh, good digestion and a clear mind. He is full of "pep," and fun and does not easily get "catching" diseases.

It is no use giving children a good education unless they are well, because otherwise they lose a great deal of its benefit.

A child who is always ailing loses ground at school, he cannot take the same interest, his mind does not work so quickly and so his future as a wage earner as well as a good and happy citizen may be affected.

Check the family budget and see how much is being spent on food. Next month we shall talk about the kinds of foods that are wholesome and nourishing, and see how they can be bought out of even a small income in spite of the high prices of some items.

Any further information on this or any other matter concerning Maternal and Child Welfare may be obtained by communicating personally with the *Maternal and Child Welfare Information Bureau*, 184 *St. Paul's Terrace, Brisbane*, or by addressing letters *Baby Clinic, Brisbane*. These letters need not be stamped.

IN THE FARM KITCHEN.

Fruit and Vegetable Salads.

Nutrition experts maintain that at least one fresh, raw vegetable should be included in the diet each day to supply certain minerals and vitamins necessary for health. In view of this, salads should be part of the daily menu throughout the year, and not confined to the summer months as is often the case.

Salads lend themselves most suitably for luncheon dishes, and when served as a main course may include cheese, hard cooked egg, cold meat or fish. Lettuce leaves usually form the foundation of a salad, although cabbage, cress, or tender inside leaves of spinach may be substituted. Other uncooked vegetables suitable for use are tomatoes, celery, cucumber, carrots (usually grated), thinly sliced onion and spring onions.

Many cooked vegetables may be used in combination with others to add variety in flavour and colour and to make the salad more substantial. Beetroot, peas, carrots, cauliflower, potatoes and asparagus are suitable. The fruits most commonly used in mixed salads are oranges, grapefruit, bananas, apples, pears, pineapples, and avocados.

Parsley, mint and chives are suitable for garnishing and for added flavour.

Fruit and Vegetable Combinations.

Following are some suggested combinations for fruit and vegetable salads. These should be arranged on lettuce, garnished and served with mayonnaise.

1. Sliced avocado with grapefruit and orange sections.
2. Sliced pineapple with cream cheese.
3. Diced cooked carrots, potatoes and peas mixed with salad dressing and served in tomato cases.
4. Halved pears spread with cream cheese and sprinkled with chopped nuts.
5. Apple rings topped with chopped celery which has been moistened with mayonnaise.
6. Grated carrot, chopped celery and spring onions mixed with mayonnaise and served with sliced tomatoes.

Points in Salad Preparation.

The following points are of importance when preparing salads:—

1. Salad greens must be fresh, crisp and thoroughly washed.
2. Best results are obtained from chilled vegetables and fruit.
3. A stainless knife should be used for cutting, to prevent discolouration.
4. If using cabbage with, or in place of lettuce, choose one that is young and mild in flavour.

A well flavoured dressing or mayonnaise should be served, although some prefer just vinegar or lemon juice.

Moulded Salads.

Moulded or jellied salads are decorative and colourful and if well arranged and garnished can lend quite a festive air to an otherwise simple meal. Vegetables such as tomatoes, peas, asparagus, beetroot and carrots and almost any of the fruits are suitable for moulding in a savoury jelly. They can be arranged in quite attractive patterns on the bottom of the mould by first setting in a thin layer of the prepared jelly and then adding the remainder of the ingredients. Jellied tomato puree or juice is very popular because of its colour, flavour, and food value.

Always unmould the salad on a dish sufficiently large to allow room for garnishing.—June Chancellor in *The New South Wales Agricultural Gazette*.

QUEENSLAND WEATHER IN MARCH.

