Supplement to the "Queensland Agricultural Journal, October, 1951.

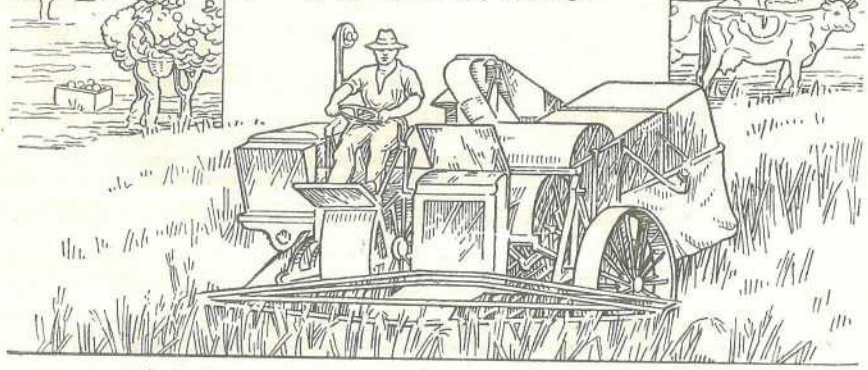
Volume 72

QUEENSLAND AGRICULTURAL JOURNAL

ISSUED BY DIRECTION OF

THE HONOURABLE
THE SECRETARY
FOR AGRICULTURE
AND STOCK

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



JANUARY TO JUNE, 1951.

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A. H. TUCKER, Government Printer, Brisbane.

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DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL

Banana Plantation in a Scrub Clearing, Mary Valley.

LEADING FEATURES

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

Volume 72 Part 1

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JANUARY, 1951

Issued by Direction of
THE HONOURABLE H. H. COLLINS
MINISTER FOR AGRICULTURE AND STOCK

GOVERNMENT PRINTER, BRISBANE

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SUBSCRIPTION RATES

Farmers, graziers, and all other persons in Queensland and Northern Territory whose main source of income is from the land; Schools, Schools of Art, Agricultural Societies, and Students in Queensland, **One Shilling per annum.**

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It is suggested that subscribers on the One Shilling rate might pay for say two or three years. This will ensure continuity of despatch.

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THE MINISTER'S NEW YEAR MESSAGE.

«»

The year just ended has provided the farmers and graziers of Queensland with a surfeit of rainfall rather than the deficiency with which they are all too familiar. The heavy rains have been a mixed blessing, and it is to be hoped that in all cases of hardship the long-term benefits will more than compensate for the losses which have been experienced.

Hon. H. H. Collins.

Droughts and floods are part and parcel of the primary industries of the State. The pioneers met these vicissitudes with courage and determination and laid the basis of the wealth of Queensland. The present generation, so much better equipped with material things and scientific knowledge, is in a much more favourable position to meet the fickle moods of Nature.

Flood mitigation is embodied in various dam schemes now under construction or contemplated by the Government. Drought risks likewise will be considerably reduced by water conservation schemes, but the individual landholder himself must in most cases accept the responsibility of feeding his stock in drought periods. I strongly urge stockowners to start at once to build up fodder reserves against the coming of the next dry period, which may not be far away.

A spirit of confidence in the future prevails in practically all the land industries. This faith appears to be fully justified, though current prices of some commodities may be expected to fall to somewhat lower levels. The appointment during the year of Royal Commissions to report on various phases of primary production is an earnest of the Government's desire to ensure planned expansion of major industries and the preservation of our natural resources.

I trust that the coming year will see increased production, adequate financial returns, and a continuation of those less tangible rewards of country life which the primary producer and his family are privileged to enjoy.

H. H. Collins

Minister for Agriculture and Stock.

Certificate in Agricultural Science.

ATTENTION is drawn to the certificate course in agricultural science now being conducted by the University of Queensland in collaboration with the Department of Public Instruction and the Department of Agriculture and Stock. It should be noted that the course is intended primarily for people who have been educated to Queensland Junior Public Examination standard or who have sufficient aptitude for study to enable them to assimilate something of the basic sciences.

Groundwork Studies.

As some knowledge of chemistry and physics is essential to the proper understanding of soils and plant and animal growth, an introductory course on the principles of these subjects must be taken by those who have not studied sufficient chemistry and physics previously.

The first year of the main course will be devoted to two subjects—the science of animal life, and the science of plant life. In the second year the science of soils and the growing of crops will be dealt with.

Specialisation.

After the first two years of the main course have been completed, the student can choose between livestock production and crop production for his specialisation in the final two years.

The livestock production course covers animal husbandry, stock breeds, pastures, and other aspects of the subject.

Those electing to study crop production can specialise in either field crops or horticultural crops. Subjects common to both groups include plant pests and diseases.

Requirements for Certificate.

Any of the subjects may be taken individually if the University agrees, but to secure a certificate, a full course in one of the special subdivisions must be completed.

Cost of Enrolment.

An enrolment fee of ten shillings is payable for each subject; the fee is paid as the subject is commenced. Certificate students may be required to attend a summer school of about a fortnight's duration each year at the Agricultural College at Gatton. The cost of board, etc., at the College should not exceed £5.

How to Apply.

Those interested in the course may obtain full particulars from the Supervisor, Brisbane Technical Correspondence School, G.P.O. Box 1389R, Brisbane. As the course commences in February, early application is desirable.

Soil Conservation in Queensland.

6. Pondage and Diversion Structures.

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

IN order to control erosion and to enable the efficient management of pastures it is often necessary to utilise pondage or diversion structures on pasture lands with the object of retaining the maximum amount of runoff for the benefit of the pasture and also to prevent it from entering vulnerable lower arable lands and causing accelerated erosion.

In many of the more severely eroded areas of the State a contributing factor has been the excessive concentration, on cultivation fields, of large volumes of runoff from overlying pasture lands. The overstocking and burning of many of these pastures has greatly increased the runoff; improved pasture management is a necessary step in the reduction of this erosion hazard. In a well-managed pasture paddock the protective influence of grass and more particularly the grass residues ensures the absorption of the maximum amount of rainfall and the risk of scouring is reduced. The reason for this lies in the fact that where a pasture is burned or overstocked the ground protection is removed and the soil surface seals readily; the infiltration rate is considerably reduced and runoff occurs with even minor falls of rain.

But even with the best conditions of pasture management, occasions do arise when runoff will occur, representing a loss to the pasture and an additional hazard to lower arable lands. This is the case where the soils become saturated during protracted rains and are incapable of immediate absorption of further rain. The stocking of pastures under conditions favouring soil packing may result in an increased runoff from areas which are otherwise well managed.

Provision should be made to temporarily pond this surplus runoff so that it can be absorbed later for the benefit of the pasturage; this also reduces the volume of water reaching lower arable lands and so lessens the risk of erosion. Two main types of pondage structures may be utilised for this purpose—namely, pasture furrows and pondage banks.

PASTURE FURROWS.

These are a series of level furrows constructed in pasture land and spaced so that they will pond a maximum amount of runoff, but with a minimum risk of overtopping. They are normally spaced 10 to 20 feet apart down the slope (Plate 1), each furrow ponding the runoff from the space between two furrows. It is essential that pasture furrowing operations commence at the crest of a catchment or, alternatively, immediately below a diversion or pondage bank.

Plate 1.

A Series of Pasture Furrows on Cultivation Land which is to be Retired to Pasture.

The spacing of pasture furrows is governed by a number of factors, including soil type, degree of slope, nature of cover and the implement to be used for construction. Furrows constructed with a single-furrow plough are usually of much lower capacity than those built with grader equipment and consequently a closer spacing is required in the former to reduce the catchment area above the furrow. Plough-built pasture furrows usually have a cross section of less than one square foot and in general the distance apart of these furrows should not exceed 10 feet. The capacity of grader-ditcher furrows (Plate 2) varies from 1 to 2 square feet cross section and provided reasonable plant cover exists they may be spaced up to 20 feet apart.

The closer spacing of furrows is required on steep slopes, on areas which have been overstocked or burnt, and on certain soil types such as the fine sandy loams where surface cementing of the soil readily occurs.

Apart from their soil conservation value, pasture furrows are often utilised solely for pasture improvement purposes; because of the additional water ponded in the furrows they are a satisfactory means of introducing into a pasture many legumes and grasses which might otherwise be difficult to establish. In this case the furrows should be spaced as closely as possible, consistent with economic considerations.

Plate 2.
A Pasture Furrow Constructed with a Grader-ditcher.

Pasture furrows are particularly useful for the regeneration of "scalded" pastures and claypan areas; because of the smooth sealed surface of scalded areas, water infiltration is slow and seeds readily blow away. Pasture furrows break the surface and facilitate the entry of rainfall and provide a receptive site for the lodgment of seed; they also reduce the ground velocity of wind, which is an important factor in areas subject to wind erosion.

Construction of Pasture Furrows.

These furrows can be effectively constructed with a very wide range of equipment, including the single-furrow road plough, multiple disc (Plate 3) or mouldboard ploughs, grader ditchers (Plate 4), and various other types of graders.

The soil is thrown downslope to increase the pondage capacity of the furrows and consequently two-way implements are an advantage for this work. Where one-way equipment such as the orthodox plough is used, it is necessary to carry out a non-productive return trip, which increases the cost of construction.

Plate 3.
Pasture Furrow Construction with a Three-disc Plough.

Plate 4.
A Modified Grader-ditcher being Utilised for the Construction of Pasture Furrows.

Grader-ditchers with a low centre of gravity are the most suitable as they are stable on steep slopes and, since the blade can be turned, they can be used continuously in throwing soil downslope.

The cost of construction of pasture furrows varies according to the nature of the terrain, spacing of the furrows and type of implement used. Where equipment specially designed for the work is utilised, the cost of construction even with an 8-foot spacing may not exceed 8s. per acre. With improvised machinery the cost is higher, but rarely exceeds 10s. per acre.

PONDAGE BANKS.

These are large level banks 3 to 5 feet high and with a water storage capacity of from 5 to 10 cubic yards per yard of length (Plates 5-7). They are designed to pond the maximum amount of runoff, but provision is made for overflow at one or both ends to avoid overtopping in the event of protracted rains; for this reason weirs are provided at the ends and are slightly lower than the top of the bank, enabling the maximum amount of pondage without risk of overtopping.

Plate 5.
A Level Pondage Bank Constructed in Pasture Land to Hold Surplus Runoff.

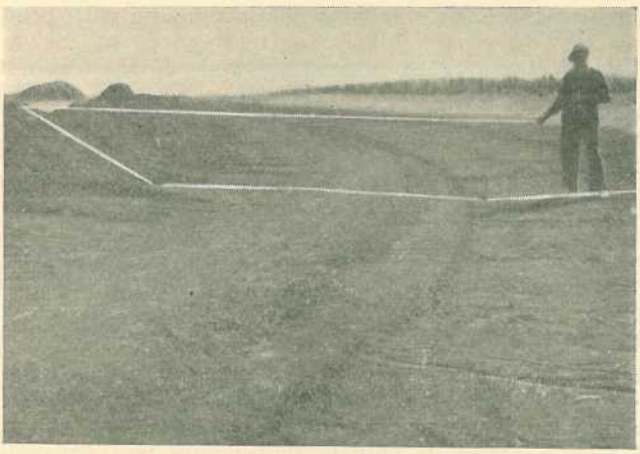


Plate 6.
A Completed Pondage Bank Built with a Farm Dozer.

Plate 7.

Pondage Bank holding back Water off the Cultivation Land Below.

The purpose of these banks is to pond the major portion of storm rains, which generally cause severe erosion damage, and if necessary, to flow the later part of the storm, which is usually of lower intensity.

The earth weirs at the end of these banks should be broad and level along the top and are usually 18 inches lower than the crest of the bank; if correctly tapered to ground level and well covered with vegetation, they are a very stable outlet through which water is transferred to a grassed waterway or spread on pasture.

The chief advantage of these pondage structures is that they can be constructed at any point in a pasture catchment and need not be situated at the crest of a slope, as is the case with pasture furrows. They are therefore particularly useful in steep or rocky areas where pasture furrows cannot be constructed right to the top of the slope.

Pondage banks function virtually as large pasture furrows but with the main disadvantage that the irrigation value of the stored water is restricted to the area in the vicinity of the banks; since they are usually spaced many chains apart the water distribution is not as satisfactory as with pasture furrows, which are rarely more than 20 feet apart.

Because of the extent of earth moving involved, pondage banks are usually constructed with a bulldozer; dozer units fitted to farm tractors are proving very useful for this purpose and are almost as efficient as the larger units (Plate 8).

The surveying of a level or true contour line is the first requirement for the construction work; a strip 25 feet is then ploughed as deeply as possible above this line. A dozer unit operating at right angles to the line, by a series of shuttle movements will excavate a channel about 20 feet wide above the line, and the soil is deposited below the line to form a bank 3 to 5 feet high and 15 feet wide at the base.

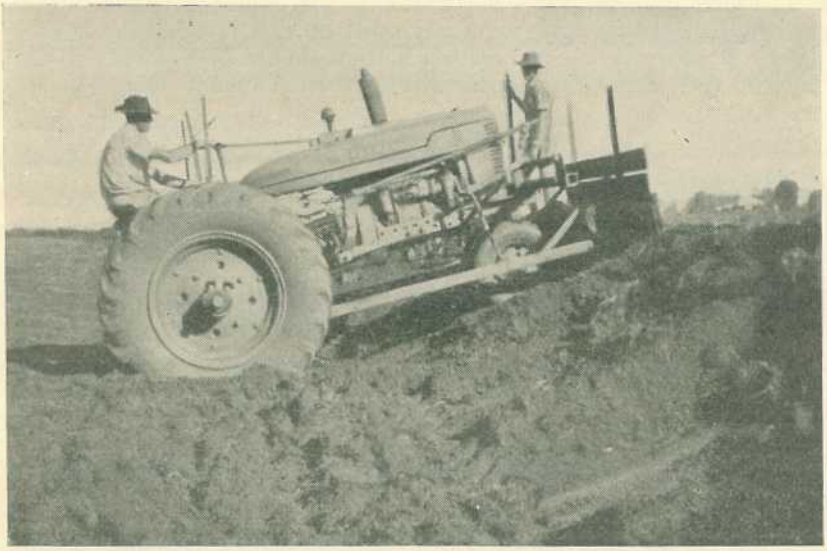


Plate 8.

Pondage Bank being Constructed with a Farm Dozer.

When construction is complete the crest of the bank is checked closely for errors in height and low spots built up. After the final level of the bank crest has been determined, an earth weir is pushed up at one or both ends, and is levelled at a point 18 inches lower than the bank height. The weir is then sloped down to ground level so that it will have a long steady gradient. Kikuyu or couch grass sod is then planted in the sill and covered with a thin layer of mulch, which is held in place with a cover of wire netting. This ensures protection of the weir while the grass is being established.

The cost of construction of these banks rarely exceeds 20s. per chain of length; a small bank will pond 100 cubic yards of water per chain, so the cost of 3d. per cubic yard of water held is a very reasonable expenditure for the benefits conferred.

DIVERSION BANKS.

Circumstances occasionally arise where it is not practicable to utilise pasture furrows or pondage banks because of the hazards associated with their use where major water flows are involved. A type of bank which will safely divert large volumes of water to a stable outlet is required in these cases.

These structures, known as diversion banks (Plate 9), are always designed with a gradient towards the outlet end; a grass cover is usually established in the channel and consequently a greater tolerance in channel gradients is permissible. A fall of 6 inches per 100 feet is usual, but in special cases where the soil type is suitable and very large flows are involved, the gradient may be increased to a maximum of 2 feet per 100 feet.

The size of bank varies according to the expected runoff, and for large catchments they are frequently built up to 4 feet high with a base width of 10 to 15 feet; the channel bottom should be flat with a width of 5 to 15 feet, depending on the size of the catchment area.

