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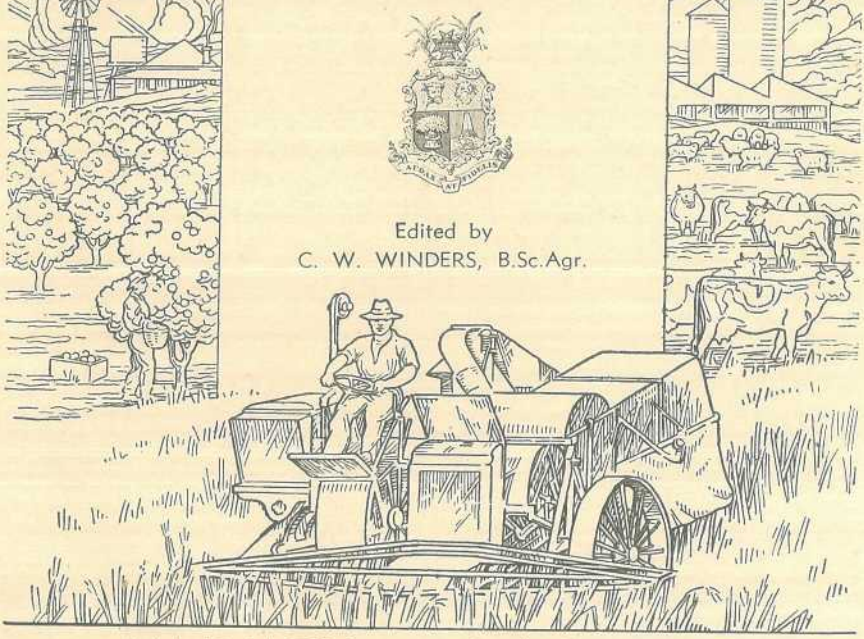
Edited by
C. W. WINDERS, B.Sc.Agr.



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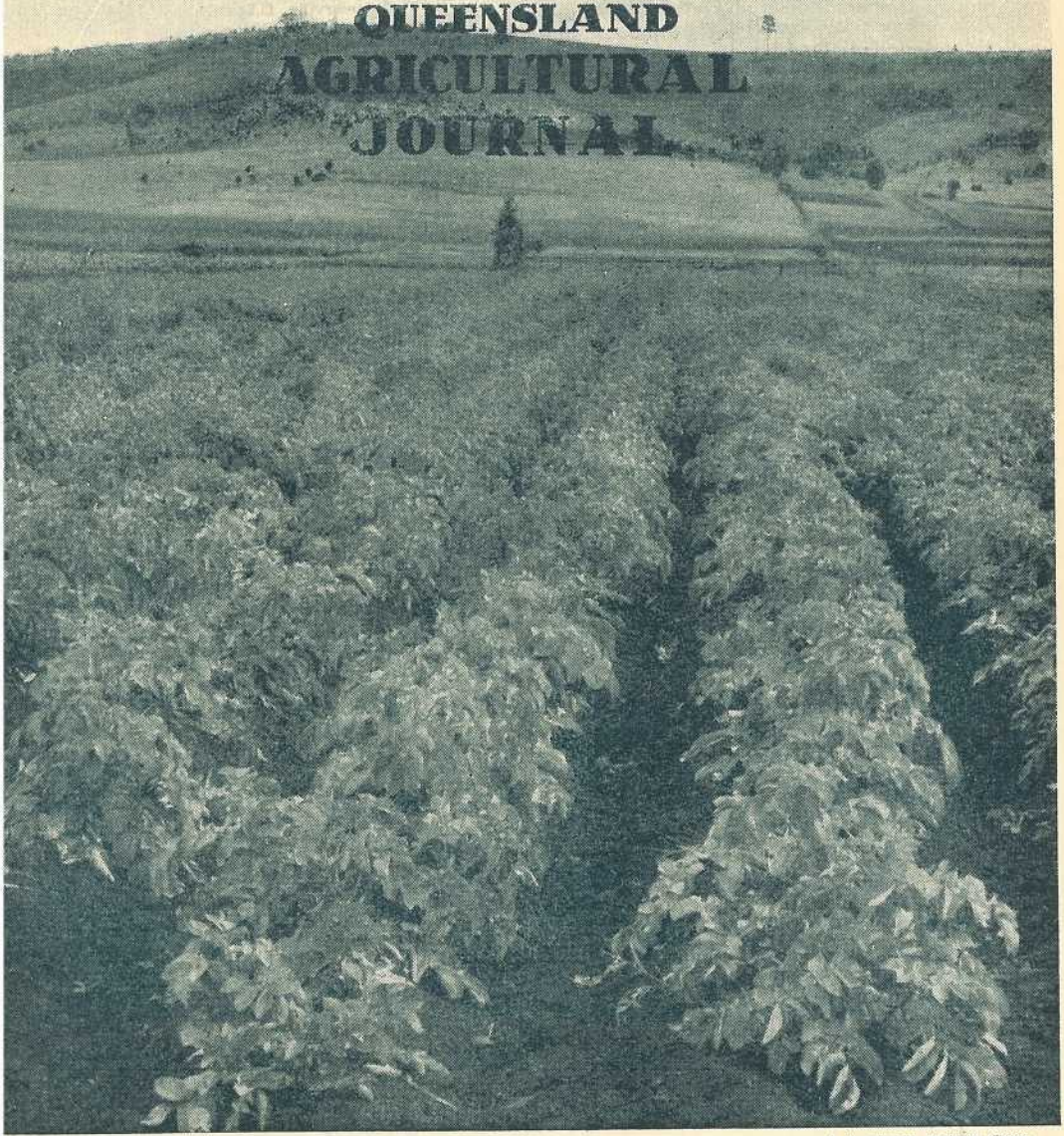

A Lockyer Potato Crop.

LEADING FEATURES

Expanding Services to the Man on the Land
Soil Conservation in Queensland
Agriculture in the Mackay Area
Avocado Growing in Queensland
Cooling Milk on the Dairy Farm
Swine Brucellosis
Vibrionic Abortion in Cattle

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THE MINISTER'S NEW YEAR MESSAGE.

» «

Looking back on agriculture in Queensland during the 1940's, primary producers might well feel proud of their achievements in a period filled with difficulties. The magnificent way in which they responded to the Nation's call for food during the war years, and their enterprise in producing crops to which they were unaccustomed, will long be remembered. The setting of records in some fields of production within recent years, despite many handicaps, similarly merits commendation.

Hon. H. H. Collins.

The year 1949 has seen a strengthening of the price structure for important agricultural and pastoral commodities produced in Queensland. Producers' organisations and Governments alike have been striving to secure or maintain a good measure of stability in the marketing of primary products. Long-term contracts, reviewable at intervals, and participation in international planning for the disposal of farm products, have contributed to this end, and the coming decade promises to be one of prosperity for Queensland producers.

This note of confidence, however, must be tempered by the realisation that selling at a profit implies efficiency in production. It is with this aspect of primary production that the technical services of the Department of Agriculture and Stock are particularly concerned. It is well recognised that there is usually a lag in the application of the findings of agricultural research to farm practice, but I feel sure that the circumstances of farming during the next decade will ensure a receptive field for the application of technological advances. The Department certainly will continue, with the very welcome co-operation of producers, to play an active part in the solution of farm problems and the dissemination of information.

On the eve of the new decade, I join with the members of the Department's staff in extending good wishes to all engaged in the land industries.

H. H. Collins

Minister for Agriculture and Stock.

Expanding Services to the Man on the Land.

ARTHUR F. BELL, Under Secretary.

War Activities and Re-organisation.

IN common with most organisations, the development and many of the basic activities of the Department of Agriculture and Stock were suspended during the war. One-third of the staff were absent on duty with the armed forces, or technical services directly associated with the war effort.

Those who remained were called upon to perform many duties far outside the normal range. The Department provided advisory personnel to assist numerous national committees and other organisations; it provided the State Executive of the National War Agricultural Organisation, while field staff acted as the executive officers of the forty District War Agricultural Committees; it undertook the rationing of fertilizer and stock foods and assisted in the allocation of the short supplies of farm machinery and materials; it co-operated with the Manpower Directorate in the provision of rural labour, the release of army personnel for rural work, and the placement on farms of Women's Land Army girls and prisoners of war; it fostered special new crop and food production drives; and it provided special technical services to the armed forces.

The magnitude of the extra duties during the years 1942-46 may be gauged from a statistical summary of some of these activities:—

More than 180,000 applications for the release of materials were received and considered, and recommendations made to the appropriate Commonwealth releasing authorities.

Sixteen thousand applications for the release of personnel from the Services for rural work were examined for recommendation to Manpower; this almost invariably required an inspection of the property in question and its activities.

Ten thousand applications for fertilizer rations received individual attention each year.

Two hundred and fifty thousand permits to buy stock food were issued to 130,000 applicants.

Twenty-five thousand applications were received for the release of tractors, engines, and other farm machinery, evaluated, and nearly 12,000 releases made.

Equipment of permanent and seasonal camps, allocation to farms, and the organisation of transport was carried out on behalf of the Australian Women's Land Army.

One thousand one hundred and ninety-seven prisoners of war were placed on farms or pastoral holdings.

Innumerable representations were made in respect of improved petrol rations, priority for goods, and many other matters affecting primary production.

In 1943 the Deputy Public Service Commissioner and the writer (then acting as Director of Sugar Experiment Stations) were directed to enquire into the organisation, staffing, and services of the Department of Agriculture and Stock, with a view to determining in advance the adjustments necessary to meet post-war needs. On the basis of the report submitted the Department was completely re-organised.

The re-organisation took cognizance of the growing complexity of the services demanded of a modern Department of Agriculture, probable avenues of development in primary production, and deficiencies in the services then being rendered. For administrative purposes the Department was divided into five Divisions, namely—Plant Industry, Animal Industry, Dairying, Marketing, and General Administration. Each Division in turn is composed of constituent branches of which there are now twenty-two.

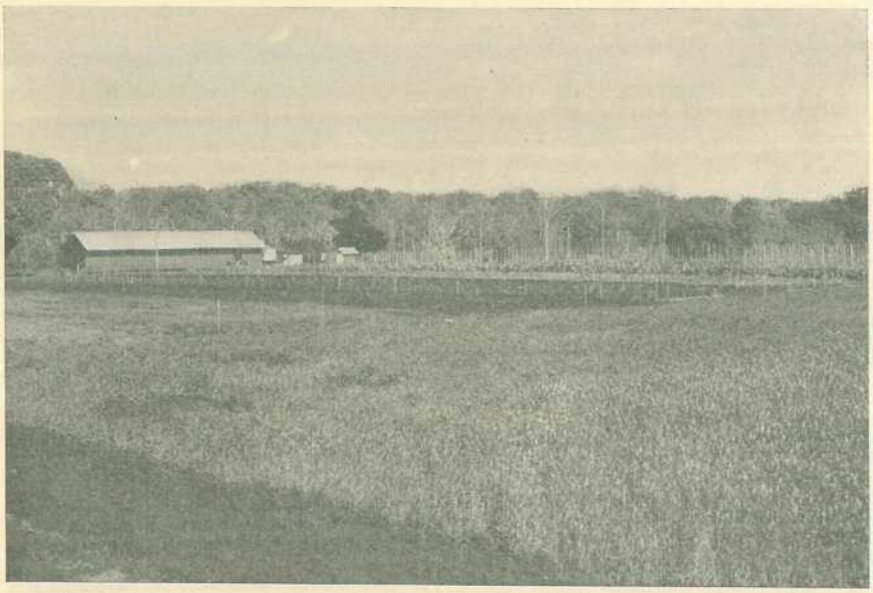

Plate 1.

REDLANDS HORTICULTURAL EXPERIMENT STATION.—This new station, of 26 acres, provides facilities for experimental work on fruit and vegetable crops.

Recent Developments.

The purport of this short article is to give an outline of the development of *new* services to the primary producer since the re-organisation in 1945. It could not, within reasonable limits, attempt to cover the full range of Departmental activities (in this connection it might be noted that the Annual Report for 1948-1949 occupied 100 pages of foolscap size). Omission of mention of particular services should therefore be interpreted as indicating no substantial change in form and scope of activities since 1945.

Broadly speaking, the functions of a Department of Agriculture are twofold. On the one hand it should carry out continuous research and investigation into problems which adversely affect primary production and the processing and marketing of primary produce or, alternatively, into avenues of new or increased production. At the same time it must take to the farmer the information so gained, in order that it may be translated into practice. To carry out these requirements the Department employs officers trained in more than twenty professions, and has field officers stationed in more than eighty centres with a State-wide distribution.

The extension of these services since 1945 is outlined below:—

Experiment Stations.

There has been a marked advance in the provisions of experiment station facilities, particularly in tropical North Queensland. From Mackay north there are long-established Sugar Experiment Stations at Gordonvale and Mackay, a Tropical Agricultural Station at South Johnstone, and an Animal Health Station at Townsville. Within the

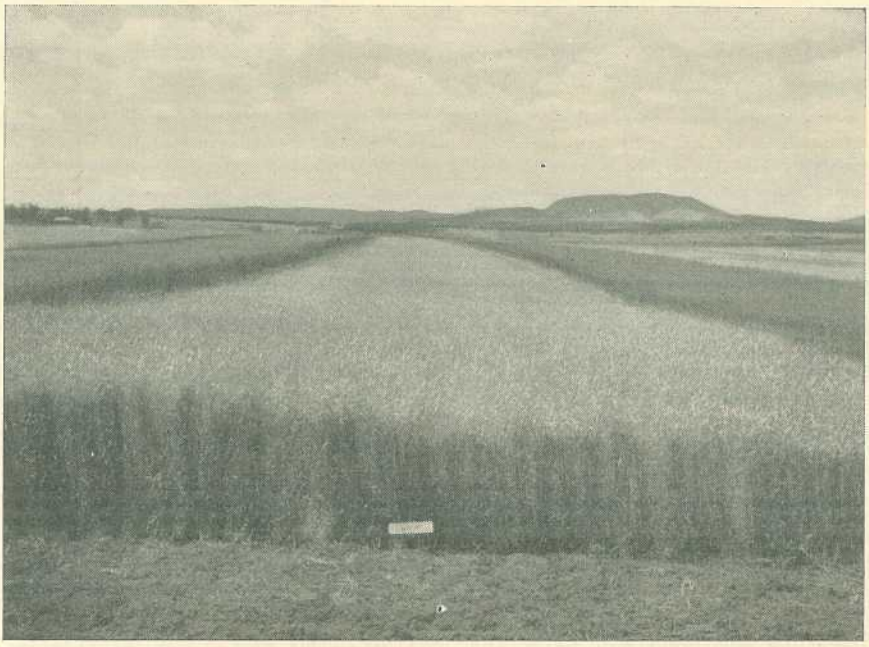

Plate 2.

HERMITAGE REGIONAL EXPERIMENT STATION.—Situated near Warwick, this station is engaged in investigations of crop and livestock production problems of the eastern Darling Downs. This view is of a wheat variety trial.

last few years there have been established Regional Experiment Stations at Kairi, near Atherton, and at Ayr; a Tobacco Experiment Station at Mareeba, with sub-stations on the Herbert and Burdekin Rivers (the latter serving as a demonstration area for soldier settlement); another Sugar Experiment Station in the irrigated area of the Burdekin, and two cane breeding sub-stations at Babinda and Mackay; a Horticultural sub-station at Cairns; and a Pasture sub-station at Utchee Creek, which will serve as an adjunct to the South Johnstone Station. In addition a Beef Cattle Research Station will be established conjointly by the Australian Meat Board, the Commonwealth Scientific and Industrial Research Organization, and the Department of Agriculture and Stock.

In Southern Queensland the cotton station at Biloela has been incorporated in a Regional Experiment Station, and a Regional Station has been established near Warwick; a Horticultural Experiment Station has been established at Nambour, and a Vegetable Station at Ormiston in the Redlands district; this Department is responsible for the technical

Plate 3.

BILOELA REGIONAL EXPERIMENT STATION.—This station has taken over the activities of the Cotton Research Station, and now devotes attention to crop and livestock production in the central agricultural areas. Linseed, shown in this picture, is one of the newer crops under trial.

Plate 4.

BURDEKIN TOBACCO SUB-STATION.—The security of ex-servicemen settlers in the Clare district is assisted by this Departmental tobacco station. The view is of tobacco seed-beds, with a curing barn in the background.

operations of the Irrigation Research Station provided by the Bureau of Investigation of Land and Water Resources at Gatton; the Sugar Experiment Station at Bundaberg, and the Animal Health Station at Yeerongpilly are expanding their long-standing services; a second jointly-operated Beef Cattle Research Station will also be developed in Southern Queensland in the near future.

Plate 5.

INTRODUCING NEW METHODS IN SHEEP HUSBANDRY.—Graziers are shown here practising the Mules operation at a Field Day organised by the Department. This operation provides a high measure of protection against breech strike by the blowfly.

The Department is under more or less constant pressure to open new local experiment stations. However, while a certain coverage of experiment stations is necessary for investigational work, resources should not be dissipated in maintaining an excessive number. As stated in the Annual Report for 1948-1949, experiments actually carried out on the farms are the basis of progress and, while some experiment stations are a necessary adjunct to this work, they are not a substitute for it.

Sheep and Wool.

The sheep and wool industry now occupies first place in monetary earnings. From a very small section in the Department, with only one field officer stationed outside Brisbane, there has been developed an active Branch with officers stationed in eleven pastoral centres, with more staff in training. This greatly increased service has enabled the value of improved practices to be brought home to increasing numbers of sheep men. During the year 1948-1949 this staff visited 1,249

KEY TO SERVICES

-A-: Agricultural advisory.
-AR-: Agricultural research.
-C-: Sugar Bureau.
-D-: Dairy advisory.
-E-: Poultry branch.
-H-: Horticultural advisory.
-HR-: Horticultural research.
-P-: Pig branch.
-S-: Stock and slaughtering inspection.
-VR-: Veterinary research.
-V-: Veterinary.
-W-: Sheep and wool.
R: Regional Experiment Stations.

BOONDOOMA -S-
PROSTON -D-
MURGON -VJ- -D- -P-
GYMPIE -S- -D- -H-
WONDAI -S-
COOROY -H-
KINGAROY -S- -V- -D- -A- -AR-
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SOUTHPORT
GOONDIWINDI -S-
STANTHORPE -H- -HR-
WALLANGARRA -H-

SE INSET

20°
25°
140°
145°
150°

properties in an advisory capacity, held 21 field days, and carried out 718 demonstrations; drought feeding of stock by approved methods was supervised on 120 properties.

A scheme for subsidising the purchase of long-wool rams, so as to improve the quality and quantity of lamb meat, was introduced in 1948, and the purchase of some 400 rams was subsidised in the year. Two officers were sent to New South Wales to study the latest developments in fat-lamb raising.

Equipment has been imported, and during the current year it is anticipated that a fleece-testing unit will be put into operation; this will enable breeders to secure the information on fleece characteristics which is essential for progeny testing in sheep breeding.

As a result of energetic advocacy and demonstration of the Mules operation as a measure for blowfly control, this method has been introduced into a large proportion of breeding flocks. Vaccine for the control of scabby mouth, brought out initially by the Animal Health Station at Yeerongpilly is being increasingly used and 522,500 doses were distributed in 1948-1949.

Sugar Experiment Stations.