Rainfall distribution throughout the greater part of the State was not only well above average but most opportune, particularly during the latter half of the month when a critical pastoral situation was amply relieved in many Carpentaria districts and supplementary falls in the South-West consolidated the good relief rains of February, while further heavy to flood rains extended over the greater part of the south-east quarter. Far South-West streams reached reporting levels but were not in the category providing sufficient run-off from higher catchments to give an extensive soaking outside the main channels. Throughout most of the rest of the State, most rivers and streams were either flowing strongly or in flood presenting the not unusual seasonal factor of valuable surplus water running to waste. Aggregate district storms in the Peninsula were just short of normal and the North Coast Barron was 21 per cent. below. A slight deficiency was experienced in parts of the Central Highlands. The Central Lowlands and Lower West Divisions with aggregates of 1¾ in. and 1 in. were respectively 27 per cent. and 38 per cent. below normal. Although sections of these districts received 3 to 5 in. falls in February, other parts recorded only patchy benefit. The same Central Interior areas missed the otherwise almost general March rains, and early falls are required to ensure winter and spring pastures. Over most of the pastoral areas of the State, however, reasonably good to very good wintering conditions should be now realized and since February recovery and bountiful to flood falls have spread over all south-eastern and coastal pastoral, dairying and farming areas. Some heavy monthly totals included:—Burketown 3,151 points (record), Normanton 2,284, Mt. Surprise 929, Atherton 1,089, Innisfail 3,231, Giru 2,521, Rolleston 836, Duchess 633, Bulgroo 315, Calliope 1,667, Childers 1,666 (several Port Curtis districts 10 to 15 inches), Springbrook 3,038, (many Moreton districts 10 to over 20 inches), Chinchilla 1,075 (many eastern Downs districts 4 to 8 inches), Talwood 757, St. George 617, Dirranbandi 317, and a number over two inches in the Far South-West.

Floods.—There were flood rises in all streams from the Fitzroy River to Southern Border Divisions, both coastal and inland, on the first of the month, and run-off was maintained along the Mary and Burnett until the 3rd with rises continuing to pass down the Balonne and MacIntyre. On 6th and 7th, the Fitzroy and other streams in south-west divisions were again swollen until conditions eased by the 10th. At the end of the month there was a heavy rain run-off along the MacIntyre and Condamine and streams in the South Moreton districts with also moderate freshes in Fitzroy and Burdekin; flood waters were temporarily over the Inkerman Bridge on the 31st.

Temperatures.—Maximum temperatures ranged from 1.3 deg. above normal at Georgetown to 2.8 deg. below at Thargomindah, relatively cool conditions. Minimum readings were somewhat above normal except at Thargomindah 1.7 deg. below. Highest maximum 106 deg. (7th) at Urandangie where over 100 deg. was recorded on 14 days. Richmond had 16 days above 100 deg.

Brisbane.—Mean pressure $\frac{9 + 3}{2}$ 29.967 inches (normal 29.965). Temperatures.—Mean maximum, 81.2 deg. (normal 82.2); mean minimum, 68.0 deg. (normal 66.4 deg.); mean temperature, 74.6 deg. (normal 74.3 deg.). Highest daily, 88.6 deg. on 18th (lowest since 88 deg. 2nd March, 1936); lowest daily, 62.8 deg. (22nd). Rainfall.—1,124 points on 19 days (average 565 on 15 days); Brisbane rainfall for three months January-March 3,292 points, highest since 1931 (3,955 points).

The rainfall position is summarised below—

Division.	Normal Mean.	Mean March, 1947.	Departure from Normal.
	Points.	Points.	Per cent.
Peninsula North	1,219	1,186	3 below
Peninsula South	687	639	7 ,,
Lower Carpentaria	398	1,149	19 above
Upper Carpentaria	344	749	118 ,,
North Coast Barron	1,379	1,091	21 below
North Coast Herbert	1,390	1,916	38 above
Central Coast East	603	792	31 ,,
Central Coast West	345	352	2 ,,
Central Highlands	279	266	5 below
Central Lowlands	239	174	27 ,,
Upper Western	197	219	11 above
Lower Western	161	100	38 below
South Coast Port Curtis	427	875	105 above
South Coast, Moreton	637	1,054	65 ,,
Darling Downs, East	277	576	108 ,,
Darling Downs, West	232	397	71 ,,
Maranoa	263	385	46 ,,
Warrego	193	213	10 ,,
Far South-West	133	239	80 ,,

Commonwealth of Australia, Meteorological Bureau, Brisbane.