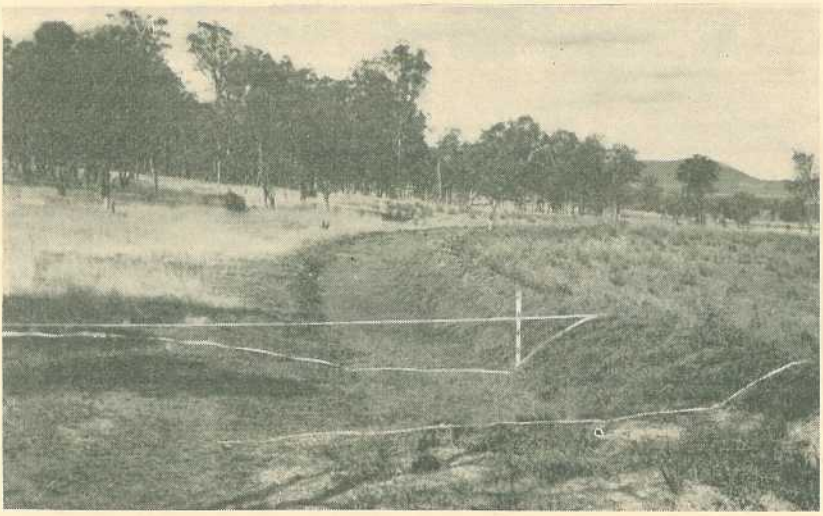


Plate 9.
A Typical Diversion Bank Protecting Lower Arable Lands.

Because these banks carry large flows of water it is most essential that they discharge on to a well-stabilised outlet or waterway; a vegetated disposal site must be available before the construction of a diversion bank is contemplated.

The method of construction will vary according to the type of bank required. Small banks may be constructed either with ploughs or graders, but large banks can be most economically constructed with dozer units by the method advocated for pondage bank construction.

An important difference between the construction of diversion banks and contour banks is that in the former the soil is moved entirely from the upper site, resulting in a lower cost of construction per unit of flow capacity.

Control of Lantana by Cultural Methods in the Mackay District.

N. E. GOODCHILD, Senior Adviser in Agriculture.

ORIGINALLY lantana was introduced into Queensland as a flowering shrub for the garden. However, environmental conditions with high rainfall and humidity proved admirably suited to its propagation and it spread rapidly, particularly throughout the coastal belt of Queensland, where in many areas it is now regarded as a major pest.

In the Mackay district, lantana has become a problem in two separate areas—namely, on the Eungella Range and in the coastal fringes. Two distinct methods of control have been used in the district —destruction by mechanical means, and control by grass establishment and burning.

CONTROL BY MECHANICAL MEANS.

The Eungella Range is situated approximately 50 miles west of Mackay and has the most concentrated area of dairy farms in the Mackay district. The southern end of the Range is portion of the Connors Range, which joins the Clarke Range in the vicinity of the township of Dalrymple Heights.

The area consists of a rather narrow rain forest belt averaging five miles wide by forty miles long. Its altitude ranges between 2,000 and 3,000 feet above sea level. Its rainfall is approximately 80 inches per annum.

The country generally is broken and varies from undulating to steeply sloping land with deep gullies. The soils are mainly of granitic origin, varying from chocolate to yellow clay, but there are limited areas of red volcanic soil.

Areas overgrown with lantana on the Eungella Range are fortunately limited. Lantana apparently became established on clearings of the early settlement in the Bee Creek district and spread to other farms opened up along the Diggings Road, which later became heavily infested. As the settlement further developed in the Dalrymple Heights area, lantana extended along the roads, but farms were kept comparatively free of lantana by hand work.

Further penetration and wider distribution of lantana was brought about by timber getters opening tracks through the scrub, thus providing clearings in which the lantana became established.

The more recently settled areas of Broken River and Crediton have not experienced dense lantana infestation, due to care in eradicating the pest in its early growth. It is nevertheless a potential weed pest in this area.

In the past, lantana has been cleared by brushing and grubbing, but this method has proved both slow and costly and has not been satisfactory in controlling spread of lantana. Farmers have therefore experimented with mechanical means of clearing by utilising bulldozers which are located in the district for making access roads into the rain forest for pulling out logs for timber. It has been shown that these crawler-type tractors are capable of negotiating the lantana infested slopes on the settled area.

Where the slopes are not too precipitous it has been found possible to clear dense lantana on a face, pushing it into windrows in readiness for burning off. On steep slopes where heavy growth of lantana exists, clearing has been effected by the bulldozer proceeding up a spur with the blade raised and operating only on the downhill sweep. This entails considerable loss of time but is essential for the successful operation of the machine on difficult country.

Time of Clearing.

The most appropriate time for clearing has been found to be when the ground is wet. Under these conditions, the blade of the bulldozer cuts the stems of lantana cleanly below ground level, and the debris is then pushed into windrows or into nearby gullies for burning, leaving the land quite free of rubbish.

When conditions are dry and the soil hard, the bulldozer does not work efficiently. It tends to ride over the top of lantana bushes, stripping the stems and leaves and leaving the butts in the ground without cutting the roots below the surface of the ground. Under such conditions the land is covered with debris, while the butts left in the ground must be grubbed out by hand to prevent regrowth.

Cost of Clearing by Bulldozer.

Mechanical clearing of lantana is a costly undertaking and suitable only for dense growth. The use of the bulldozer on scattered growth would not justify the loss of time involved when the machine was not effectively in use. Before becoming involved in considerable expenditure, careful consideration should therefore be given to the use to which such clearing is to be put and the value of the land when cleared.

The cost of hiring a bulldozer varies according to the locality. The hire charge at Eungella was £3 per hour in 1948-49 (including the cost of its operator) for actual working time. All stoppage time was deducted, including lunch periods. The actual cost of clearing dense lantana, when conditions allowed treatment on a face, was approximately £5 per acre.

It can be readily understood, however, that the efficiency and experience of the operator can have an important bearing on the cost of the clearing.

Treatment of Land after Clearing.

It is essential that cleared areas be grassed down as soon as possible after clearing to check weed growth which may develop rapidly.

Pastures and crops which were tried at Eungella included kikuyu grass, white clover, Rhodes grass, prairie grass and oats.

Kikuyu grass seed is not available commercially and it is therefore necessary to propagate this grass by cuttings or rooted pieces. It should be planted from runners and roots which are not broken into small tufts but left in generous sized clumps and should be spaced approximately 6 feet by 6 feet, thus requiring 1,200 clumps per acre. If weather conditions are suitable, a complete ground cover can be expected in six to eight months.

Planting may be carried out by opening holes with a light axe, which when driven into the soil is prised sideways to provide a hole suitable for the rooted pieces or clumps. A light hoe or mattock can be used for the same purpose.

Planting material is carried in a bag strapped around the waist and dropped at appropriate intervals; after planting, the soil is consolidated by foot around the runners or roots. The cost of planting kikuyu grass in this way was approximately £2 per acre at Eungella in 1948-49.

It has been found at Eungella that when kikuyu grass establishes and maintains a complete ground cover, lantana is no longer a serious pest.

White clover, broadcast at the rate of 1-2 lb. per acre, will establish readily under reasonably good conditions in this area. The clover population will increase under proper management once good initial establishment has been obtained.

In one instance at Eungella, Rhodes grass and prairie grass, each sown at 2 lb. per acre, and oats planted at ½ bushel per acre, gave early grazing while the kikuyu grass was completing its cover. In this way valuable winter grazing was obtained.

CONTROL OF DENSE LANTANA BY GUINEA GRASSES.

Considerable areas of scrub occur along the main coastal range and have been felled and converted to pasture lands for dairying. Invariably lantana encroachment takes place and unless the weed is eradicated during its early growth it becomes a major pest.

This may be accelerated by heavy stocking, a practice often forced on farmers during the early development of dairy lands. The result is that pastures are denuded and insufficient cover is available to hold lantana in check; where burning off is not practicable, lantana growth has free and unrestricted scope for development.

Heaviest infestations in coastal parts of the Mackay district occurred on the dairy lands along the O'Connell River and East Funnell Creek areas, originally carrying dense rain forest. These areas were opened for settlement in 1931-33 and lantana became established quickly following the felling of the scrub.

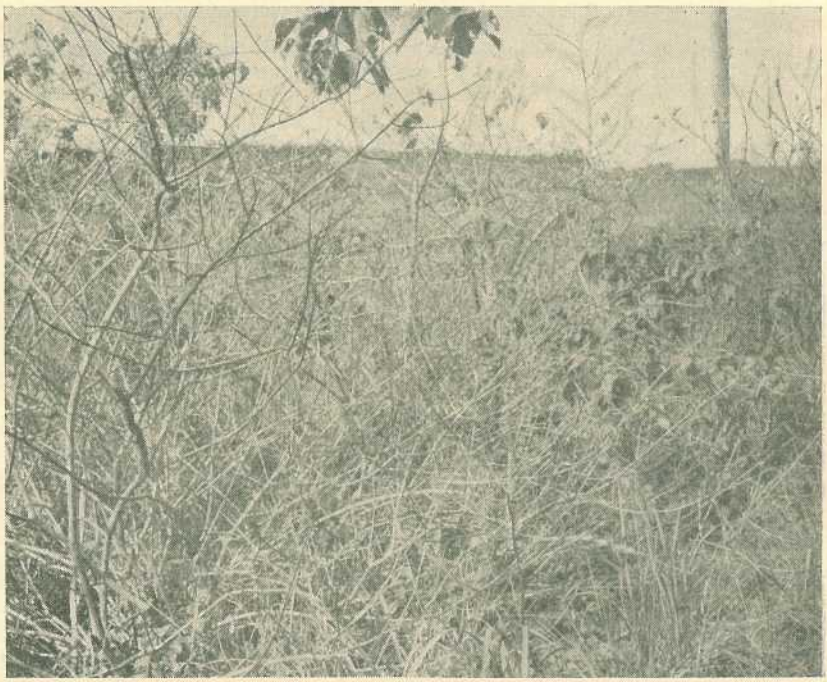


Plate 10.
Guinea Grass Seedlings Growing in the Shade of Green Lantana.

Plate 11.
Young Guinea Grass among Dead Lantana following a Burn.

Plate 12.
Prolific Growth of Guinea Grass in Dead Lantana after a Burn.

The original grasses sown in the newly-cleared scrub land were those used in southern scrub areas—namely, Rhodes grass and paspalum. These grasses did not thrive as they do in the sub-tropical areas and fires were not sufficiently fierce to control the vigorous growth of lantana. The usual method of grubbing had proved too slow and costly in controlling the pest and it appeared as if lantana might completely ruin good farm lands in these areas.

To combat the vigorous growth of lantana it was essential to introduce strongly growing, bulky grasses, such as the Guinea grasses (*Panicum maximum*), which can not only compete with the growth of lantana but also provide a heavy body of grass for firing at the appropriate time; furthermore these grasses possess the ability to recover well after burning.

Guinea grass has given excellent results in controlling the spread of and in eradicating lantana on the O'Connell River and East Funnell Creek dairy lands.

A mixture of 2 lb. of common Guinea and 2 lb. of green panic grass (*Panicum maximum* var. *trichoglume*) planted during the wet season (January, February and March) will produce a complete cover and will set seed before winter. This seed will remain dormant until the following wet season.

An interesting feature of Guinea grasses is that they will thrive under shaded conditions of growing lantana and will germinate on old deteriorated pastures on scrub lands. If the grasses are planted on the top of a ridge, seed quickly washes down under lantana bushes, and when grass growth is sufficiently thick, firing can take place.

During its early stages of growth, Guinea grass is readily pulled up by stock and grazing at this period could considerably reduce the stand of grass. Grazing should therefore not be attempted until the growth of grass has reached a height of two or three feet.

The cost of Guinea grass (common Guinea) is approximately 4s. per lb. Green panic seed can be obtained at present at approximately 5s. per lb. The total cost of seed would thus be approximately 18s. per acre. As sowing the grass seed can be done for approximately 3s. per acre, the cost per acre of establishing these grasses would be approximately £1 1s. per acre.

It is expected that increased carrying capacity and increased production of dairy products so urgently required at the present time will follow the reclamation of lantana-infested dairy lands in these areas.

CONCLUSIONS.

Where country on the Eungella Range, heavily infested with lantana, can be cleared mechanically, regrowth can be effectively stopped by the establishment of a good cover of kikuyu grass.

On the lower coastal areas of Mackay, lantana growth can be eradicated and further spread can be prevented by planting Guinea grasses. The grass should be left unstocked and allowed to seed during the first year, and then fired at an appropriate time. The regrowth of grass, and firing as required thereafter, will eliminate lantana.

Lawrence—A New Wheat Variety.

D. ROSSER, Assistant Plant Breeder.

THE wheat-growing industry of Queensland owes much to plant breeding by the Department of Agriculture and Stock for the production of high yielding, drought-resistant and rust-resistant wheats of good grain quality. The breeding and testing of new wheats has been carried on and expanded since the retirement in 1948 of Mr. R. E. Soutter, who previously played such an important part in the development of new varieties. It is confidently hoped that future years will see further releases of improved varieties to assist the expansion of the industry in Queensland.

The hybrid wheat selection, Florence x College 3813, more familiarly known to growers as "Flo-Col," has now been registered as a new variety and named Lawrence. It has already been grown commercially on the Darling Downs for some years, and can be recommended where there is a demand for a highly-rust-resistant wheat which is palatable and capable of useful grain yields after grazing.

History of the Variety.

Lawrence was developed by officers of the Department of Agriculture and Stock from a cross made by Mr. R. E. Soutter at Kincora in 1932. The parents were Florence and a variety designated "College." The latter was almost certainly the North American variety, Hope, which is used as a source of rust resistance. In 1938, Lawrence was selected from the progeny of this cross for further testing and seed was released to growers six years later.

Characteristics of the Variety.

Lawrence is a slow-maturing variety with narrow blue-green leaves and a spreading habit of growth somewhat resembling Ford in the early stages of development. It tillers freely and produces a good bulk of foliage which is resistant to frost injury.

In the mature plant, the straw is moderately tall and creamy white. It is fine and hollow in structure, but fairly strong in resistance to lodging. The ears are beardless, small to medium sized, tapering and slightly curved in shape. The chaff is smooth and creamy white in colour; while the lemmas carry only short tip-awns usually less than $\frac{1}{4}$ inch long. The heads thresh readily, but there is normally no loss of grain in a standing crop.

The grain is of medium size with fairly smooth bran. It is amber coloured, semi-vitreous in texture, and produces a flour of very satisfactory baking quality.

Rust Resistance.

In possessing a large degree of resistance to rust, Lawrence is superior to other slow-growing varieties available in Queensland. This resistance applies to both stem and leaf rusts in the field. As yet, stem rust does not attack this variety severely and rust pustules are confined largely to a small area immediately above the lower nodes. In other cases, there is a darkening of the internodes. This suggests that the resistance was derived from Hope, in which such a discolouration occurs also.

Yield of Grain.

Although the variety is somewhat less drought-resistant than most of the quick maturing varieties grown in Queensland, it is capable of

useful yields of grain under good conditions. The following results have been obtained with Lawrence and other slow-maturing varieties in yield trials on the Darling Downs:—

YIELD IN BUSHELS PER ACRE.

Variety.	1948.	1949.	1949.
Lawrence ..	44·1	39·5	9·7
Ford	44·6	27·4	12·6
Warput ..	41·9	34·3	13·7
	No rust	Medium rust	Heavily grazed in dry season

Utilization.

Lawrence is rust resistant, palatable and more cold resistant than most Queensland varieties; so it is suitable for early sowing and feeding off. It is recommended (i.) as a dual-purpose wheat to replace Ford and Warput in early plantings, and (ii.) as a hay or grazing wheat in mixed farming districts. Planted main-season, it is capable of useful yields, but cannot be expected in most seasons to compete with the quicker growing standard varieties in grain production.

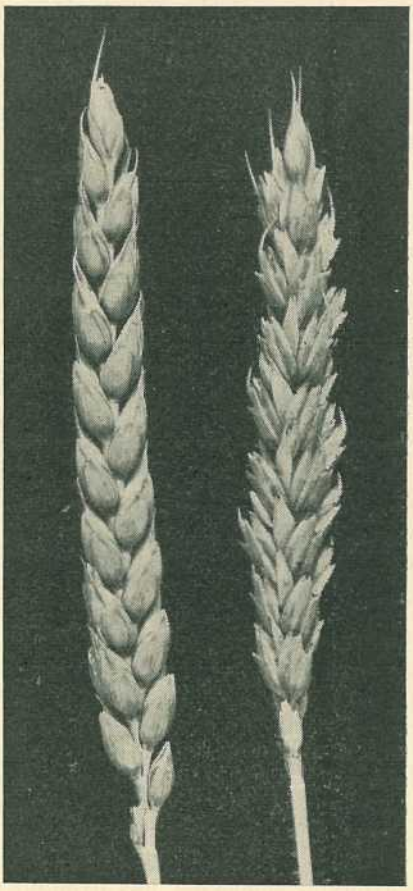
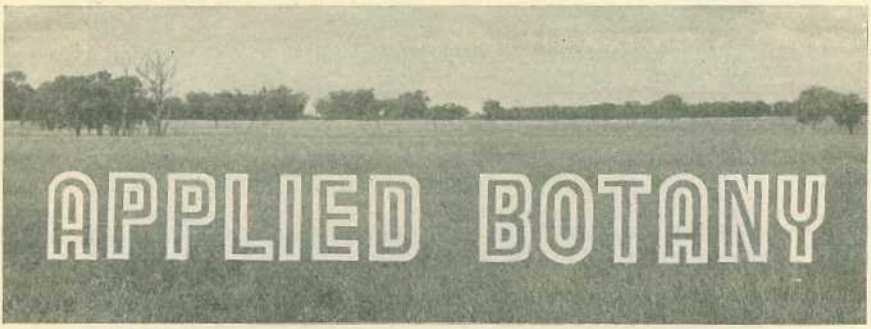


Plate 13.
Heads of Lawrence Wheat (natural size).