The Bureau of Sugar Experiment Stations was brought to a high state of development in the early nineteen thirties; the yield of sugar per acre was 40 per cent. higher in 1939 than in 1929, and the total crop 70 per cent. higher. In view of the pronounced success which attended cane breeding operations at Cairns, Mackay, and Bundaberg, these activities have now been extended by the establishment of a new experiment station at Ayr, and two cane breeding sub-stations at Babinda and Mackay. Two Bureau canes, Q.28 and Q.50, which were bred at the Mackay experiment station within the last few years, now constitute some two-thirds of the crop in the central district. More than 25 per cent. of the State's 1948 crop was comprised of canes bred by the Bureau in recent years.

A New Pineapple Section.

In view of the importance, and potentially greater importance, of the pineapple industry a special pineapple section has recently been set up within the Horticulture Branch. An officer with experience in both research and field advisory work has been placed in charge of this team and it will be his responsibility to translate the findings of research workers into the practical advice of the field officer. With headquarters at Nambour, pineapple research and field specialists will be stationed at Townsville, Ayr, Gympie, Nambour, and Caboolture, and also in the research laboratories in Brisbane.

Dairying.

Butter production in Queensland steadily declined from the record of 69,000 tons in 1938-39 to the low figure of 33,000 tons in the drought year of 1946-47, but had increased to 47,000 tons in 1948-49. Special efforts are now being made to restore production by increased efficiency and in this work the Department is being aided by a financial grant from the Commonwealth Government.

The staff of the Dairying Division has been doubled in the past four years. In order to further improve the research and investigational services two young men were sent to New Zealand in 1948 and it is expected that a third will go in 1950. On their return these

officers will specialise in butter manufacture, cheese manufacture, and whole milk production respectively.

A system of group herd recording has been developed and rapidly extended. A group consists of about 22 herds each of which is tested once per month; the promulgation of the results of the tests among the farmers of each group is assisting culling, is stimulating interest in better husbandry, is of great general educational value, and is engendering a healthy spirit of competition. Thirty-one such units, each under the control of a special officer, are now working and more are in course of organisation.

Plate 6.

BREEDING BETTER SUGAR CANE.—This is a crop of the variety Q.50, bred by the Bureau of Sugar Experiment Stations and now widely grown in central and southern cane districts.

The number of producers supplying milk to Brisbane increased from 700 in 1943 to 1,400 in 1948; whereas in 1938 some 4,000 gallons of bottled pasteurised milk were sold in Brisbane daily, the daily average in 1948 was 24,000 gallons, while a further 10,000 gallons of pasteurised milk is sold unbottled. The proportion of bottled pasteurised milk sold in Brisbane is higher than in any other State capital. The necessary inspections and examination of milk have increased correspondingly and in the year 1948-49 a total of 121,505 samples of milk was examined in the Dairy Research Laboratory, compared with 56,108 in 1943-44. The quality of milk has rapidly improved and in 1948-49 the number of samples of unsatisfactory quality was little more than half that in 1943-44.

Pasteurisation of milk is being fostered and pasteurisation plants now operate in Brisbane, Southport, Merrimac, Ipswich, Toowoomba, Warwick, Nambour, Murgon, Rockhampton, Mackay, Innisfail, Cairns and Malanda.

Pure bred herd recording, which naturally was virtually at a standstill during the war, has increased rapidly and 154 herds were tested in 1948-49. Any further extension of this rather exacting work is limited by the pressure of other duties on dairy officers.

The Division of Dairying, the Agriculture Branch and the Cattle Husbandry Branch have co-operated in an intensive drive to promote dairy efficiency.

Six organised group feeding trials are being carried out on 24 farms in major dairying districts, while two more groups will be launched shortly. These groups each consist of four farms and carefully determined rations are being fed to cows on three of these, while the fourth remains on the old feeding basis; the methods of feeding will be rotated each year to give a further check on the relative value of the different feeding methods.

Forty-two farms have been selected as "demonstration farms" and selection of another twelve will be completed shortly. The owners of these farms have agreed to carry out recommended practices in respect of pasture improvement, fodder conservation, subdivision of paddocks, care of the herd, &c. The results obtained will demonstrate the benefits and increased yields which may be expected.

Fifty-five pasture improvement trials, distributed through the main dairying districts, are now in progress. Over the past two years 215 varieties of newly imported pasture plants (grasses and legumes) have been planted on the Regional Experiment Stations, where their performance under Queensland conditions is being investigated.

A scheme for the systematic tuberculin testing of dairy herds supplying the metropolis was initiated in 1945 and during the year 1948-49 over 71,000 animals from 1,243 herds were tested. Although a heavy incidence of the disease was found in certain districts the number of affected animals found in the second round of tests has been very small. T.B. testing is also being carried out on the Darling Downs and in areas supplying Ipswich, and South Coast towns, and will be extended to other areas as circumstances permit.

An associated scheme for the encouragement of resident fully qualified veterinary practitioners in dairying districts was put into operation some 18 months ago. Approved practitioners are given "block testing" within a defined district with the proviso that the practitioner may be required to live within a stipulated area. The granting of testing rights ensures the initial steady income necessary to attract the practitioner; nine veterinarians are now testing under this scheme.

Veterinary Services.

A scheme for the encouragement of private practitioners is outlined in the preceding paragraph; this will relieve Departmental veterinary officers of routine testing and increase their concentration on disease prevention and advisory services.

Realising the need for expanded veterinary services the Department in 1945 commenced the award of veterinary scholarships at the University and there are now twenty scholarship holders in various stages of their course. Since they have entered into bonds to serve the Department upon graduation, a very material increase in veterinary staff is imminent. In addition the Premier has recently announced that the University will be given the financial assistance necessary to reopen the Faculty of Veterinary Science on a fully operative basis, thus ensuring a steady flow of veterinarians to the animal industries of the State.

Decentralisation of Pig and Poultry Advisory Services.

In the past the instructional staffs of the Pig and Poultry Branches were all stationed in Brisbane, whence they made periodical visits to country centres. However, the building up of the advisory services which has taken place since the reorganisation has enabled the stationing of officers in country centres where they can maintain better contact with the producers.

Advisory officers of the Pig Branch are now to be found in Brisbane, Toowoomba, Murgon, and Atherton, one will take up duty at Biloela shortly, while young officers in training will soon be available for other centres. During the past year these advisers paid visits to nearly 1,700 farms.

The poultry industry is to a considerable degree concentrated in or near the Greater Brisbane area and there is thus necessarily some concentration of advisory officers at Headquarters; in addition, advisers are now stationed at Toowoomba, Rockhampton, Atherton, and Townsville, while another officer has been attached to the Regional Experiment Station at Kairi in order to carry out poultry feeding experiments under North Queensland conditions.

Cattle Husbandry.

Branches providing advisory services aiming at improved methods of sheep, pig and poultry husbandry have been established for many years and, as stated above, these services have recently been markedly expanded. However, for various reasons, no similar service was provided for raisers of beef and dairy cattle.

In 1948 steps were taken to correct this position by setting up a Cattle Husbandry Branch; the technical staff of this Branch now numbers five, while several holders of Departmental scholarships will take up duties on completion of their University studies.

Up to the present the Branch has concentrated upon investigating and advocating improved methods of dairy cattle husbandry in association with the drive for greater efficiency in the dairy industry. Meanwhile steps are being taken to recruit staff for the study of beef cattle husbandry problems and the first appointee is now obtaining practical cattle management experience on a northern station property.

Improved standards of cattle husbandry are closely associated with improved levels of nutrition; pasture experiments are a most important phase of the necessary investigations and are outlined in the section dealing with dairying.

Soil Conservation.

Immediately prior to the war officers of the Agriculture Branch established a number of soil conservation experiments on the Darling Downs and in the Kingaroy district. The first step towards the establishment of a soil conservation service was taken by the appointment of a Soil Conservationist in September, 1947. In the intervening two years it has been possible to increase the technical staff to nine and field officers are now located on the Darling Downs, at Kingaroy, and at Atherton.

Steps have been taken to establish soil-conservation demonstration areas in districts menaced by erosion and to date twenty such demonstrations have been completed and stand as a permanent reminder that this menace can be overcome.

The factors influencing soil erosion in Queensland are very different from those ruling in those countries where most of the research on soil conservation has been carried out. Consequently the Departmental soil conservation service must devote a great deal of its resources to investigation and develop methods suitable to Queensland conditions as it proceeds. In this respect the Regional Experiment Stations have proved indispensible; experience gained on the Kairi (Atherton) Station, for example, where a trial contour banked area withstood the onslaught of 21½ inches of rain in eight days, will be of great value as a basis for recommendations on the Atherton Tableland.

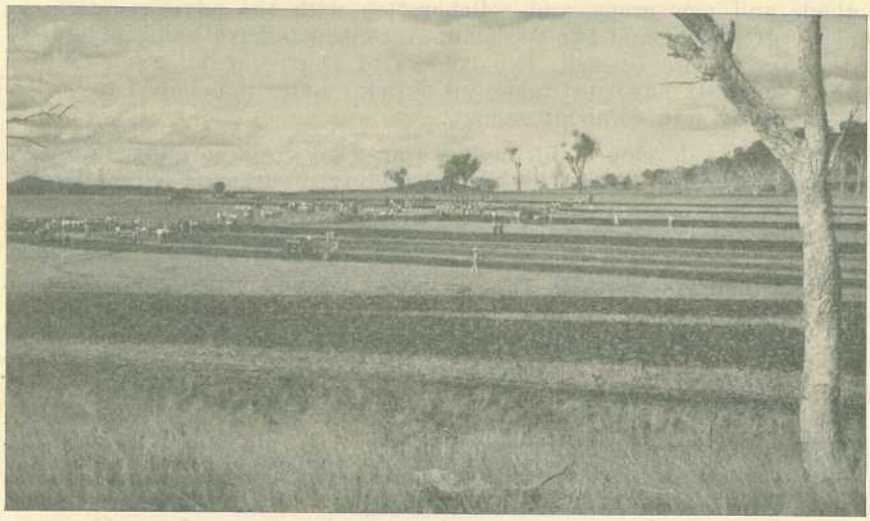


Plate 7.

BEATING SOIL EROSION.—This is a view of a Field Day gathering of farmers getting first-hand information on soil conservation practices on a Soil Conservation Demonstration Farm.

Interest in conservation practices is growing rapidly and the staff cannot as yet cope with the requests for assistance. Naturally, persons trained and experienced in conservation technique are not readily available and steps have been taken to train enthusiastic young men. At the same time, it must be appreciated by the community that the function of the soil conservation service is to demonstrate and advise upon the necessary measures of prevention and correction—not to carry them out. Queensland is a vast State with less than two persons per square mile, while the United States has nearly 50; it would obviously be difficult to provide a service on the United States pattern in Queensland.

New Crops.

Less than one half of one per cent. of Queensland is under cultivated crop and there is room for great expansion of agricultural production both by the extension of old crops and by the development of new ones. In this connection it is apparent that the diminishing gap between the wages paid to white and coloured labour, and the increasing degree of mechanisation, will make it possible for Queensland to produce an increasing number of commodities hitherto regarded as the close preserve of countries employing coloured labour.

The development of a new crop, particularly if it is markedly different from the staple crops, requires a great deal of careful investigation of its climatic, cultivation, and harvesting needs, pest and disease problems, and the storage, processing and marketing of the product. Such investigations, or the development of new methods for old crops, require concentration and specialised knowledge; they do not proceed very fast if they are merely incidental to a thousand and one jobs. Consequently there has comparatively recently developed in the advanced countries of the world a new profession, that of "Agronomist."

In order to provide the staff facilities for such investigation of new methods and new crops, and collaboration with the advisory staff, a Senior Agronomist and two Assistant Agronomists have been appointed to the Agriculture Branch; two holders of Departmental scholarships at the University have just taken up duties. Later it is hoped to build this agronomy staff to about eight.

New crops developed during the war were grain sorghum, ginger, and canning beans. An active plant breeding programme is now being pursued so as to extend the range of growth of grain sorghum; ginger cultivation followed the cessation of supplies from China and a processing factory has been established at Buderim. Linseed was expanded from less than 200 acres in 1947 to 5,500 acres in 1948 and approximately 10,000 acres in 1949. Cultivation of a dwarf-type sunflower (suitable for harvesting with wheat harvesters) shows promise on the Darling Downs and is increasing. Attention is now being given to rice production and the possibilities of tea are being explored.

Seed Certification and Pedigreed Stock.

Official testing of seeds for germination has long been adopted but, short of growing a plant, there is no means of telling whether it is true to type. Consequently there has been initiated a seed certification service whereby seed is grown and harvested under the supervision of Departmental officers who can then certify as to trueness to type. Such certification is being made for seed of hybrid maize, grain sorghum, Sudan grass, beans, tomatoes and papaws; in addition a seed selection service for wheat growers is provided in co-operation with the Wheat Board, and all cotton seed is selected by Departmental officers. A large proportion of the tobacco seed is selected and distributed by the Agriculture Branch and the bulk of Queensland peanuts is grown from selected seed.

In order to achieve uniformity of product a selection has been made of stock of the smooth-leafed pineapple and this pedigreed stock is now ready for distribution to approved propagators from the Horticultural Experiment Station at Nambour; a similar service is being developed for avocadoes. The distribution of certified citrus budwood has been in operation for some years.

The most spectacular advance arising from this system of selection and certification has been made in tomato production. The four certified strains now recommended for the Stanthorpe district have yielded up to six times as much as the old standard varieties when grown side by side with them. A similar investigation has been started at Bowen.

Market and Crop Reports.

There is much more to farming than growing crops successfully; farming can be a successful business only if, in addition, crops are grown

when and where needed and are marketed under the best obtainable conditions. To achieve this end it is essential that the farmer have reliable information as to supply and price trends. On the other hand, the services rendered to the farmer by merchants, financial houses, and transport agencies can be more efficiently provided on the basis of advance knowledge of production trends.

Daily market reports were instituted in 1947, and comprehensive reports on prices and quality of fruit, vegetables and farm produce sold in the metropolitan markets are compiled and issued before noon each day. These reports are accepted as standard quotations.

Monthly reports on production trends, commenced in 1946, are much in demand by farmers, Government Departments, and commercial houses. They are compiled from the reports of the many Departmental field officers, Marketing Boards, and correspondents.

Individual crop forecasts are also issued as compiled. These crop forecasts are based on an Honorary Crop Correspondent scheme and have obviously been much appreciated. Public spirited correspondents representing particular areas submit reports on the extent of plantings and progress of crops and from this information forecasts (which are proving to be very reliable) are made. So far the service has been limited to certain major crops but it is being extended gradually.

Staff Training.

The training of staff today determines the calibre of tomorrow's services to the man on the land. The training of juniors has been greatly facilitated by the development of experiment stations distributed through the State; the value of this opportunity for experience in practical farm operations cannot be over-emphasised.

Since the war organised schools for field officers have been conducted at Head Office by senior scientific personnel. These schools have covered the general subjects of agriculture, horticulture, cattle husbandry, sheep husbandry, poultry raising, and control of diseases of stock.

Central Publicity Services.

The "Agricultural Journal" has for over fifty years been the main vehicle of publicity for the Department. With the increase of research work it was felt that one Journal could not satisfactorily serve as both a research and an extension publication, and in 1943 the "Queensland Journal of Agricultural Science" was launched.

A weekly "News Bulletin" was inaugurated in July, 1949, and is issued to the metropolitan and country press and radio stations; this deals with subjects of educational and topical value. In addition, special press releases on subjects of interest to residents of city and country are made almost daily.

Field days have proved a valuable extension medium and in association with the Queensland Dairymen's Organisation and other organisations of primary producers they are now being held on an extended scale. During the year 1948-49 some 65 field days were conducted by Departmental officers.

Wireless, a modern and powerful medium for extension activities, has been exploited and each year about 60 talks are given by Departmental officers.

Soil Conservation in Queensland.

J. E. LADEWIG, Senior Soil Conservationist, and A. F. SKINNER, Soil Conservationist.

1. The Erosion Problem.

So much has been written and spoken of soil erosion in recent years that it is scarcely necessary to attempt any definition at this stage. However, it is as well to bear in mind that, when reference is made to erosion, it is accelerated man-induced erosion which is normally meant nowadays

Natural erosion, by means of which rocks of the earth's crust are broken down to form fine particles of soil which are subsequently transported to new sites, is a most important and generally speaking a wholly beneficial phenomenon. It is a slow and essentially ultimately a building process.

Man-induced erosion, on the other hand, is a rapid degradation process, destructive instead of constructive, and as such must be arrested or at the very least retarded if our civilisation is to be retained.

In order to avoid the cumbersome use of terms when erosion is discussed in this series of articles it is to be taken as meaning man-induced erosion and will be prefixed by the word "water" or "wind" to indicate the chief agency by which it is being effected.

Man-induced erosion is not, as many believe, something new, but to-day the problem has aroused the interest of many thinking people throughout the world, because it is realised that our future existence depends upon the preservation of the vital resources of soil, forests and water.

World-wide surveys of the total available area of land suitable for the production of food and clothing materials have indicated that urgent steps must be taken if the rapidly increasing human population is to be adequately clothed and fed in the future, and these steps must include measures to mitigate soil erosion.

The extent and the fertility of arable land in Queensland are at present more than adequate to provide all the essential requirements

for the present population, but evidence of serious erosion damage has already become apparent. The immediate introduction of soil conserving methods of land utilisation is essential if the land resources are to provide a satisfactory standard of living for the future population of this State.

Queensland has a serious water erosion problem affecting both agricultural and pastoral lands, but fortunately the incidence of wind erosion is restricted to isolated parts of the west of the State and is comparatively unimportant. These articles will therefore deal mainly with conditions influencing water erosion in Queensland, and will outline the measures necessary to prevent and repair such damage.

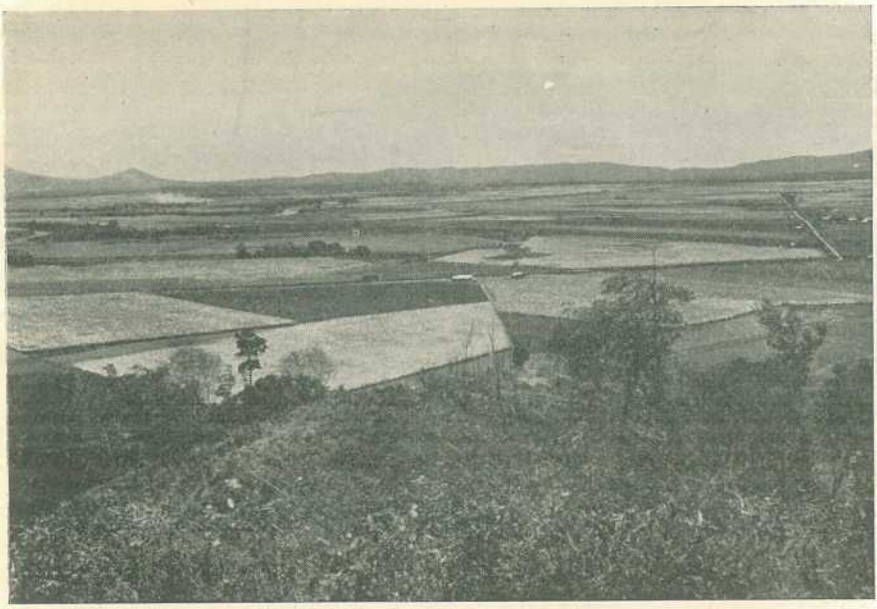


Plate 8.

THESE ALLUVIAL FLATS OF THE NORTHERN COASTAL PLAIN HAVE BEEN FORMED THROUGH THE AGENCY OF GEOLOGICAL EROSION.

