Queensland
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DEPARTMENT OF PRIMARY INDUSTRIES

Mr. K.G. Pegg, Senior Plant Pathologist, Department of Primary Industries, in a developing avocado plantation at Mt. Tamborine where lupins are being used in soil fertility studies to control avocado root rot.

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QUEENSLAND AGRICULTURAL JOURNAL

Contents

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Journal now every second month

QUEENSLAND primary producers will continue to receive their State farming magazine, the *Queensland Agricultural Journal,* which had been in danger of being discontinued, due to rising costs.

The Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) said today that the journal now would be published bi-monthly, instead of monthly.

'However, from the January 1975 issue,' he said, 'it will be twice the size of the monthly issue.

'The price will remain the same—a nominal $1 a year—although postage alone has risen to $4'.

Mr. Sullivan said the new journal would provide the same amount of information to farmers and graziers as previously and the quality of the material would be improved.

There would be new, coloured inserts which would help producers to identify and control weeds, pests and diseases of plants and livestock and to recognize and rectify deficiencies of minerals and fertilisers.

'In the *Queensland Agricultural Journal,* my Department has been publishing valuable information for farmers and graziers for about 80 years,' the Minister said.

'We are determined to maintain that flow in the face of rising costs.'

Mr. Sullivan added that the Department's quarterly technical journal, the *Queensland Journal of Agricultural and Animal Sciences,* would be consolidated into two six-monthly issues. The change would be made in March, 1975.

No reduction in annual content would result and the price would be unchanged.

Planning for drought

Water supplies and facilities

by Officers of Irrigation and Water Supply Commission.

GRANTED that long-term planning is desirable in developing the water resources on a property, the owner will find it necessary to base his plans on two main assessments.

These are, first, an assessment of the available water resources, which includes—

- Existing surface water resources such as creeks, excavated tanks and dams
- Run-off from catchments which can be directed to, and conserved in, constructed storages
- Existing bores and wells
- The potential for further development of underground water supplies.

The second is an assessment of the total water requirements for the most favourable utilization of the property.

The assessment of total water requirements is the sum of stock water supplies, domestic water supplies, and irrigation water supplies.

Stock water supplies should be sufficient to give stock on the following daily ration per head:

	Litres
Dry sheep	7
Ewes and lambs	9
Dry cattle	45
Cows with calves	90
Milking cows	90
Pigs	14
Horses	45

It is usual to provide domestic water supplies when the property homestead is being constructed, keeping in mind that the normal amenities of civilization: reticulated water supplies through the house, hot water service, septic systems, and water for lawns and flower and vegetable gardens. These are not considered to be luxuries. They are accepted as being essential to the welfare of those living on the property and charged with its proper management and development.

Provision for irrigation should be considered after the property has been developed as far as economically practicable under non-irrigated conditions.

This is a special form of development, and should be examined in consultation with men experienced in irrigation development: private landowners and/or officers of the Department of Primary Industries and of the Irrigation and Water Supply Commission.

Source of Supply

Water required for property development must necessarily come from any or all of three possible sources—

1. Streams.
2. Underground water in bores or wells.
3. Constructed surface storages such as excavated tanks, gully dams, hillside dams or ring tanks.

In most of Queensland, except where supplemented from Irrigation and Water Supply Commission storages, streams are of doubtful permanence and will not by themselves provide a permanent water supply.

Often, however, they are used as a source from which water is pumped into constructed storages to meet requirements when the stream fails.

Mostly, local experience will be sufficient to guide a landowner on the permanence of any stream to which his property may have frontage.

Information on bores is accumulating. This information must be provided to the Irrigation Commission for all bores constructed within certain proclaimed areas. From this data and information available about adjacent bores in areas outside the proclaimed areas, the Irrigation and Water Supply Commission can give a reasonably accurate assessment in most areas. The assessment is of the probable depth at which underground water may be obtained and of the quantity and quality of that water.

Such assessments, of course, can be only as good as the information on which they are based.

Where information from other bores is not readily available, reference to the available geological information of the area will enable an opinion to be given on whether test boring for water is worth while.

Rotary drilling plants make test boring economically practicable, provided the available knowledge of the area justifies a reasonable expectation of obtaining underground water.

Types of Water Storages

Constructed surface storages may be excavated tanks, gully dams, hillside dams or ring tanks. Ring tanks are usually used in irrigation projects and are filled by pumping from a watercourse.

Excavated tanks, hillside dams and gully dams are serviced by catchments, which must be suitable in area and characteristics to provide, under the rainfall conditions for the area, the requirements at that particular water point.

How Big?

These storages, for stock and/or domestic water supplies, must be big enough to meet the calculated water requirements over a predetermined period in which it may be expected that run-off will come from the catchment to replenish supplies. To this, it is necessary to add losses expected from seepage and evaporation.

The length of this period will be influenced by the rainfall pattern, the vegetable condition of the catchment and the nature of the catchment itself.

In an 'over 900 mm rainfall area', annual replenishment may be expected. In the 'under 500 mm rainfall areas', provision should be made for storage of at least 2 years' water requirements, allowing for evaporation and seepage losses.

Where the catchment has been sown down to improved pastures, experience is that run-off is substantially reduced. This, of course, is all to the benefit of the pastures, but the reduced run-off must be recognized in such circumstances by providing increased storage to last for a longer period without replenishment.

In the brigalow areas, it is considered that storage should be adequate for 2½ to 3 years without replenishment.

To keep evaporation losses to a minimum, depth of storage is an essential objective.

Location Factors

Normally, effective storage can be provided more cheaply in suitable gully dams than in excavated tanks, provided that, for the gully dam,—

- The material to build the embankment is obtained by constructing an excavated tank within the storage area in the bed of the gully.
- The embankment is constructed with proper regard for adequate compaction, fairly flat batters, an effective 'cut-off' under the embankment, provision of at least 1 m of freeboard above spillway level and provision of adequate spillway capacity. (A rough rule for estimating width of spillway

required for catchments of up to 200 ha is: width of spillway in metres equals twice the square root of the catchment area in hectares).

- A site is chosen that has a storage/excavation ratio of 4:1.

With storages for irrigation purposes, the objective should always be to seek a site having a high storage to excavation ratio, so that cost per cubic metre of water stored will bear an economically reasonable relationship to the value of the crop on which it has to be used.

Small crops, for example, can carry relatively high water costs and so it is not unusual to have small crops irrigated from excavated tanks that have a storage-excavation ratio of only 1:1. Pastures, on the other hand, give a much lower return per hectare, and so require much cheaper water, which can be provided by storages which have a high storage-excavation ratio.

In the drier parts of Queensland, it may well be economically practicable, at the appropriate time in the overall development of a property, to construct storages of very high storage-excavation ratio (as much as 30:1), to plant suitable crops on the rains that fill the storages, and to use the stored water to bring those crops to maturity for use as fodder reserves.

Water in storages of very high storage-excavation ratio is very cheap water, but it is also very vulnerable to loss by evaporation, so must be converted as quickly and as cheaply as possible into a more enduring fodder reserve or fodder supply.

While open storages or streams may be regarded as suitable water supplies in the early stages of the development of a property, the overall long-range plan must provide for reticulated supplies to all planned water points.

Need for Careful Use

Queensland cannot afford the wastage from the Great Artesion Basin which has resulted from distribution in bore drains. The only new artesian bores that are allowed to flow into bore drains are those which are replacing existing bores and then only when the existing bore is plugged and the flow restricted so that there is no increase in water use.

All other new bores now, and for some years, have been fitted with regulating valves. Water must be reticulated in pipelines, either direct to troughs or to storage tanks feeding troughs.

There is the same need to fence in surface storages and install pumping equipment, storage tanks and reticulation systems. The reasons are—

- To make the water much more easily accessible to stock at all times.
- To avoid having weak stock go down steep banks to boggy low water supplies and be unable to extricate themselves from the bog.
- To avoid pollution of the water supply, including pollution by dead stock or wild animals.

Moreover, a storage equipped in this way will last longer than one to which the stock have direct access.

How Many Water Points?

Water points should be located to meet the requirement of 'an adequate supply of good quality water easily available to stock at all times.'

The number of water points will be determined mainly by the subdivision of the property as demanded by management requirements.

With reticulated supplies, it is possible to take water wherever it is required, from a suitable source of supply, either existing or constructed, within economically acceptable distance.

Where paddocks are many square kilometres in area, water points should be located with the objective of having water within reasonable walking distance of any part of the paddock. This will ensure that the available feed is fully utilized; that none of it is beyond the distance stock can walk in time of drought.

Assistance Available

COMMONWEALTH GOVERNMENT. Certain concessions are available under the Income Tax Act for carrying out capital improvements for conserving and reticulating water.

Simultaneously with this, it must be accepted that the right time to carry out water supply improvements is in the good seasons. In this way, there is maximum benefit from reduced income tax.

In good seasons, too, soil conditions are most favourable for excavating tanks and dams. Contractors for constructing bores are more easily available than in drought time when there is a very heavy demand on their services. This applies equally to the supply and installation of equipment.

The landowner who has prepared his water supplies in the good seasons is free from any worry about them in the drought years, and can devote his whole time to feeding problems and management.

STATE GOVERNMENT. In 'The Farm Water Supplies Assistance Acts 1958–1965', the term 'farm water supplies' includes, by definition, water supplies for all primary industries associated with the land.

Under the provisions of these Acts administered by the Irrigation and Water Supply Commission, technical assistance and long-term loans by the Agricultural Bank are available for all works of improved water supply.

Such works include dams, excavated tanks, bores, pumping equipment, reticulation systems, and individual irrigation systems.

The Irrigation and Water Supply Commission has staff trained in farm water supply work located at district offices throughout the State. These men are available to investigate projects and prepare plans and specifications for landowners.

No charge is made for the investigation and for preparation of preliminary plans and specifications. Where such projects are satisfactory to the landowner, detailed plans and specifications are prepared for the landowner for a fee, usually 2% of the estimated cost of the work.