Hoary Cress—Declared a Noxious Weed.

S. L. EVERIST, Botanist.

HOARY cress (*Lepidium draba*), a serious weed of wheatfields in many parts of the world, has recently been declared a noxious weed throughout the State. This note is issued to enable those interested to recognise the plant so that it may be destroyed wherever it makes its appearance.

Description.

Hoary cress is a perennial with an intricate system of underground roots which may penetrate to a depth of six feet or more. The roots spread horizontally and vertically through the soil and at frequent intervals give rise to shoots. The first shoots through the ground bear a rosette of leaves at the base; they are spoon-shaped, blunt at the tip and tapered at the base to a slender stalk; they are greyish-green, somewhat resemble cabbage leaves in colour and are of similar, though somewhat thinner, texture. The flowering shoots are upright and grow to a height of 12 to 18 inches; they bear scattered leaves which have no stalks but are attached to the stems by a broad base. In colour and texture they are similar to the rosette leaves, $1\frac{1}{2}$ to 3 inches long and $\frac{1}{2}$ to 1 inch wide. At the top of the stalks are borne dense clusters of small white flowers; these are followed by seed pods about $\frac{1}{8}$th inch across and divided into two compartments, each compartment containing one seed, egg-shaped, dark brown to purplish in colour and with a dull surface.

Distribution.

The plant is native to Europe and western Asia. It is a serious weed of wheatlands in England and North America and in the southern States of Australia. In Queensland it has been reported from several places on the Darling Downs.

Properties.

It has been reported that hoary cress is not eaten readily by stock, but if it is eaten by dairy cows it will taint milk.

Plate 14.

Portion of a Hoary Cress Plant. Note the stout whitish root, the stalkless leaves, and the clusters of white flowers.

Eradication.

Because of the extensive system of underground roots, eradication is not easy. Recent work has shown that the plant can be killed by spraying with hormone weedkillers at the rate of 2 lb. active ingredient per acre. Several applications may be needed to destroy the plant completely.

When a knapsack spray pump is used, the spray should be made up at a strength of 0·2 per cent. and applied at the rate of 100 gallons per acre. With boom sprays the strength of the solution should be adjusted according to the amount of liquid per acre delivered by the machine.

The method of making a 0·2 per cent. solution depends upon the amount of active ingredient in the original preparation. With a liquid preparation containing 10 per cent. active ingredient, use 1 gallon to 50 gallons water; with a 50 per cent. solution use 1 gallon to 250 gallons water; with powders use 1 lb. to 40 gallons if the preparation contains 80 per cent. active ingredient, 1 lb. to 35 gallons if the powder contains 70 per cent. active ingredient, and so on. The material should be applied with a fine spray and care should be taken to wet the leaves thoroughly.

Maroochy Experiment Station.

K. M. WARD, Senior Horticulturist, and K. FISHER-WEBSTER, Manager, Maroochy Experiment Station.

THE Maroochy Experiment Station (see view on pages 30 and 31) is situated three miles from Nambour in the heart of the Near North Coast, which is the most important fruit district in Queensland. It comprises 113 acres of land on the foothills of the Blackall Range, and like most farms in the district possesses several soil types with variable aspects and marked differences in elevation. This makes it a suitable centre for investigating many types of fruit and vegetable crops. The more important of these are pineapple, banana, citrus, avocado, Macadamia nut, strawberry, French bean and ginger.

SCOPE AND FUNCTION.

The station was brought into being to facilitate the investigation of cultural problems in the tropical and sub-tropical fruits grown in southern Queensland. In the past, work of this kind had of necessity to be conducted on private farms, where its scope was usually limited to projects which involved no radical changes in accepted cultural practices, and in which the risk of crop loss and inconvenience to the farmer was small. The solution of some problems calls for the trial of new and sometimes unorthodox cultural methods, or of new varieties of fruit plants, over a long period in which high yields are not necessarily the main consideration. Such trials on private properties are fair to neither the farmer nor the experimentalist. Adequate attention cannot be given to the problems of an important and growing fruit industry unless continuity of research—very often on the same piece of land—can be assured. An experiment station is indispensable for this purpose, and that at Maroochy therefore fills an obvious need.

The station not only provides a venue for long-term investigations; it also serves as a training ground for the horticultural research and advisory staffs of the Department of Agriculture and Stock, a centre where junior officers can gain practical experience in crop production

as well as a grounding in the principles of horticulture. In addition, it is an institution where the practical application of experimental results can be effectively demonstrated to the farming community.

CLIMATE.

Climatic conditions at the station are more or less typical of those in the wetter parts of the Near North Coast. The mean annual rainfall is 72 inches and 54 per cent. of this falls in the period December to March. Under cyclonic influences, individual falls may be torrential in character, as for instance in July, 1950, when eight inches of rain fell in a period of three hours. Under such conditions, precautions must be taken to prevent soil erosion, particularly on the steeper slopes of the property, which are representative of much of the land in the district. Usually the late winter and spring are relatively dry and tree crops may suffer severely if irrigation facilities are not available.

Temperatures at the station are those normal to coastal areas in the sub-tropics. The January mean maximum temperature is 86·5 degrees; the July mean minimum 45 degrees. Frosts of 4 to 6 degrees sometimes occur in winter but they affect only the lower portions of the slopes and land flanking Coe's Creek, which runs round the northern end of the property. As a number of the perennial fruit crops grown at the station are susceptible to frost and the susceptibility of each differs, the planting programme is highly selective for topographical features such as elevation and aspect. These, of course, influence the severity of frosts and also the amount of exposure to cold southerly and westerly winds. They are therefore particularly important in such crops as the banana, which, though endemic to the tropics, are grown extensively in sub-tropical regions for economic reasons such as their proximity to fresh fruit markets. The warmth assured by a northerly aspect, for instance, has a marked bearing on the rate of plant growth and the length of the period to fruit maturity.

TOPOGRAPHY.

The Maroochy Experiment Station is bounded on the north by Coe's Creek. This creek normally contains running water the year round, but if little or no rain falls in winter and spring the flow may cease. In the wet season it spills over the adjacent alluvial flats. The alluvial flats which are least subject to floods formerly grew sugar cane, but are too cold for most of the perennial plantation fruits grown in the district. From these flats the land rises by easy slopes, intersected at intervals by gullies, to a relatively steep spur some 150 feet above the level of the creek, which in turn is about 60 feet above sea level. The northerly aspect of the spur looking down on Coe's Creek is the main cropping area at the present time. The land on the opposite or southern side of the spur, together with the northerly slope of a second spur running more or less parallel to the first, is so far undeveloped, though part of the area has been planted to exotic pine trees. Both spurs run upwards to a rocky mass in the south-western portion of the station. The two tributary creeks heading in this rocky mass divide the station into three parts as they run to their junction with Coe's Creek.

Though the property had been farmed for about 30 years before it was acquired for experiment station purposes in 1945, much of the land is still in its virgin state although the more valuable timber was felled long ago. Most of the area, however, carried forest timbers such

as blackbutt, bloodwood and tallow-wood, all of which are indicative of a reasonably fertile soil. Rain forest influences are, however, noticeable along the creeks and in the upper reaches of the gullies.

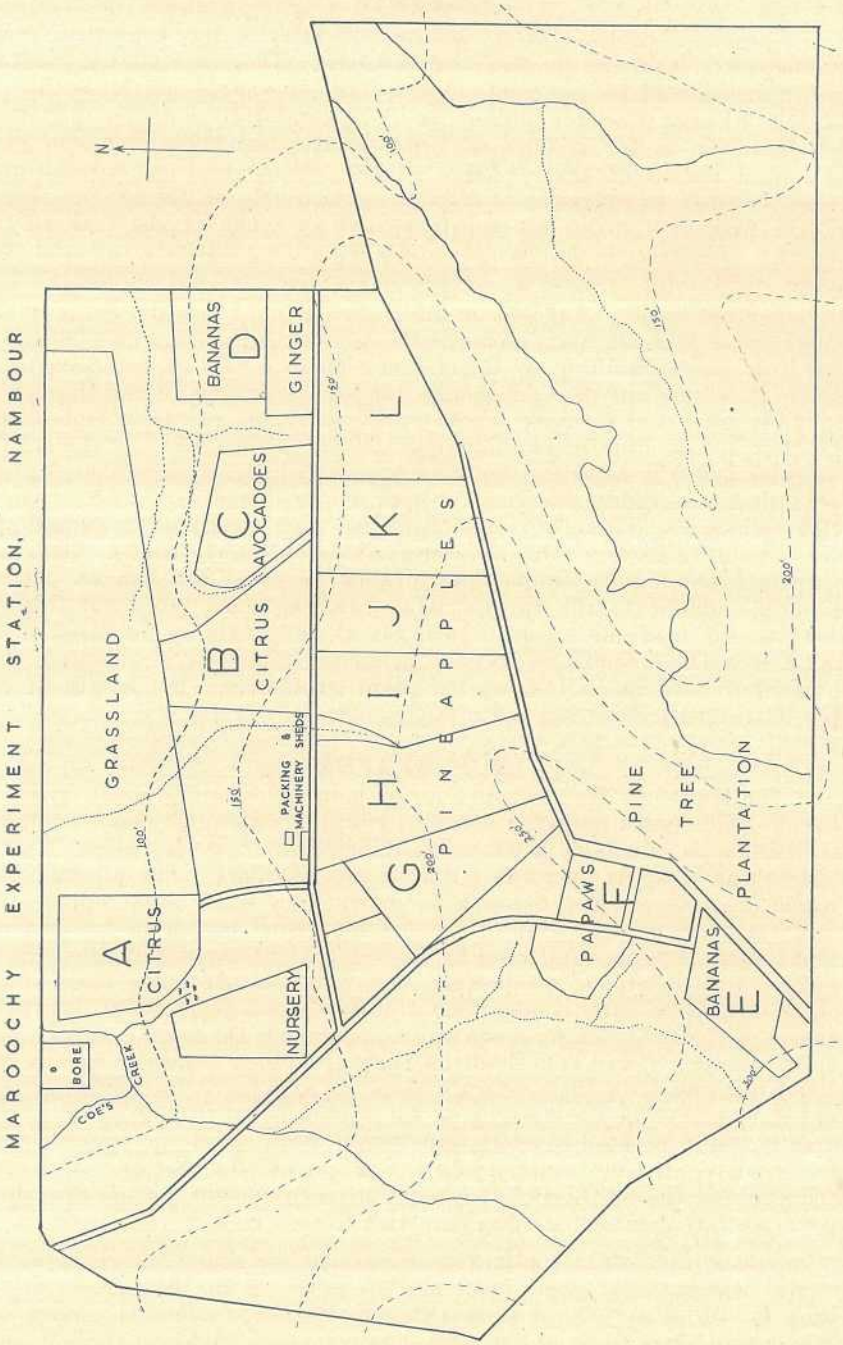


Plate 15.

Sketch Showing Layout of the Station.

SUBDIVISION AND RECORDS.

For experimental purposes, the area under crop is divided into blocks, designated A, B, C, etc., the size of which varies from one to two acres, the boundaries being determined by the position of gullies, the suitability of the area for cultural work, uniformity of soil type and aspect (Plate 15). Each block is further subdivided into borders, which are the units for experimental work and in which the cultural treatment is uniform. The borders are numbered so that any piece of land can be suitably designated—for example, B1, C3, and so on.

Station records are kept in the form of crop logs and border logs. The former give the complete history of experimental work carried out on particular crops, such as pineapples, since the inception of the station. Border logs on the other hand record for each border cultural practices, fertilizer applications and other treatments which might in any way affect the physical and chemical condition of the soil. Their importance lies in the fact that the behaviour of a crop can often be understood only in terms of the soil's earlier cultural history and management.

DEVELOPMENT.

The clearing and stumping of land was followed by the construction of access roads necessary for the efficient management of each block, and of surface drains for the control of runoff water. Roads which have already been constructed are shown in Plate 15. Some of these will eventually be surfaced to provide access in all weathers. Several areas now planted to tree crops, notably blocks A, B and portion of F, are permanently terraced as a soil conservation measure.

In the first five years of the station's existence, 24 acres of land have been brought under cultivation and an additional eight acres are planted with an exotic pine (*Pinus caribaea*) and flooded gum (*Eucalyptus saligna*). Fruit crop plantings are now as follows: Avocadoes, ½ acre; bananas, 2·7 acres; citrus, 4 acres; papaws, 2 acres; and pineapples, 7·5 acres.

Windbreak trees consisting of *Cupressus torulosa, Araucaria excelsa,* and *Pinus caribaea,* and ornamentals such as the jacaranda, Phoenix palms, flame tree and others, have also been planted where required.

Buildings erected for the storage of equipment and materials and for the handling of produce consist of a 72 feet x 18 feet machinery shed, suitably divided to house machinery and store fuel, fertilizers and tools, and a properly equipped packing shed 40 feet x 25 feet. The latter serves as a demonstration and lecture room when necessary. The station farm machinery, which is based on a 30 h.p. crawler-type tractor as the power unit, is adequate to cultivate hillsides as well as gentle slopes, to handle bulky green manure crops, to carry produce after harvesting, and to construct roads, drains, terraces and contour check banks. The provision of irrigation facilities has been initiated by the sinking of a 114-ft. bore which is expected to provide approximately 4,000 gallons of water per hour.

SOILS.

The soils of the station consist of several widely differing types (Plate 16), each of which fulfils the requirements of one or more of the horticultural crops grown in the district. It is possible, therefore, to plant each crop in a soil which is well suited to it. The soils are developed on sandstone and shales.

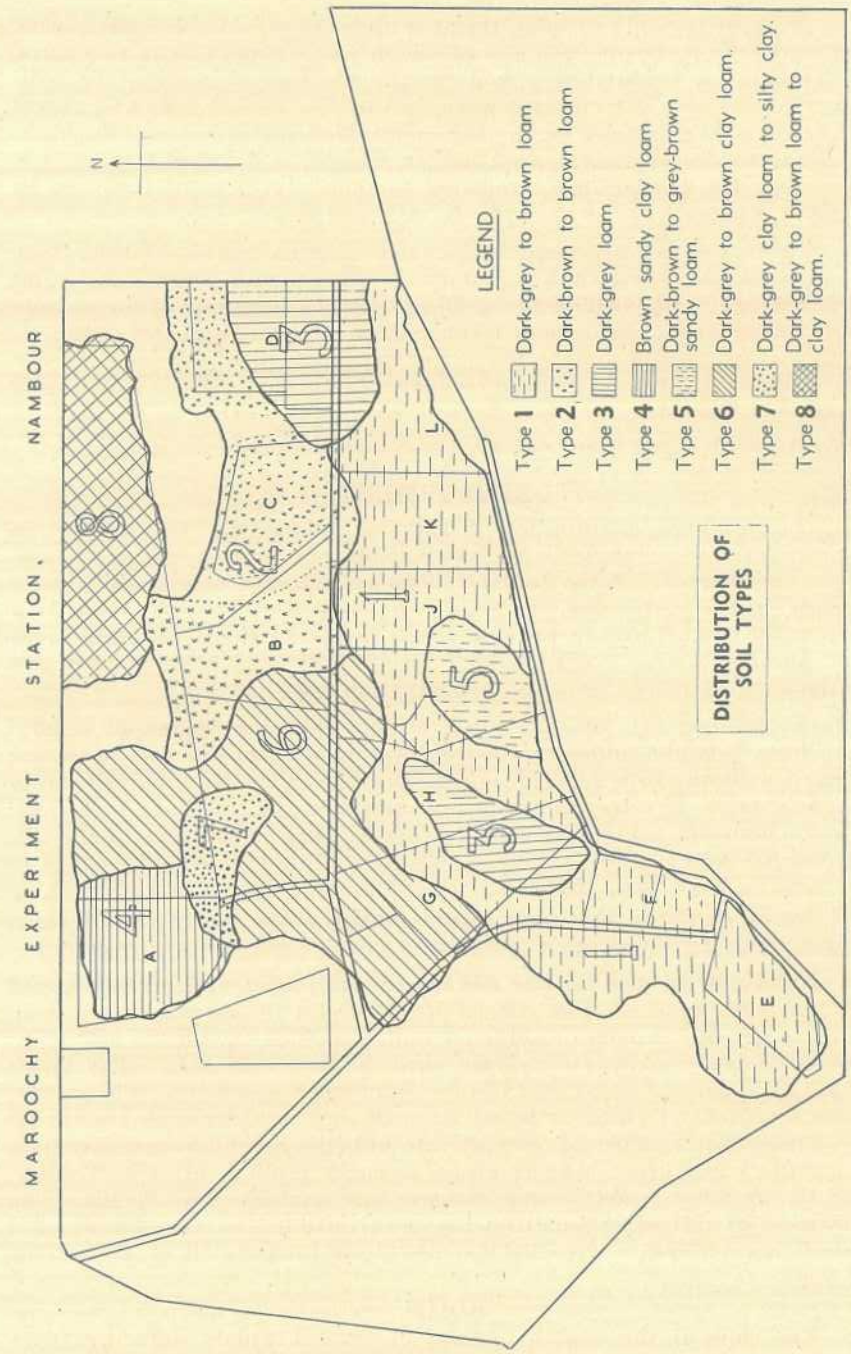


Plate 16.