HISTORICAL ASPECTS OF SOIL EROSION.

Prior to the settlement of land by civilised races, the protective influence of vegetation preserved nature's balance between soil formation and erosion, and the soil resources increased through the almost imperceptible agency of geological erosion.

The practices adopted in the establishment of civilised communities produce conditions of instability, rendering the soil vulnerable to erosion. In some regions the topsoil now lost in one year through man-induced erosion is greater than was created in 1,000 years by geological erosion.

In the past, cities and civilisations have declined and vanished as a result of erosion; the ruins of some of these now lie buried beneath feet of earth in Mesopotamia and Syria as testimony of the disastrous effects of this insidious menace.

Erosion is not, however, confined to the past but is rampant in countries which are still historically young; in the United States of America, South Africa and Australia, erosion has followed the rapid exploitation of natural resources; the insatiable urge to exploit virgin land has led to the indiscriminate destruction of nature's protective devices and in many cases this has been aided by the unwise use of modern farm machinery.

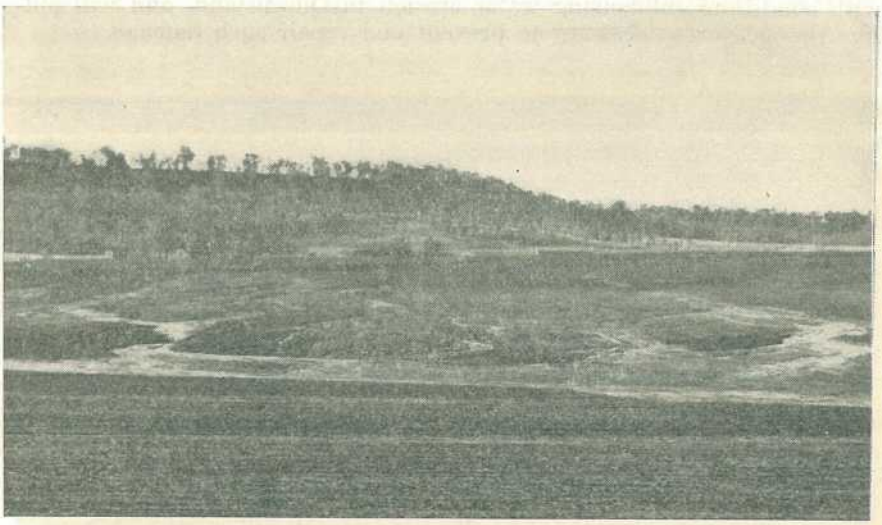


Plate 9.

EROSION ON THE FARMING LANDS OF THE EASTERN DARLING DOWNS.—Soil loss in this way is less spectacular than by gullying, but is just as serious.

In the United States of America an aggregate of 50 million acres of land is so badly eroded that it has been abandoned, and a further 250 million acres are subject to erosion in varying degrees, all requiring urgent treatment. In 15 years nearly 100 million acres of this land have been safeguarded by the application of soil conservation practices.

The New South Wales Soil Conservation Service reports that, as a result of a recent survey in New South Wales in the Eastern and Central Divisions, it has been shown that over half-a-million acres of once fertile land are beyond economic reclamation, and 20 million acres are rapidly becoming unproductive; a further 20 million acres have been affected by sheet erosion or by moderate wind erosion.

Soil erosion is similarly presenting problems in all other States of the Commonwealth, and appropriate measures are being taken by the soil conservation authorities of each State to meet the threat.

EROSION IN QUEENSLAND.

Erosion surveys of the agricultural areas of Queensland are not complete, but there is ample evidence that soil erosion is widespread in the State and that its incidence is rapidly increasing.

A Bureau of Investigation survey of the Darling Downs has shown that at least 40,000 acres have been withdrawn as useless for further cultivation; an additional one-and-a-half million acres are subject to erosion to some degree. The survey report states that, at the present rate at which erosion is ravaging the undulating portions of the Downs, it appears certain that unless active control measures are soon adopted as standard practice, the productivity of increasingly large areas will be seriously impaired or completely lost.

In the South Burnett district an estimated total of approximately 100,000 acres of land is affected by erosion in some degree. The damage in this district is mostly from the less spectacular sheet erosion, but its effect on productivity is cause for grave concern.

Plate 10.
SERIOUS GULLY EROSION ON THE DARLING DOWNS.

Other areas showing evidence of declining productivity due to erosion include the Atherton Tableland, Stanthorpe district, West Moreton district, the near North Coast, undulating tobacco lands in the Mareeba-Dimbulah districts, undulating cane lands from Bundaberg to Cairns, and many of the coastal banana and pineapple areas. In general, throughout the State, all undulating arable lands are subject to some degree of erosion, and abandoned cultivation fields have been observed in all the main agricultural areas.

In the pastoral areas both sheet and gully erosion occur, though the former is having the more serious effect on productivity through the development of "scalded areas" which are devoid of vegetation. These scalds result from the erosive action of both wind and water combined, and now occupy comparatively large tracts of country, particularly in the far western areas.

Wind erosion is fortunately restricted to the pastoral areas; there are no extensive areas of arable lands in the State yet affected by this type of erosion because, in general, the soil types so far utilised for cultivation are not readily affected by wind action.

EROSION LOSSES.

A few inches of topsoil supports all life on earth; and, as each inch of this vital topsoil is lost, subsoil farming draws nearer. Subsoil will produce crops, but experience shows that its productive capacity may be only one-tenth that of topsoil, and rarely does it reach half that amount. There is a prevalent misconception that many Queensland soils are feet deep, but a chemical examination shows that even on the deep soils the readily available plant foods are situated in the surface 12 inches. These facts emphasize the necessity of preserving every inch of available topsoil, irrespective of the apparent soil depth.

In some Queensland agricultural areas, as much as one inch of topsoil is frequently lost in one severe storm; this inch required perhaps 500 to 1,000 years for its formation, and represents as much as 125 tons of productive topsoil which may never be replaced. Carried away in this topsoil are large quantities of plant nutrients; when one inch of a typical Darling Downs soil is washed from an acre of land, with it is removed:—

37 cwt. of organic matter;
2,100 lb. of calcium;
420 lb. of phosphate;
980 lb. of potash;
420 lb. of nitrogen.

Apart from the fact that the organic matter cannot be replaced artificially, the other losses, interpreted in terms of commercial fertilizers, may be stated as follows:—

34 cwt. of lime;
19 cwt. of superphosphate;
17½ cwt. of muriate of potash;
18 cwt. of sulphate of ammonia.

Although with this loss of topsoil goes man's chance of earning a living from the land, the effects of erosion damage do not stop even there; the soil thus removed from the farm silts the streams and reservoirs, and in the latter case not only is the water storage capacity considerably reduced but often the only suitable storage site on a stream is lost for ever.

WATER EROSION.

Water erosion is the term usually applied to the erosion of soil by the agency of water, and the older conception of this type of erosion envisaged the direct scouring action of a body of water moving down a slope at a velocity sufficiently high to dislodge soil from its site and transport it from the area; this is true, but it neglects the fundamental causal factor, which is raindrop impact.

Raindrop Splash on Bare Soil.

Recent observations on the action of raindrops indicate the importance of raindrops, singly and collectively, as a factor in the complicated picture of soil erosion. While a single raindrop possesses only a limited amount of energy at its point of contact with the earth, the accumulated effect of the innumerable drops in a rainstorm assumes considerable proportions.

On a soil unprotected by vegetation, or other cover, this energy is expended in the destruction of surface soil crumbs and in packing the particles closer together. Plate 11 shows that at the point of impact of raindrops on a bare soil surface, or soil covered by a thin sheet of water, droplets of water and particles of soil are hurled into the air, the extent of the splash being dependent on the size of the raindrops

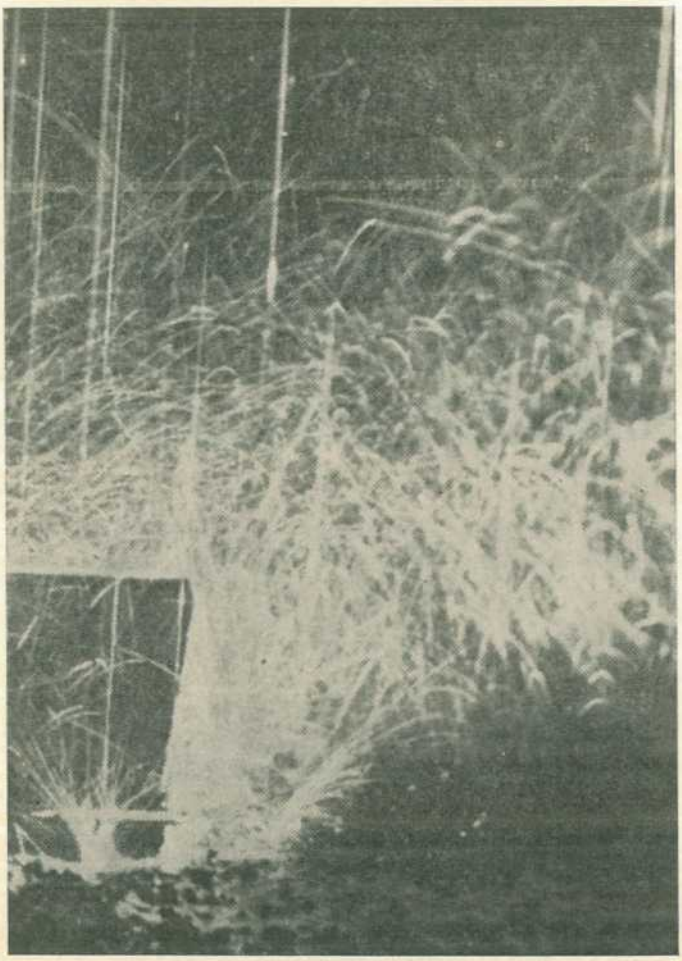
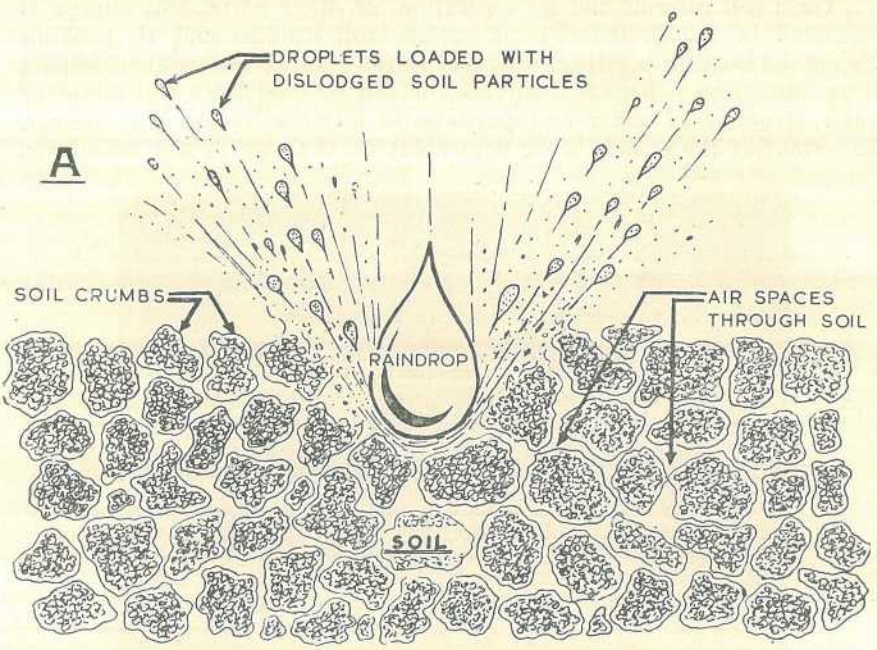


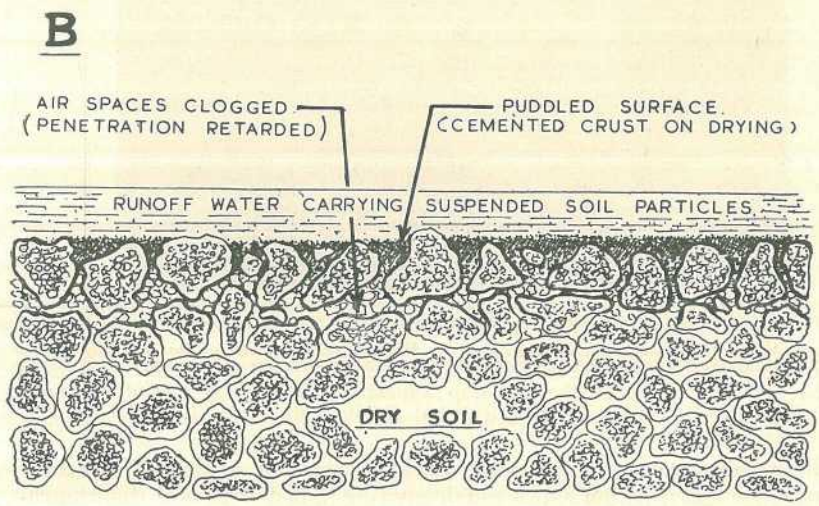
Plate 11.

PHOTOGRAPH SHOWING THE ACTION OF RAINDROP SPLASH.—The straight lines are falling raindrops, and the curved lines are fragments of water and soil thrown into the air as a result of the raindrop impact. Exposure $\frac{1}{25}$ second. (Photo. published by W. D. Ellison in "Agricultural Engineering," April, 1944.)

and their velocity; the large drops of high velocity typical of Queensland summer storm rains cause much greater splash and soil disintegration than the smaller low-velocity drops which are typical of steady winter rains. On level land the droplets are evenly distributed in respect of the point of impact, but on sloping land a greater proportion of the splashed droplets and dislodged soil particles fall on the downhill side of the point of impact. It is estimated that, on a 10 per cent.



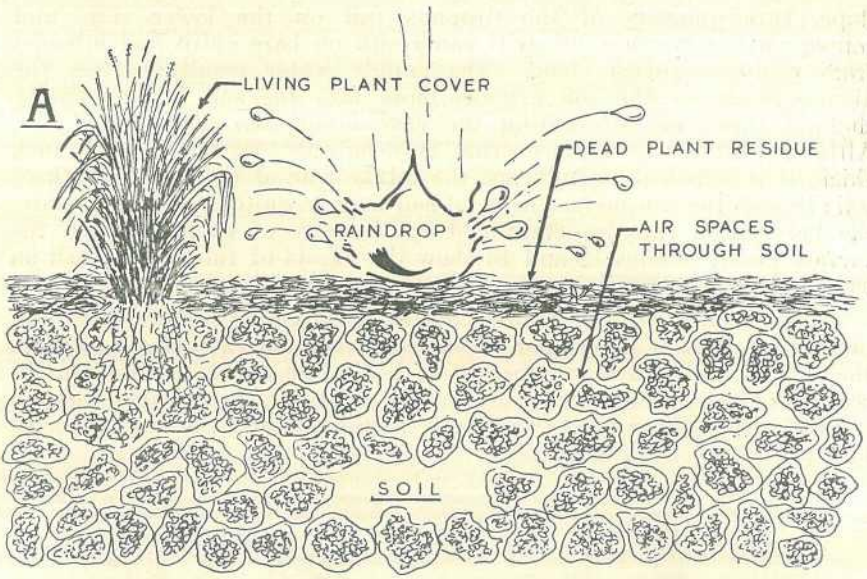
EFFECT OF IMPACT OF RAINDROP ON BARE SOIL.



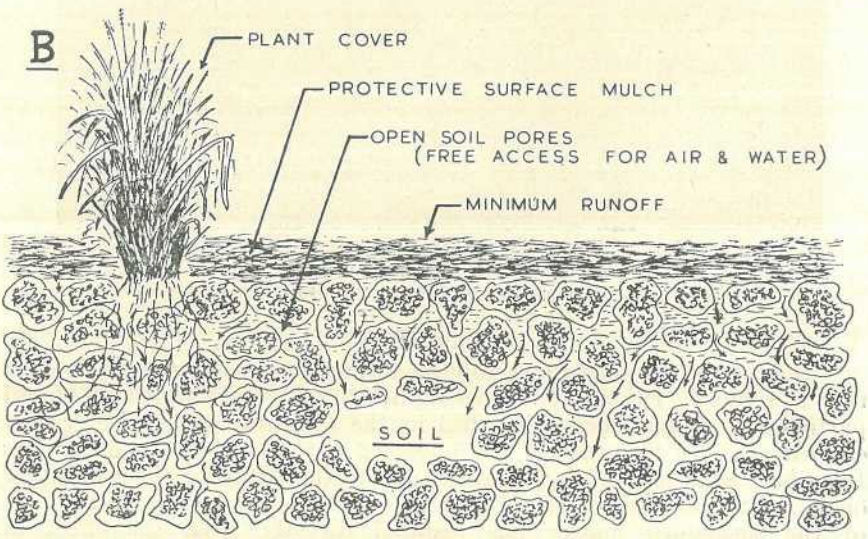
SOIL & WATER LOST AS SURFACE RUNOFF.

Plate 12.

SKETCHES ILLUSTRATING THE EFFECT OF RAINDROP SPLASH ON A BARE SOIL SURFACE.
(Sketches by A. F. Skinner.)



EFFECT OF IMPACT OF RAINDROP ON COVERED SOIL.



WATER ABSORBED & SOIL CONSERVED.

Plate 13.

SKETCHES ILLUSTRATING THE EFFECT OF RAINDROP SPLASH ON A PROTECTED SOIL SURFACE. (Sketches by A. F. Skinner.)

slope, three-quarters of the droplets fall on the lower side, and consequently a serious soil drift can result on bare cultivated hillsides from raindrop splash alone. The muddy water resulting from the disintegration of the soil crumbs flows into the soil pores, rapidly choking them and preventing the easy absorption of further rain. Although this dense surface crust may be only one-tenth of an inch thick, it is sufficient to influence the intake rate of the whole depth of soil; though the sub-surface layer of soil may be quite open in structure, the percolation rate is determined by the rate of entry through the surface crust. Plates 12 and 13 show the effects of raindrop splash on bare and protected soils.

Lowdermilk, in the United States of America, observed that a muddy suspension percolated through soil columns at about one-tenth the rate of clear water, the reduction being due almost entirely to the sealing of the surface layer of the soil; further, percolation did not improve when clear water was later applied unless the surface crust had previously been disturbed.

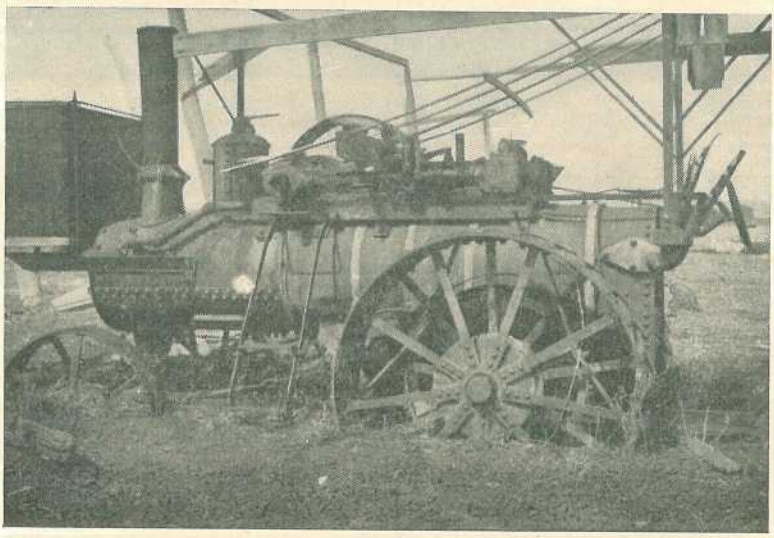


Plate 14
EVIDENCE OF SHEET EROSION.