Loans available on the recommendation of the Irrigation and Water Supply Commission, through and with the approval of the Agricultural Bank, are long-term loans of up to 90% of the cost of the work, bearing normal Agricultural Bank rates of interest and repayable over periods ranging between 10 years and 20 years, depending on the nature and extent of the project. Advances on equipment are normally repayable over 10 years.

In many areas in Queensland, landholders have considerable difficulty in providing reliable 'on property' water supplies. In many of these areas it has been, and is, possible to provide Rural Water Supply Schemes under the provisions of 'The Water Acts'.

Such schemes may be established by the constitution of Water Areas and Boards, the construction of works by the Irrigation and Water Supply Commission or the Boards, the operation and maintenance of the Scheme and the levying of rates by the Board to cover operations, maintenance and capital repayment costs.

These schemes may take the form of—

1. Bore Water Supply Trusts to reticulate artesian supplies in pipelines.
2. Reticulation of surface water supplies through natural or artificial channels to fill surface storages on properties or, as in the Burdekin Delta, to recharge depleted underground aquifers.
3. Pipe reticulation under pressure from a central source of supply in relatively closely settled areas, particularly dairying areas, on scrub soils where both surface and underground supplies are frequently poor.

Most schemes in category 3 have, to date, received State Government subsidy only so far as works of general benefit are concerned. These are the works that comprise the Water Area, and for which the Board is responsible.

Works of private benefit on each individual property remain the responsibility of the individual landowner, and are eligible for assistance under the provisions of 'The Farm Water Supplies Assistance Acts'.

For advice on State Government assistance, both technical and financial, landowners should apply to the nearest District Office of the Irrigation and Water Supply Commission, or to its head office in Brisbane at P.O. Box 74, Brisbane, North Quay, Q. 4000.

Licensing of Water Facilities

ARTESIAN BORES. It is necessary to apply for and obtain a licence before beginning the construction of an artesian bore. When the

licence has been granted, the construction of the bore must be undertaken by a contractor licensed to carry out such work.

Bore logs must be forwarded to the Irrigation and Water Supply Commission for all such bores constructed. The information thus provided enables the Commission to build up the geological picture of the Artesian Basin and, from that, to help landowners with advice on prospects and problems in artesian supplies.

There is no advertising fee and no licence fee.

SUB-ARTESIAN BORES. Within proclaimed areas, it is necessary to apply for and obtain a licence before beginning the construction of a bore or well, except for domestic water supply.

As in the case of artesian bores, a bore log must be submitted to the Irrigation and Water Supply Commission for every bore constructed under licence.

At present the proclaimed areas include: the whole of the Great Artesian Basin; the Shires of Emerald, Bauhinia and part of Duaringa; the 'Brigalow III' Area; Pioneer Valley and Shire of Sarina; the Shire of Belyando; Bundaberg area; the Shire of Monto and the Callide Valley; the Darling Downs; part of the Shire of Thuringowa; the Giru area; the Shires of Bowen and Proserpine; and several minor areas.

This list does not fully define the boundaries of the areas, and the number of proclaimed areas is being added to frequently. Consequently it is advisable, when thinking of sinking a bore even in areas outside those listed, to inquire whether a licence is required.

Such an inquiry might well be combined with a request for advice on the prospects for success in such a bore.

There is no licence fee and no advertising fee.

PUMPING PLANTS. For pumping plants for stock and domestic water supply from streams, it is necessary to inform the Irrigation and Water Supply Commission of plant proposed to be installed. There is no fee and the Commission will issue and register a Permit under Section 9 of the Water Act.

In this way, the Commission has, with its record of other such permits and licences, a complete record of the commitments on each particular stream.

GULLY DAMS. It is necessary to obtain a licence from the Irrigation and Water Supply Commission before undertaking the construction of a gully dam. This is to protect the interests of the landowner proposing to construct the dam as well as the interests of other riparian landowners downstream from the proposed dam.

Such applications are advertised so that those landowners may know of the proposal, and have any objections investigated and dealt with by the Irrigation and Water Supply Commission and later, if necessary, by the Land Court.

A fee of $3.50 to cover the cost of advertising is the only charge made.

DIVERSIONS. Every diversion from streams for irrigation must likewise be the subject of an application to the Irrigation and Water Supply Commission for a licence before equipment is installed.

Here again, there is an advertising fee of $3.50.

The application is dealt with in the same way as for licences for gully dams.

Where the licence relates to diversion of water from an unregulated stream, there is no licence fee.

Where it relates to diversion of water from a stream in which the flow is regulated by a major storage, as distinct from a weir, the amount thus diverted is metered, and a charge is made for the water taken.

Applications for licences should be made to the nearest district office of the Irrigation Commission, or to its head office in Brisbane and, where an advertising fee is payable, this should accompany the application.

How to guard farm buildings against white ants

by N. W. HEATHER, Entomology Branch.

DAMAGE by termites (white ants) is the most likely cause of damage in the life of any farm building.

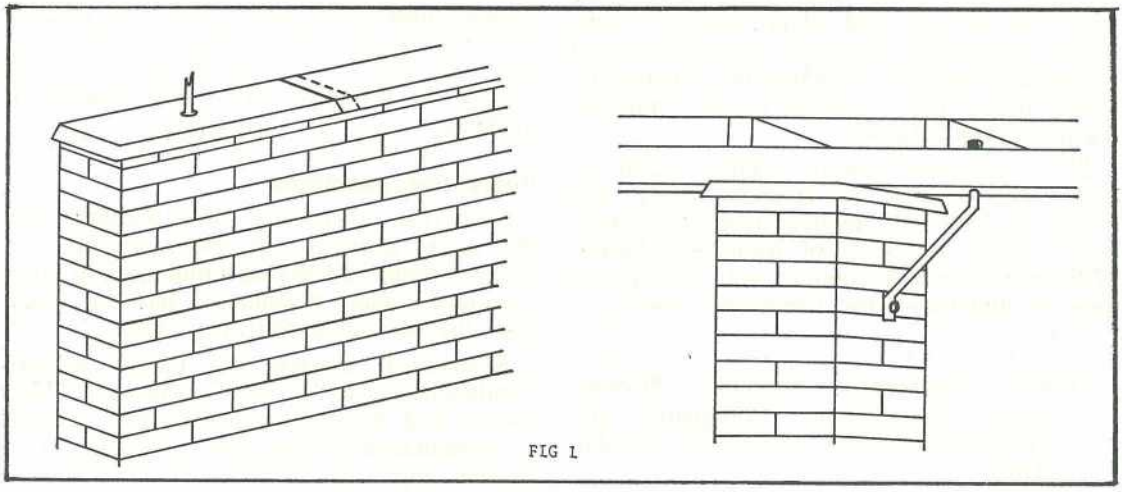
Incidence of attack varies from place to place and local experience is perhaps the best guide to the hazard at any place. It is only rarely that buildings are completely free of materials susceptible to termites, either as an integral part or as contents. Providing protective measures should be a normal procedure.

Termites are best excluded by means of a barrier system. Such barriers may be structurally impermeable and deny access physically or they may be chemical and repel or kill termites attempting to gain entry. Where barriers have been omitted or where breakdown has occurred there is often need of remedial treatments. Drywood termites cannot be excluded with barriers and require special control treatments.

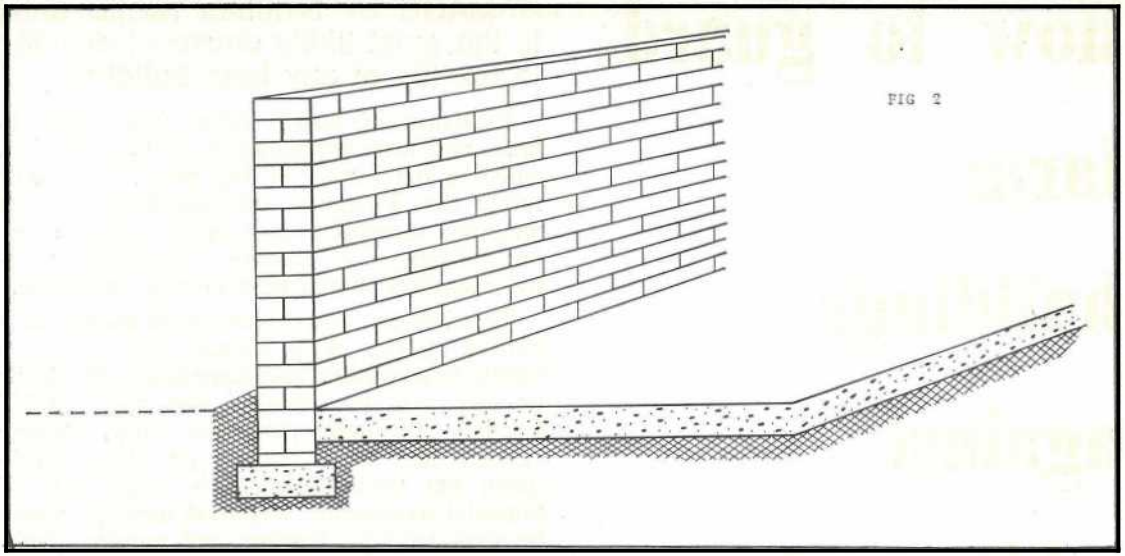
Pest species

The giant termite[1] is the most destructive pest species encountered in Queensland but is restricted to monsoon areas of north Australia. Where it occurs, damage is likely to be very

[1] Giant termite: *Mastotermes darwiniensis* (Froggatt)



Mechanical barriers for substructure walls and piers (figure 1).



The extent of a chemically-treated soil barrier under a concrete slab and around a wall and its footing (figure 2).

severe. One other subterranean termite* is a most serious pest in Queensland because of its wide ranging distribution and destructive habits. A third species[x] has similar habits but is less widespread. Only one drywood termite[y] is a pest.