ASTRONOMICAL DATA FOR QUEENSLAND.

MAY, 1947.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.13	5.17	Cairns	12	46	Longreach	28	42
6	6.16	5.13	Charleville	26	28	Quilpie	37	33
11	6.19	5.09	Cloncurry	38	61	Rockhampton ..	2	18
16	6.21	5.06	Cunnamulla ..	31	28	Roma	15	18
21	6.24	5.04	Dirranbandi ..	21	17	Townsville	11	38
26	6.27	5.02	Emerald	13	26	Winton	31	50
31	6.29	5.00	Hughenden ..	23	47	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Date.	Rise.	Set.
	p.m.	a.m.
1	3.10	2.05
2	3 42	3.05
3	4.14	4.03
4	4.47	5.00
5	5.21	5.56
6	5.56	6.54
7	6.35	7.51
8	7.19	8.47
9	8.06	9.42
10	8.57	10.33
11	9.50	11.21
		p.m.
12	10.45	12.04
13	11.41	12.43
14	..	1.19
	a.m.	
15	12.38	1.53
16	1.34	2.25
17	2.32	2.57
18	3.31	3.31
19	4.34	4.08
20	5.39	4.49
21	6.48	5.37
22	7.59	6.32
23	9.08	7.34
24	10.11	8.41
25	11.07	9.49
26	11.55	10.56
	p.m.	
27	12.36	11.59
28	1.13	..
		a.m.
29	1.46	12.59
30	2.18	1.57
31	2.49	2.54

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29 ; Dirranbandi 19 :
Quilpie 35 ; Roma 17 ; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	16	23	31	39	7	14	36	45
6	26	13	43	28	18	3	50	32
11	29	10	45	25	20	0	52	28
16	22	17	38	33	13	8	44	37
21	12	28	27	43	2	19	30	52
26	12	26	27	42	2	17	30	49
31	22	17	38	33	13	8	44	37

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	22	38	45	57	30	42	19	33
3	33	28	52	49	37	34	27	24
5	43	17	59	42	44	27	36	16
7	51	9	65	36	49	22	42	9
9	54	4	67	33	51	19	44	5
11	53	5	67	34	50	20	44	6
13	45	10	61	37	46	23	37	10
15	42	19	58	43	43	28	35	17
17	31	30	51	50	35	35	25	25
19	20	40	44	58	29	43	18	34
21	10	50	37	63	22	49	9	42
23	5	52	35	65	19	50	5	44
25	7	49	36	63	20	49	7	41
27	16	39	41	57	26	42	14	34
29	27	35	48	55	33	40	22	30
31	36	24	55	46	40	32	30	21

Phases of the Moon.—Full Moon, May 5th, 2.53 p.m.; Last Quarter, May 13th, 6.8 p.m.; New Moon, May 20th, 11.44 p.m.; First Quarter, May 27th, 2.35 p.m.