Run-off.

Because of the surface sealing on unprotected soils, the infiltration rate is reduced, run-off commences quickly, and large numbers of soil particles which have been disturbed by the raindrop impact are readily carried away in the water. The observed muddiness of run-off waters from bare soils was originally attributed to the scouring effect of water on bare ground; this is true to an extent, but it is certain that much of the suspended matter has resulted directly from the effect of raindrop impact.

Sheet Erosion.

As the depth of run-off increases, so does the velocity, until ultimately the run-off water is able to dislodge and transport soil particles; this velocity, coupled with the abrasive effect of the suspended soil particles, scours off the surface of the topsoil and so sheet erosion commences.

Since this type of erosion results in the removal of more or less regular but very thin sheets of soil, its development may proceed unnoticed for many years. For this reason, though it is the least spectacular of the various forms of water erosion, it is probably the most dangerous. On land of regular conformation it is possible for a foot or more of topsoil to be lost through sheet erosion without any evidence of gully development, or without attracting any attention whatsoever. Crop yields then decline, but this is seldom attributed to loss of soil; farmers then often refer to their soils as "worn-out", when in fact the correct term would be "washed-out".

The symptoms of sheet erosion are very obvious, however, and will be indicated by the extent to which soil has accumulated against lower fence lines or other obstructions (Plate 14).

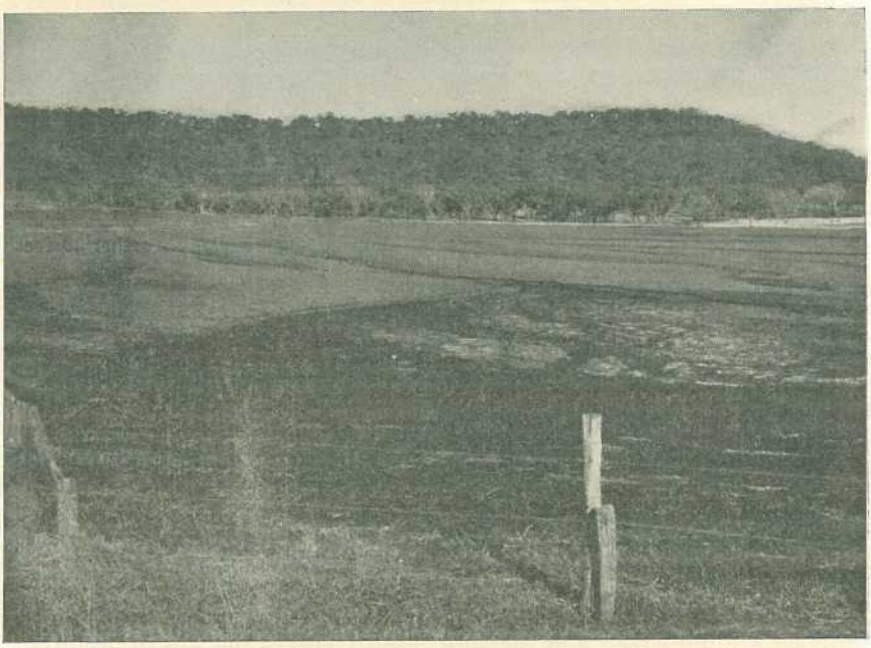


Plate 15.
SERIOUS SOIL LOSS BEFORE THE DEEP GULLY STAGE HAS BEEN REACHED.

Gully Erosion.

As sheet erosion proceeds, there is a tendency for the run-off water to accumulate in minor depressions on the land; this increased concentration of water results in the development of rills, and if no protective action is taken these ultimately become small gullies.

Usually, at some point in a gully a marked difference in height occurs, and this is generally at the point where it enters a watercourse. On erodible soils a steep face or "overfall" is developed, with the resultant tendency for the water to undercut the base of this wall, causing the rapid collapse of large masses of soil at this point. Once an overfall commences, the gully deepens rapidly, following along the line from which the water is entering. This completes the water

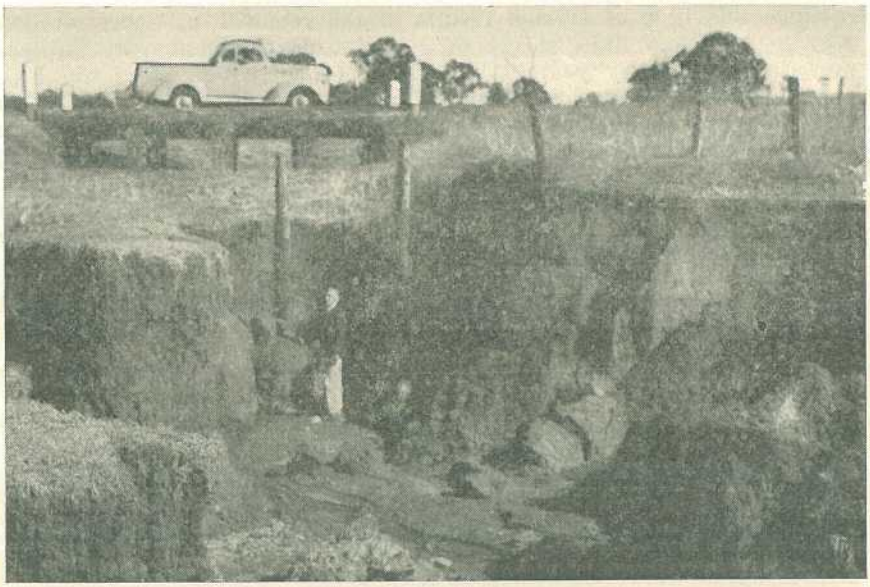


Plate 16.

PHOTOGRAPH SHOWING A GULLY OVERFALL.—This gully extended a further 30 feet towards the road in one series of rains.

erosion picture, but it is important to appreciate that the final awe-inspiring gully erosion has developed in successive stages from a bare cultivated soil exposed to the impact of raindrops.

Raindrop Splash on Protected Soil.

When a raindrop strikes land with an adequate protective cover, whether it be a mattress of dead crop residues, a living cover of crops on arable land, a carpet of grass on pasture land, or a forest with its associated ground litter, the initial energy of the drop is expended against the barrier of vegetation; the drop shatters and trickles through the vegetative covering and clean water enters the soil without obstruction. The raindrops carry no suspended soil particles, there is no surface sealing effect, and the rain rapidly enters the soil in accordance with the sub-surface infiltration capacity; if the soil is of good open structure, large quantities of rain can be rapidly absorbed.

Water commences to move down the slope much later in a storm than under the bare soil conditions described earlier; since the barrier of vegetation also hinders the down-slope progress of the run-off, greater opportunities for water absorption are presented and rarely is the run-off water able to attain sufficient velocity to cause scouring.

WIND EROSION.

Surface soil is moved by the agency of wind only where wind velocities at the ground surface are sufficiently high to dislodge and transport soil particles. With the exception of deserts, sufficient vegetation is normally present under natural conditions to obstruct wind flow and to reduce ground velocities to a point where soil cannot be transported.

The depredation of rabbits, and overstocking combined with adverse seasonal conditions, have each resulted in the decline of perennial plants in many inland areas. Once this protective cover is removed or reduced, and constant intense winds coincide with drought conditions, the topsoil is rapidly removed, and in some areas there is rapid formation of a hard impervious surface known generally as a clay-pan or a "scalded area". These areas, because of a higher clay content

Plate 17.

PHOTOGRAPH OF A SCALDED AREA IN THE SOUTH-WEST, FOLLOWING A VERY FAVOURABLE SEASON.—The sparse cover of annual herbage disappears in dry seasons. Note the islands of better vegetation where the topsoil has been retained.

than the original surface soil, are rapidly beaten hard by raindrop impact, and eventually present a surface which is unsatisfactory for the reception or retention of plant seeds or for the absorption of rain. In very favourable seasons annual plants may occur on these scalded areas only to die and be blown away in the next dry season; perennials are rarely established, because the low infiltration rate results in dry subsoil conditions unfavourable to these deeper rooted plants.

Wind erosion is usually restricted to the sandy and sandy loam soils; those with a high colloid content are not appreciably affected. Some of our pastoral areas are subject to this type of erosion, but, fortunately, because of soil type or climatic conditions, little agricultural land in Queensland is affected by it.

[TO BE CONTINUED.]

Agriculture, other than Sugar Culture, in the Mackay Area.

N. E. GOODCHILD, Senior Adviser in Agriculture.

THE discovery and settlement of the Mackay district is of considerable historic interest. In 1860, a 21-year-old Scotsman, John Mackay, accompanied by a small party, set out from Rockhampton in an endeavour to locate a river that Leichhardt had reported. This river was believed to have a watershed between the Burdekin and the Isaac Rivers, and was supposed to flow into Repulse Bay. On May 16, the party reached the summit of the main coastal range and, quoting from John Mackay's diary, saw "a bold deep river with well defined banks, the landscapes on both sides being rendered picturesque by clumps of palms which appeared like sentinel giants keeping watch over the surrounding expanse of rich tropical vegetation unlike anything we had hitherto seen on our travels."

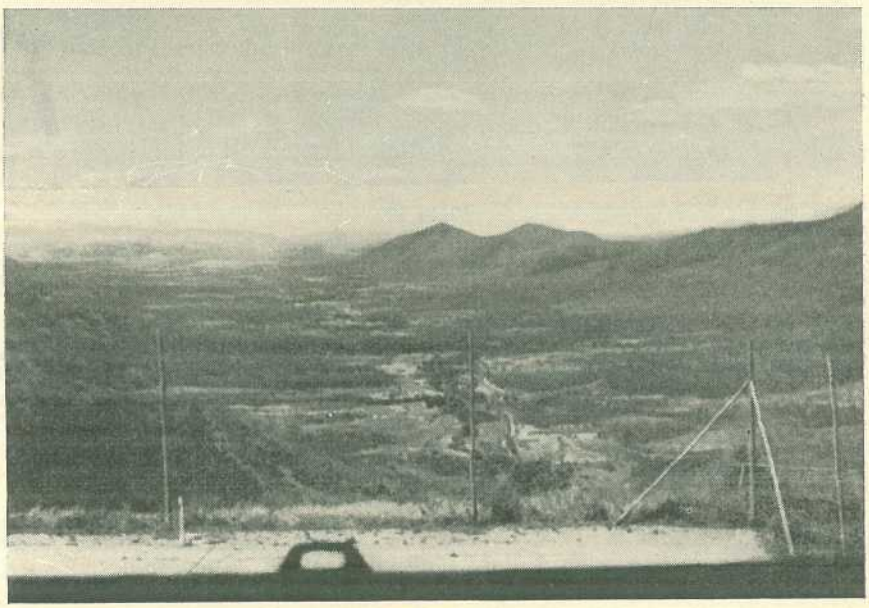


Plate 18.
PIONEER RIVER VALLEY, MACKAY DISTRICT.

The river, the valley of which is shown in Plate 18, was named Mackay. Later, Commander Burnett, navigating the coast in H.M.S. "Pioneer," observed that a river named Mackay flowed into Rockingham Bay and to avoid geographical mistakes renamed the river Pioneer. Mackay, however, received due recognition of his discoveries when the township was named after him.

Plate 19.
SKETCH MAP OF THE ST. LAWRENCE–BOWEN AREA.

John Mackay acquired a lease of the Mackay river country and established himself on what is now known as Greenmount holding, 12 miles from Mackay, to which he brought 1,200 cattle and 50 horses. The leasehold on the northern side of Mackay river was later acquired by John Cook and is now known as Balnagowan. Further grazing areas were established along the coast as well as on areas west of the main coastal range. The pastoral industry was by then firmly established in one of the finest fattening areas of the State.

Although early settlers were cattlemen, it was soon realised that soil and climatic conditions were suitable for other forms of primary production. Maize, coffee, and cotton were grown with some degree of success. John Spiller, who had experience in sugar cane growing,

imported cane plants from Java, and in 1868 the first cane crops were harvested. Gradually the pastoral industry gave way to sugar culture on the coast but continued to expand in Mackay's hinterland.

Rapid increase in population provided an outlet for other agricultural and horticultural crops and their development was accelerated during the war years by the urgent need of essential food and increased milk supplies.

Plate 20.
EUNGELLA RANGE COUNTRY AFTER OCCUPATION.

For the purposes of this article the Mackay area is defined as that part of the coast and near coastal region of the State between St. Lawrence in the south and Bowen in the north; it includes the important primary producing centres of Mackay and Proserpine on the coast, and Nebo to the west of the main coastal range. The main features are shown in Plate 19.

The coastal range which extends along the coast from St. Lawrence to Dalrymple Heights is known as the Connors Range, and it continues north to Bowen as the Clarke Range. The width of the coastal margin between the coast and the range varies from eight miles at Carmila to 50 miles at Mackay. The eastern slopes of the coast range are covered by heavy rain forest. Coastal plains occur at St. Lawrence, Inneston, Proserpine, and Bowen.

The area is well watered by numerous short creeks flowing from the main coastal range to the sea, as well as by several rivers, including the St. Lawrence, the Pioneer, the Proserpine, and the Don. Eungella Range (Plate 20), 50 miles west of Mackay, consists of a rather narrow rain forest belt averaging 5 miles wide by 40 miles long, with an altitude ranging from 2,500 to 3,000 feet.

Sarina Range, with an altitude of 1,000 feet, contains a limited area of rain forest but is essentially undulating open forest country. The adjacent areas of Blue Mountain and Bolingbroke are of somewhat similar country. The Nebo area comprises undulating slopes and open downs with some broken country.

Land tenure varies in different districts. Fruit areas consist of freehold, perpetual lease, and agricultural farm tenures. Fruit farms are relatively small. They average about 30 acres in the Seaview area, 100 acres in the Seaforth area, and 160 acres in the St. Lawrence district. Dairying lands comprise perpetual lease holdings, agricultural farms, and grazing farms. The areas of the farms differ according to the fertility and carrying capacity of the country concerned.

On the Eungella Range, farms range from 180 to 300 acres in area, and in the O'Connell river area the holdings are of approximately 250 acres. The carrying capacity of these areas is comparatively high, due to the establishment of introduced grasses. A reliable carrying capacity on the Eungella Range rain-forest area is generally regarded as being one beast to 3 acres, whilst on the O'Connell River a reasonable carrying capacity is considered to be a beast to 3-4 acres.

The East Funnell Creek district comprises agricultural farms and perpetual lease selections. Here farms range from 700 to 1,200 acres in area. Introduced grasses planted on these holdings have improved the carrying capacity of the country, which is approximately a beast to 5-6 acres.

The Bolingbroke and Blue Mountain districts comprise agricultural selections and grazing farms which vary in size from 1,200 to 3,000 acres. The carrying capacity of these lands is lower than that of other dairying lands in the Mackay district. The country is generally regarded as being capable of carrying a beast to 10-12 acres.

CLIMATE.

The climate in the Mackay area is generally pleasant in the winter, but hot and humid in the summer months.

The rainfall distribution in the area is very variable, as shown by the following rainfall data for the main centres, which are given in points of rain based on 76-year averages:—

	Mackay.	Bowen.	Proserpine.	St. Lawrence.	Nebo.
January	1,365	965	1,503	906	602
February	1,180	877	1,291	759	472
March	1,221	579	1,248	527	410
April	608	263	567	272	176
May	382	125	420	174	122
June	274	163	330	247	185
July	167	93	158	136	125
August	100	62	135	78	65
September	163	78	199	122	105
October	173	99	160	180	107
November	307	128	285	240	202
December	692	430	731	464	394
Total	6,632	3,862	7,027	4,105	2,966

At St. Lawrence, in the southern portion of the area, the annual rainfall is 41 inches. This increases at Carmila to 56 inches, increases further at Mackay to 66 inches, and approaches 80 inches on the Eungella Range. There is a gradual tapering off at Proserpine to 70 inches and a rapid decline between Proserpine and Bowen, where the mean annual rainfall drops to 38 inches.

The sub-coastal rainfall recedes rather rapidly. The Blue Mountain and Bolingbroke districts register between 50 and 56 inches per year, while Nebo, 60 miles south-west of Mackay, receives only 29 inches.

Summer rainfall is usually reliable. "Wet season" rains may commence in December, but are occasionally delayed until February and sometimes as late as March. Long wet seasons periodically extend into April. Fair winter rains, sufficient to provide for winter pastures and fodder crops, often occur. Storm rains in the spring months are erratic and unreliable and usher in a dry spell not unusually extending into November and sometimes into December.

Excessive precipitations in the summer months occur in the Mackay-Proserpine area from time to time, causing waterlogged conditions, leaching of soil nitrates, and a check to plant growth. Under such conditions, agricultural crops are detrimentally affected during the wet period.

Provided crops are planted and a good root system established prior to the wet season, satisfactory growth may be maintained. The coastal areas of Sarina, Mackay, and Proserpine have a reasonably reliable growing period of approximately six to seven months.

The distribution of rainfall has an important bearing on crop production. For example, in the 1948 season, when only 29 inches were registered during the first seven months of the year, potato crops were harvested which yielded considerably in excess of any previous year's production. Pastures also were palatable over a greater period with the diminished rainfall.

SOILS.

The agricultural soils are varied and patchy in the Pioneer Valley. They consist largely of river and creek alluvials and red volcanic soils, grey clay flats and brown loam ridges. On the Eungella Range, the principal type is a red and yellow granitic soil, while there is also an area of red volcanic soil on the plateau. Carmila and Sarina valleys comprise two main types—namely, alluvial flats and brown loam ridges.

Agricultural land in the O'Connell River area is restricted by the somewhat broken country. The limited flats are alluvial and the slopes red volcanic and granitic soils.

In the Proserpine area, the principal types are heavy black loam alluvial flats, with red volcanic soils in the scrub belt. Soils at Bowen include heavy grey clay alluvial flats, with areas of sandy loam adjacent to the Don River.

Open downs country extends to the coastal areas at St. Lawrence, Inneston, Eton, and Proserpine, and consists of brown and black loams. In the Nebo area, brown, chocolate, and black soils occur extensively on the open downs, and brown and chocolate loam soils on the undulating slopes. Adjacent to the Isaac River, sandy loam flats extend back to sandy flat country.

The more fertile soils are associated with the various creek and river flats and the broken country originally covered by rain-forest.

Considerable areas in this district are flat, poorly drained lands with impervious clay subsoils, and are unsuitable for general agriculture.

Soil erosion is not serious on the flat lands used for general agriculture but is apparent wherever slopes are cultivated. Some difficulties, however, have been experienced by erosion along the river and creek banks due to destroying timber and cultivating land to the edge of banks. During the course of time, timber growth has developed in the river and creek channels, obstructing the free flow of water and causing an accumulation of debris, resulting in diversion of the normal course. Lower creek and river terraces are then periodically flooded.

In the absence of timber and other vegetation to hold the soil, considerable erosion has taken place, particularly along Cattle Creek, but corrective measures are now being undertaken in this area. Already approximately 25 miles of creek and river channels have been cleared and banks stoned where erosion has occurred. On the lower terrace it is impossible to prevent flooding, and in such areas fallowing of land during the rainy season should be avoided.

WATER FACILITIES.

The coastal belt is well served by numerous creeks and rivers, most of them permanent streams, which flow from the coastal ranges to the coast. The water is of excellent quality for stock and irrigation purposes. Ample supplies for stock are obtainable at from 25 to 50 feet. The extent of the underground water supplies is at present under investigation, but there is a considerable variation in supplies throughout the district.