Sketch Showing Distribution of Soil Types.

The main types distinguished in preliminary surveys are described below. Refer to Plates 17-21.

Type 1 (parts of blocks E, F, G, H, I, J, K) occurs on the greater portion of the main ridge and consists of a dark grey-brown loam. Two variants of the type are recognisable. One (Plate 17) is dark-grey in colour, possesses an excellent crumb structure, and has a clay loam subsoil at about 12 to 15 inches; the other is a grey-brown sandy loam, with a good crumb structure, but has less clay in the subsoil. The latter closely resembles the more important soils of the Nambour-Woombye-

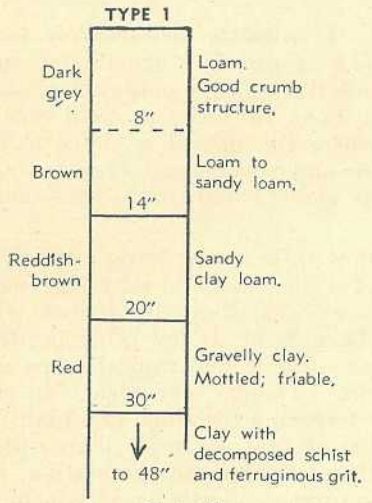


Plate 17.
Profile of Type 1.

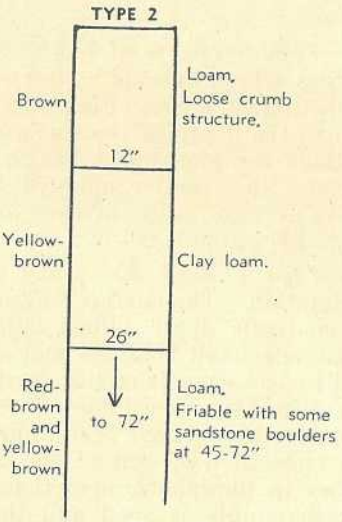


Plate 18.
Profile of Type 2.

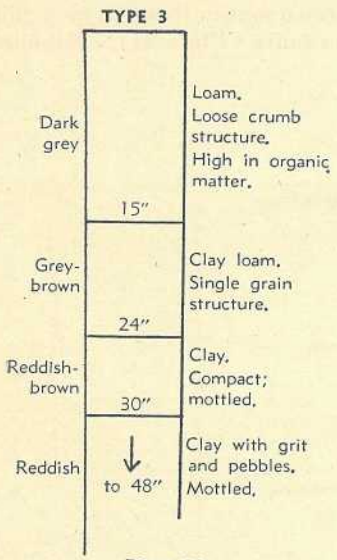


Plate 19.
Profile of Type 3.

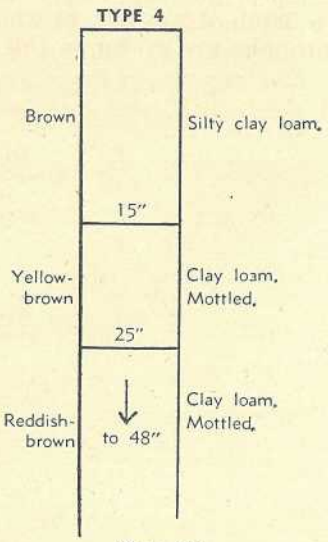


Plate 20.
Profile of Type 4.

Palmwoods area. The first of these two variants is devoted to bananas, papaws and pineapples; whilst the second is utilised solely for pineapples, for which it is primarily suitable. Chemical analyses have shown that the nitrogen, potash and carbon content are high, phosphoric acid is low, and pH value 5·8.

Type 2 (parts of blocks B, C, D) is a very deep, brown, friable and well drained loam with little clay in the subsoil (Plate 18). Physically it is one of the best soils on the station, and is very suitable for trees such as avocadoes and citrus which require good aeration in the root zone. In one area this soil type is relatively shallow, with a clay loam subsoil.

Type 3 (parts of blocks D, F, G, H) consists of dark-grey loam having a high organic matter content and an excellent crumb structure in the top six inches (Plate 19). The subsoil is a fairly porous clay loam. Where the depth of the surface layer is 12 to 15 inches this soil type is suitable for pineapples, but in areas where the subsoil is closer to the surface, it is better adapted to ginger and some small crops. It is above average in its nitrogen and potash content, but low in phosphoric acid; pH value is 5·4.

Type 4 (block A) occurs on a shallow ridge in the lower portion of the station. The surface soil consists of a fine sandy to silty clay loam of moderate depth (Plate 20). The area was originally strewn with numerous small boulders and stones. Because of its low-lying position and the consequent risk of frost, it is not suitable for tropical crops and has therefore been planted with citrus. Though not ideal for this crop, conditions have been improved by terracing the ridge and planting the trees in deep soil at the outer edge of each terrace. This soil is richer in phosphoric acid than any other soil type on the station, the potash supply is good and the carbon-nitrogen ratio is satisfactory; pH value is 5·9.

Type 5 (parts of blocks H, I, J) exists on a single small area near the top of the main ridge. It is a dark brown sandy loam, very friable to a depth of two feet, at which sandstone occurs (Plate 21). Excellent pineapples are grown on this area.

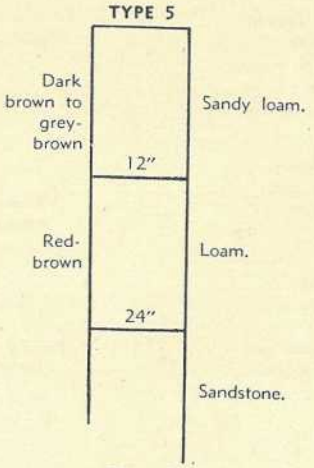


Plate 21.
Profile of Type 5.

Types 6, 7 and 8 are situated on low-lying sections of the farm. In most of these areas heavy clay occurs close to the surface, and the land is not likely to be used extensively for perennial fruit crops. A portion of type 6 may, however, prove suitable for Macadamia nut trees.

In the southern portion of the station, which as yet has not been brought under cultivation, there are two areas with aspects and soils which are suitable for tropical and sub-tropical fruit crops. The first of these lies in a small valley and the soil is a fine sandy loam of considerable depth, presumably deposited by the adjoining creek. It should grow excellent citrus and avocadoes. The second is a ridge rising on the southern side of the valley where the soil resembles the sandy loam variant of type 1; it is very well suited to pineapples and papaws.

The western portion of the property consists of rocky, timbered land suitable only for reafforestation.

INVESTIGATIONS.

The investigational work of the station is conducted under the supervision of technical officers each of whom specialises in a single crop or group of crops. These officers plan the investigations, and work in close collaboration with the station manager, who is responsible for all cultural operations and developmental work. Investigations undertaken to the present time are described in the following sections.

Pineapples.

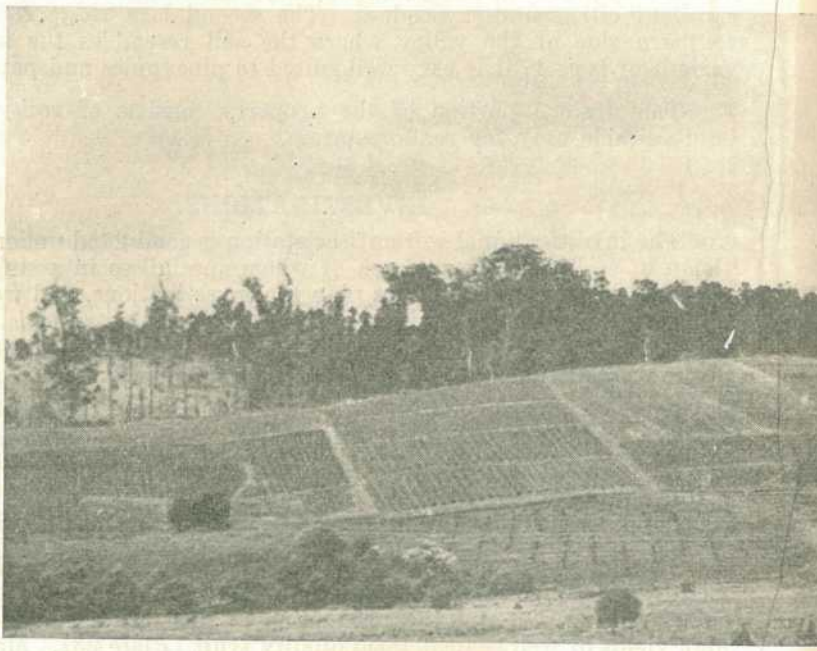
The pineapple is the most important fruit crop grown in this region of the State and there is room for both an expansion of the area under crop and an increase in the productivity of existing plantations.

One long-term project at the station is concerned with the improvement of planting material by the systematic rogueing of off-types of low commercial value, and the production of new types capable of giving high yields of well shaped, good quality fruit (Plate 23). Mass selection has therefore been practised for some years on the station and the crops now grown are particularly uniform. Following the original selection made on commercial plantations, the first re-selection is made on the station in the plant crop, the land being broken up after the fruit from this crop is harvested, and all available planting material obtained; it is then planted to pigeon pea for twelve months, and subsequently replanted with selected tops. Operations are so arranged that one block of about two acres is planted each year. The mass selection programme is supplemented by clonal selection, which, though slower in producing results, should finally give a much more uniform and better accredited line of planting material than can be obtained by mass selection methods. An outcome of the selection work will be the release of limited quantities of high-class planting material to the industry.

A second long-term project has developed out of the urgent need for soil conservation measures on the relatively steep slopes often used for pineapple production on the north coast. Unless such erosion can be checked, it seems inevitable that many farms, including the station itself, will steadily deteriorate and become less and less productive. The better known and more generally applied soil conservation measures are not designed for hilly country on which cultivated crops are grown.

and the more simple modifications may not be suitable for the pineapple crop, which is very sensitive to excessive water round the root system. Something has to be done to conserve the soil on these slopes and experimental work is in hand to explore possible procedures.

With the several pineapple blocks reserved for plant selection, there is ample scope for short-term projects. Two which attracted attention were the demonstration that alpha naphthalene acetic acid effectively induces flowering in pineapples when applied in solution at a



View of Maroochy Experiment Station. Panorama looking sou

concentration of 10 to 20 parts per million, and the experimental testing of sodium pentachlorphenate as a weedicide. Both projects have supplied information for advisory recommendations which were quickly incorporated in farm practice.

Block G—Plant Selection Block (2·75 *acres*).—Cleared in 1945 and planted in May, 1946, with selected tops from commercial plantations. Broken up in September, 1949, and planted with pigeon pea. Contoured in 1950 for planting in March, 1951.

Supplementary projects: Top rot and flower induction trials in 1948.

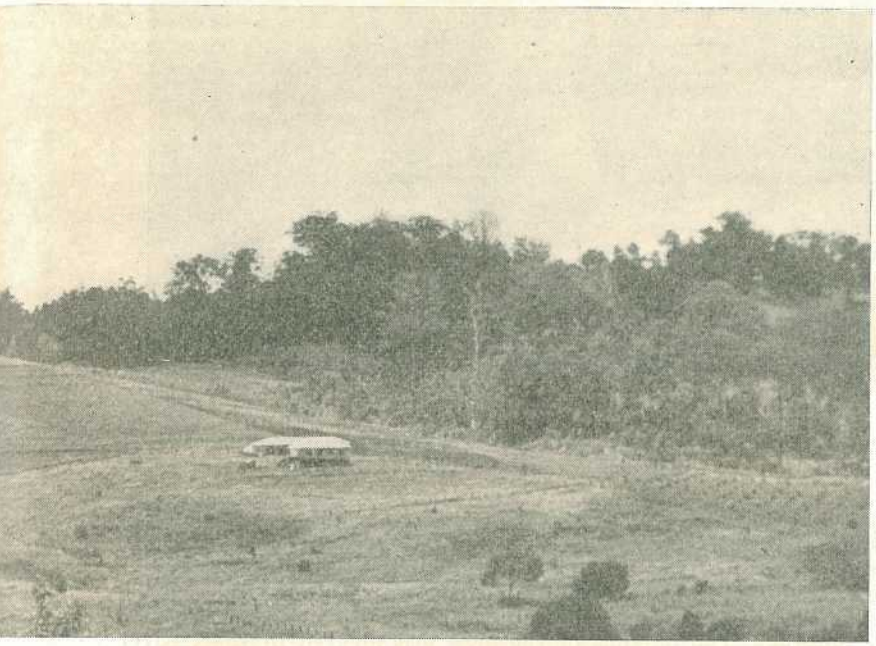
Block H—Plant Selection Block (1·75 *acres*).—Under a commercial crop of pineapples in 1945. Area extended in 1948, and the whole sown to pigeon pea in November of that year. Both the cover crop and the pineapples were broken up in 1949 and the area designed as a soil conservation project with the following treatments:—

(*a*) Drainage furrows lie between paired rows of pineapples planted on "contour" lines graded to 1 in 100, with check banks at 45 feet intervals;

(*b*) Drainage controlled by contour drain and check bank or bund, with pineapples planted directly up the slope; 45 feet intervals between check banks;

(*c*) Drainage by furrows situated at the rear of a bench terrace, with pineapples planted on the contour; minimum width of terrace—15 feet;

(*d*) Drainage by sectional drains with pineapples planted directly up the slope.



e 22.
hows main spur under pineapples, with citrus blocks on lower slopes.

This block was planted with selected suckers and slips in 1949.

Block I.—Plant Selection Block (1·9 acres).—Cleared in 1946. Borders 1-3 planted in March, 1947, and Borders 4-5 in March, 1948, with selected tops. The whole area was broken up late in 1949, sown to Poona pea, and replanted with selected tops early in 1950.

Supplementary projects: Fruit maturity studies in 1948 and flower induction studies in 1949.

Block J—Miscellaneous Pineapple Investigations (1·75 *acres*).—Partly under commercial pineapples in 1945. Borders 3 and 4 assigned to a soil management trial with intercycle treatments such as the trashing of old pineapple plants and the growing of a green manure such as cowpea. These should demonstrate whether or not working organic matter into the soil before planting will lengthen the fruiting period of replant crops. Soil management trial planted with selected slips and suckers in 1948. Borders 1 and 2 cleared in 1948, cover cropped during the following summer and then planted with selected tops in March, 1949.

Supplementary projects: A weedicide trial in 1950 and a comparison of single and multiple tops as planting material in the same year.