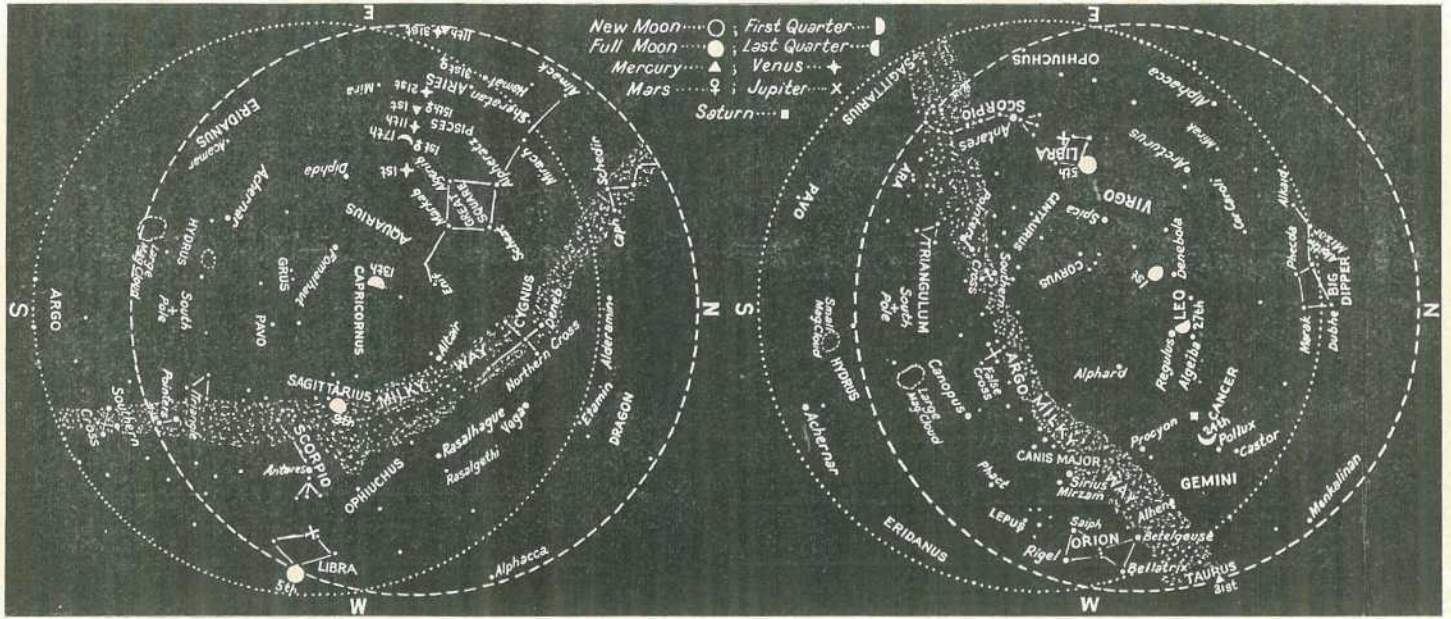
On May 17th the Sun rises and sets 20 deg. north of true east and true west respectively, and on May 2nd and 17th the moon will rise and set approximately at true east and true west respectively.

Total Eclipse of Sun, May 20th.—The path of totality—about 100 miles wide—will stretch from about 200 miles to the west of Concepcion, in Chile; across South America to Bahia, in Brazil; across the Atlantic Ocean to Liberia, in Africa; across the centre of Africa to just east of Lake Victoria. It will be seen from all Africa and nearly all South America as a partial eclipse.

Mercury.—On the 1st in the constellation of Pisces will be a morning object, rising about 1 hour 15 minutes before the Sun. The interval of its rising before sunrise will decrease until the 15th, when it will be in superior conjunction and will rise and set with the Sun. After this date it will become an evening object and on the 27th will pass between Aldebaran and Nath. On the 31st, in the constellation of Taurus it will set about 1 hour after the Sun.

Venus.—Now observable low in the east during morning twilight. At the beginning of the month in the constellation of Pisces, will rise about 2½ hours before the Sun. On the 17th it will pass 1 degree to the south of Mars. At the end of the month, in the constellation of Aries, it will rise at about 2 hours before sunrise.

Mars.—At the beginning of the month, may be seen between Mercury and Venus when it will rise about 2 hours before the Sun. At the end of the month, in the constellation of Aries, it will rise nearly 2½ hours before the Sun.



Jupiter.—Will rise near sunset at the beginning of May and will be visible throughout the night. At the end of the month, it will rise during the afternoon and will set about 1 hour 15 minutes before sunrise.

Saturn.—Now rises before midday and will be well up in the heavens by evening. On the 1st it will set about 1 hour before midnight and on the 31st between 9 p.m. and 10 p.m.