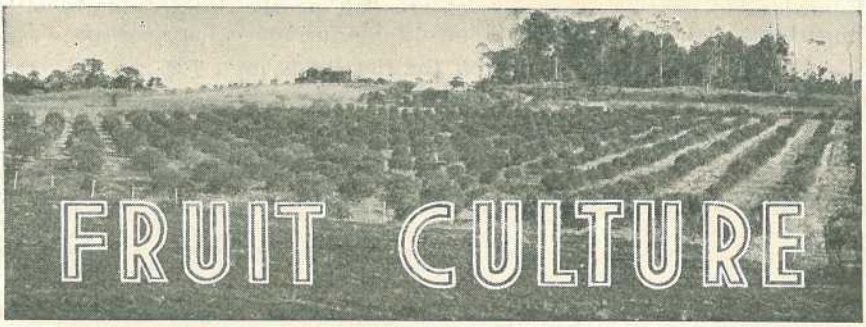
Located in various portions of the district are some 120 irrigation plants on general agricultural and horticultural farms irrigating from 2 to 20 acres per plant. Water supplies are obtained from creeks and rivers as well as from bores and wells and by duplicated spear systems. Almost invariably the overhead sprinkler system operates, and little or no flood irrigation is practised. The various types of plants are utilised for the production of such crops as potatoes, tomatoes, truck crops, oats, maize, sorghum, lucerne, bananas, pineapples, and pastures. The maximum advantage is gained in the winter and spring months when natural rainfall is less reliable.

A striking feature in the Nebo area is the lack of surface water other than the good supplies in Lake Elphinstone. Water is, however, readily available at a shallow depth in the sandy creek beds and in the Isaac River. Water supplies on the downs country are more difficult and it is necessary to bore 150 to 500 feet. Boring has not always proved successful and in such cases large dams varying in size from 10,000 to 30,000 cubic feet are sunk. These dams when filled usually hold for at least 12 months.

There are several irrigation plants in the Nebo area—on the Isaac River; on Nebo Creek; on Cooper's Creek; and on the Bowen River. Irrigation is used mainly for the production of fodder crops, such as maize, sorghum, oats and lucerne, and to a limited extent for vegetable production for home consumption.

In the Bowen area ample supplies of water are available at shallow depths for irrigation in the Delta region and numerous plants operate from the Don River. The main crops in this area are tomatoes, cucumbers, and pumpkins. A small amount of tobacco is grown.

(TO BE CONTINUED.)



The Avocado in Queensland.

R. L. PREST, Senior Adviser in Horticulture.

THE avocado has for many years been a staple food of the natives in Central and South America and the West Indies. From there it was introduced to the United States of America, where it is now extensively produced commercially. The fruit is pear-shaped in some varieties and because of this it is sometimes referred to as the avocado pear. The fleshy, edible portion inside the skin of the fruit may be upwards of an inch in thickness, and normally surrounds a single large seed. When ripe, the flesh has the consistency and colour of butter, possesses a rich, nutty flavour, and in the best varieties has a fat content of about 25 per cent. The flesh may be eaten fresh with the addition of pepper, salt, or vinegar, while it is a tasty addition to green vegetable salads.

In the commercial sense, the avocado is a comparatively new fruit in Queensland. The history of its introduction is somewhat obscure, but records indicate that the earlier introductions were planted as seedlings about 30 years ago. Many of these trees are still fruiting.

Avocadoes may be grown successfully on good soils along practically the whole of the Queensland seaboard. Trees (Plate 21) planted in the foothill districts along the lower north and south coasts and in northern Queensland have grown vigorously and some are now in heavy bearing. These trees were mainly grown from seed introduced from time to time by the Department of Agriculture and Stock and the Queensland Acclimatisation Society. In recent years, budwood and grafted trees of promising varieties have also been imported from the United States by private individuals, while selections from several locally-raised seedlings of excellent quality have been propagated.

BOTANICAL RELATIONSHIPS.

Botanically, the avocado belongs to the genus *Persea* and is a member of the laurel family. The home of the cultivated species is generally conceded to be Central and South America.

Avocadoes are grouped into two species belonging to three races, known respectively as Guatemalan, West Indian, and Mexican. The Guatemalan race matures its fruit in winter and spring, while the other two mature their fruit in summer and autumn. The fruit of the Mexican race is usually smaller and thinner skinned than that of the others.

The avocado is an evergreen, though some varieties are virtually leafless for a short period during blossoming. The habit of growth is variable, some trees being tall, upright, and unbranched, while others are small, well-branched, and spreading. The leaves also vary considerably in size and shape. Young foliage often exhibits various shades of red and bronze, but when mature it is usually bright-green in colour.

The flowers are borne in terminal clusters; they are small and pale-green or yellowish in colour.

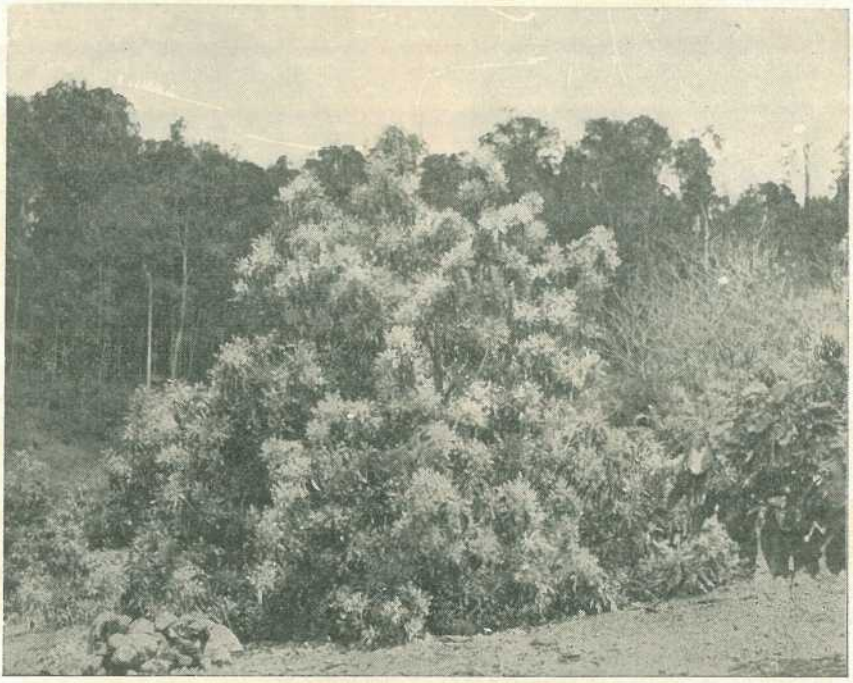


Plate 21.
AVOCADO TREE IN BLOSSOM.

The fruits of different varieties (Plates 22, 23, and 24) vary greatly in size, shape, and colour. In shape they may be round, oval, pear-shaped, or of any gradation between these forms. The colour may be light-yellow, green, dark-green, maroon, purple, or purplish-black.

SOIL REQUIREMENTS.

In Queensland, the avocado thrives on a comparatively wide range of soils.

The ideal soil for avocadoes is a loam of medium texture overlying a moderately heavy but porous subsoil which, in turn, overlies a gravelly wash. In no circumstances should trees be planted on poorly-drained soils, as the roots are extremely sensitive to excessive moisture and the trees quickly succumb to "wet feet."

Some of the loams of basaltic origin on the coastal ranges and the sandy loams along the foothills are excellent. The more sandy soils,

reddish to brown in colour, occurring in the lower north and south coast districts are often too well-drained and, unless they can be irrigated, are often unsuitable for fruitgrowing. Where the subsoil at 18 to 30 inches deep is compact and deep red in colour, these soils are capable of growing good fruit.

Heavy clay soils and the grey sands found in lowlying areas should be avoided.

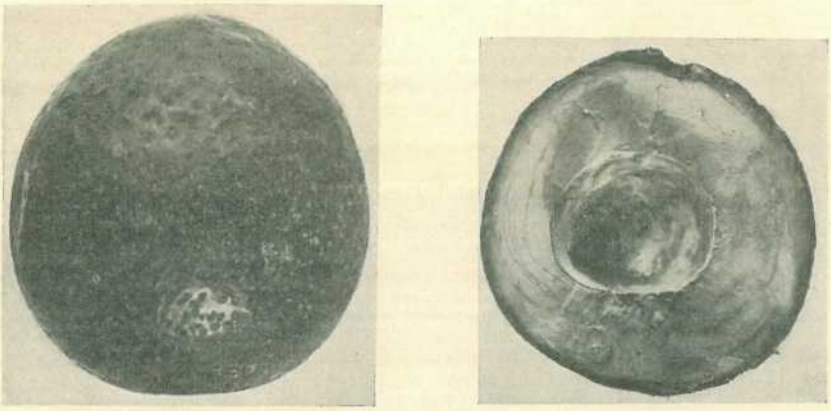


Plate 22.
NABAL AVOCADO FRUIT.

CLIMATIC CONDITIONS.

As the avocado is a sub-tropical fruit, its commercial culture must necessarily be confined to tropical and sub-tropical regions. In practice, it has been observed that the trees do not tolerate low winter temperatures, high spring and summer temperatures, low atmospheric humidity during the blossoming and fruit-setting period, and heavy winds.

ORCHARD LOCATION.

Avocadoes thrive best in frost-free, well-sheltered, warm situations. If winds are likely to interfere with normal tree growth, belts of standing timber should be retained for protection where practicable. In districts denuded of the natural timbers, shelter belts should be planted.

The orchard site should be an area of unbroken, nearly level, or gently sloping land. Steep hillsides should be avoided, for, in addition to the risk of irreparable losses by soil erosion, costs of cultivation are excessively high.

Where hillside orchards are contemplated, contour planting should be undertaken, the contour grade varying from 1 to 3 per cent., according to the length of the tree rows.

POLLINATION AND VARIETIES.

Avocado flowers (Plate 25) have two distinct opening periods, one during the morning and one during the afternoon. All varieties fall into one or other of two flowering groups, which, for convenient reference, have been designated A and B.

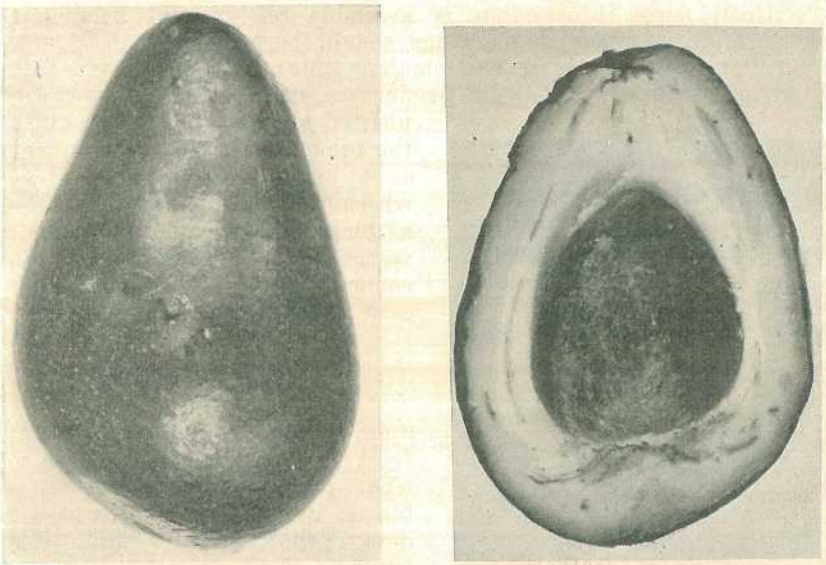


Plate 23.
FUERTE AVOCADO FRUIT.

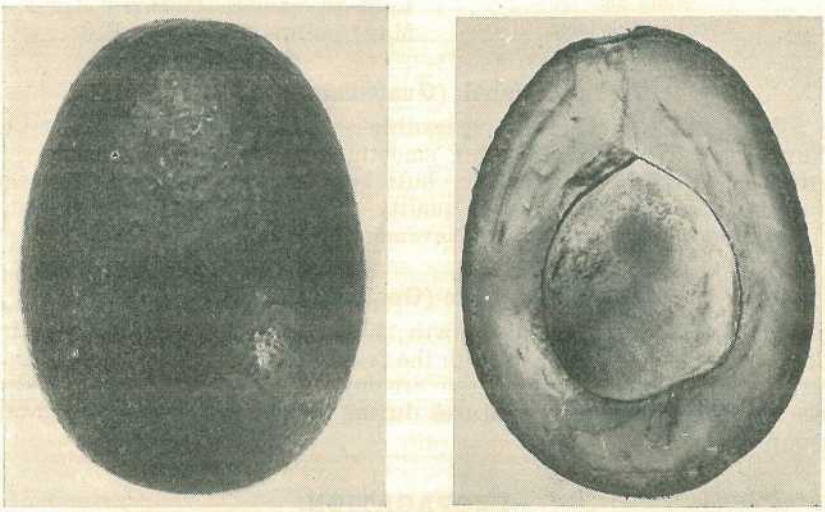


Plate 24.
ANAHEIM AVOCADO FRUIT.

Observations have shown that the flowers of varieties in group A open for the first time in the morning and are then receptive of pollen. They close usually between noon and 2 p.m. and open a second time during the afternoon of the following day, when the anthers burst and pollen is shed. The flowers of varieties in group B open for the first time in the afternoon, when they are receptive, and open a second time the following morning to shed pollen.

It is probable that when one or more varieties selected from each of these two groups are interplanted fruit-setting will be improved.

Until more information is available on varietal behaviour in Queensland, commercial plantings should be restricted to Fuerte (a hybrid type), Nabal (a Guatemalan type), and Anaheim (also a Guatemalan type). Anaheim produces a small fruit and is normally planted at the rate of 1 tree to 9 of the other two. Such plantings may meet cross-pollination requirements where these are necessary and give a tolerably long spread in the harvesting period, which is desirable in commercial practice. The habits of each variety are as follows:—

Plate 25.
AVOCADO BLOSSOM.

Fuerte (Hybrid).

Tree straggling, spreading; blossoms very early in July and August; fruit pear-shaped, oblong, base somewhat pointed, apex obliquely flattened; green with numerous yellow dots, pebbled; skin thin, pliable, leathery; flesh creamy-yellow, greenish near skin, texture buttery, very rich flavour, quality excellent; seed tight in cavity; matures April and May; pollination group B.

Nabal (Guatemalan).

Tree well branched, spreading; blossoms late October and November; fruit almost round, smooth, green in colour; skin thick, granular; flesh creamy-yellow, buttery texture, greenish near skin; flavour exceptionally good; quality excellent, seed small, tight in cavity; matures October and November; pollination group B.

Anaheim (Guatemalan).

Tree tall with upright growth; blossoms midseason, September to October; a prolific bearer, though the fruit is easily shed; fruit elliptical; skin rough, glossy, green; flesh creamy; flavour good; seed medium size and tight in cavity; matures during July and August; pollination group A.

PROPAGATION.

Raising the Seedlings.

Seed should be selected from matured fruits of healthy, vigorous seedling trees, and should be washed, cleaned, and planted as soon as possible after removal from the fruit.

The seed is planted in seed boxes or seed-beds containing a mixture of equal parts of clean sand and loam. The seeds are placed in the soil with the base down and with the apex just protruding above the surface. The soil should be kept moist, but not soaked. During hot weather, shading will be necessary; hessian or lath screens are useful for this purpose. Under favourable weather conditions, germination will take place within a few weeks.

The seedlings should be transferred to nursery rows when they reach a height of 6 to 8 inches. Care should be taken to prevent root damage during transplanting because avocado seedlings have a particularly long tap root. In the nursery, the plants are set out 12 to 18 inches apart in the row, the rows being 30 to 36 inches apart. Immediately after planting, the seedlings should be watered. Temporary protection from the sun is necessary; shading on the north-eastern side is particularly advisable. Frequent waterings are again necessary.

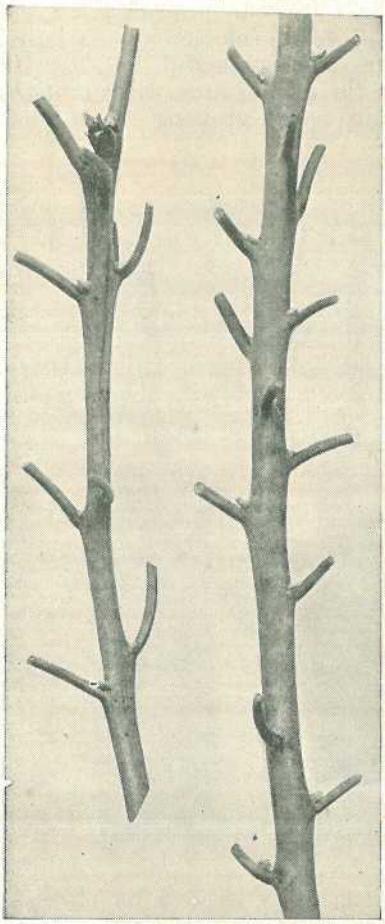


Plate 26.

AVOCADO BUDSTICKS. Left—Suitable for bark graft. Right—Suitable for T budding.

Budding.

When the seedling stocks have attained a diameter of about three-eighths of an inch at their base and the sap is flowing freely, they may be budded. In Queensland, this is usually done during autumn or spring. When the stock is ready to receive the bud, a "T" cut is made in the bark 6 to 8 inches above the ground level. The perpendicular cut should be 1½ to 2 inches long and should penetrate just through the bark to the cambium layer. The "T" cut should be made preferably on the southern side of the stock, where the bud will not be exposed to the sun.

Budding requires rather more care in avocadoes than in some other fruits because, while the union of the stock and scion takes place readily enough, the bud often fails to grow and the eye falls out. It is necessary, therefore, to use only the plump full buds in the middle of the bud stock. (Plate 26.)

The bud may be cut from either above or below, the general practice being from below the bud upwards, commencing from ¾ inch to 1 inch below the bud and ending from ¾ inch to 1 inch above it. A sharp, thin-bladed knife is used to make the cut, which should be just deep enough to remove a thin layer of wood. The bud is inserted in the "T" cut in the stock and gently pushed down between the bark and the cambium layer. The bud and stock are then bound closely together with raffia. About three weeks are required for the bud to unite with the stock. During this period the tie should be inspected frequently; where bulging appears, the tie can be loosened to prevent restriction.

As soon as the union takes place, the stock may be headed back a few inches in order to force the bud into growth. The ties are not removed from the union until the bark flaps have entirey healed over, which is usually 6-8 weeks after budding.

As soon as the bud has made 3 or 4 inches of growth, it should be first tied to the stem of the stock and later trained to a stake. The final removal of the stock stub may be done when the bud shoot is 12 to 18 inches long and capable of remaining erect. The cut is made at a slope just above the union, and should be sealed with Bordeaux paste or lime sulphur.

REWORKING.

In Queensland avocado plantings, there are some unprofitable types of seedlings which can be reworked to good commercial varieties. Reworking by means of bark grafting has been successful, but, as with budding, should only be done—except in the case of large trees or trees with no branches close to the ground—during the growing season when the sap is flowing freely.