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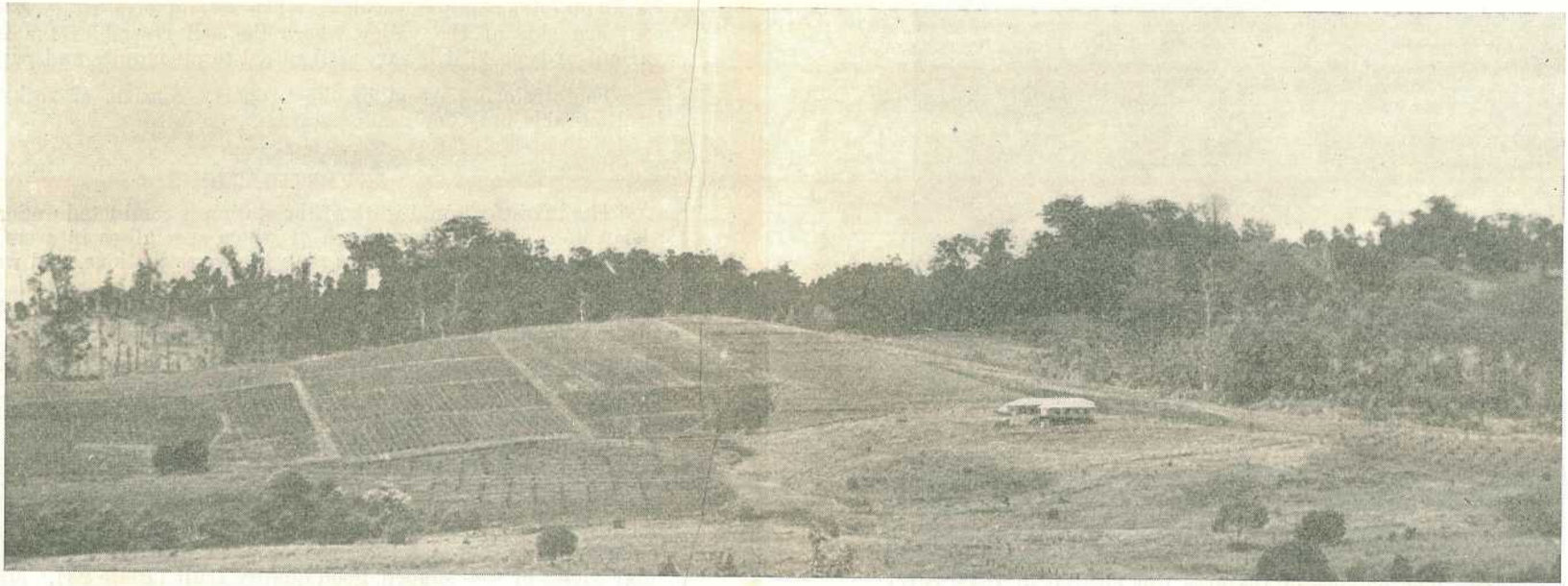

Plate 22.

View of Maroochy Experiment Station. Panorama looking south, shows main spur under pineapples, with citrus blocks on lower slopes.

concentration of 10 to 20 parts per million, and the experimental testing of sodium pentachlorphenate as a weedicide. Both projects have supplied information for advisory recommendations which were quickly incorporated in farm practice.

Block G—Plant Selection Block (2·75 *acres*).—Cleared in 1945 and planted in May, 1946, with selected tops from commercial plantations. Broken up in September, 1949, and planted with pigeon pea. Contoured in 1950 for planting in March, 1951.

Supplementary projects: Top rot and flower induction trials in 1948.

Block H—Plant Selection Block (1·75 *acres*).—Under a commercial crop of pineapples in 1945. Area extended in 1948, and the whole sown to pigeon pea in November of that year. Both the cover crop and the pineapples were broken up in 1949 and the area designed as a soil conservation project with the following treatments:—

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This block was planted with selected suckers and slips in 1949.

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Supplementary projects: A weedicide trial in 1950 and a comparison of single and multiple tops as planting material in the same year.

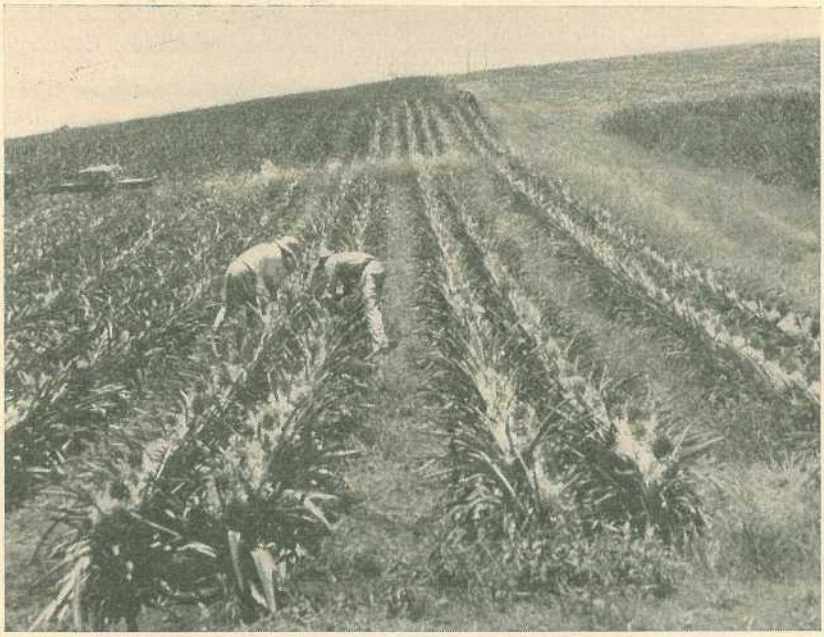


Plate 23.
Portion of the Pineapple Plantation. Fruit is being covered with woodwool for protection against sunburn.

Block K—Plant Selection Block (2·2 *acres*).—Partly under commercial pineapples in 1945 which were broken up in 1946, then under pigeon pea until March, 1948, then planted with selected tops. This crop was disposed of early in 1950, and the block will be green cropped for twelve months. The balance of the area was cleared in 1948, cover cropped during the whole of the following year and then planted with selected tops in March, 1949.

Supplementary projects: A weedicide trial in 1949 and fruit maturity studies in 1950.

Bananas.

The banana has been an important developmental crop in Queensland for very many years. It was formerly grown on virgin ground from which the rain forest had been cleared, and production declined when suitable country of this kind became scarce in southern Queensland. The future of the industry depends largely on the ability of the grower to handle the crop on land which lacks the high fertility of virgin rain forest country. This involves not only correct soil management but also efficient control of bunching, particularly in the ratoon crops.

Work on the latter subject began at the Maroochy Experiment Station in 1949 with the planting of two acres of bananas in contour rows with the necessary provision for inter-row drainage. A grass mulch is applied in June each year to conserve soil moisture, and prevent erosion (Plate 24).

The main aim is to find a practical basis for selecting the suckers which form the ratoon crop. Information is therefore being sought on the correlation, if any, between the age of the parent when the sucker is set and the subsequent growth of the sucker; on the time of the year at which the sucker should be set; and on the relative merits of different types of sucker from which a selection can be made in the plantation. All have a particular significance in southern Queensland where both temperatures and rainfall are often far from the optimum requirements of the plant during winter and spring.

Block E—Banana Suckering and Spacing Block (2 *acres*).—Partly under commercial pineapples in 1945. Broken up in 1948 and the rest of the land cleared and stumped. Planted with bananas in 1949, partly at normal spacings and partly at wide spacings.

Block D—Banana Planting Material (1 *acre*).—This portion was cleared in 1947 and was green cropped until 1949, when a trial was initiated with Cavendish bananas to evaluate bits and suckers as planting material when planted in different ways.

Papaws.

The papaw industry has made rapid headway in Queensland but the future depends very largely on the practicability of placing high-quality fruit on the southern market in volume. One handicap is the lack of uniformity in the type of fruit grown at the present time. Commercial plantations are almost entirely established from seed which is far from pure owing to uncontrolled cross pollination. Every plant

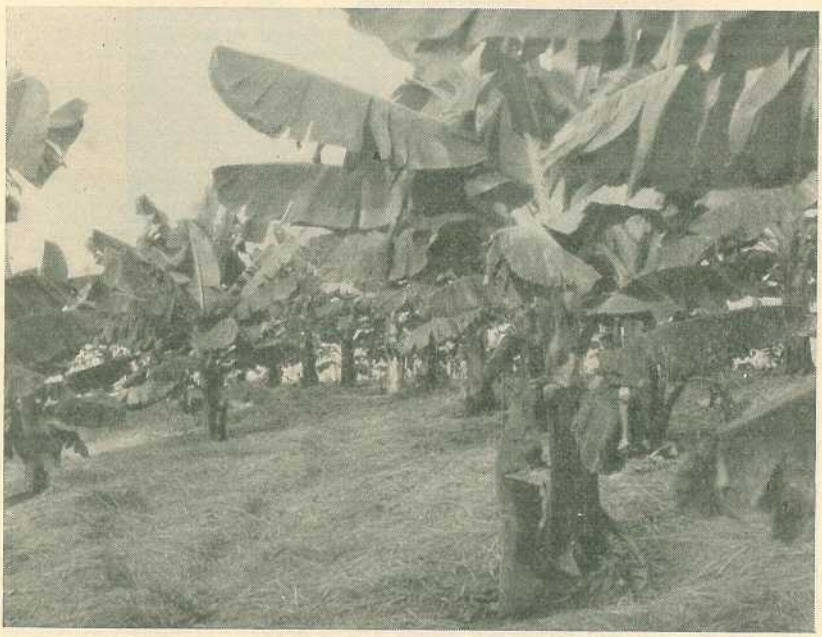


Plate 24.

Experimental Cavendish Banana Block Showing Contour Planting, Drainage Furrow and Blady Grass Mulch.

therefore differs from others in the plantation in one or more characters such as the time of fruit maturity, thickness and colour of the flesh, size of fruit and yield potential. In these circumstances, it is difficult to produce the even-sized high-quality fruit which is required for both the fresh fruit market and canneries.

Plate 25.
Bettina Papaws Produced by Controlled Pollination.

The primary horticultural consideration in this crop is therefore the development of suitable varieties by selection and hybridization, their fixation by controlled pollination, and finally the production of pure seed in sufficient volume to meet growers' requirements (Plate 25). This involves a long-term breeding project, which has been in progress for some time. The work is now located at the Maroochy Experiment Station. Pure seed of the varieties Bettina and Improved Petersen was released from the station in 1949 but the available stocks have been insufficient to meet the demand.

Block F—Papaw Breeding Block (2·25 *acres*).—Under old bananas in 1945. Cleared in 1947 and regularly cover cropped until planted with papaws in 1948. One border is assigned to a lime level trial and the production of pure seed, a second to the production of hybrid strains, and a third to line selection.

Citrus.

Good trees are the foundation of a first class orchard and the production of such trees depends largely on the type of rootstock used and the quality of the buds worked onto it. In order to ensure that seed and budwood shall be the best obtainable, the Department of Agriculture and Stock supplies both to nurserymen each year. The seed and budwood come from parent trees which are true to type, in good health, and possess a consistent cropping record.

In the past, seed has been collected and budwood cut from privately owned orchards but this procedure is not altogether satisfactory. One difficulty arises from the fact that citrus trees should be specially pruned for budwood production and the methods used are quite different from those applied in normal orchard practice where the out-turn of fruit is the primary consideration. The Department has therefore decided to grow citrus trees on its own properties from which part of the budwood required can be cut.

Two orchards were established at the Maroochy Experiment Station in 1948 for this purpose. The plantings are designed not only to simplify the cutting of budwood, but also to give information on the behaviour of several varieties of citrus when grown on different rootstocks. The more important stocks are the rough lemon, which normally induces vigorous tree growth; sweet orange, which is associated with high quality fruit and long tree life; Emperor mandarin, which is particularly suited to mandarins; and Trifoliata, which may prove to be the best commercial stock in areas where the root disease, brown rot gummosis, is potentially dangerous.

Plate 26.

New Zealand Blue Lupin Green Crop being Mown in Citrus Block.

Block A—Citrus Budwood Block, No. 1 (1·75 *acres*).—Cleared in 1946 and cropped with green manures during that and the following year. Contour terraced in 1947 and planted in May with trees produced in the Station nursery.

Block B—Citrus Budwood Block, No. 2 (2·25 *acres*).—Cleared in July, 1947, and then cover cropped until contour terraced in July, 1948 and part planted two months later. Planting completed in 1949.

Routine maintenance in both blocks involves the use each year of cowpeas in summer and either New Zealand blue lupin or a rust resistant cereal in winter as a cover crop (Plate 26).

Avocadoes.

The avocado is a comparatively new fruit commercially in Queensland. Overseas experience, particularly in California, indicates that, once the public is assured of regular supplies of good quality fruit and has acquired an appreciation of its merits, the consumer demand should be very keen.

The fruit from seedling trees is variable and such trees cannot therefore form the basis of a worthwhile industry. The Department is interested in selecting suitable varieties for commercial production and then working out methods of propagation which will ensure that trees of the desired type can be made available to growers from well managed nurseries. Both are long term projects for which the Maroochy Experiment Station provides a suitable location. Three varieties, Fuerte, Nabal and Anaheim, which are at present recommended to growers as suitable for the Australian market, have been planted and the area will be gradually extended. The orchard should provide a convenient source of budwood and also prove a useful centre for observations on tree behaviour under north coast conditions.

Block C—Avocado Varietal Block (1·75 *acres*).—Cleared in 1946, cover cropped for the following three years, and then part-planted with avocadoes in 1949.

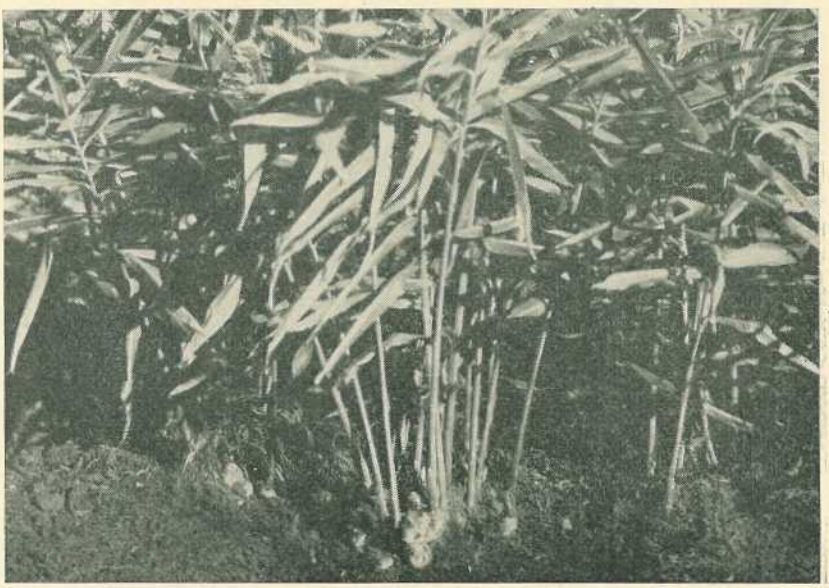


Plate 27.

Ginger Plants, Showing Rhizomes or "Roots."

Miscellaneous Crops.

Ginger.

The ginger industry is firmly established in the Nambour-Buderim area, where the crop is grown in close proximity to the processing factory which is located at Buderim. The crop is relatively new to the State and until recent years its cultural requirements were not well known, but investigations have assisted materially to elucidate these. Experimental work, which was transferred to the station in 1947, has reached the concluding stages, and firm recommendations on cultural methods are now available.

Block D—Ginger Experiments.—Portion of this area was cleared in 1946 and planted with ginger (Plate 27) in 1947; it has been under this crop for four years. In alternate years a ratoon crop is grown.

Green Crops.

Studies on the growth and behaviour of potentially useful green crops have formed the basis of the station's green cropping programme and recommendations to growers. An outstanding crop developed by the station for horticultural purposes is pigeon pea (*Cajanus cajan*), a perennial plant which is proving a most useful soil improver and conserver, particularly during periods between pineapple plantings. Short-term crops which provide ground cover during the wet period, and green manure for incorporation with the surface soil in autumn, are Poona pea and Black Mauritius velvet bean. Worthwhile winter crops are New Zealand blue lupin and Victoria x Richland oat. Miscellaneous perennial legumes from North Queensland tried under Nambour climatic conditions included Calopogonium, Stylosanthes and Centrosema, which were the most promising; though they made excellent growth during the summer they usually suffered from winter frosts.

GREEN CROPPING PROGRAMME.

Green cropping on the station is based on the principle that cultivated land must not be left bare, and accordingly the following schedules are adhered to:—

(1) A perennial legume, usually pigeon pea, is grown for a period of about 12 months between successive plantings of pineapples, papaws and bananas. The green crop is sown after the fruit crop has been trashed, and at maturity it is disced and ploughed in the course of land preparation for the next fruit planting.

(2) Summer and winter legumes and cereals are grown in orchard areas. Cowpeas are usually sown in October-November to provide ground cover in summer, and New Zealand blue lupins or oats in March-April for the winter crop. The cowpeas are disced in February or early March, and the winter crop is mown in September and later disced for the sowing of the summer crop. If at any time either of the two annual crops shows signs of competing with the trees for soil moisture, it is promptly mown.