Habits

Termites live as highly organized colonies in nests which range from highly specialized structures of soil and plant material (subterranean termites) to simple tunnels in wood (drywood termites). Colonies are founded by parent pairs which, in some species, may live for more than 20 years.

Nests of subterranean termites occur in trees, logs, stumps, or mounds. They can extend at least 100 metres from the central nest through a system of foraging galleries. With rare exceptions, contact with the ground must be maintained for a moisture supply.

Destruction of the central nest eventually kills all dependent termites in most species but the giant termite is an exception. Similarly, where access to the ground is broken, termites above the break will normally die. The time taken is related to availability of moisture.

By contrast, drywood termites live in galleries entirely within affected timber and have no contact with the soil. Colonies are always relatively small although numerous colonies may be present in close association. Infestations may be recognized most easily from the fine dry granular frass (excreta) present in galleries and often ejected by workers.

Preventive measures

ELEVATED BUILDINGS. For buildings with the main structure on piers or brick or masonry walls and having a minimum of 60 cm clearance under, mechanical barriers usually offer the best all round protection.

Mechanical barriers are placed to deny termites access to the building through hidden routes, and have downturned edges extended to minimum of 38 mm outwards (figure 1) to prevent bypassing. They are commonly made of galvanized iron of at least 26 gauge, but

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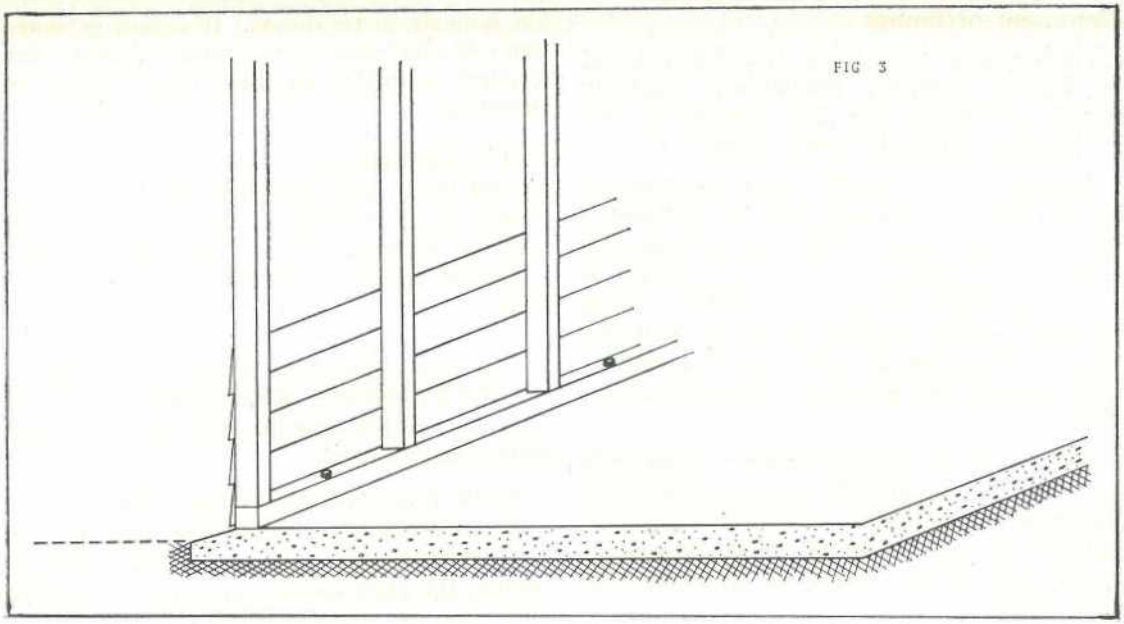
Common subterranean termites: **Coptotermes acinaciformis* (Froggatt) and [x] *Schedorhinotermes intermedius* sens.lat. (Hill)

[y] Drywood termite: *Cryptotermes primus* Hill



Zone of treated soil under a concrete slab supporting a wooden building (figure 3).

other materials such as copper, brass, stainless steel or aluminium may prove more suitable in special situations.

It is important for a barrier system to be complete at installation and to remain so. An understanding of the way they function makes for superior installation and a good barrier. Code of Practice CA50 of the Standards Association of Australia (which may be purchased direct from the Association) specifies suitable minimum standards of design and installation of these barriers.

CONCRETE SLAB. Buildings erected on a concrete slab are best protected by a barrier of chemically treated soil under and around the slab.

Materials recommended are—

aldrin	0.5%	as a water emulsion
BHC (lindane)	0.8%	as a water emulsion
chlordane	1.0%	as a water emulsion
dieldrin	0.5%	as a water emulsion
heptachlor	0.5%	as a water emulsion

Treatment of soil with any one of these solutions should be at 50 litres to 10 m^2 for surfaces and 175 litres to 1 m^3 for vertical sections (figure 2). This is designed to give a minimum barrier depth of 50 mm by soakage from the surface; vertical barriers should be 150 mm wide.

Sandy soils may require prior wetting for even penetration of solution. On sites where absorption of the required amount is not possible the rate may be decreased provided that the strength is increased proportionately.

Code of Practice CA43 of the Standards Association of Australia (also available direct from the Association) specifies minimum standards of installation and materials for this type of treatment in new buildings.

GENERAL. It will be seen that termites are favoured by dampness, so measures to promote dryness under and around buildings will act as a deterrant. These depend on ventilation and drainage.

Similarly, wood offcuts distributed through soil close to a building provide a food source which can attract strong termite activity. These are a threat to buildings and should be removed, as should falseworks and concrete form work which, in addition, could enable barriers to be bridged.

Treatment of timber

Timber to be placed into soil should be of the highest durability obtainable. Naturally durable timbers are the most economical, but are in short supply in many areas.

Treatments are available which can increase the durability of otherwise unsuitable timbers. Of these, the best is by vacuum pressure impregnation using either creosote or a copper-chrome-arsenate (CCA) salt mixture. Both are non-leachable when exposed but only the sapwood of hardwoods can be treated and not all softwoods can be totally treated satisfactorily.

The use of treated timber for a building is not usually a practicable means of ensuring protection from termites. However, it may be desirable in some situations for other reasons, such as prevention of decay or attack by drywood termites.

Remedial control measures

SUBTERRANEAN TERMITES. Detection of infestations is probably the most difficult aspect of termite control. A proper barrier system largely precludes this problem by ensuring that any infestation is easily apparent at the point of entry but subsequent additions to a building often negate a good initial installation. It is important to detect activity before damage occurs and frequent inspections for this purpose should become a routine maintenance practice.

Where activity is detected, the best procedure is to introduce a small quantity of arsenical dust into newly opened galleries in which termites are active at or near ground level. Dusts containing dieldrin, chlordane, DDT or BHC may be used but are less effective.

Continuity of the gallery system with the soil should be broken and this in itself will normally ensure the early death of all termites above the break. The procedure should be followed whenever activity is noted. If a secondary source of moisture is available the kill is likely to be slower. It should be noted that *Mastotermes*, the giant termite, can develop normally in this special type of situation.

It is sometimes an advantage to treat the soil around posts, walls or buildings as a barrier. It may be done using the method outlined for chemical barriers. Creosote may be used with advantage where it is desired to prevent decay also.

DRYWOOD TERMITES. Since drywood termites live in galleries entirely within wood and have no contact with the soil, barrier systems cannot deter attacks.

Small fragments of colonies can continue normal development, unlike the more specialised subterranean termites although *Mastotermes*, the giant termite, also has this faculty. Therefore, in the control of drywood termites total eradication of any infestation is essential.

The dry, granular frass of drywood termites is very characteristic, permitting ready identification. Damaged timber may be replaced as a more economical means of control where this can be undertaken conveniently, taking care to ensure that all infested boards are located and burnt.

Surface treatment with insecticides requires good penetration and a solvent which is active against termites, as it is not possible to obtain penetration of actual insecticide. Paraffin solvents such as kerosene are relatively effective in this way and dichloroethylether is particularly so.

The insecticide remains at the surface, preventing reinfestation and one having long residual life is best. Some of the insecticides commonly used in this role are pentachlorophenol, BHC, dieldrin and chlordane.

In summary, effective termite control consists of good preventive procedures, regular inspection for signs of activity and carefully applied remedial measures. The insecticides recommended are all persistent poisons but used as directed are safe and specific in their action.

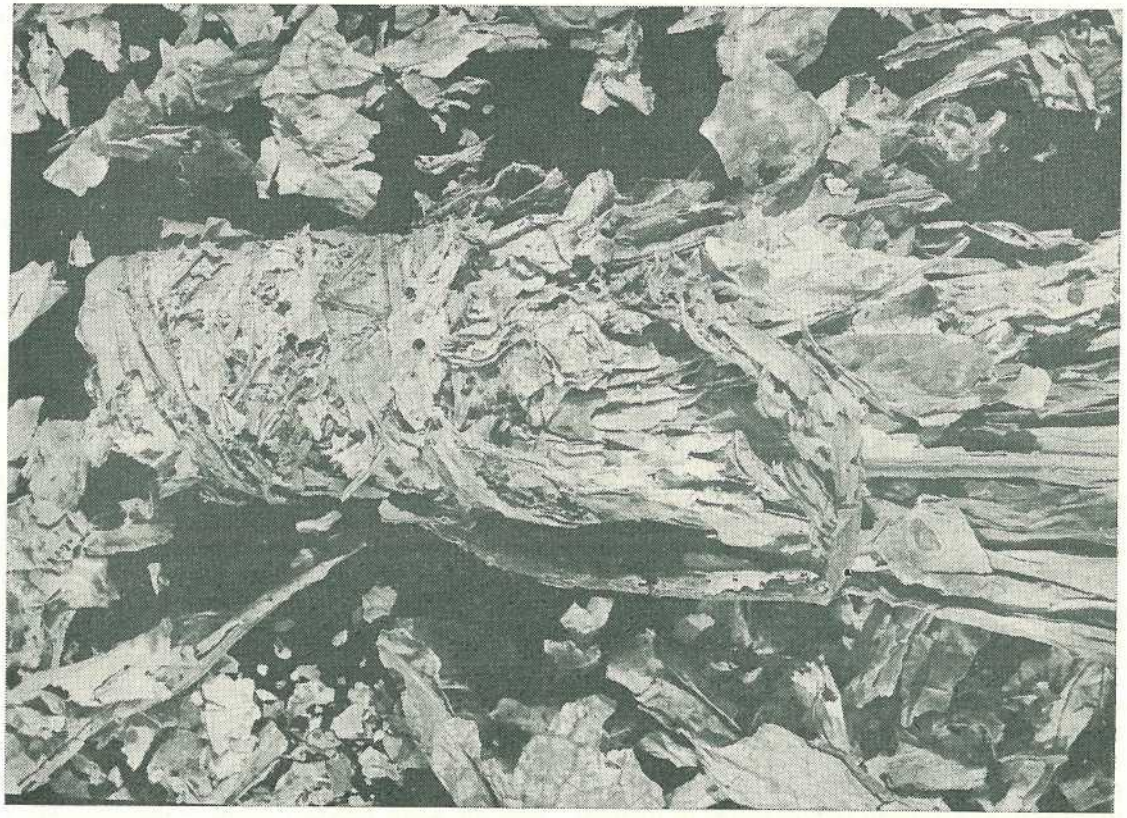
Tobacco beetle control

by N. T. CURRIE, Agriculture Branch.