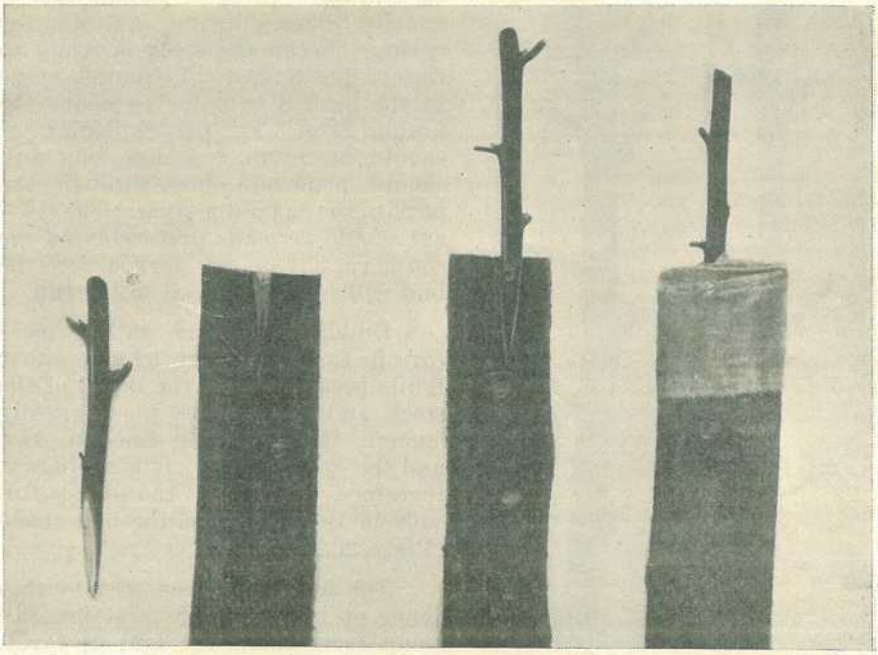


Plate 27.

BARK GRAFTING THE AVOCADO. Left to right—scion prepared for insertion; bark opened to receive scion; scion inserted under bark; graft completed and tied.

When using the bark graft, three or four limbs evenly spaced round the trunk of the tree are selected and sawn off square about 2 or 3 feet from the trunk. The cut surfaces should be smoothed over with a sharp knife and two scions inserted opposite each other in each limb. If both scions grow, the weaker one may later be removed. The scions are easily inserted by making a cut about 3 inches long for each scion through the bark at the end of the stumps and then pushing the scions down between the bark and the wood (Plate 27).

The scions are selected from well-matured second-growth wood, the terminal growth being discarded. Each should contain two or three plump buds, which at the same time are not too far advanced. Where

possible, it is an advantage to include a node, as adventitious buds often develop from this zone. The scions are prepared by making a long sloping cut about 2-2½ inches long on one side. The cut surface is inserted next to the wood, or more correctly, the cambium layer. When the scions have made good growth, the remaining branches of the tree, which have not been cut back for grafting, may be completely cut away.

Large trees, or trees with no branches within 3 or 4 feet of the ground, require slightly different treatment. During winter, when the trees are dormant, the whole of the top of the tree may be removed by sawing through the trunk at a height of 3 feet from the ground and at the beginning of spring inserting three or four scions under the bark. Two of these, or at most three in the case of very large trees, may be allowed to grow.

Plate 28.

NEWLY PLANTED AVOCADO TREE WITH PROTECTION FROM SUN AND WIND.

PLANTING.

On level land and gently sloping land, orchards are generally laid out on the square system. On the steeper hillsides, contour or modified systems of contour plantings should be adopted. When planted on the square system, the planting distances are 30 feet by 30 feet; avocadoes are vigorous-growing trees and require plenty of room.

The union of the stock and scion is always a weak spot in a tree (Plate 28) and should, therefore, be kept above the level of the soil. If the land has been properly prepared there is no need to dig big holes for the trees. So long as the holes are wide enough to spread the roots, they need not be more than 12 inches deep. The roots should be evenly spaced at a downward angle of about 45 degrees, and the hole then almost filled with fine topsoil and tramped firmly. Before the hole is completely filled, the application of 3 to 4 gallons of water to each tree is desirable.

The season of planting may be governed by local conditions. Spring plantings often entail frequent waterings, as the young trees should never lack moisture. Planting in February during the wet period, therefore, is often preferable.

CULTIVATION.

Cultivation to suppress weed growth is important during the drier spring months. Summer and autumn rains are utilised for growing green manure crops, which, however, should be ploughed or disced in not later than the middle of July. Such crops both improve the physical condition of the soil and reduce soil losses by erosion.

In young avocado orchards, cultivation to a depth of 8 to 10 inches is advisable. However, as the trees become older, their rooting systems extend widely in all directions and shallower cultivation is preferred, particularly close to the trees.

Avocado trees up to two or three years old occupy a relatively small proportion of the total area on which they are planted, and thus the early years of an avocado plantation afford an excellent opportunity for building up a reserve of organic matter in the soil. At this stage, cultivation, even early in the season, may be confined to the immediate vicinity of the trees, the space down the middle of the tree rows being occupied by a succession of summer and winter green manure crops, each of which is turned under as it approaches maturity.

PRUNING.

The avocado tree requires little or no pruning once its framework has been established. In general the aim should be to establish a strong, symmetrical tree having well-spaced branches which will support heavy crops of fruit.

At planting, the young tree should be headed back just above the strongest of the dormant buds which terminate the growth cycles of the trunk. These buds usually make upright growth. Subsequent pruning consists in pinching out terminal buds and the removal of crossing and crowding branches. The kind and amount of pruning differ with varieties. Trees of a straggling and spreading habit should be pruned to direct the growths upwards. On the other hand, tall-growing varieties require to be topped and cut to buds pointing outwards to preserve low heads. As the trees grow older, the lower limbs are shortened back and finally removed to make room for the upper larger ones which bear down.

HARVESTING.

The avocado does not soften on the tree, and in many varieties external indications of maturity are hardly perceptible. The correct stage at which to harvest is thus difficult to define, particularly in the green varieties. Usually a slight change in colour occurs on the skin and stem as the fruit approaches maturity. The gloss on the skin is not quite so pronounced and a yellowish tinge is perceptible on both skin and stem. Mature fruit ripens without any crinkling of the skin.

All fruits should be clipped from the tree and double cut so as to ensure that the stem is cut flush with the fruit. Pulling the fruit should be avoided, as damage to the button usually occurs and facilitates the entry of decay organisms.

CERTIFICATE COURSE IN AGRICULTURAL SCIENCE.

The Professor of Agriculture of the University of Queensland (Professor L. J. H. Teakle) advises that arrangements have been finalised for the commencement of this course on 1st February, 1950. The Certificate Course in Agricultural Science is being conducted by the University of Queensland and the Department of Public Instruction and will cover a minimum of 4 years. It is available to persons interested in agriculture.

All correspondence in respect of this course should be addressed to The Supervisor, Technical Correspondence School, Box No. 1389 R, G.P.O., Brisbane.

Cooling Milk on the Darling Downs by a Water-cooling Tower.

P. McCALLUM, Division of Dairying.

CLEANLINESS in all operations is essential for the production of milk of good keeping quality. However, even in cleanly produced milk bacteria will multiply rapidly and affect its keeping quality if it is not kept at a low temperature. The cooling of milk may therefore be regarded as a necessary step in its efficient production.

Table 1 illustrates the influence of temperature on bacterial growth in milk.

TABLE 1.

EFFECT OF TEMPERATURE ON BACTERIA IN MILK.

Milk immediately after milking	1,480 bacteria per ml.
Same milk, after standing 18 hours—	
At 48° F.	2,100 bacteria per ml.
At 54° F.	5,600 bacteria per ml.
At 59° F.	156,000 bacteria per ml.
At 64° F.	550,000 bacteria per ml.
At 70° F.	6,750,000 bacteria per ml.

Methods of Cooling.

Many methods of cooling milk on the farm have been tried over the years. They are:—

1. *Refrigeration.* This is the ideal medium, but requires a costly plant often beyond the means of many farmers.

2. *Water Cooling.* Devices which use water to effect a cooling of milk may be subdivided into—

   (*a*) Tubular coolers, in which the water used is pumped from an underground concrete pit or tank, or is gravity-fed from a windmill or other tank.

   (*b*) Water-cooling tower systems.

3. *Aeration.* This method affects only a very limited degree of cooling under Queensland conditions because of the high atmospheric temperatures. Aeration may be effected by the following means—

   (*a*) Blower-type coolers, in which a mechanical fan blows a strong current of air into the milk as it enters an enclosed drum, causing it to be broken up into a fine mist.

   (*b*) Fan coolers, whereby a car fan is used to blow a current of air into the milk as it passes over an aerator.

   (*c*) Aerators of the drop-cooling principle, whereby cooling is effected by running the milk over a series of metal plates or dishes set one below the other.

It is not the purpose of this paper to give details of the various types of coolers, but to record some observations made on the cooling of milk by a water-cooling tower system used on a farm in the Pittsworth district on the Darling Downs.

Plate 29.

WATER-COOLING TOWER.—Showing Position of Tower (left) to Milking Bails and Milk Stand.

The Water-Cooling Tower.

The advantages of the cooling tower are well known around Brisbane and Beaudesert, where milk is produced for the Brisbane liquid milk trade. The Darling Downs, with its dry atmosphere, is well suited for this type of cooling system. With the object of testing this system on the Darling Downs, where a large quantity of liquid milk, and most of the milk for cheese-making in Queensland, is produced, Mr. H. R. Trott, of Yarranlea, created the first tower cooler (Plates 29 and 30) on the Downs.

This cooler has now been in operation for over 12 months and has given satisfactory results. Observations were carried out regularly each month to ascertain the degree of cooling practicable, and methylene blue tests carried out regularly at the Yarranlea cheese factory have also shown that first quality milk is produced consistently, even under hot summer conditions, from the farm on which the cooler is installed.

With the water-cooling tower system, the water is pumped from a cement pit (1 ft. deep) at the bottom of the tower, through a tubular milk cooler, and then to the top of a 12 ft. wooden tower, where it enters a tray and showers down over a series of baffles to the pit at the bottom of the tower, to be recirculated again. By this means the cooling water is cooled down to the wet-bulb temperature, which is usually much lower than the dry-bulb reading of the thermometer. Tests carried out on the Downs have shown that the temperature difference between the wet

Plate 30.

CLOSE VIEW OF WATER-COOLING TOWER.

and dry-bulb readings at 5 p.m. during the summer is usually from 10 to 20 degrees Fahrenheit. The wet-bulb thermometer is simply an ordinary thermometer, the tip of which is covered with cloth kept saturated by a small glass of water in which it is suspended. When the atmosphere is dry the water on the wet bulb thermometer evaporates rapidly, causing a cooling effect, so that the wet-bulb thermometer reads lower than the one with the dry bulb. The greater the difference between the two thermometers, the drier the air and the greater the cooling effect. If the air is saturated with moisture, there will be no evaporation from the wet bulb and the two instruments will read alike.

Table 2 sets out some comparative results obtained by checking various cooling systems on some farms in the Pittsworth district.

TABLE 2.

Date.	Type of Cooler.	Wet Bulb Temperature. °F.	Temperature of Milk in Can. °F.	Deviation from Wet Bulb Temperature °F.
24th September	Mechanical blower ..	a.m. 61	73	12
		p.m. 58	72	14
	Water-cooling tower ..	a.m. 61	63	2
		p.m. 60	64	4
25th September	Underground cement pit	a.m. 48	65	17
		p.m. 56	68	12
	Water-cooling tower ..	a.m. 48	51	3
		p.m. 58	62	4
30th November	Water from windmill tank	a.m. 62	81	19
		p.m. 60	82	22
	Water-cooling tower ..	a.m. 62	66	4
		p.m. 60	64	4
2nd December	Fan driven from engine ..	a.m. ..	..	..
		p.m. 66	81	15
	Water-cooling tower ..	a.m. ..	..	..
		p.m. 65	68	3

The above figures show that on an average it is possible to cool the milk from 10° to 15° lower by the water-cooling tower system than by other systems now in general use. The beneficial effect that 10 degrees would have in keeping down bacterial development will be evident from a perusal of Table 1.

Other results obtained with the tower cooler during the summer months are given in Table 3.

TABLE 3.

Date.	Wet Bulb Temperature. °F.	Temperature of Milk in Can. °F.	Average Deviation from Wet Bulb. °F.	Cooling Range of Milk. °F.
10th January	p.m. 69	74	5	20
11th January	a.m. 64	66	2	28
21st January	a.m. 64	68	4	25
	p.m. 79	74	5	20
5th February	a.m. 62	66	4	25
	p.m. 65	72	7	20
10th March	p.m. 74	77	3	16
11th March	a.m. 70	72	2	20
14th March	p.m. 72	76	4	18
15th March	a.m. 68	72	4	..

Details of the construction of a water-cooling tower for cooling farm milk supplies are given in a Departmental leaflet. Where the farmer can erect the tower himself the cost is not very great. All hardwood sawn timber was used in this case and cost about £8; cement cost £2 10s.

ANIMAL HEALTH

Swine Brucellosis.

A. K. SUTHERLAND, Senior Veterinary Pathologist, Animal Health Station, Yeerongpilly.

Definition.

Swine brucellosis is a chronic infectious disease of swine which affects particularly the reproductive organs and causes infertility in both sexes. It is caused by a specific bacterium, *Brucella suis.*

History.

The disease was first described in Hungary in 1909, but precise knowledge of it dates from 1914, when Traum, in California, identified and studied the cause. The disease was referred to for some years as Traum's disease, and later as infectious abortion of swine, but the name swine brucellosis is now almost universally used by both farmers and scientists.

Brucellosis occurs in swine throughout Europe but it is apparently absent from Great Britain. It is of special interest to note that the disease spread into Denmark in the 1920's, but, as a result of determined efforts by farmers and veterinarians, it was completely eradicated from that country by 1932. It is quite common in the United States, particularly in the middle western States, which have a heavy and dense swine population.

Although swine brucellosis had probably been present in Australia for many years, it was first identified in 1932 by R. O. C. King at the Veterinary Research Station, Glenfield, New South Wales.

In Queensland, the first diagnosis was made in 1936 when a number of blood samples submitted to the Animal Health Station at Yeerongpilly gave positive reactions to the agglutination test. In recent years *Br. suis* has been isolated from pigs in this State. The numbers of blood samples tested for swine brucellosis at Yeerongpilly in the last few years are as follows:—

Year ended 30th June, 1943	450
Year ended 30th June, 1947	1,367
Year ended 30th June, 1948	1,610
Year ended 30th June, 1949	1,107

In the past 3 years all the breeding stock in 65 separate herds have been tested. Of these 65 herds, 21 (or 32 per cent.) were found infected and 44 (or 68 per cent.) showed no infection. Of the 34 herds which have been tested more or less regularly during the last 3 years, 28 herds (or 82 per cent.) are clean and only 6 herds are still infected. The disease is present in all the major swine raising areas of the State.

Economic Importance.

Although some pig producers have claimed that the presence of brucellosis is of no importance to the financial return from their herds, it is a disease which farmers cannot afford to neglect. It may be true that in some infected herds the financial loss is not great. On the other hand, in a great many herds brucellosis has rendered profitable production impossible. Careful records of infected herds in U.S.A. showed only 4.5 pigs weaned per sow bred, and there is no reason to believe that the disease behaves differently in Australia.

The causes of sterility in swine have been the subject of very little investigation, but the few studies that have been made in the United States have shown that the commonest cause of sterility in sows and boars is brucellosis.

No survey of the causes of infertility and sterility in swine in Australia has been reported. It seems probable, however, that in Queensland infertility, sterility, and birth of weak or dead pigs are most frequently due to either malnutrition or brucellosis.

Br. suis is important also because it may infect human beings, the disease being referred to as undulant fever. It often runs a chronic course, which may be fatal. Few human infections have been reported in Australia, but it is probable that many undiagnosed cases occur. It is seen most frequently in farmers and veterinarians through their contact with infected pigs and cattle. Since the swine organism, *Br. suis*, is more dangerous to man than the bovine organism, *Br. abortus*, the eradication of brucellosis from his pigs is the most important step that a farmer can take to reduce the risk of contracting undulant fever.

The Causal Organism.

Br. suis is related to, but distinct from, the organism *Br. abortus* which causes bovine brucellosis or contagious abortion of cattle. It is important to note that—

(1) *Br. suis* is found mainly in swine, but it does infect man and on rare occasions cattle; whereas

(2) *Br. abortus* is found mainly in cattle, and occasionally in man, and rarely in naturally infected swine.

Br. suis does not grow or multiply outside the body of an infected animal, but it will survive in moist, shaded situations about pens and yards for 2 to 3 months. In clean, dry yards the organism is probably quickly destroyed, especially if exposed to sunlight.

How do Pigs Contract Brucellosis?

Infected pigs may excrete *Br. suis* in urine, dung, milk, semen, or in the fluids and membranes expelled from the womb at farrowing. The infection is then carried from these materials to susceptible pigs, either by direct contact or indirectly on such things as boots, clothing, shovels, buckets, brooms, &c.

Infection is, however, contracted most often by service from an infected boar. Conversely, a clean boar may contract brucellosis by serving an infected sow. Besides service, infection can be contracted by swallowing contaminated food or water, or through contamination

of the eye or cuts or wounds on the skin. The organism is excreted in the urine for long periods and this is one of the important sources of infectious material. Uncooked offal fed to swine is also a source of infection.

Suckers quite often contract infection from their dams, either through contact or through drinking the infected sow's milk. Many animals which contract the disease as suckers or weaners throw off the infection, but a few will continue to harbour infection through to adult life.

Effect of Brucellosis on the Animal.

Once a pig has contracted infection the organism circulates in the blood for some days or weeks and then may localise in almost any part of the body—the lymph nodes, liver, spleen, bladder, udder, bones, joints, or the reproductive organs of either sex. Quite often an infected animal appears healthy, and the presence of the disease becomes evident only when the breeding record is studied carefully.

The symptoms of brucellosis may be summarised as follows:—

(1) In boars, a swollen testicle is the symptom most often observed, but quite often the infection is confined to sexual organs within the body (prostate, seminal vesicles, bulbo-urethral glands) so that no abnormalities are visible externally. When brucellosis becomes established in a boar it usually results eventually in sterility.

(2) In sows, brucellosis in the womb causes infertility, which may be either temporary or permanent. All or part of the litters produced by infected sows may be born dead or they may be weak and die a few days after birth. The disease also causes abortion, which often occurs 3 to 4 weeks after mating and so frequently escapes attention because the sow is apt to eat the afterbirth and the aborted piglets. Sows may suffer only temporary infertility and thereafter breed normally, or they may abort once or twice and then carry succeeding litters to full term. In other sows, however, infection may persist indefinitely in the womb, causing sterility.

(3) When the organism localises in the bones or the joints it usually persists there for years and causes swollen joints, lameness, or paralysis.

Diagnosis.

Neither the symptoms nor the post-mortem findings are sufficiently characteristic to enable one to make a definite diagnosis. Infertility, abortion, stillbirths, swollen joints, and lameness are often due to other diseases (such as malnutrition, paratyphoid, erysipelas, or tuberculosis), hence we have to rely on laboratory tests for exact diagnosis.

The Agglutination Test.

This test is done at the laboratory on blood serum samples. The test is based on the fact that in the serum of infected animals there are substances, called agglutinins, which act on a watery suspension of Brucella bacteria in such a way that the bacteria clump together (that is, agglutinate). Thus, the test is done by mixing together in small

glass test tubes accurately measured amounts of serum and a standard suspension of Brucella bacteria. The tubes are placed in an incubator at 37 deg. Cent. for 48 hours and then examined. When a *small* quantity of serum causes visible clumping of the bacterial suspension, then the serum is said to have a high titre and it is classed positive to the test. When even a large amount of serum has no action on the bacteria, then the serum is said to have a low titre and it is classed negative to the test (see Plate 31). Serums whose titres are in between the low titre (negative) and the high titre (positive) are called suspicious.