(3) As each new piece of land is cleared it is customary to plant pigeon pea until the area is required for a horticultural crop.

CONCLUSION.

In its brief history of five years, Maroochy Experiment Station has initiated work which should lead to the solution of a variety of horticultural problems.

Directions in which the work seems likely to develop in the future are:—

(1) Improved soil management and soil conservation practices. This work will involve the use of surface mulches, and of green crops for soil coverage and green manure, contour planting and the practicability of terracing on sloping land.

(2) The production of high-class propagating material of pineapples, papaws and citrus.

(3) The propagation and culture of Macadamia nuts and avocadoes.

(4) The uses of various weedicides, both for preventing weed emergence and for destroying growing weeds, including grasses.

(5) The uses of substances which control growth and flowering of plants, particularly pineapples.

(6) Banana plantation management, particularly with reference to control of suckering and fruiting.

(7) The control of diseases and pests in various fruit crops.

Foot Rot and Foot Abscess of Sheep.

G. R. MOULE, Director of Sheep Husbandry.

FOOT rot and foot abscess are two diseases of sheep which are well known in the southern States of Australia, but which are comparatively unknown in Queensland. Even in districts where these diseases are prevalent they are not always differentiated, and any lameness of sheep, associated with painful or suppurating conditions of the hooves, is often regarded as being due to foot rot.

In Queensland, the majority of the sheep are to be found in the semi-arid pastoral country, where rainfall is low and poorly distributed. In addition, evaporation is high and the consequent aridity has been an important factor contributing to the freedom of Queensland flocks from foot rot or foot abscess. During the last two years, however, bounteous seasonal conditions have prevailed, and in southern Queensland quite heavy rains have fallen in the winter. In a good deal of the semi-arid pastoral country, which usually enjoys between 18 and 20 inches of rain each year, over 70 inches fell in 1949 and the first eight months of 1950. This was followed by further widespread and rather persistent rain in the spring. Foot rot and foot abscess occurred amongst some flocks in southern Queensland during the winter and spring of 1950, and the object of this article is to draw the attention of woolgrowers to the treatment and control of these diseases.

Neither condition is known to cause serious trouble in this State, though foot abscess was quite prevalent in a few flocks in the central-west following the wet conditions which prevailed in 1941 and the continuous winter rains of 1942.

Foot Rot.

Foot rot is a specific contagious disease caused by an organism referred to as the K organism. It is seasonal in nature and occurs mostly in wet periods.

The infective organisms are voided from the feet of "carrier" animals, which contaminate the pastures. The organism persists on the pasture for two weeks and on gaining entrance to the foot of an unaffected animal it causes inflammation of the skin between the two

hooves, especially in the vicinity of the heels. From there, it invades the deeper tissues and enters the sole, suppuration working forwards towards the toes. More than one hoof and more than one foot may be affected at once.

Animals suffering from foot rot are very lame, and when both front feet are affected at once the sheep may go down on its knees.

Suppuration of the skin, separation of the sole, and finally separation of the hard wall of the hoof are often part of the usual course which the disease runs. Small amounts of foetid, grey, dry, crumbly pus may be found between the separating layers of the sole or wall.

Sometimes concurrent infections with pus-forming organisms may set up abscesses around the coronet, and while these may run fairly rapid courses, true foot rot is essentially a chronic disease.

Foot Abscess.

Foot abscess is sometimes called digital suppuration. It also is a specific disease, caused by an organism known as *Fusiformis necrophorus*. This disease is seasonal in nature and occurs particularly in wet years. It may occur in one foot only, or even in one hoof of one foot, and up to 40 per cent. of a flock may be affected.

The causative organism enters through the fissures in the horn, particularly when they are cracked during a dry time, or through abrasions. Most commonly, infection occurs through the toe, although it may occur through chafed skin in the vicinity of the heels.

When infection does occur, an abscess, which is virtually encased in the foot, develops and the pus may break out at the coronet.

Acute lameness is usually the symptom first noticed. Detailed examination reveals that one claw is hot and inflamed and pressure causes pain. The imprisoned pus, which is thick and creamy, may break out at the coronet. If the condition remains untreated, serious consequences, such as sloughing of the back tendons, may occur.

Distinguishing Foot Infections.

The differential diagnosis between foot rot and foot abscess is made largely on the clinical appearance of the affected feet, although there are other points worthy of consideration. Foot abscess affects sheep of any age and a large proportion of a flock may suffer from the disease at one time. In addition only one hoof may be affected, whereas foot rot is more prevalent in younger sheep, more than one claw is affected, and it is unusual for such a large proportion of the flock to be affected.

Treatment of Affected Animals.

Animals suffering from either of these diseases should be isolated from the rest of the flock. Treatment is easily effected by trimming the sheeps' feet with secateurs or a sharp knife. All dead horn should be removed and pus exposed. Treated animals should then be made to walk through foot baths containing a 10 per cent. solution of copper sulphate (bluestone) every 2 or 3 days until they have recovered.

Sulphanilamide ointment (10 per cent.) is useful when applied to the feet of sheep suffering from foot abscess. Its use would probably be restricted to valuable stud animals.

Prevention.

Particular attention should be paid to the feet of stud sheep imported from States where foot rot is prevalent. Should an outbreak occur, it is advisable to examine the feet of all the sheep in a flock and isolate any showing abnormalities such as chafing at the heels or overgrown horn. These animals should not be returned to the flock until they have been normal for over one month.

After an outbreak of foot rot it is essential to spell the paddocks for at least one month, to make sure the infective organism dies out of the pasture before more sheep become affected.

TUBERCULOSIS-FREE CATTLE HERDS

(AS AT 15th DECEMBER, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth W. Henschell, " Yarranvale," Yarranlea Con. O'Sullivan, " Navillus Stud," Greenmount H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, " Sunny View," Kingaroy Sullivan Bros., " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman J. F. Dudley, " Pasadena," Maleny
Jersey	W. E. O. Meier, " Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, " Glen Erin Jersey Stud," Greenmount J. F. Lau, " Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, " The Craigan Farm," Aspley

ANIMAL HEALTH

Salmonellosis of Chickens.

A. K. SUTHERLAND, G. C. SIMMONS and G. S. COTTEW, Animal Health Station, Yeerongpilly.

SALMONELLOSIS is a serious infectious disease that was first recorded in chickens in Queensland in 1946. Since then it has been diagnosed with increasing frequency, as shown in Table 1. It is therefore a relatively new disease in chickens, and often receives little or no mention in books on poultry diseases. In ducks and turkeys it occurs more frequently and has been well known for many years under such names as paratyphoid, infectious enteritis and "keel" disease. This article, however, deals with the disease in chickens only.

TABLE 1.

FREQUENCY OF PULLORUM DISEASE AND SALMONELLOSIS IN CHICKENS UNDER THREE WEEKS OF AGE EXAMINED AT ANIMAL HEALTH STATION.

Year.	Number of Batches Examined.	Pullorum Disease.	Salmonellosis.
1946	43	24	1
1947	37	13	3
1948	60	13	12
1949	41	2	5
1950 (to 31 October) ..	61	7	16

It can be seen from Table 1 that salmonellosis now ranks with pullorum disease as a cause of losses in chickens. Mortality in different outbreaks has varied from 10 per cent. to 90 per cent. but most often it has been between 25 per cent. and 50 per cent.

The Salmonella bacteria that cause disease in chickens can also infect man and other animals. Salmonellosis in human beings has been called food poisoning, gastro-enteritis or paratyphoid fever and it may be fatal, especially in babies.

Cause.

Salmonellosis is an infectious disease caused by bacteria called Salmonella. About 200 different types (or species) of Salmonella are known and all of them, except *Salmonella pullorum*, cause a similar disease in chickens. Pullorum disease, caused by *Salmonella pullorum*, has special features that distinguish it from salmonellosis so it is not considered in this article.

The salmonellae that infect chickens also quite often cause disease in ducks, turkeys, pigs, cattle, sheep, horses, dogs, rats and mice. In fact almost any Salmonella type can infect almost any animal or bird (wild or domesticated), or man. Thus, sick individuals or healthy carriers of any of these species of animals can be the source from which chickens contract salmonellosis.

Symptoms.

Salmonellosis can occur in birds of all ages, but is most common in chickens under three weeks of age. The symptoms are similar to those of pullorum disease. The affected chicks are dull and they seek warmth and chirp continuously. Some of them may show evidence of diarrhoea. Quite often chicks are found dead without having been noticed sick.

Post-mortem examination usually shows nothing that would enable one to make an accurate diagnosis. There may be congestion of the lungs, pneumonia, inflammation of the intestine or a general water-logging of the tissues, but similar lesions occur in other chick diseases.

Diagnosis.

The symptoms and lesions of salmonellosis are often indistinguishable from those of other chick ailments, such as pullorum disease, chilling and faulty brooding, so bacteriological examinations must be done to obtain a correct diagnosis. Several dead chicks, or preferably some dead and some live sick chicks, should be sent with full particulars to the Animal Health Station at Yeerongpilly or at Oonoonba. The specimens should be sent by rail or road transport to reach the laboratory without delay, otherwise they may arrive unfit for examination. If the specimens are dead they should be sent in a box or tin packed with dry wood-wool or sawdust.

The earliest that results of bacteriological examinations can be expected is 24 hours after the specimens are received, and complete examination requires several days.

Control of Outbreaks.

The three steps that have proved effective for controlling outbreaks of salmonellosis are:—

(1) Destroy all the sick chicks each day; if mortality has been heavy, it is better to destroy all the surviving chicks in the affected batch;

(2) Treat immediately with sulphamezathine or sulphamerazine in the drinking water; and

(3) Clean and disinfect the brooder house and the feed and water vessels.

Sulphamezathine and sulphamerazine are sold by poultry supply houses as 16 per cent. solutions, so two fluid ounces of solution per gallon of drinking water will give the recommended dosage, namely 0·2 per cent. of the drug. Treated water is given for four days and during this time no access to untreated water should be allowed. These drugs should not be administered for more than four days because they may produce harmful effects.

Treatment does not protect the chickens from re-infection, so hygienic measures must be taken to eliminate the Salmonella bacteria from the environment. The brooder house and the brooding equipment

should be thoroughly cleaned. The feed and water vessels should be washed clean in hot soapy water and then immersed for one hour in a disinfectant solution, such as 5 per cent. lysol.

A brooder that has been occupied by infected chickens should be cleaned and then left unoccupied for a month before it is used again for a fresh batch of chicks.

Vermin such as rats, mice and cockroaches should be controlled, because they can harbour and spread Salmonella bacteria.

All the surviving birds from an affected batch should be fattened and sold for slaughter as soon as possible. It is known that a proportion of these birds, called carriers, remain infected and excrete salmonellae in their droppings.

Prevention.

Salmonellae do not live and multiply outside the animal body, so the ultimate source of infection is always an infected bird or animal, either domesticated or wild. A proportion of the birds, or other animals, that have been exposed to salmonellosis remain carriers of the disease and excrete the organism in their faeces. Hens may harbour salmonellae in their ovaries and so may lay infected eggs. These carrier animals or birds appear normal and healthy and can be detected only by bacteriological examinations. Unfortunately, the blood test that is so efficient for detecting carriers of pullorum disease is not reliable for detecting Salmonella carriers.

It is evident that chickens can contract salmonellosis by ingesting or inhaling the excreta of carrier animals or birds, or, as in the case of pullorum disease, they may be infected in the incubator.

A high standard of hygiene in the brooder will protect chickens from contracting the disease through the ingestion of excreta. The feed and water vessels must be cleaned regularly, and fouling of the feed or water by the chickens themselves or by any other birds or animals must be avoided. Salmonella bacteria can multiply rapidly in water containing particles of fowl feed.

The brooder pen should be kept clean and dry. Salmonella bacteria are destroyed by dryness, but they can live for weeks in wet places, particularly if shaded from direct sunlight.

Chickens should be reared in isolation so that they have no contact with fowls or other animals, and attendants should avoid carrying infection into the brooder pen by means of dung on their boots.

Eggs produced by carrier hens may be infected in the ovary where they are formed or by contact with excreta when laid. In the latter case, the Salmonella bacteria penetrate the egg shell during incubation and infect the developing chick embryo. When the infected chick hatches, the organisms are rapidly spread through the machine so that the whole batch of chickens is exposed to infection. Formaldehyde fumigation 6 to 8 hours after the hatch is set should be used to destroy bacteria on the surface of the eggs. Fumigation must *not* be done between 24 and 84 hours after the eggs are set because it impairs fertility. Soiled eggs must not be used for hatching and a high standard of hygiene must be maintained throughout the hatchery.

Beef Cattle Production on Some of the Gulf Watersheds.

J. C. J. MAUNDER, Director of Veterinary Services.

PROBLEMS associated with beef cattle production in the area between the Mitchell and Gilbert Rivers, in the lower eastern portion of Cape York Peninsula, were the subject of enquiry by the writer during a visit to the area in September, 1949. The area reported upon here is situated west of longitude 144 degrees and between latitudes 15 and 18 degrees. It extends over the main portions of the basins of the Gilbert-Einasleigh, Staaten, and Mitchell-Walsh Rivers and includes marine plain country abutting on the Gulf of Carpentaria (Plate 28).

Only an incomplete survey was possible, and much of the matter presented is necessarily of a somewhat general nature, but the article will serve as a broad survey of the cattle-raising industry in this rather remote area.

VEGETATION AND WATER SUPPLIES.

The cattle country of the Gilbert, Einasleigh, Staaten and Mitchell Rivers consists of two main and very distinct types—the "frontage" (Plates 29-32) and the "forest" (Plates 33-35). Probably 80 per cent. of the cattle are run on the river frontages, and the greater the proportion of frontage to forest on a holding, the better the carrying capacity of the property.

Frontage.

The depth of frontage country varies considerably. On some holdings there is a good expanse of double frontage up to twenty miles wide; on others the frontage extends less than a mile from the main channel of the river; on still other places there is a good frontage on one side and practically none on the other.

Soils of the frontages are light-grey, structureless alluvial deposits of fine-textured silts and clays. Normally they are hard and compact, and when worked up they are loose and powdery. As well as being of poor physical condition, they appear to be fairly infertile and low in organic matter. There are no black soil plains similar to those in the country of the Gregory, Leichhardt and Flinders Rivers, with the exception of an area on Gamboola and Wrotham Park on the Mitchell River.

Usually the frontages carry a fair body of grass, but there are some "scalded" areas where the grass is thin or absent; these are described locally as "clay pans" or "scalded flats."

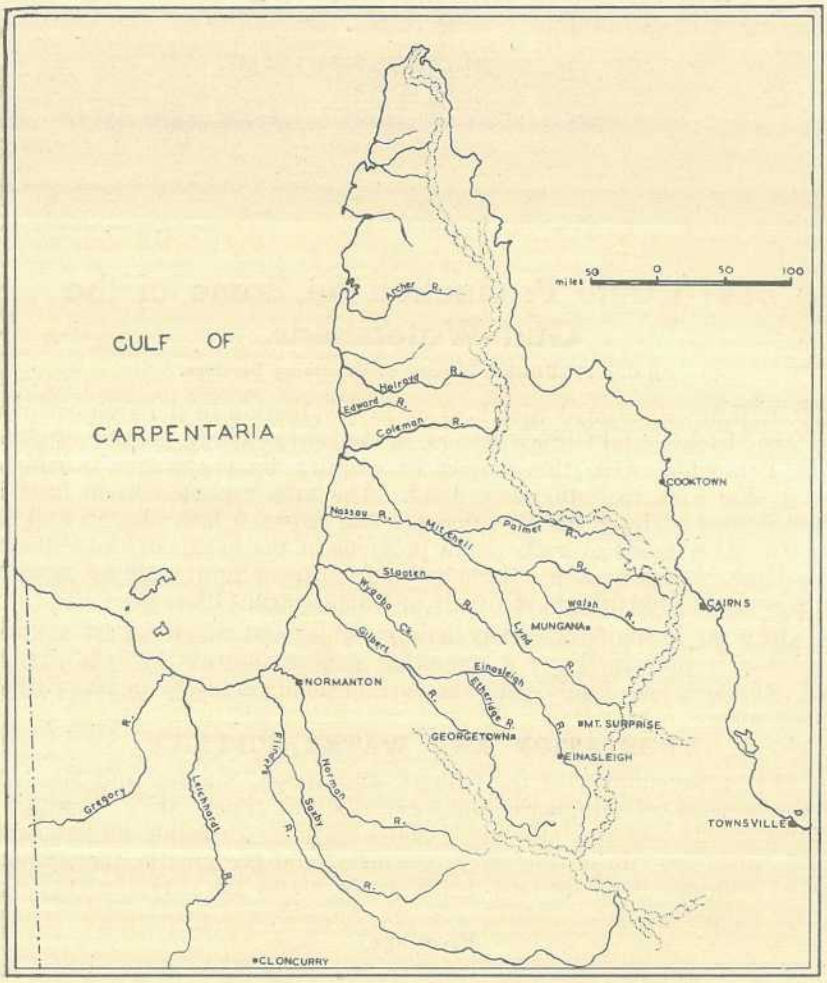


Plate 28.