AN ideal agent to destroy the tobacco beetle (*Lasioderma serricorne F.*) is one that can kill the insect at any of the stages of its life cycle, egg, larva, pupa and adult, without leaving harmful residues, or altering the taste, colour or texture of the tobacco.

In addition, such an agent must also possess a high degree of penetration and at the same time be safe to handle and economical to use.

Admirably fulfilling all of these requirements is Phostoxin,* a solid-form fumigant consisting of aluminium phosphide, ammonium carbamate and pharmaceutically pure paraffin. On exposure to moisture in the air,



Tobacco leaf damaged by tobacco beetle.

* Registered trade name.

Phostoxin slowly releases within 1 to 3 days, phosphine gas (PH_3) diluted and protected against spontaneous combustion by ammonia and carbon dioxide, both fire inhibitors. Phosphine is an extremely volatile gas with a density similar to that of air and readily penetrates through the most tightly packed and compressed tobacco.

Phostoxin is now in common use on tobacco farms in north Queensland, and it might be thought reasonable to assume that, with such an efficient fumigant, tobacco beetles would be easily controlled.

Unfortunately this is not so, and the reason for this is, among other things, the extreme penetrative ability of phosphine gas.

Farm bulking sheds were constructed for efficient storage of tobacco and were not designed for fumigation. In their present condition, they are simply not capable of containing phosphine gas at the concentration and for the period of time necessary, to bring about a **totally effective fumigation.**

A totally effective fumigation is one in which **all** stages in the life cycle of the tobacco beetle—adults, larvae, pupae, eggs and **young** eggs are destroyed. A **partially effective fumigation** destroys only the adult beetles and a proportion of the larvae.

Currently, the industry accepts that a satisfactory level of control has been achieved if bales of leaf at the time of sale are free from live adults and larvae of the tobacco beetle.

Under the conditions of sale laid down by the Australian Tobacco Board and therefore accepted by farmers, farmer organizations and manufacturers, no reference is made to viable beetle eggs or pupae. These are two stages in the life cycle of the tobacco beetle which are very much more difficult to destroy, than is the adult stage.

With the possibility that a higher level of efficiency in control of the tobacco beetle may well be required of tobacco growers in the future, it was considered that a close investigation of the situation was warranted. Information stemming from this investigation is available to farmers. They may now be prepared in advance and thus be in a position to meet more stringent requirements in tobacco beetle control should this be required of them.

The current recommendations for fumigating with Phostoxin, based on experiments carried out in the U.S.A., were found to be inadequate under local conditions in north Queensland. In addition, many of the sheds in this area were demonstrated to be totally unsuitable for fumigation purposes, even at very high and uneconomical dosage rates of Phostoxin.

In a series of exhaustive tests, the correct dosage rate at which to fumigate the better class of shed has been determined. In addition, a method to convert those sheds totally unsuitable for fumigation into efficient fumigation chambers was worked out during the tests and demonstrated to be highly effective.

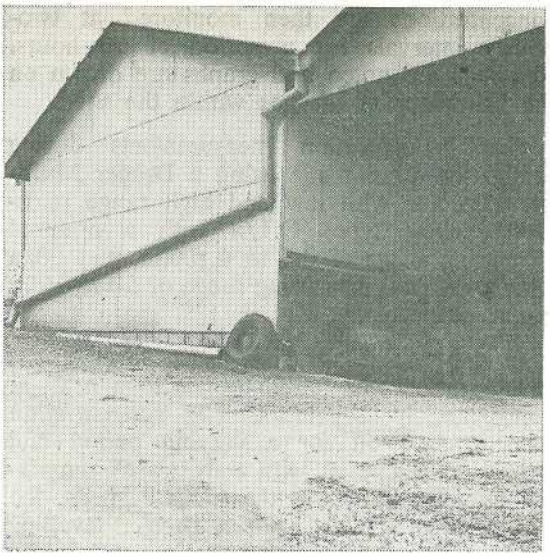
At this point, it must be emphasized that the tests which were carried out refer only to fumigations conducted in bulk sheds in which the effectiveness of the **shed** as a fumigation chamber was being tested. The results do not refer to fumigations conducted inside plastic sheet 'cocoons' within the shed. A plastic 'cocoon', properly sealed and with the correct dosage of Phostoxin tablets, will invariably result in a totally effective fumigation.

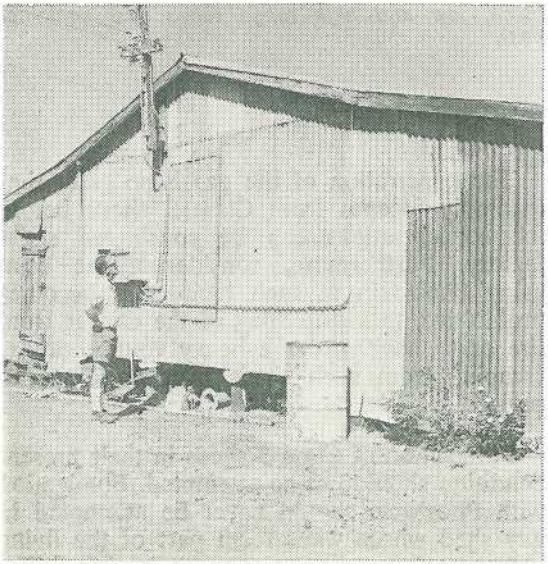
To destroy the tobacco beetle, the insect has to be exposed to a concentration of phosphine gas for a number of hours. The number of hours varies according to the concentration of gas within the shed and this concentration depends on how effectively the shed is sealed and the number of Phostoxin tablets being used in relation to the volume of the shed.

To the scientist, this gas concentration during a number of hours is known as a **Concentration-by-Time product** (CxT) product. From laboratory experiments, the CxT product required to kill each stage in the life cycle of the tobacco beetle has been determined.

The CxT product necessary to kill the adults, larvae, pupae and eggs is respectively 1600 p.p.m. hrs., 4 800 p.p.m. hrs., 5 600 p.p.m. hrs. and 5 600 p.p.m. hrs. However, to kill **young eggs** it is necessary to achieve a CxT product in excess of 50 000 p.p.m. hrs. That is, approximately 10 times the CxT product required to kill all other stages.

From a study of these figures it is obvious that the adult tobacco beetle stage, that which is most easily identified, is also the stage in





TOP LEFT. Class 1. A shed of new construction, solidly built and well sealed.

TOP RIGHT. Class 2. An older shed of good construction and reasonably well sealed.

BOTTOM. Class 3. An old and ramshackle shed incapable of effectively containing phosphine gas.

the life cycle which is easiest to destroy. Indeed, all farmers who use Phostoxin are successful in destroying **adult** beetles. But the **other stages** in the life cycle of the beetle which are **not** being destroyed, having survived the fumigation, will develop into adults to infest the tobacco and so the process continues relatively unchecked.

The effectiveness of any fumigation in this area depends mainly on the class or type of shed being fumigated. For the purpose of this investigation, farm bulk sheds have been classified into three classes. These are—

CLASS 1. A shed of new construction, soundly built and well sealed.

CLASS 2. An older shed of good construction and reasonably well sealed.

CLASS 3. An old and ramshackle shed, incapable of effectively containing phosphine gas.

During the tests, sheds from each class were selected and each shed was tested using varying amounts of Phostoxin tablets. Tablets were distributed evenly throughout the shed, which was then sealed as completely as possible. Sealing is done with good quality masking tape around doors, windows and over all cracks and holes. Plastic tubing, 6.35 mm I.D., is led from the centre of the shed through a hole bored in the floor to the outside, and gas

concentrations are then monitored at two-hourly intervals for a period of 96 hours. Readings are noted and graphs are drawn on the behaviour of the gas within the shed.

Gas concentration measurements during fumigation were made using a Drager Multi-gas Detector with low and high range phosphine tubes; types O.1/a with a nominal measuring range of 0.1 to 4 p.p.m. and 50/a with a nominal measuring range of 50 to 1000 p.p.m. respectively.

In a typical Class 1 shed, the level of gas concentration was found to rise to a peak in approximately 30 hours. The concentration then levelled off for a varying period and gradually dissipated with only traces remaining after 96 hours. In the Class 2 sheds, the pattern was similar, with a shorter levelling off period and accelerated dissipation. In the Class 3 sheds, the behaviour of the gas concentration was extremely erratic, rising and falling violently according to temperature and wind changes outside of the building.