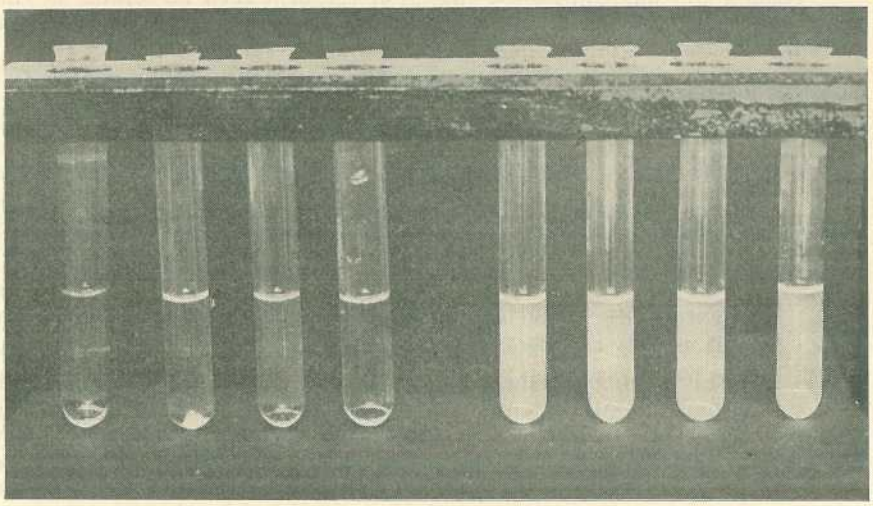


Plate 31.

AGGLUTINATION TEST FOR BRUCELLOSIS.—Four tubes are set up for each serum to be tested. The four left-hand tubes show a positive reaction—the bacteria have been agglutinated and settled to the bottom of the fluid. In the negative reaction on the right, the serum has had no action on the milky bacterial suspension.

Although the agglutination test for swine brucellosis is not as efficient as some other laboratory diagnostic tests (for example, the agglutination test for bovine brucellosis), it is the only practicable test available. It has been frequently criticised but, provided its shortcomings are realised, it can be profitably used for controlling brucellosis. The facts regarding the agglutination test for swine brucellosis have become clear as the result of intensive studies in several laboratories in U.S.A. in only the last few years. These facts are summarised as follows:—

(1) A few weeks after a pig contracts brucellosis, its blood gives a positive reaction to the test. Most animals continue to give a positive blood reaction as long as they have infection in their bodies, but in some animals the blood reaction becomes weaker so that they become suspicious and later even negative to the test, notwithstanding that they are still infected. Unfortunately, some infected animals give a positive reaction for only a short period (weeks or months) after they contract the disease.

(2) The animal that gives a suspicious reaction may be either—

(*a*) An infected animal whose blood reaction is on the increase from negative toward positive as a result of recent infection (a few weeks later such an animal would be positive); or

(*b*) An infected animal whose blood reaction is on the way down from positive toward negative; or

(*c*) An animal which is not in any way infected with brucellosis.

(3) Therefore, a negative reaction in an animal in an infected herd is not definite evidence of freedom from brucellosis, because—

(*a*) The animal may have been only recently infected so that its blood had not had time to develop a positive reaction; or

(*b*) The animal may have previously been positive and then come back to negative although still infected.

On these facts are based certain guiding principles for using the agglutination test in the control of swine brucellosis. To establish whether a herd is infected, all the breeding pigs should be tested.

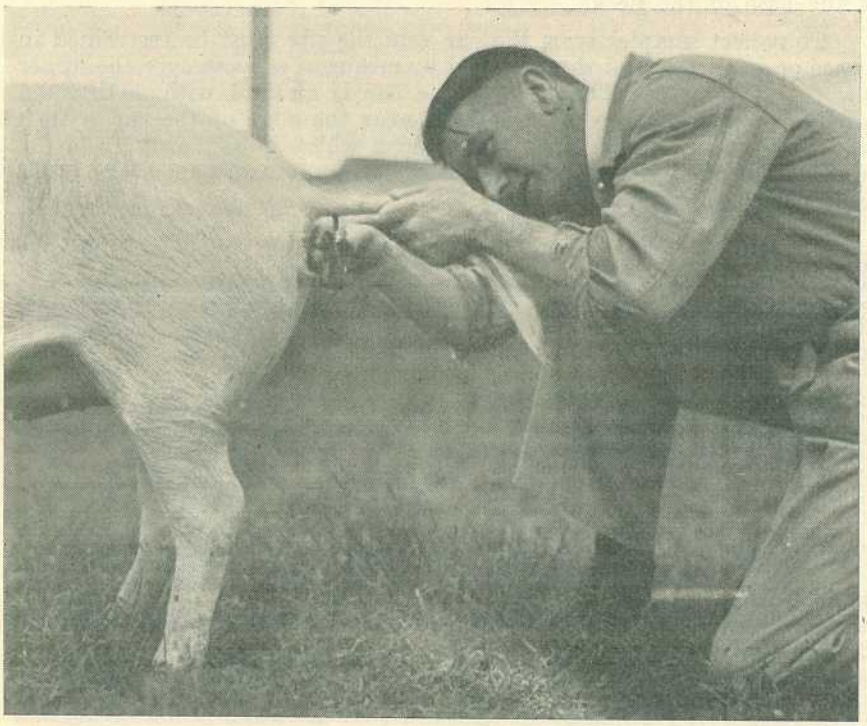


Plate 32.

COLLECTING A BLOOD SAMPLE FROM THE TAIL.

When a whole herd is negative to the test, the breeding history is normal and there have been no recent introductions, then the herd can be regarded as clean. Repeat tests at prescribed intervals would, of course, be necessary for certification as a brucellosis-free herd. In a herd with a normal breeding record and no recent introductions and no positive reactors, the presence of a few suspicious reactors is not regarded as evidence of brucellosis.

In an infected herd a negative reaction in individual pigs does not indicate freedom from infection. In *any* herd a positive reaction is definite evidence of infection.

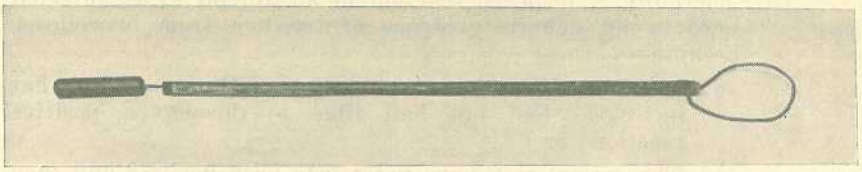


Plate 33.

AN IOWA HOG-HOLDER MADE FROM 5/8-INCH STEEL PIPE 24 INCHES LONG AND A 3/16-INCH WIRE CABLE.

Collecting Blood Samples for the Agglutination Test.

Blood samples for the agglutination test may be taken from the veins of the ear or the tail or from the great vein (anterior vena cava) at the base of the neck.

To collect samples from the ear vein the pig must be restrained in a race or small pen and then secured by means of a noose over the upper jaw tied to a post. The edge of the ear is cleaned with methylated spirits and then dried. A large vein near the edge of the ear is then cut across with a sharp knife. The blood which flows slowly from the cut vessel is then collected in a 1-oz. bottle as it drops from the outer margin of the ear.

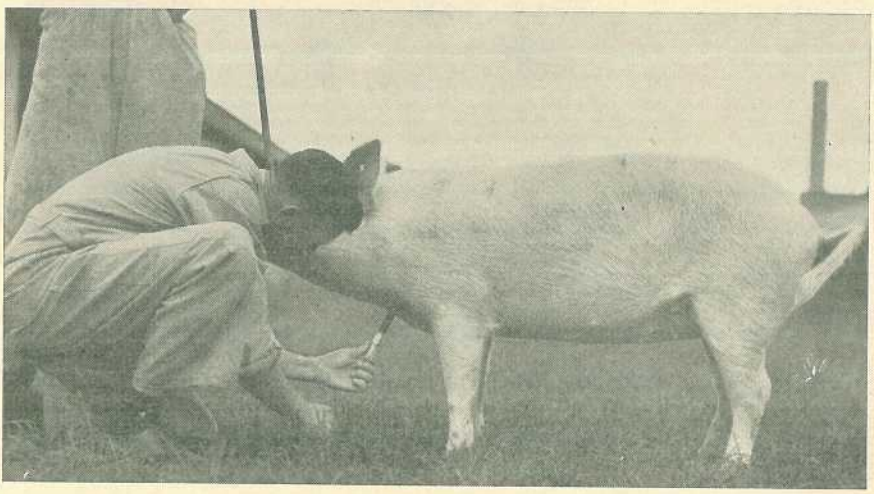


Plate 34.

COLLECTING A BLOOD SAMPLE FROM THE ANTERIOR VENA CAVA.

The technique for collecting blood from the tail is shown in Plate 32. A knife with a rather sharp point is used to make a stab about ¼-inch deep exactly in the mid-line on the under surface of the tail about 1 inch from its root. For this operation the pig may be held in a crate or race, or he may be caught and held in a small pen by means of an "Iowa hog holder" (Plate 33) over the upper jaw. Another method which is quite useful when other means of restraint are not available is to withhold the morning feed and then offer a small feed at the desired time so that the tail can be cut and the blood collected while the pig feeds greedily at a trough.

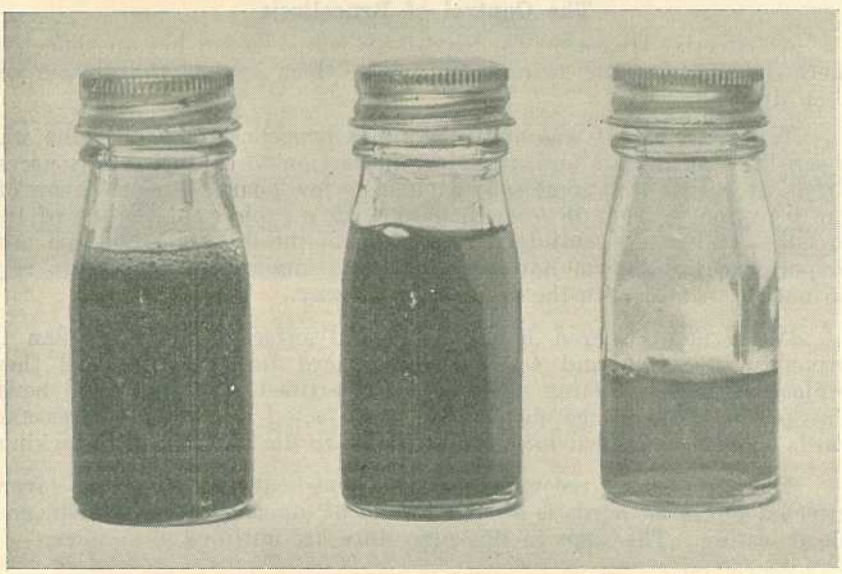


Plate 35.

Left.—Blood sample before clotting. Centre.—Blood sample with clear serum separated from clot; Right.—Serum sample.

The technique of collecting blood from the anterior vena cava by means of a syringe, shown in Plate 34, is now widely used by veterinarians in U.S.A. The pigs are placed in a small yard and then caught and held with an Iowa hog holder. Small pigs are easier to bleed if they are held by hand on their backs in a V-shaped trough. This technique requires more practice than ear or tail bleeding, but once the technique is learned it is the quickest and best method and it has the great advantage that it yields better and cleaner samples for testing. It is, however, essential to use the proper syringe needle according to the size of the pig for this technique.

Whatever method is used, about ½-oz. blood is collected in an absolutely clean, dry bottle. After the samples have clotted (about 30 minutes) they are taken to an office or other suitable place to allow them to stand undisturbed for several hours. At this stage clear serum should have separated from the blood clot (Plate 35) and the serum can be poured or pipetted into another clean, dry bottle. The serum must be poured carefully to avoid including the red colouring matter from the blood. For best results the work should be arranged so that the

pigs are bled in the morning and the serum poured off late on the same afternoon. The serum samples are then sent with all haste to the Animal Health Station at Yeerongpilly or at Oonoonba. If the samples can reach the laboratory on the same day that they are collected, then the whole blood sample may be submitted instead of the serum only. However, if whole blood samples are delayed reaching the laboratory these are very likely to be unfit for testing.

It is, of course, necessary to label every sample carefully so that it is accurately identified with the pig from which it was taken.

The Control of Brucellosis.

No effective treatment for brucellosis is known nor has any effective method of vaccinating swine to immunise them against the disease yet been discovered.

Ten years ago it was often said that brucellosis among swine was a self-limiting disease and, therefore, no action to control it was necessary. It is true that some sows (but very few boars) tend to throw off the infection, so that in a small herd with a rapid replacement of the breeders and a high standard of sanitation the disease might die out. Experience has shown, however, that it is unwise and unsafe to rely on nature to deal with the disease in this way.

When non-purebred herds are found infected the best plan is probably to fatten and sell the whole herd for slaughter and then replace with new, young stock from a certified brucellosis-free herd. The premises should be cleaned and disinfected and the pastures and yards should be spelled to allow infection to die out before restocking.

The procedure recommended for eradicating brucellosis from infected purebred herds is a combination of quarantine, sanitation, and blood testing. The steps in this procedure are outlined as follows:—

(1) All breeding sows and boars are tested.

(2) Weaners are selected from negative sows with a normal breeding record and isolated at eight weeks of age on clean ground. Thereafter, these young stock are kept in strict isolation. They are tested immediately before weaning, then several times up to breeding age, and particularly immediately before mating and during pregnancy. Any animals found positive are immediately culled from the isolated clean unit. By this procedure it is possible to replace an infected herd by a brucellosis-free herd in a year or so.

(3) The whole of the old herd of breeders (negatives as well as positives) is sold for slaughter as soon as they are marketable, because there is always a risk that infection may be carried from them back to young stock being reared in isolation as disease-free replacements.

(4) If it is particularly desired to conserve the progeny of a positive sow, then her litter may be weaned at eight weeks and isolated and tested as already described. However, there is some risk in doing this because a small percentage (roughly 10 per cent.) of animals infected as suckers remain infected up to their first farrowing and, in the case of boars, sometimes throughout their lives.

Disinfection.

The selection of premises for rearing the clean replacement herd requires careful consideration. Clean pasture away from and receiving no drainage from infected premises is the ideal. If pens or houses previously occupied by infected stock are used they must be thoroughly cleaned and exposed to sunlight, and left vacant for two months. Chemical disinfectants (for example, 5 per cent. lysol) may be used where they are applicable, as in concrete pens.

Care of Clean Replacement Herd.

Certain precautions are necessary to prevent infection being introduced into the clean replacement herd of young stock. It is desirable that they should be cared for by separate persons, but if this is not practicable, then they should be attended first before the remainder of the herd. Rubber boots should be worn and disinfected to avoid spreading infection.

The clean replacement unit should be provided with new troughs and equipment; or, if previously used materials are used, they must be thoroughly cleaned and disinfected beforehand.

Protecting Brucellosis-free Herds.

To prevent infection being introduced into a clean herd, or when assembling a new herd, certain important points should be noted. Pigs should be bought, if at all possible, from certified brucellosis-free herds only. Animals from infected herds or herds of unknown status are always a danger even if they are negative to the agglutination test. If it is particularly desired to purchase pigs from herds which are not certified, then they should be held in isolation and tested several times at monthly intervals before being allowed to mingle with the herd, although even this procedure is not certain to prevent introduction of a diseased animal. Pigs exhibited at shows may also introduce infection unless proper precautions are taken.

The practice of lending boars or accepting sows for service is also dangerous.

Care should be taken against introducing infection through either equipment or boots or clothing which has had contact with an infected herd.

Summary.

(1) Brucellosis is a serious infectious disease of swine because of its effects on the fertility of both boars and sows.

(2) Infected pigs may transmit the disease to human beings having contact with them, causing human brucellosis (undulant fever).

(3) The symptoms and post-mortem findings are not characteristic, so that laboratory tests are necessary for an exact diagnosis.

(4) The only practicable test available for use on large numbers of animals is the agglutination test, which is done at the Animal Health Stations on samples of blood serum.

(5) The agglutination test for swine brucellosis is not highly efficient for diagnosis but its shortcomings are now much better understood as a result of extensive studies completed in only the last few years.

(6) Notwithstanding its deficiencies, the agglutination test has proved effective in eradicating the disease from many herds in this State and in other parts of the world.

(7) To eradicate brucellosis from an infected herd, attention should be concentrated upon replacing *all* the older breeding stock with young stock which have been weaned at eight weeks of age from sows negative to the agglutination test. The young replacement herd should be reared in strict isolation and tested several times so that any infection among them may be promptly detected.

(8) The purebred herds of Queensland are at present not heavily infected. It is therefore considered that because of the effect of brucellosis on the efficiency of production, and because of its public health importance, eradication by blood testing and segregation should be pursued (in spite of possible difficulties), otherwise the disease may get out of hand, as it has done in some parts of the world.

Vibrionic Abortion in Cattle.

G. C. SIMMONS, Assistant Bacteriologist, Animal Health Station, Yeerongpilly.

Introduction.

A NUMBER of species of microorganisms has been incriminated as the cause of infectious abortion in cattle, the most important being *Brucella abortus*, which causes brucellosis. However, two other organisms—*Trichomonas foetus* and *Vibrio fetus*—can cause considerable economic loss by causing abortion and sterility in infected animals.

Recently, abortion due to *V. fetus* infection was diagnosed in three herds in Queensland, two in the Brisbane division and one on the Darling Downs. These cases were brought to the notice of Departmental officers by farmers who had abortions occurring in cattle which had been vaccinated with *Br. abortus* Strain 19 vaccine. Inoculation of calves with this vaccine has proved very successful in increasing the animals' resistance to brucellosis and greatly reducing losses from abortion and sterility. It is known, however, that vaccinated cattle may succumb to brucellosis by exposure to large doses of virulent strains of *Br. abortus*. On the other hand, when vaccinated animals abort it should be remembered that microorganisms other than Brucella may be responsible.

Economic Importance.

Vibrionic abortion has been diagnosed in most parts of the world in both sheep and cattle. As a cause of abortion and sterility in cattle, vibrionic infection is less important than brucellosis or trichomoniasis. Usually only single sporadic cases occur. However, in infected herds studied in America, up to 20 per cent. of cows mated have aborted because of this disease.

It has also been suggested that udder development is retarded in cows which abort.

Cause.

Vibrionic abortion is caused by infection with a bacterium named *Vibrio fetus*. The organism is not very resistant and rapidly dies outside of the animal body.

Mode of Infection.

Cows are probably infected by coming into contact with the "slink" (aborted calf) or the fluids and membranes expelled by infected cows. They may also be infected by service from an infected bull.

Symptoms.

The most obvious sign of this disease is the failure of cows to carry the calf to full term, the calf being aborted at any time 2-8 months after mating. If the abortion occurs early in the gestation it may not be noticed and the cow will return to the bull again.

In many cases the after-birth is retained and a discharge may occur from the womb.

In both cows and bulls no obvious sign of ill-health is produced.

Diagnosis.

This disease can be diagnosed with certainty only by bacteriological examination of the foetus. It is therefore advisable for farmers to contact officers of the Department of Agriculture and Stock or a practising veterinary surgeon if abortions are occurring, so that suitable arrangements can be made to forward a freshly aborted foetus, or specimens from one, to the laboratory for examination.