Sketch Map of the Gulf and Peninsula Country.

The trees and the grass cover vary somewhat according to soil variations, but the dominant trees are a box and a bauhinia on the flats, with a tea-tree on the watercourses. The best grasses are a species of blue grass, Flinders grass, some false Mitchell grass on the better flats, and spear grasses. Fire grass is prevalent on the scalded flats; it is a slight and very inferior annual feed.

Plate 29.

Hereford Cattle on Frontage Country of the Gilbert.

Forest.

The forest country is very much inferior to the frontage country. It comprises the bulk of the areas between the Gilbert and the Einasleigh, the Gilbert and the Staaten, and the Staaten and the Mitchell, as well as the country immediately north of the Mitchell.

The forest country is flat and devoid of landmarks, of lower elevation than frontage country, and therefore more "boggy" and susceptible to flooding in the wet season than the frontages.

The soils are light-grey silt loams and loams, which are structureless and apparently of low fertility. The surface soil is shallow and overlies a heavy, impermeable clay. In wet seasons, the soil readily becomes waterlogged and boggy. Low ridges of sandy soil are interspersed with these flat, poorly-drained areas.

The grasses are in thin tussocks, with much bare space between, and carry practically no flag. It is all ant-hill country, and some of the colonies are 12 to 15 feet high. The trees consist mainly of broad-leaved tea-tree and "gutta percha." There are strips of wattle scrub and a sprinkling of beefwood, messmate, narrow-leaved tea-tree, plaited tea-tree, dogwood, and ironwood, with occasional bloodwood. The dominant vegetation type consists of tall lean grasses in scrubs of broad-leaved tea-tree and "gutta percha," freely ornamented with ant-hills.

The Staaten and Red Rivers and Wyaaba Creek have very little frontage country, the true forest coming practically to the banks.

Apparently, the value of the forest country lies in the fact that, on the lighter sandy strips, green shoots come away fairly quickly after storms and provide an earlier green pick than the frontages.

Water Supplies.

The water systems of the river basins under discussion are rather unusual. The main systems of the Mitchell-Walsh-Lynd-Palmer, the Staaten, and the Gilbert-Einasleigh-Etheridge head in the ranges of the Great Dividing Range or its spurs and flow in a general north-westerly direction to empty into the Gulf. A peculiar feature of the Mitchell and Gilbert systems is the formation of distributaries—creeks flow out from one river and empty into another, or back to the mother stream, or flow from a river and pursue individual courses direct to the sea. For example, Magnificent Creek flows out of the Mitchell and rejoins it near the mouth; the Scrutton River flows from the Mitchell into the Nassau, which itself comes from the Mitchell and empties into the Gulf. The Staaten, in comparison with the other two, is a very poor water system.

The combination of permanent "holes" in the rivers (Plate 36) and creeks with lagoons (Plate 37) and shallow swamps ensures good reliable water in both the forest and frontage country. Lagoons are situated in watercourses; some are permanent, but others are shallow and, like the swamps, dry up in August and September.

Generally speaking, all holdings are well supplied with surface water from these sources. One large place, however, is not so well served and has put down a number of bores equipped with mills and troughing. As a rule, bores are not very satisfactory in this area, which is outside the artesian basin. The permanent lagoons begin to thin out on the eastern fringe of the area, in the vicinity of the Walsh River, and artificial watering facilities such as wells have to be provided.

Cattle feed in the lagoons and swamps only while they contain water. There is no vigorous growth of fringing pasture, so once the water goes, the cattle feed elsewhere. This is contrary to the widely-held view that, in this country, cattle feed on a lush cover of grass as the waters gradually recede from the shallow banks of lagoons and swamps. In fact, although the lagoons carry a large and varied population of birds, the soil or water (or both) do not appear to be suited for the growth of good fringing pasture.

Coastal Country.

Impressions of this type of country (Plates 38-41) were obtained from observations on Rutland Plains and the Mitchell River Mission, which are said to be typical of the country from Delta Downs, through Macaroni, Galbraith, Rutland Plains, and Mitchell River Mission to Edward River and perhaps slightly north of the Edward. It extends inland from the coast for about 30 miles and therefore the scope is approximately 200 miles by 30 to 35 miles—that is, 6,000-7,000 square miles of country.

In this area there is no frontage and forest as described for the country further inland. The country has more the nature of downs and plain, freely broken by a network of watercourses and strips of lighter sandy ridges that are fairly heavily timbered and somewhat resemble "forest" country.

The plain country between the breaks of watercourses and timbered strips consists of grey loams and clay loams of moderate depth and apparently of fair fertility; they are tight and compact. It is sparsely timbered with a box and a bauhinia and carries a good body of feed

Plate 30.

Rank Pasture on the Banks of Walker's Creek, which Runs Out of the Gilbert. Similar pastures are found on the banks of many of the rivers and creeks.

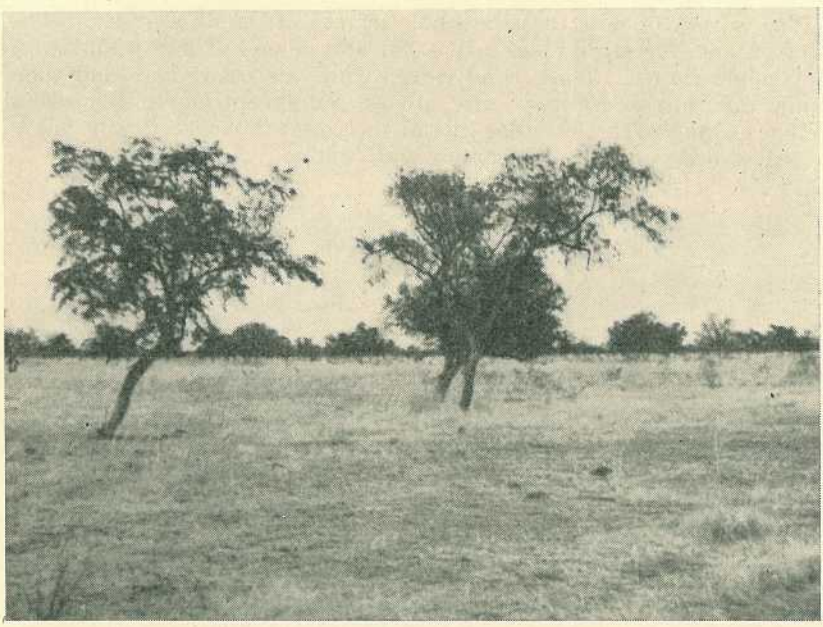


Plate 31.

Bauhinia Flats on Frontage Country of the Gilbert. This is some of the best of the frontage country on which "short feed" retains fair nutritive value when dry.

similar to typical good frontage country. The lighter ridges are fairly heavily timbered with another species of box, various gums, ironwood, "pear," "plum," and a sprinkling of pandanus. The feed here consists of a fair cover of thin spear grasses of low nutritive value.

The marine plains are much more extensive than the box and bauhinia plains and extend almost unbroken from the coast. They are extensive areas of grey loams and clay loam soils, fairly well drained and carrying a good body of grass, with various grasses, particularly Flinders and spear grasses, dominating the cover. The plains, which are almost treeless, are hard and compact. They are not subject to flooding from the tidal streams. The marine plains are six or seven miles wide and within about a mile of the coast give way to a light sandy timbered belt.

The coastal country is very well watered with permanent lagoons and creeks and shallow swamps, all of which break the continuity of the box and bauhinia plains. The marine plains are poorly watered; there are no lagoons and the shallow swamps give only temporary supplies. The poorer water supply system of the marine plains appears to be due to the fact that the numerous tributaries, distributaries and creeks, along the courses of which the lagoons are found, have formed up into the main streams such as the Scrutton and Nassau, which run direct to the sea. The swamps and lagoons of the box and bauhinia plains, and the shallow swamps of the marine plains, provide a certain amount of good swamp feed. However, there is very little marine couch on the shallow banks, so when the swamps dry out the cattle leave them and feed elsewhere. Apparently the hard clayey nature of the soils of the swamps and lagoons is not suitable for growth of marine couch, which, though present, is sparse and far from vigorous.

It is worthy of note that the whole terrain of the area under discussion (frontage, forest and coastal) is flat and devoid of any undulations or noticeable ridges. Those sand ridges which do occur here and there through the forest country are almost imperceptible to the casual traveller. From over 100 miles inland the country is practically flat to the coast, and beyond into the shallow gulf waters.

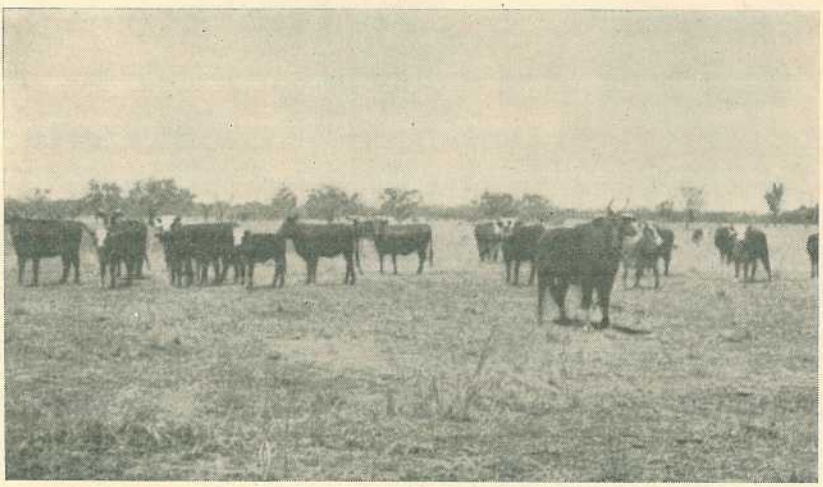


Plate 32.

Mixed Cattle, with an Admixture of Zebu Blood, on Frontage Country of the Gilbert.

Plate 33.

Forest Country off the Gilbert. This is rather better than most of the forest country in the area, but is still rather poor.

Plate 34.

Poor Forest Composed of Broad-leaved Tea-tree and "Gutta Percha."

TABLE 1.

AVERAGE MONTHLY RAINFALL RECORDS.

Recording Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Gilbert River .. .. (Average 65 years)	in. 8·87	in. 7·40	in. 4·79	in. 1·33	in. 0·34	in. 0·40	in. 0·23	in. 0·14	in. 0·19	in. 0·67	in. 1·59	in. 5·39	in. 31·34
Miranda Downs .. (Average 34 years)	9·72	6·96	5·77	1·07	0·27	0·35	0·06	0·02	0·06	0·47	1·64	3·94	30·33
Mitchell River .. (Average 22 years)	12·54	12·21	10·47	2·37	0·19	0·27	0·05	0·19	0·11	0·41	1·89	7·42	48·12
Strathmore .. .. (Average 17 years)	9·48	6·33	6·29	0·78	0·09	0·70	0·34	0·18	0·06	0·46	1·50	4·80	31·01
Van Rook .. .. (Average 16 years)	7·74	7·45	7·12	1·00	0·05	0·63	0·17	0·27	0·05	0·42	2·11	5·19	32·20
Walsh River .. .. (Average 41 years)	8·33	7·18	6·67	1·28	0·43	0·39	0·19	0·05	0·10	0·60	1·62	6·11	32·95
Cumberland .. .. (Average 52 years)	7·66	5·98	4·10	0·95	0·40	0·53	0·23	0·24	0·23	0·52	1·39	4·84	27·07

Plate 35.
A Wattle Scrub Typical of the Vegetation on Some of the Ridges in Forest Country.

Plate 36.
A Permanent Waterhole in the Einasleigh.

CLIMATE.

The area lies mainly between the 30 and 45 inch average annual rainfall lines and is much safer from drought than any other major breeding (as distinct from fattening) area of the State. The figures for several properties are given in Table 1.

It will be seen that the main rainfall is received in January, February and March. Storms are responsible for most of the rain in the pre-wet season months of November and December. A perusal of records shows that the rains in December, January and February are fairly reliable, while those of November and March are more variable. Prolonged droughts do not occur, but when the normal dry period is extended by a dry March and a dry November, stock losses are experienced. These are due mainly to the very low nutritive value of the dry feed rather than to shortage of surface water. Considerable additional losses may occur in these years because of the banks of many of the lagoons becoming boggy.

Temperature and humidity are important factors in the beef cattle industry of the area. The average maximum temperature at Georgetown, towards the headwaters of the Etheridge, is above 90 degrees for each month from September to March inclusive, and is over 82 degrees in the coldest months, June and July. The average monthly minimum temperature ranges from 53 degrees in July to 73 degrees in January. The relative humidity at this town is between 50 and 66 per cent. in all months except August to November.

Maximum and minimum temperatures are a few degrees higher on the Gulf coast than at Georgetown, and relative humidity is higher also.

Plate 37.
A Lagoon Off Dunbar Creek.

Plate 38.
Cattle Following the Green Shoot on Burnt Coastal Country.

Plate 39.
Good Plain Country Near Van Rook Creek.

Plate 40.
A Typical Plain of the Coastal Country.

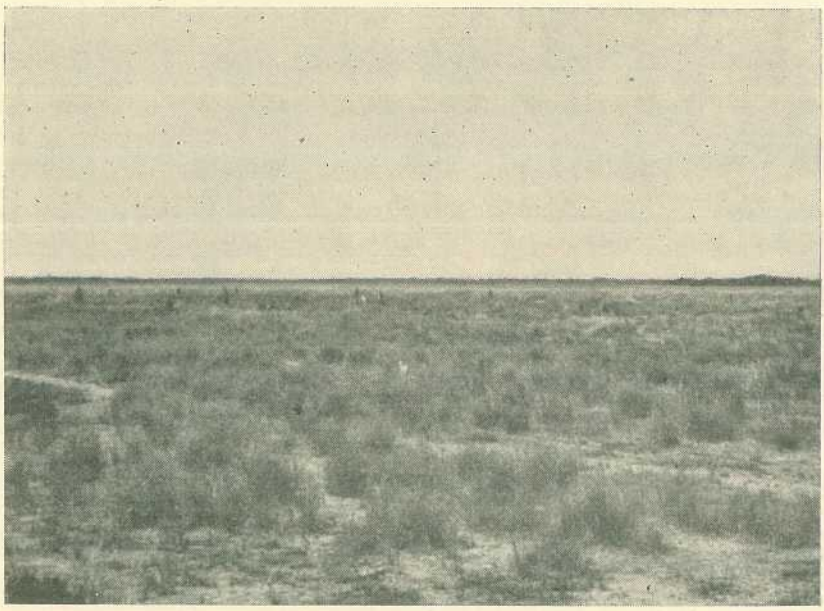


Plate 41.
The Beginning of a Marine Plain.

CATTLE PRODUCTION.

Size of Holdings.

Most of the holdings are large, varying from 1,000 to 4,000 square miles, with carrying capacities from five up to twelve beasts to the square mile. The bulk of the cattle are carried on frontage country; most of the forest country carries no more than two beasts to the square mile, while some of it carries only one. When it is remembered that there is far more forest than frontage, it will be realised that most of the frontage country is called upon to support a fairly heavy cattle population. The coastal country carries a more even distribution of cattle and generally has a better carrying capacity than those places further inland.

The holdings are all Crown leases. The majority are held by large pastoral companies which are associated with meat companies.

Breeds of Cattle.

There is a great diversity of breeds throughout the area, or rather, a great variation in the combinations used. The breeds are Shorthorn, Devon and Hereford in many combinations, with the Devon-Shorthorn cross predominating. There are no straight herds of any breed and on only one holding is there any Zebu blood.

The Devon-Shorthorn cross is most favoured on account of its hardiness and apparent ability to "breed up" quickly after losses from drought or flood, but it is a very slow maturing beast in this area. Herefords appear to do fairly well but have the reputation of "running out" quickly unless high percentages of fresh bulls are kept up to the herd. This is a marked disadvantage in country where bulls are subject to tick and buffalo fly infestation.