Initially in the tests, 20 tablets per $28m^3$ were used. This was the recommendation originally given to farmers with the proviso that the shed be effectively sealed; this recommendation was based on experimental work carried out in the U.S.A.

If it were possible to seal the sheds effectively, this recommendation would indeed result in effective fumigations. However, **no** shed in this area is capable, in its present condition, of achieving a CxT product of 50 000 p.p.m. hrs. or anything remotely approaching that figure. So, for the moment, we will accept a CxT product of 5 600 p.p.m. hrs. as being satisfactory. (This will destroy all stages in the life cycle of the Tobacco Beetle **with the exception of the young eggs).**

The sheds were tested again, using progressively higher dosage rates of Phostoxin in each case until satisfactory results were obtained. In Class 1 sheds, this was found to be 30 tablets per $28m^3$ and in Class 2 sheds, 40 tablets per $28m^3$. In Class 3 sheds, rates as high as 80 tablets per $28m^3$ were tried and, although the CxT product of 5 600 p.p.m. hrs. was achieved in one case, results from Class 3 sheds cannot be considered to be satisfactory.

Drager Multi-gas Detector Kit (pump with tube in place, low and high range tubes and container box).

The penetration of the gas is so great that it simply escapes from Class 3 sheds before the concentrations can be considered satisfactory. Furthermore, considering the cost, using Phostoxin at such high rates becomes prohibitive, to say nothing of the danger from fire or to health from a heavy volume of gas escaping from such sheds over an extended period.

Fumigation of Class 3 sheds in their present condition should not be attempted. Fumigation with Phostoxin should never be attempted in **any** shed whose walls form part of the living quarters of people working on the farm. The gas can easily penetrate a solid wall and may seriously harm a person sleeping near by.

The problem of the young eggs still remains. To destroy these eggs and thus achieve a **totally effective fumigation** in sheds of Class 1 and Class 2, it is necessary to fumigate the shed again, 10 days after completion of the first fumigation. During the 10 days between fumigations, the young eggs will hatch into larvae which will be destroyed in the second fumigation.

The question of costs must be considered at this point. Take as an example a farmer who wants to fumigate tobacco in a Class 2 shed, measuring 12 m x 12 m x 3 m (432 m^3). If this farmer follows the recommendation to fumigate once, and then a second time 10 days after the first fumigation is completed, he will achieve a totally effective fumigation and destroy all tobacco beetles in all stages of their life cycle. But he will have used 1 280 tablets of Phostoxin costing approximately $157. Many farmers fumigate on two separate occasions during the year, so the cost in controlling tobacco beetles to this particular farmer would then amount to $164.

At the present time, when farmers are very conscious of production costs, such a charge for fumigation is unacceptable.

However, a simple yet effective solution has been found to this problem, which not only reduces such fumigation charges by 60%, but also makes it possible to carry out **totally effective fumigations** in **all** sheds including those of Class 3.

All that is necessary to convert an old ramshackle Class 3 shed to a first class fumigation chamber, is to line the shed throughout with plastic sheeting on the walls, floor and ceiling. A Class 3 shed treated in this manner is then far superior, for purposes of fumigation, to the most modern well constructed bulk shed not lined with plastic sheeting.

The recommendation for a shed lined with plastic sheeting, irrespective of the class of shed, is **one fumigation** at a dosage rate of 30 tablets per 28m^3. This will result in a **totally effective fumigation.**

A simple graph illustrates vividly the improvement in fumigation efficiency which can be achieved by lining a bulk shed with plastic sheeting. See page 593.

It can be seen that, at the end of the 96-hour period, all gas had escaped from the Class 1 shed, whereas the plastic lined Class 2 shed still contained a very high concentration of gas. Virtually no gas escaped from this shed.

What does it cost to line a shed with plastic sheeting? Assuming the average height of sheds to be 3 m, a small shed measuring 3 m x 3 m (27m^3) will cost approximately $8. A medium sized shed measuring 6 m x 9 m (162m^3) will cost approximately $24 and a large shed measuring 12 m x 12 m (432m^3) will cost approximately $54. These costs include the price of the glue required to stick the plastic sheeting to the walls, floor and ceiling.

Plastic sheeting 2.25 m in width can be purchased for approximately 20c per metre. With reasonable care, such a lining will last for years.

In addition to ensuring totally effective fumigation, lining a shed with plastic sheeting brings about a very real saving in fumigation costs. Details are shown in Table 1.

Bearing in mind that to achieve a **totally effective fumigation** in a shed which has not been lined with plastic, **double fumigations** are necessary and that subsequent to lining with plastic sheeting, a **single fumigation** will suffice, the following table clearly illustrates the considerable savings effected by lining a Class 2 shed with plastic sheeting.

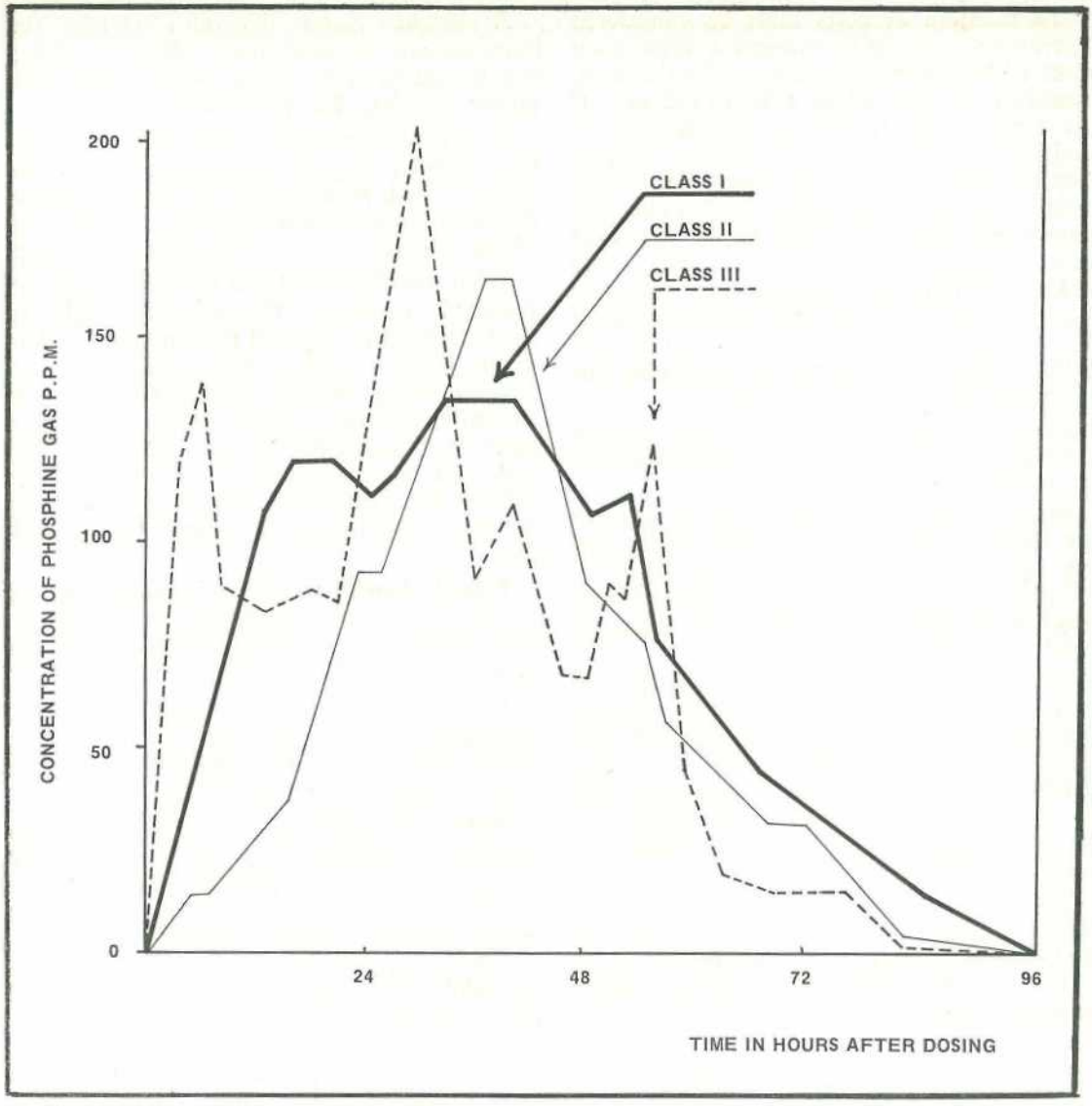
TABLE 1

Shed size in m^3	Tablets Double Fumigation	Cost of Tablets*	Cost of Plastic Lining	Tablets Single Fumigation	Cost of Tablets*	Savings per Fumigation
		$	$		$	$
30	80	9.84	8	30	3.70	6.14
170	480	59.20	24	180	22.20	37.00
450	1 280	157.87	54	480	59.20	98.67

* September 1974.

It will be seen that the cost of lining the shed with plastic sheeting will, in most cases, be largely recovered in savings in Phostoxin costs at the first fumigation. Where a farmer fumigates twice in one year, the savings in the last column will be doubled.

Further tests were carried out with the dual purpose of testing the effectiveness of the plastic sheeting itself and to find out how rapidly an effective fumigation could be achieved in a plastic 'cocoon'.