Treatment and Control.

No treatment is available for this disease.

The disease in many herds tends to be self-limiting—that is, after causing a number of abortions, which may be few, or as high as 20 per cent., the disease of its own accord dies out.

Control steps, applicable not only to vibrionic abortion but to any other type of infectious abortion, are—

(1.) A Departmental officer or a practising veterinary surgeon should be consulted so that the type of abortion can be determined.

(2.) If abortions are occurring, the cows should be watched closely so that those showing signs of impending abortion may be promptly isolated.

(3) The aborted calf and the membranes should be located as soon as possible so that they may be promptly burned or buried deeply under lime to prevent spread of infection.

(4.) The cow should be held in isolation and not bred until all discharge from the womb has ceased.

TUBERCULOSIS-FREE CATTLE HERDS
(AS AT 1st DECEMBER, 1949).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.

The Young Farmer.

MONTO FIELD DAY.

THE Monto Q.D.O. and Junior Farmers' Club members staged a most successful field day on the Monto Showgrounds on Thursday, 1st December, when officers of the Department of Agriculture and Stock carried out a number of demonstrations and addressed those present on various aspects of farm and dairy work. The attendance numbered nearly 50 persons.

Mr. B. Ostwald, President of the Q.D.O. Branch, presided and welcomed the visitors and local residents. He stressed the importance of such days and the value to young and old of the demonstrations and lectures which had been arranged for their benefit.

Visitors included Mr. T. L. Williams (State Director, Junior Farmers' Organisation), Mr. M. L. Cameron (General Manager of the Agricultural Bank), and Mr. C. Sewell (Local Inspector of the Bank).

Lunch and afternoon tea were provided by a band of willing workers headed by Mrs. Bartlam, wife of the district Dairy Adviser, Mr. R. H. Bartlam, who with other local officers of the Department of Agriculture and Stock was responsible for the arrangements.

New Clubs.

Three new Junior Farmers' Clubs—Chinchilla, Warra, and Brigalow—were formed early in December after meetings of local farmers and their sons and daughters had been addressed by the State Director of the organisation.

Officials elected for the respective clubs were as follows:—

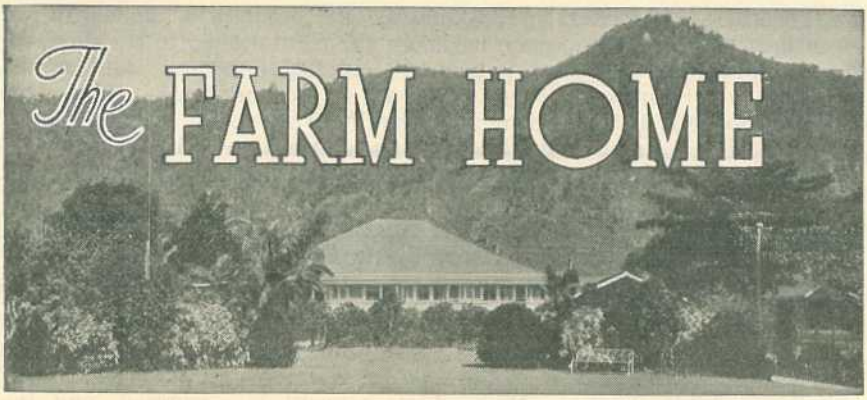
Chinchilla—Club leader, George Powell; deputy-leader, Albert Valler; secretary-treasurer, W. Mann; advisory committee, Messrs. Roy Evans, J. Gormley, T. W. Crawley, and J. Hinds (Dairy Adviser, Chinchilla).

Warra—Club leader, P. Wright; deputy-leader, Neville Taylor; secretary, Brian Moore; treasurer, Cliff Parsons. An advisory committee to assist the club in its various activities is to be elected during the club's first meeting in January.

Brigalow—Club leader, Harley Fisher; deputy-leader, Norman Stewart; secretary-treasurer, John Beutel; advisory committee, Messrs. W. Beutel, T. T. Schloss, W. Woolley, and J. Hinds.

Appointment of Assistant Organiser.

Owing to the growth of the Junior Farmers' Organisation in Queensland, the State Government recently approved of the appointment of an Assistant State Organiser to assist Mr. Williams in his work. Mr. C. V. Lilley, Stock Inspector in the Department of Agriculture and Stock, has been selected for the position and will commence duties in February.



Problem Children.

HAVE you a so-called problem child in the family? One who worries you to distraction because he won't eat, won't sleep, won't move his bowels at the appropriate time, or is subject to temper tantrums, and other behaviour problems? In fact, a child who has an uncontrollable tendency to do what he ought not to do and to leave undone what he ought to do, with the result that there is no health left in him? This attitude of mind is described in scientific circles as "negativism" but to the ordinary parent it is probably better known as "cussedness" or "contrariness."

Now, before losing patience with the child or arriving at the brink of a nervous breakdown, it is wise to review the situation placidly and calmly and above all with a broad and enlightened mind. For, more often than not, the fault does not lie with the child but with its parents and guardians. But, having lavished all the care and attention at your disposal upon your particular problem child, you may deny this with some feeling. However, if you still remain calm and unbiassed you may have diagnosed the flaw in your parentcraft, for too much care and attention may do as much harm as too little.

The Only Child.

The majority of these children are either "solitary children" or children who come from broken homes and are deprived of a normal happy family life.

It is with the solitary problem child that this article is mainly concerned.

The solitary child is not necessarily an only child, although his troubles are so characteristic as to lead to the stock label of "only-childism." Any child who is brought up alone amongst grown up people may suffer from it. Others of course are so happily constituted by nature, or are so fortunate in the character of their parents, that they escape the disorder altogether.

Let us consider for a moment the peculiarities of the environment of the solitary child. A child so situated is constantly associating with grown up people and so fails to learn the salutary lessons of give and take or social adaptation imposed upon more fortunate children by

their brothers and sisters or playmates. It becomes a misfit in an essentially adult society, which leads, on the mental side, to the development of precocity and what is termed "old fashionedness" and on the physical side to nervous strain with all its concomitants. The value of Kindergartens in such situations should be obvious. Almost inevitably, too, the solitary child has too much attention paid to it. It is apt to get to feel that it is the most important person in the house, and the pivot around which the whole domestic world revolves. It thus acquires a liking for being in the limelight and the centre of the stage, and will resort to any devices, some quite abnormal, rather than allow itself to be thrown even for a moment into the shade.

Further, as the parents or guardians of the solitary child have all their eggs in one basket, they naturally enough tend to fuss over the basket to an undue degree. There results from this an extreme anxiety about the child's health. Every little ailment is magnified, and the resulting atmosphere of apprehension is communicated to the child itself. Matters are made worse by the habit, so frequent with such parents, of discussing the child's health in his presence, with the result that he becomes in time, a veritable little hypochondriac.

All this however does not necessarily imply that the "only" child is at the same time a "spoilt" child. The mother will often, and rightly, repudiate with indignation that her child is spoilt. But if the child is not over-indulged he is at least over-studied and pampered. As a matter of fact, the mother of the only child is often over-conscientious in the discharge of her maternal duties but lacks a sense of humour and proportion. As well as pampering the child physically, mentally and emotionally, she also makes her child's "moral being" her main care, and is for ever correcting, exhorting and forbidding. The result is that she induces in the child what plain people term "cussedness" but what it is now the fashion to speak of as "negativism." It is this mental condition which is the explanation of the refusal to eat, the refusal to sleep, and all the other "refusals" which are characteristic of the solitary child.

You will see, then, that only-childism is a complex condition, made up of physical, mental and moral ingredients. Physically, the child who suffers from it is thin, restless and nervous. He eats, digests, and sleeps badly and tires easily. Mentally he is excitable, emotional, precocious, introspective and hypochondriacal. Morally he is disobedient, troublesome and often ill-tempered and "impossible."

If after calm consideration you cannot find any flaws in your parentcraft, it would be wise to take your problem child to a doctor and enlist his help in getting to the root of the trouble.

Is Your Child Ill?

A child who is naughty may merely be suffering from lack of sufficient sleep, from malnutrition (which means improper feeding as well as underfeeding), from teething or ear troubles, or from some more serious illness. If you are worried on this score, call in your doctor and he will resolve your problem for you. If no doctor is available, endeavour to obtain advice from your nearest Clinic or some qualified person. Do not listen to alarmist advice given gratuitously by neighbours, relatives, or in-laws.

Is the Child Worrying?

If the child is obviously not ill, has he got some hidden problem or anxiety of his own? Is he worrying over the loss or illness of a beloved relative, friend or toy, or some other matter? If he is, reassure him and comfort him.

Is he suffering from a sense of insecurity or unwantedness brought about by family disharmony or a broken home? Parents forget how impressionable children are and what a devastating effect family quarrels, or any situation where the normal father-mother-and-children sort of relationship is missing, may have on a sensitive child. It is no coincidence that such a high proportion of delinquent and neurotic children come from such unsatisfactory homes as these.

Maybe he is merely jealous of a new addition to the family. He may not show it openly—in fact he may be most loving and affectionate—but subconsciously he may strongly resent the usurption of his usual place in the family by the new arrival. He may compete with the baby in every way, even to the extent of reverting to infantile habits and becoming wet and dirty again and refusing to take his milk except from a bottle, &c. It is now generally recognized that this emotional upset can become the cause of various disturbances, such as difficulties of sleeping and feeding, bed wetting, temper tantrums, and other behaviour problems. But these troubles will pass if he is treated wisely and justly. He should not be allowed to feel out in the cold—he should be taken into your confidence beforehand and told that you are going to present him with a new brother or sister, and when it arrives you should endeavour to give the older child the same amount of affection and attention as he has been used to before.

Is the Parental Attitude Right?

Having cleared up these points, it is now time to ask whether your attitude towards and general management of the child is correct or not. It must be remembered, of course, that every child is an individualist and requires to be respected as such. However, for the generality of children some general principles may be stated.

A child's education in the home consists primarily not of what is said to him, but in certain fundamental experiences.

The first essential condition to normal, healthy development within the home is *Affection and Security* and this can only come from parents who are in harmony with one another as well as with their offspring.

If a child receives normal affection from his parents he has a good start. He takes it for granted that he will receive affection in the world and is ready to respond with good feelings.

On the other hand, over-possessive, suffocating love can do considerable harm. The child's personality is choked by it and lacks freedom to grow. If the atmosphere surrounding him is too tense and emotional he is likely to prove a hothouse plant who cannot stand up to the storms of everyday life. "Love them and leave them alone" is a good maxim.

Secondly, it is in the home that the experience of *Law and Order* must begin; where the clamorous claims of small individualists must first be brought into proper adjustment to the needs of other members.

It is absolutely impossible to get along in this world without some rules and regulations, and children will for the most part obey reasonable rules in a reasonable manner. But complete laxity, harsh discipline or injustice may cause havoc to the developing mind of a child. What is essential is that the measures taken should be consistent, reasonable, and administered calmly and unemotionally on the part of the parents. There is no doubt that reasonable punishment has its uses, especially for minor faults, but for major faults what the child more often wants is help over some difficulty in life.

A correct balance must be struck between scope for self expression and necessary limits to freedom.

Foolish threats which frighten the child or too many "Don'ts" are most unwise and should never be resorted to; and, remember, never lose your temper when dealing with a child, for example is always better than precept.

Thirdly, the young child needs *Outlets* for his emotional, social and intellectual development. He should be given opportunities to create and construct, to experiment and to explore, to learn about things and people in his own way and in his own time. This is best accomplished by play. Ideally, children need some space that they can call their very own, where they can be about their own ploys, use messy materials such as sand, water and plasticine, and indulge their fertile imaginations in play-acting and such like activities.

As the child grows up, his measure of self reliance in facing the difficulties of life, and in attending to his own desires, should steadily increase. You must let him struggle with some difficulties, make some painful mistakes, destroy by foolishness some useful or valued article, for it is by such experience that mental growth is secured.

Furthermore, during these tender years a child should never be unnecessarily exposed to disparagement or to depreciation of his efforts or capabilities. So far as possible, failures and errors should be ignored. When the child is doing something he should be left to his own devices until he asks for help or obviously needs it; the child learns most effectively by his own struggles and errors, and from his own successes he gains confidence. While the failures should be ignored, the achievements should be praised and admired; encouragement here builds up the self-reliant and creative character.

Any further information on this and other matters connected with children 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.

RENEW YOUR JOURNAL SUBSCRIPTION EARLY.

Journal subscribers are requested to renew their Journal subscriptions well in advance of the month of expiry, as it is often difficult to provide missing numbers.

ASTRONOMICAL DATA FOR QUEENSLAND.

FEBRUARY.

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	5.21	6.42	Cairns	41	17	Longreach ..	40	30
6	5.24	6.40	Charleville	29	25	Quilpie	34	36
11	5.28	6.36	Cloncurry	57	42	Rockhampton ..	15	5
16	5.32	6.32	Cunnamulla ..	28	30	Roma	18	16
21	5.35	6.28	Dirranbandi ..	18	20	Townsville ..	34	16
26	5.38	6.23	Emerald	24	14	Winton	46	34
28	5.40	6.21	Hughenden ..	42	27	Warwick	3	5

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Date.	Rise.	Set.
	a.m.	a.m.
1	5.43	3.04
2	6.29	4.07
3	7.11	5.12
4	7.48	6.18
5	8.23	7.22
6	8.56	8.26
7	9.29	9.30
8	10.04	10.34
9	10.44	11.40
		p.m.
10	11.28	12.47
11	..	1.55
	a.m.	
12	12.19	3.00
13	1.16	4.01
14	2.18	4.54
15	3.22	5.40
16	4.25	6.19
17	5.26	6.52
18	6.24	7.22
19	7.19	7.50
20	8.12	8.18
21	9.04	8.45
22	9.58	9.15
23	10.52	9.47
24	11.47	10.23
	p.m.	
25	12.44	11.05
26	1.41	11.53
27	2.37	..
		a.m.
28	3.30	12.47

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	9	30	25	45	0	21	26	54
6	19	20	35	36	10	11	41	42
11	29	10	44	24	19	0	52	27
16	27	13	43	28	18	2	51	31
21	16	23	32	39	8	14	36	45
26	9	30	25	45	0	21	26	54
28	9	30	25	45	0	21	26	54

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	3	56	34	67	18	53	4	46
3	12	48	38	62	23	48	11	40
5	24	38	46	56	31	41	21	33
7	36	25	55	47	40	32	30	22
9	47	12	63	38	47	24	39	12
11	52	4	66	33	50	19	43	5
13	57	2	69	32	53	17	47	3
15	53	7	67	35	50	21	44	8
17	43	17	60	42	45	27	36	16
19	34	28	53	49	38	34	28	24
21	23	38	46	56	30	41	20	33
23	13	47	39	62	24	47	12	39
25	5	55	35	67	19	52	5	45
27	1	56	32	67	16	53	2	46
28	2	55	33	67	17	52	3	45

Phases of the Moon.—Full Moon, 3rd February, 8.16 a.m.; Last Quarter, 10th February, 4.32 a.m.; New Moon, 17th February, 8.53 a.m.; First Quarter, 25th February, 11.52 a.m.

On 15th February the Sun will rise and set 15 degrees south of true east and true west respectively, and on the 6th and 19th the Moon will rise and set at true east and true west respectively.

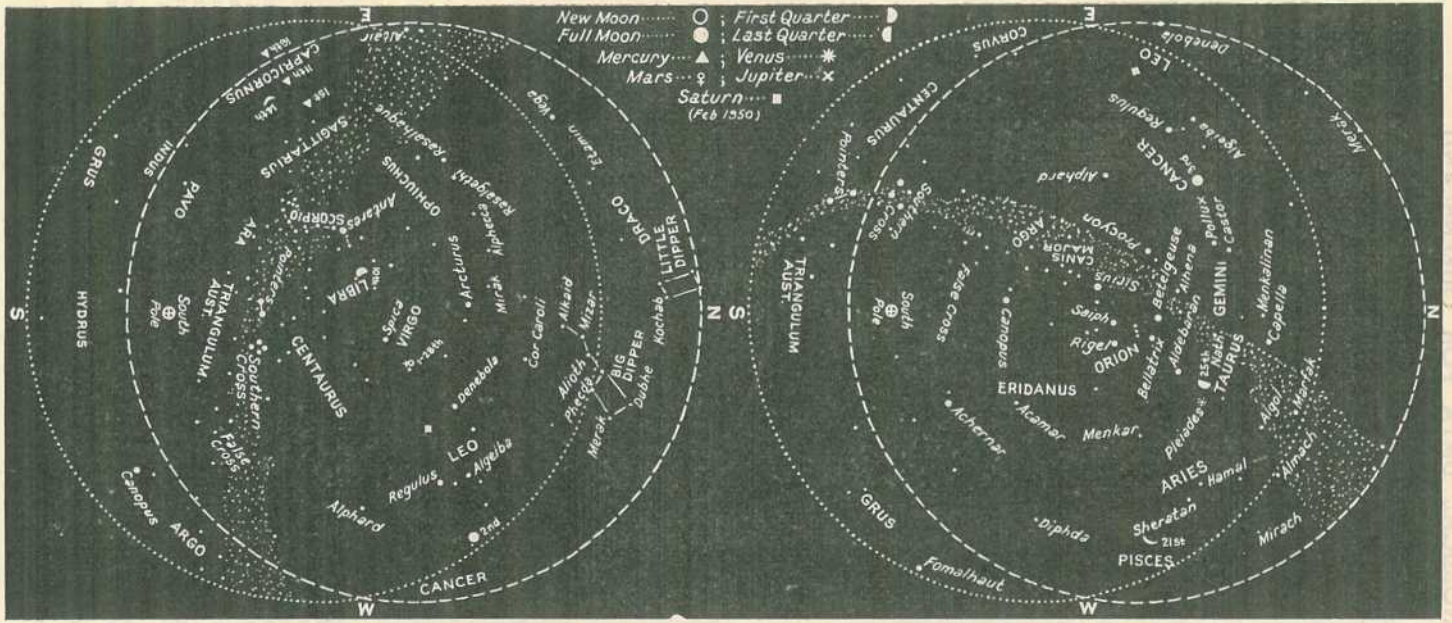
Mercury.—At the beginning of the month, in the constellation of Sagittarius, will rise 1½ hours before the Sun, and on the 10th, in the constellation of Capricornus, will reach its greatest angle west of the Sun, when it will rise 2 hours before sunrise. At the end of the month, still in the constellation of Capricornus, will rise 1½ hours before the Sun.

Venus.—Too close in line with the Sun for observation at the beginning of the month, but by the end of the month will rise 2¾ hours before the Sun and will be conspicuous in the morning sky in the constellation of Capricornus. About the middle of the month Mercury will pass close to Venus.

Mars.—Now well placed for observation in the early part of the night, rising between 9.45 p.m. and 11 p.m. at the beginning of the month and between 7.45 p.m. and 10 p.m. at the end of the month.

Jupiter.—Not favourably placed for observation, this month being in conjunction with the Sun on the 3rd.

Saturn.—In the constellation of Leo, will rise between 8.30 p.m. and 9.45 p.m. at the beginning of February and between 6.45 p.m. and 8 p.m. at the end of the month.



Star Charts.—The chart on the right is for 8.15 p.m. in the south-east corner of Queensland to 9.15 p.m. along the Northern Territory border on the 15th February (for every degree of Longitude we go west the time increases by 4 minutes). The chart on the left is for 8 hours later. On each chart the dashed circle represents 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 1 hour later than the time stated for the 15th and at the end of the month about 1 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.