On one holding, the infusion of some Zebu blood is being practised successfully. The absence of fences makes it impossible to control breeding, so the actual proportion of Zebu blood to that of British breeds is largely a matter of chance. The bulls that are used appear to be one-quarter to one-eighth Zebu, and they are used on crossbred cows that are a mixture of Shorthorn, Devon and Hereford, but mostly Devon-Shorthorn cross.

It is generally accepted that, under favourable conditions of environment, the Zebu is a slower maturing beast than the British breeds. However, when running on the tropical and relatively poor country of the Gulf and lower Peninsula, existing for six months of the year on coarse unpalatable grasses of low nutritive value, and contending with buffalo fly and cattle ticks, the Zebu-cross cattle grow better than the British breeds and their crosses can be turned off as stores at least twelve months earlier.

The vigour and robustness of the Zebu-cross bulls seen were outstanding, and in marked contrast to the comparative listlessness of the Devons, Shornhorns and Herefords. Calves and yearling stock carrying some Zebu blood appeared more robust and were growing more quickly than others of comparable age.

General Management.

This is not easy country to work and management presents many problems not experienced in other areas. Musterings are carried out throughout the wet season, this being the best time to handle cattle

from the forest country. It is difficult to muster the forest, but during the wet season cattle are forced out on to the frontage and on to the low sand ridges of the forest.

Weaning is not practised, owing to the fact that weaners would be forced to exist on natural pasture at a time when the grasses are at their lowest nutritional value. On those occasions when weaning has been practised, quite severe losses have at times been suffered, particularly amongst males, due to the cumulative setback of marking, then weaning, plus the drop in plane of nutrition.

Most runs are unfenced, but some have bullock "paddocks" into which are mustered males that are to be turned off the following year as stores. This is an important requirement of management of country which is used primarily for the breeding of stores for fattening elsewhere. When steers and bullocks are allowed to run with female cattle, the breeders suffer in the competition for feed. It is significant that under comparable seasonal conditions the percentage of brandings on those holdings which practise this feature of management is always much better than those which do not.

As the area is inferior "growing" country, it is preferable not to send bulls into it until they are ready for work. For this reason, most herd bulls are bred and grown in the better country, such as the Burdekin basin north of Charters Towers, and then sent out ready for work.

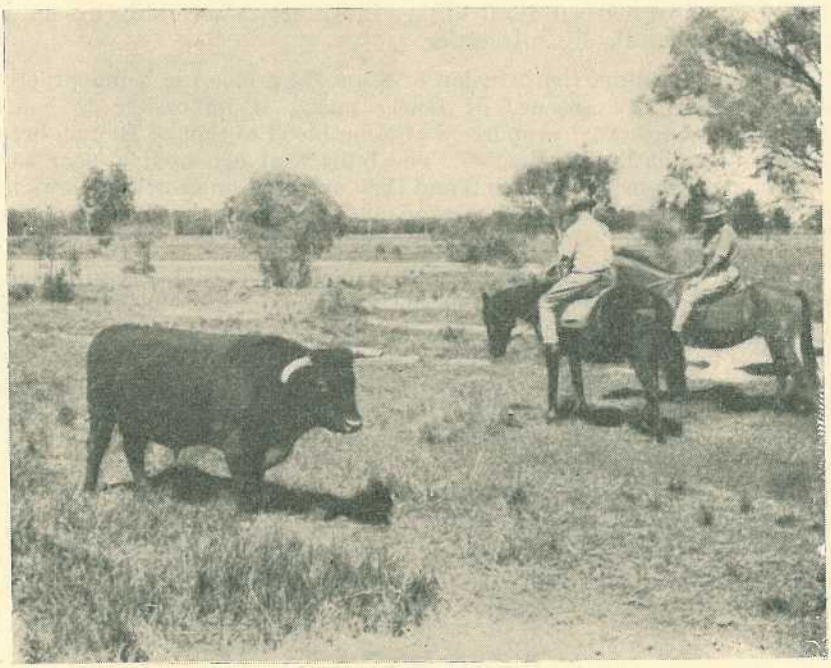


Plate 42.

A Stud Devon Bull on a Property on Which Herd Bulls are Bred for the Poorer Country.

In some of the Gulf coastal country, however, it seems to be the practice to breed the herd bulls on the place, and it is unusual to introduce any bulls. The principle of this method is that, by selection and culling, it is possible to develop a type or strain which has proved itself capable of flourishing (mere survival is not enough) in the particular environment. The success or failure of this method depends to a large extent upon the skill, knowledge and industry of the manager. Some of the cattle seen on a run where the method is practised were very good types of Devon-Shorthorn cross, indicating that the method has possibilities. However, with indifferent management, or breaks in continuity of policy, the system could degenerate into "mickey" and "scrubber" methods.

Spaying is practised fairly extensively. Spaying policy of directorates varies from time to time; it has been said to take the form of "spaying for age" without consideration of type and constitution, but a more rational policy is now operating.

It would be impossible to work the stations in this country without the reasonably adequate supply of aboriginal labour that appears to be available. Managers of holdings have a variety of duties to perform, and although some stations employ a book-keeper or a saddler, often the manager is also book-keeper, saddler, blacksmith and mechanic. Although there are some white stockmen on most holdings, occasionally one finds that all the stockmen are aborigines, with a half-caste in charge of mustering camps. These aborigines are mostly drawn from the Mission Stations, such as Mitchell River Mission.

One of the factors in successful management appears to be a knowledge and understanding of the practice of burning off. Although this practice is one which is the subject of much controversy in most parts of Queensland, all men in this part of the Peninsula seem to agree that burning off is a necessary part of management. It is realised that there are a number of generally undesirable features of burning-off, particularly the destruction of humus, and the creation of conditions suitable for soil erosion. Nevertheless, it is very likely that these do not operate in this area. There is no sign of soil erosion, and most managers try to get a "wet burn"—that is, they burn when there is a lot of moisture in the grass. In any case, it is significant that cattle prefer to feed on the burnt country carrying the green shoot and the best conditioned cattle are to be found on this type of feed.

On some of the best frontage country of the Gilbert, the feed is shorter and less rank than the average, and appears to maintain fair nutritive value beyond the usual limits. It is generally agreed that this particular type of country should not be burnt.

Cattle Turn-off.

The area is considered to be essentially breeding country and must be regarded as a reservoir from which stores are drawn to be fattened on better class country in other parts of the State. Except for the very few individual owners whose cattle are often bought by adjoining company stations, there is a regular movement each year from a particular breeding property to a particular fattening property. Breeding properties in the country of the Gilbert, Mitchell and Staaten Rivers are controlled by interests which hold fattening properties on the Saxby, Flinders and Leichhardt Rivers south of the Gulf.

The turn-off is fairly uniform from year to year, and though the actual numbers vary according to seasonal conditions, there is always some movement, and bad stock route conditions are rarely responsible for prevention of movement.

It was not possible, during the course of a brief visit to this vast area, to get an accurate idea of what annual brandings can normally be expected. The average expectation, however, in normal seasons, is approximately 25 per cent. brandings—that is, a place running 20,000 head expects to brand 5,000 calves. On holdings where young steers are removed from the general breeding herd, the managers expect about 30 per cent. brandings.

The total number of cattle in the area is below the figure which experienced men consider to be its normal carrying capacity. There were severe losses in the 1946 drought, and although these have not yet been made good, numbers have been increasing during the past few years and should almost be back to normal in 1951. There does not appear to have been any deterioration in the carrying capacity of individual properties and there is no evidence of a definite decline in cattle numbers.

INLAND KILLING AND AIR FREIGHTING.

Following the establishment of inland killing works at Glenroy in Western Australia, with air-freighting of carcases to Wyndham, a similar scheme for the Gulf and Peninsula was mooted. It was suggested that it may be possible to build works on the Gilbert or the Mitchell and air freight the carcases to Cairns, supplies of fat cattle to be obtained from stations in the Gilbert and Mitchell areas.

Investigation into this proposal revealed that, at present, it would have the following drawbacks:—

(i.) The country named as the source of fats is not suitable for fattening—it is breeding country, and any attempt to fatten on it would reduce its value as a reservoir of store cattle. It would not be possible to produce a killable beast under four years of age even with good seasons.

(ii.) At the ruling prices for store stock, the Gulf and Peninsula stations are receiving more for 3½-4 year old stores, station delivery, than they would get for 4-5 year old cattle killed at an inland works in the Gulf.

(iii.) The Glenroy venture has more chance of success than could be expected for a similar scheme in the Gulf, because Glenroy had no alternative outlet for cattle that would give comparable returns. The Gulf has an assured and profitable outlet for all the cattle that can be produced.

(iv.) Most of the country is held by pastoral companies which have controlling interests in breeding and fattening properties and substantial interests in export meatworks on the coast. It is hardly likely that the companies would alter their present programmes of breeding, fattening and marketing unless substantial financial benefit could be obtained. It is perhaps significant that when the Karumba works were operating, these companies maintained their major store cattle movements and sent only boners to the works. It is likely that the same thing would happen if an inland works were established. Some small owners may supply a limited number of fats and the company stations would supply some of their old cows as boners.

[TO BE CONTINUED.]

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.					
Day.	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	5.29	6.35	Cloncurry	57	42	Rockhampton ..	15	5
16	5.32	6.32	Cunnamulla ..	28	30	Roma	34	16
21	5.35	6.28	Dirranbandi ..	18	20	Townsville ..	18	16
26	5.38	6.23	Emerald	24	14	Winton	46	34
28	5.39	6.21	Hughenden ..	42	27	Warwick	3	5

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
		p.m.
1	..	1.56
	a.m.	
2	12.26	3.05
3	1.24	4.11
4	2.29	5.10
5	3.39	6.02
6	4.50	6.46
7	5.57	7.23
8	7.01	7.57
9	8.02	8.27
10	8.59	8.57
11	9.56	9.27
12	10.52	9.59
13	11.48	10.33
	p.m.	
14	1.24	11.12
15	1.41	11.56
16	2.36	..
		a.m.
17	3.28	12.44
18	4.16	1.38
19	4.59	2.35
20	5.37	3.35
21	6.12	4.34
22	6.45	5.34
23	7.16	6.33
24	7.47	7.32
25	8.19	8.32
26	8.54	9.35
27	9.34	10.40
28	10.21	11.48

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

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

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	28	10	44	25	19	0	52	28
6	27	13	43	28	18	3	51	31
11	15	24	31	40	6	15	35	46
16	9	31	25	46	0	22	26	54
21	14	26	29	42	4	17	33	49
26	25	14	42	29	16	4	48	33
28	30	11	45	25	20	0	53	28

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	51	5	65	34	49	20	42	6
3	56	2	68	32	52	17	46	3
5	54	7	67	35	51	21	44	8
7	43	18	60	43	45	27	36	17
9	32	29	52	50	36	35	26	25
11	20	40	44	58	29	43	18	34
13	11	49	38	63	23	49	10	41
15	3	56	34	67	18	53	4	46
17	2	57	33	68	17	53	3	47
19	7	53	36	66	20	51	7	44
21	16	45	41	60	26	46	14	37
23	27	34	48	54	33	39	22	29
25	38	23	56	45	41	30	32	20
28	54	6	67	34	51	20	44	7

Phases of the Moon.—New Moon, 6th February, 5.54 p.m.; First Quarter, 14th February, 6.55 a.m.; Full Moon, 22nd February, 7.12 a.m.; Last Quarter, 1st March, 8.59 a.m.

On 15th February the sun will rise and set 15 degrees south of true east and true west respectively, and on the 9th and 24th the moon will rise and set approximately at true east and true west respectively.

Mercury.—Still a morning object, in the constellation of Sagittarius, rising 1¾ hours before the sun at the beginning of the month and in the constellation of Aquarius, at the end of the month, rising ¾ hour before sunrise.

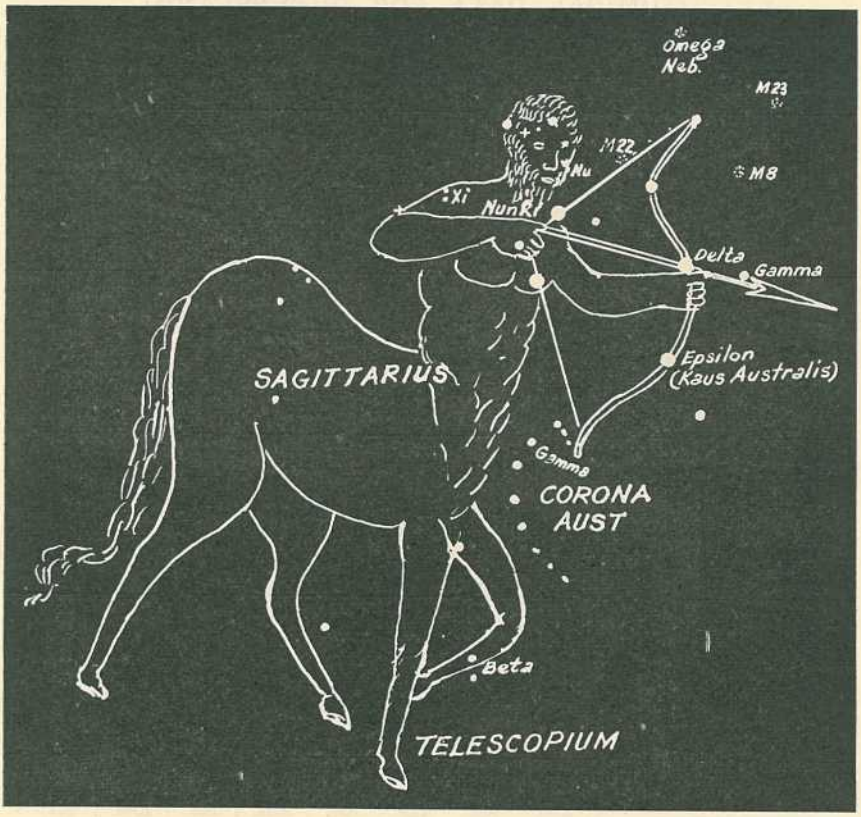
Venus.—In the constellation of Aquarius, at the beginning of the month, will set one hour after the sun and will pass Jupiter about the 11th and Mars about the 16th. By the end of the month, in the constellation of Pisces, will set 1½ hours after the sun.

Mars.—At the beginning of the month, in the constellation of Aquarius, will set about 1 hour 25 minutes after the sun, and after passing Jupiter about the 7th, by the end of the month, in the constellation of Pisces, will set 1 hour after the sun.

Jupiter.—Also in the western evening sky, setting 1½ hours after the sun at the beginning of February and ½ hour after sunset at the end of the month.

It will be interesting to watch the changing positions of Venus, Mars, and Jupiter during this month.

Saturn.—In the constellation of Virgo, at the beginning of February will rise between 9.15 p.m. and 10.30 p.m. and is now very suitably placed for observation. At the end of the month it will rise between 7.15 and 8.30 p.m.



THE CONSTELLATIONS.

Sagittarius (*The Archer*).—This is the most southerly constellation along the Zodiac and lies eastward of Scorpius; though it does not contain any first magnitude stars it adjoins the Milky Way and is very rich in faint stars, nebulae, clusters, doubles, &c. The Lagoon Nebula (M8), which is visible to the naked eye, is an indefinitely defined nebulosity, while Omega, or the Horseshoe Nebula, is a bright, large nebula shaped something like the figure "2." M22 is a bright globular cluster, about 15 minutes in diameter, which contains large ruddy stars; and M23 is an open cluster 47 minutes in diameter, with stars ranging from ninth to thirteenth magnitude. Both Delta and Epsilon are coloured doubles, while Beta is a wide double which can be seen with the naked eye. Gamma is also a double, one star being of fourth magnitude and the other of sixth magnitude. Xi and Nu are also naked eye pairs.

Sagittarius is shown as as centaur in the act of shooting an arrow from a bow, and the idea of a half man-half horse animal is said to have been developed from the wild race of men which inhabited Thessaly and who hunted on horseback.

In February the constellation rises about 3 a.m. and is seen as an evening object during the winter months, being on the meridian between 10 p.m. and 11 p.m. in July.

Corona Australis (*The Southern Crown*) adjoins Sagittarius and Scorpius, and is an unmistakable semicircle of fourth magnitude stars. Gamma is a binary of two fifth magnitude stars with a period of 120 years and is a good test for small telescopes.

Telescopium (*The Telescope*) is a modern constellation of small stars just south of Sagittarius and Corona Australis.