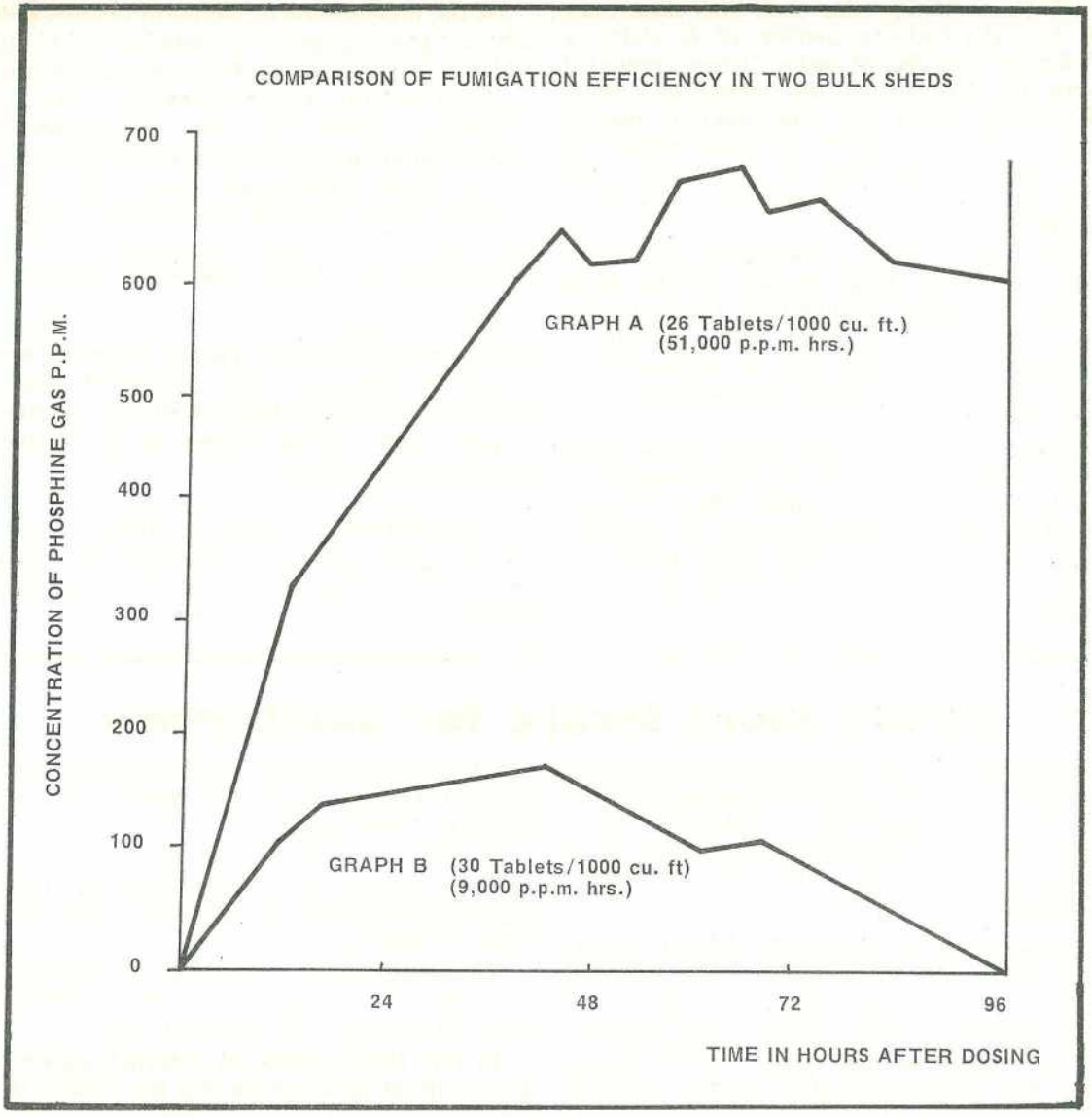
Class 1 shed—30 tablets per 28 m³—CxT product 7 045 p.p.m. hrs.

Class 2 shed—40 tablets per 28 m³—CxT product 5 700 p.p.m. hrs.

Class 3 shed—80 tablets per 28 m³—CxT product 6 140 p.p.m. hrs.

Occasions arise when a farmer finds it necessary to fumigate a number of bales of tobacco urgently. Bales may be wrapped in a cocoon of plastic sheeting and Phostoxin introduced into the cocoon. This is a very effective method for fumigating small lots of tobacco bales.

Two grades of plastic sheeting were tested: heavy (0.2 mm) and light (0.1 mm). Both grades gave excellent results. In the test under



GRAPH A. A class 2 shed lined with plastic sheeting. Using only 26 tablets per 1 000 ft³ (28 m³) a CxT product of 51 000 p.p.m. hrs. was achieved. This was totally effective fumigation.

GRAPH B. A class 1 shed. Using 30 tablets per 1 000 ft³ (28 m³) a CxT product of 9 000 p.p.m. hrs. This was only partially effective fumigation.

heavy plastic, the dosage rate was 50 tablets per 28 m³ and a CxT product of 126 358 p.p.m. hrs. was achieved in 96 hours. Under the light plastic, the dosage rate was 190 tablets per 28 m³. In this test, it was not possible to measure the total CxT product because the concentration of gas within the cocoon went far beyond the range of the Drager Multigas Detector.

The reason for using such high dose rates is that the cocoons contain, of necessity, a fractional volume of space, when compared with that contained in the interior of a shed. Phostoxin tablets are obtainable at present only in minimum lots of 30, which means that 30 tablets or multiples of 30 must be used however small the volume of space being fumigated.

The dosage rates in fumigating cocoons is often extremely high and loss of gas from within a cocoon is minimal. Consequently, great care must be taken when opening a cocoon. The operator may be exposed to a sudden release of highly concentrated, toxic and inflammable gas.

Insufficient tests have been made with cocoon fumigation as yet for recommendations to be given on the minimum time in which a totally effective fumigation can be achieved under these conditions, but initial indications are that the time can be shortened by at least 50%.

At the present time in the north Queensland tobacco growing areas, a situation exists in which a large quantity of over-quota tobacco is stored on farms, with no immediate prospect of disposal. There is an active tobacco beetle population in the area and standards of hygiene in and around buildings on tobacco farms are far from ideal. Each of these factors considered alone gives cause for concern. Together they add up to a highly undesirable situation.

Tobacco beetle populations can be drastically curtailed if every farmer improves his fumigation techniques. Any fumigation which falls short of being **totally effective** is unsatisfactory, costly and encourages an undesirable situation to continue.

The assistance of Messrs. E. Gilbert and P. Tonello, from Southedge Tobacco Research Station, in carrying out this work, is acknowledged.

Future more secure for poultrymen

THE egg industry in Queensland can look forward to a more secure future as a result of the State Government's support for a scheme to regulate egg production to a level more consistent with domestic demand.

Stating this, the Minister for Primary Industries (Hon. Mr. V. B. Sullivan, M.L.A.) said that the scheme would provide a more stable environment for both producer and consumer.

The system of hen quotas in Queensland had been determined after lengthy consultation between Departmental officers and industry leaders.

In Queensland, the scheme was embodied in the Hen Quotas Act 1973, introduced by the Government in March 1973 following representations from the egg industry and agreement by all States at the Australian Agricultural Council.

The proposal to introduce the scheme in Queensland received the industry's overwhelming support when, at a poll of growers, 78% voted in favour of its introduction.

Mr. Sullivan said that the Queensland Hen Quota Committee had now notified all egg growers of their quotas.

An Appeals Tribunal had been appointed and was hearing appeals from producers who might be dissatisfied with decisions of the Hen Quota Committee.

'The circumstances in which the industry found itself before introduction of the scheme were catastrophic,' the Minister said.

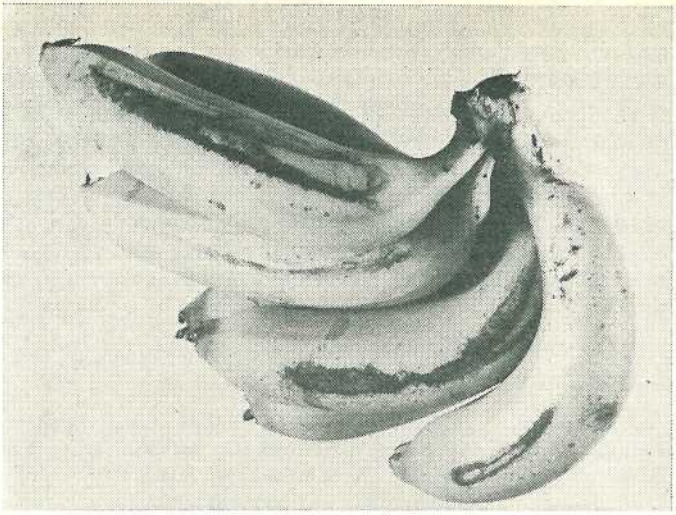
'In July 1972, returns on exported egg products were at rock bottom and the Australian stockpile of egg pulp was around 17 000 tons, more than a year's normal sales and with production still rising.

'Export prices would not even meet processing costs, let alone provide any return to the producer.'

Mr. Sullivan added that introduction of the quota scheme had transformed the industry from one which ranked among the most vulnerable of all primary industries to one which, with the co-operation of producers, had every prospect of being among the most stable.

Banana rust thrips in north Qld.

by B. A. FRANZMANN, Entomologist.



Rust thrips damage on banana fruit.

BANANA rust thrips has been recorded as a major pest of bananas in all banana-growing areas on the Australian east coast since the turn of the century.

All efforts to control the insect have been concerned with applying insecticide onto the fruit where the feeding stages of the thrips occur. However, it is apparent that, during approximately the last 10 years, rust thrips populations in commercial banana plantations have declined markedly.

Observations indicated that low populations coincided with and may have been because of the general introduction of dieldrin butt sprays for controlling banana weevil borer.

Results from recent trial work in north Queensland have confirmed that dieldrin butt spraying eliminates the necessity of applying specific treatments to bunches for rust thrips control.

Rust thrips damage

On the fruit, larvae and adults tend to congregate in colonies at the points of contact between adjacent fruit. They feed more or less within the boundaries of the colonies and therefore the damage is usually localized.

The damage may first appear on very young fruits as slightly reddish-brown, water-soaked areas. This is followed by a smoky discoloration, after which the red colour of the typical rust makes its appearance. As the fruit ages, the red colour tends to turn brown and to black.

Moderate thrips attack, although seriously reducing the market value of the fruit, does little or no harm to eating quality as the injuries are more or less superficial. However, with the filling out of the fruit, the damaged skin may crack along the length of the finger. In badly damaged fruit, the skin splits from end to end exposing the flesh beneath.