Star Charts.—The chart on the right is for 7.15 p.m. in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory border on the 15th May. (For every degree of Longitude we go west, time increases 4 minutes). The chart on the left is for 10 hours later. On each chart the dashed circle is the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing North hold "N" at the bottom; when facing South hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about one hour later than the time stated for the 15th and at the end of the month about one hour earlier than that time. The positions of the moon and planets which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

MARCH RAINFALL.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Mar.	No. of years' records.	Mar., 1946.	Mar., 1947.		Mar.	No. of years' records.	Mar., 1946,	Mar., 1947.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	9·08	42	10·61	10·89	Gatton College ..	3·33	44	4·21	4·98
Cairns	18·16	61	7·37	15·67	Gayndah	3·10	72	0·99	9·56
Cardwell	15·77	71	19·73	21·98	Gympie	6·13	73	7·83	9·21
Cooktown	15·28	67	4·14	12·78	Kilkivan	3·90	62	3·39	9·57
Herberton	7·93	57	8·58	4·31	Maryborough ..	5·90	72	7·30	9·39
Ingham	15·99	51	20·17	25·73	Nambour	9·41	47	22·11	21·17
Innisfail	26·81	62	20·13	32·47	Nanango	3·42	61	4·30	6·56
Mossman	18·75	19	4·91	16·44	Rockhampton ..	4·48	72	4·40	5·76
Townsville	7·11	72	16·78	11·59	Woodford	7·90	55	15·81	9·89
Central Coast.					*Darling Downs.*				
Ayr	6·37	56	13·15	19·11	Dalby	2·74	73	1·04	5·15
Bowen	5·74	72	13·66	8.51	Emu Vale	2·47	47	3·27	3·83
Charters Towers ..	3·71	61	7·35	3·89	Jimbour	2·43	64	0·89	7·15
Mackay	12·09	72	19·36	5·47	Miles	2·74	58	0·32	3·53
Proserpine	12·17	40	16·73	10·90	Stanthorpe	2 59	70	2·58	6·08
St. Lawrence ..	5·41	72	7·09	5·55	Toowoomba	3·78	71	4·38	8·44
South Coast.					Warwick	2·60	78	3·61	3·36
Biggenden	3·98	44	2·31	11·47	*Maranoa.*				
Bundaberg	5·35	60	4·82	9·10	Roma	2·72	69	Nil	1·93
Brisbane Bureau ..	5·65	95	8·34	11·24	St. George	2·15	62	0·68	6·17
Caboolture	7·83	67	15·16	14·62	*Central Highlands.*				
Childers	4·84	48	3·80	16·66	Clermont	3·16	72	4·55	1·91
Crohamhurst	11·12	50	21·99	..	Springsure	2·97	74	2·27	2·81
Esk	4·72	56	6·43	6·51					

CLIMATOLOGICAL DATA FOR MARCH.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Atmospheric Pressure Mean at 9 a.m.	Shade Temperature.		Extremes of Shade Temperature.				Rainfall.	
		Mean Max.	Mean Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Pts.	
Cairns	..	88	74	94	4	69	26	1,565	22
Herberton	..	80	65	86	30	59	15	431	18
Townsville	..	87	74	92	31	69	28	1,159	17
Rockhampton	29·93	85	70	92	2	65	23. 25	576	16
Brisbane	30·00	81	68	89	18	63	22	1,124	19
Darling Downs.									
Dalby	..	84	64	91	18	55	22, 24	515	9
Stanthorpe	..	77	59	85	5, 18	50	24, 25	608	18
Toowoomba	..	77	61	86	18	53	22	844	14
Mid-Interior.									
Georgetown	29·83	92	72	98	2, 9, 17	67	27	760	12
Longreach	29·87	88	73	95	5, 8, 9, 15, 16	67	31	168	8
Mitchell	29·95	85	63	89	9, 10, 16	51	24, 25	284	8
Western.									
Burketown	..	89	76	98	3	71	28	3,151	15
Boulia	29·81	96	75	106	2, 8	65	31	90	5
Thargomindah	29·88	88	66	100	9	60	3	216	5

A. S. RICHARDS, Divisional Meteorologist.

Commonwealth of Australia,
Meteorological Bureau, Brisbane.