Thus the damage associated with thrips shows all gradations from simple discoloration of the fingers at the contact surfaces to discoloration over the whole surface plus cracking of the skin.

Rust should not be confused with another red skin blemish called bronzing. This blemish has been very common in north Queensland during the last few years. The cause of bronzing is not known though it is now generally thought to be of physiological origin.

Bronzing begins as a pale, straw-coloured smear along the middle of the outer curve of the almost-mature, green fruit. The area

affected deepens rapidly in colour to bronze and ultimately may become corky and crack along its length.

In north Queensland, its spatial distribution on the bunch is very regular. Bronzing is heaviest on the top hands of the bunch and gradually decreases in severity towards the bottom hands. Similarly, it is generally heaviest on the outside wing fingers of each hand and gradually decreases in severity towards the middle.

Appearance and life cycle

Eggs of the banana rust thrips are most commonly laid in the soft tissues of the pseudostem and in the fruit. A few are sometimes laid elsewhere on the plant but they are never laid in the corm. The oviposition site is usually unmarked in any way. The duration of the egg stage is about a fortnight.

On emergence from the egg, the nymph pushes its way through the surface of the plant tissue. The nymph is slender, with the same general shape as the adult; but it is smaller, white in colour and without markings. This stage occupies about 1 week.

The full-grown nymphs leave the plant and pupate at shallow depths in the soil. Pupae are not commonly found on any part of the plant.

After emerging from the soil, the adults presumably make their way to a nearby host, though whether by flying or walking is not certain. The adult is between 1 and 2 mm long. Its colour is yellow, with two dark spots on the back towards the anterior end of the body. The folded wings form a fine, longitudinal black line down the middle of the back.

Mating may occur within a few days after emergence but it is not a necessary prerequisite for the production of offspring. Adults usually live for about 1 month although life spans of almost 3 months have been recorded. Females live considerably longer than males and lay eggs almost continuously until death.

This description should serve to distinguish the rust thrips from other thrips found on bananas.

The banana flower thrips, which causes corky scab in south Queensland, does little or no damage in north Queensland but is often found on young bunches. The male is roughly the same colour as the rust thrips but lacks the conspicuous dark markings. The front half of the body of the female is orange and the abdomen is black. The nymph in both sexes is glistening white when newly hatched, becoming red as it grows.

This thrips inhabits the bracts, flowers and young fruit of developing bunches. Unlike the rust thrips, it is not found on fingers which have lost their covering bract.

Control

In existing plantations, the recommended treatment for controlling banana weevil borer, butt-spraying with dieldrin, keeps rust thrips numbers below the level required for economic damage.

The recommended rate of application is 500 ml of 0·05% dieldrin per stool. The base of the plant, the suckers and the soil for 30 cm around the base should be sprayed. Treatment should be repeated each year.

Paring, trimming and hot water treatment of planting material as prescribed for banana weevil borer and nematodes also cleans thrips from this material and prevents or hinders spread to new areas.

Scientific names of the pests discussed are:—

Banana rust thrips *Chaetanaphothrips signipennis* (Bagn.)

Banana flower thrips *Thrips florum* Schmutz.

Banana weevil borer *Cosmopolites sordidus* Germar.

Litchi finds a new home in Queensland

THE litchi (*Litchi chinensis* family Sapindaceae) originated in a small area of subtropical southern China where it has been cultivated for more than 2 000 years.

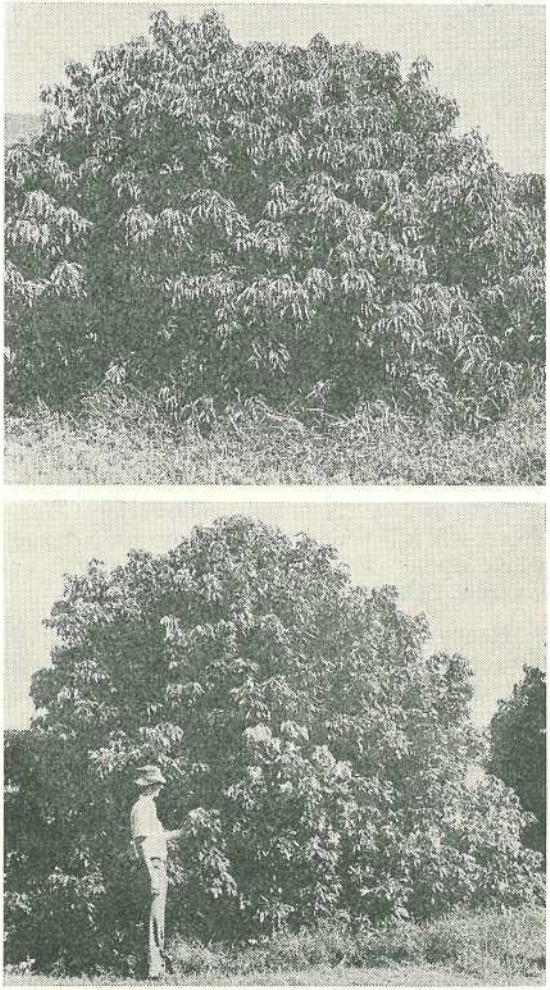
Introductions of the litchi into Australia have been made by both the Chinese and Europeans for more than 100 years. Several commercially useful varieties are available and bearing trees are found from Cairns to the New South Wales border.

The litchi is a compact, densely foliated, dome-shaped tree carrying branches to ground level. Trees reach a size comparable with the mango and well grown specimens attain a crown diameter of 12·2 m at 25 years of age.

Air-layered litchi trees will bear fruit 3 to 5 years after planting, and good yielding trees over 30 years old have produced up to 200 kg in north Queensland.

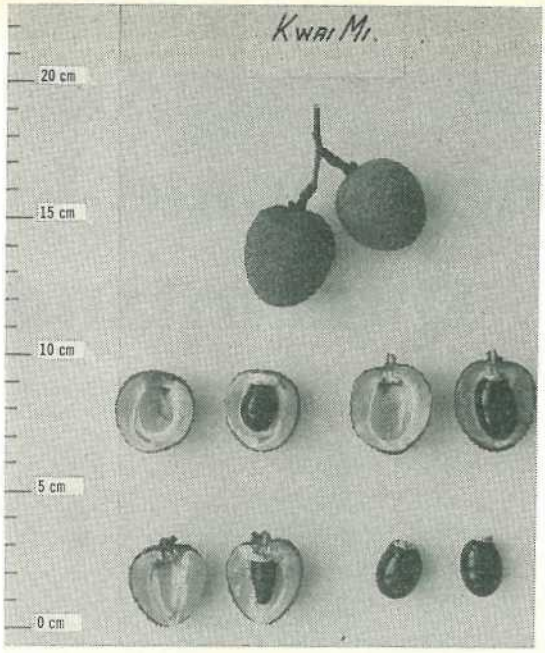
The fruit, which is produced in loose clusters of 20 or more, is conical to heart-shaped and up to 4½ cm long. The skin is hard and brittle and covered by many small protuberances which give it a very rough surface. The colour when ripe is deep red with a trace of yellow showing in some varieties.

The edible part, called an aril, is thick, fleshy and separates freely from the skin and seed. It is similar in colour and texture to grape flesh: sub-acid to sweet, juicy and flavoursome. The quality and flavour is of such a high grade that the fruit is becoming increasingly popular as more and more people become aware of it.



Two 7-year-old trees: Kwai Mi (top) and Brewster (bottom).

by B. W. CULL and F. D. HAMS, Horticulture Branch.



Fruit of the Kwai Mi variety, the earliest maturing litchi now grown in Queensland.

Climate and distribution

The litchi is best adapted to a subtropical climate. It thrives during hot, moist summer periods and warm, dry springs. A cool temperature, but not below 0°C, is required during autumn and winter to induce flowering. Heavy frosts will kill young trees and severely damage older ones. Established trees, however, can tolerate light frosts.

Heavy rain or misty conditions during the flowering period can reduce the crop, while hot, dry, windy conditions cause flower drop.

The distribution of the crop is limited by these climatic factors. Cairns is considered the northern limit and erratic bearing is a feature in this coastal area. More suitable areas are those which consistently receive cool winters without frost. These include protected areas from Bundaberg to the southern border of the State. Pockets in the drier areas north of Bundaberg, including near coastal tablelands, are also suitable, if close attention is given to moisture relations and protection from strong winds.

Varieties

The most common varieties of litchi found in north Queensland are Kwai Mi, Brewster, Wai Chi and Bedana. Mauritius, Haak-Ip and No Mai Chi are other varieties of minor occurrence.

The availability of planting material has in the past governed the distribution of varieties more so than their acceptibility. In addition, not a great deal is yet known about varietal performance outside of coastal north Queensland. Hence, when planting trees in other districts, varieties of minor occurrence are worthy of trial, in conjunction with the common varieties.

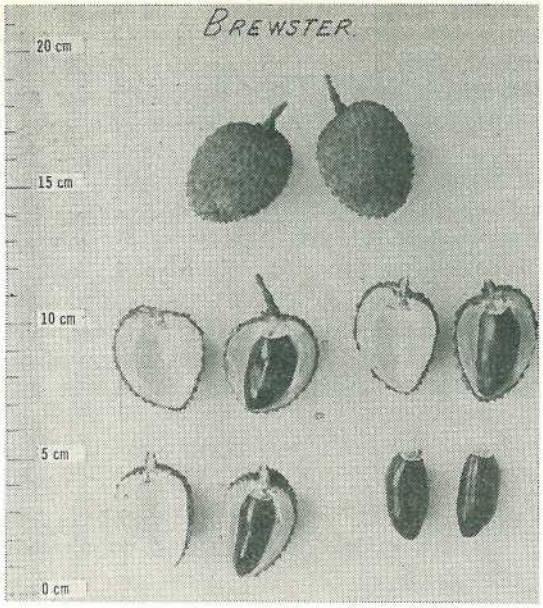
KWAI MI. Kwai Mi is the earliest maturing litchi now grown. In the Cairns area, it flowers from late June to early July and the fruit matures from late October to early November. The fruit is broad at the stem end, rounded at the apex, and roughly heart-shaped. The skin colour is light red when the fruit is ready to harvest.

The flesh is then firm and pleasantly sweet-acid in flavour. When the fruit is fully ripe the skin darkens in colour and the flesh becomes sweeter. Over-mature fruit is flatter in flavour. Fruit averages about 27 per 454 g.

The seed is medium sized and a slightly-flattened bullet shape. About 10% of the seed in fully developed fruit may be shrivelled and are known as 'chicken tongue' seed. Fruit with abortive seeds are preferred as they contain a larger proportion of flesh.

Kwai Mi trees are vigorous and spreading, and branches curve upwards towards the tip of the branch. The crotches of the tree tend to be weak. The leaflets of the Kwai Mi are glossy dark-green, smooth surfaced, and have an upward curl from the midrib to be virtually canoe-shaped. The average size of the fully-formed, mature leaflets is 13·6 cm by 3·9 cm giving a ratio of length to breadth of 3·5:1. Leaves can grow to 19·0 cm by 6·3 cm.

BREWSTER. This is a mid season variety. In the Cairns district, it flowers in early July and the fruit matures between late November and early December. The fruit is large, cone to wedge-shaped, and red when ripe. The flesh is softer but more acid in flavour than that of



Fruit of the Brewster variety.

Kwai Mi. When fully mature, the fruit tends to maintain its acidity and flavour for a longer period. Fruits average 20 per 454 g.

The seed is large and keel-shaped. Under poor growing conditions, especially moisture stress, the seed, when mature, may not be fully covered by flesh at its pointed end. The main disadvantage of Brewster is its large seed.

The trees are vigorous, with most branches growing in a semi-upright manner to form a medium-sized compact tree. The leaves are glossy and a lighter green than those of Kwai Mi. The leaflet blades are held horizontally to the midrib. However, in a typical leaflet, the blades waver distinctly and the extreme margin is slightly rolled under.

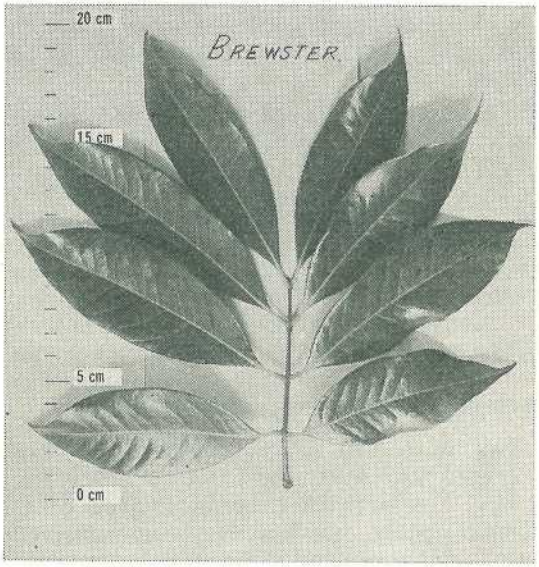
The average size of fully formed mature leaflets is 13·9 cm by 3·8 cm giving a ratio of length to breadth of 3·6 : 1. Leaves can grow to 19·2 cm by 4·9 cm.

WAI CHI. This variety bears fruit in late December and is the latest maturing variety available at present. The fruit, which are small, round, and basically red in colour with an obvious yellow background, average about 38 per 454 g. The seed is small and egg-shaped.

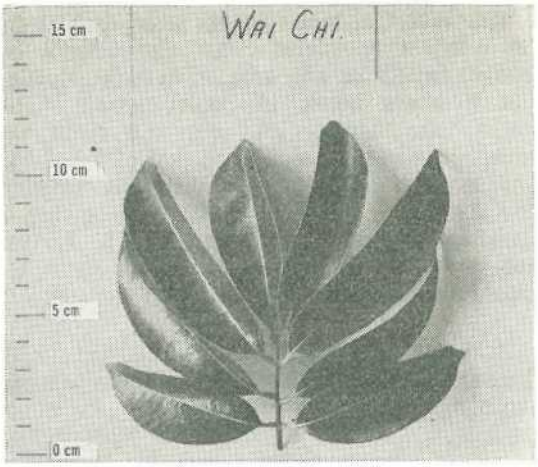
The Wai Chi tends to be a shy bearer on the north Queensland coast and cannot be recommended for this area. There is evidence that it bears better in cooler areas. The leaflets are narrow and curl up from the midrib in a fashion similar to that of Kwai Mi. The leaflets, however, are distinctly smaller. The average is 8·5 cm by 2·9 cm giving a ratio of length to breadth of 3:1. Leaves can grow to 13·5 cm by 5·0 cm. Branches grow upright and form a very compact tree.

BEDANA. This variety is found in north Queensland and is represented by a limited number of trees, growing mainly in home gardens. The Indian name 'Bedana' refers to seedless litchi types. As this particular variety is large-seeded, it appears to be misnamed.

The leaf, fruit, and seed shape, fruit quality and time of maturity of Bedana are all similar to those of Brewster. Close comparisons cannot be made under standard conditions as trees of these two varieties have not been grown in the same planting. Until this is done, this variety must remain separate and its origin unknown.



Leaves of Brewster.



Leaves of the Wai Chi variety.

At present, Bedana is not recommended for commercial plantings.

HAAK IP. This is a mid season variety. It flowers in early July and the fruit is harvested in November. The fruits, which are dark maroon-red and moderately large, average 28 per 454 g. The seeds are large and well developed.

The tree is compact, with upright and closely spaced branches. The typical leaflets are distinctly broad and short and relatively flat with the blades rising only a few degrees above the horizontal. There is a slight wavering of the blades.

The average size of fully-formed mature leaflets is 14·0 cm by 5·5 cm giving a ratio of length to breadth of 2·5:1. Leaves can grow to 16·9 cm by 5·9 cm.

MAURITIUS. Mauritius is recognized as a selection from the Kwai Mi variety and resembles it in appearance and general characteristics. Mauritius was selected in South Africa and is the main variety grown in that country. To date, no comparative studies have been carried out on these two varieties.

NO MAI CHI. This variety has been imported into Australia, but only a few trees exist. It is reputed to produce fruit of the highest quality, but has not been sufficiently tested in Queensland. Reports indicate that it does not bear well in warm areas.

HONG KONG. This variety is present in South Queensland but little is known of its potential. It appears to compare closely with Wai Chi in tree and leaf type, fruit size and colour, and time of maturity.

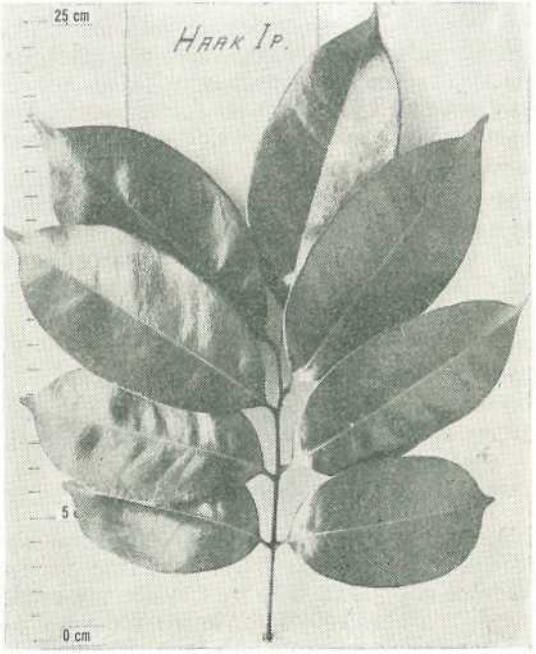
Flowering and fruiting

In north Queensland, trees flower from late June to late August. Flowering in southern Queensland is approximately 6 weeks later.

The inflorescence which is produced on the present season's wood, is a terminal, well branched plume. The individual flowers of the inflorescence lack petals and are small and inconspicuous.

Three flower types occur on the one inflorescence—

1. The male flowers appear first and have four to 12 developed stamens and an abortive ovary.
2. The second cycle of flowers carry the female parts of a well-developed style, forked stigma, and two half-connate ovaries. In addition, four to 12 rudimentary stamens



Leaves of the Haak Ip variety.

with anthers are present. These, however, do not release pollen. The double ovary can form two distinct fruits but generally only one forms, leaving the other to abort.

3. The flowers of the last cycle again consist of male flowers. The stamens are well developed and carry pollen but the ovaries are non-functional.

The three different cycles on a tree overlap, so pollen is always available during the female flowering period and the trees are self-pollinated.

The litchi is an irregular bearer in north Queensland and this is a major disadvantage of the crop. Several factors may contribute to irregular bearing. Work in Florida has shown that flowering and fruiting of the Brewster variety was better in seasons experiencing more than 200 hours at less than 7°C, than in seasons with only about 150 hours in this range.

Minimum temperatures in north Queensland rarely fall below 13°C and the Brewster variety bears approximately every second year in this area. Local experience indicates that the heavy crops are set in the cooler years.

Soil moisture conditions also influence fruitfulness of litchis and low soil moisture is desirable before bloom to promote flower bud differentiation. Ample moisture is required after bloom to prevent fruit shed.

Nutrition also has a major influence on fruit production, and trees should be fertilized during the latter period of fruiting and immediately after the crop has been harvested.

Overbearing in one year can result in a poor crop the following year.

Propagation

Seedlings are not recommended for commercial use as they vary from the parent tree, and may take up to 20 years to bear fruit.

Litchi trees are presently propagated vegetatively by air-layering. Grafting of the litchi is technically possible but has not yet been adopted by commercial nurserymen.

Air-layering

Air-layers are made on a well-developed parent tree. In selecting a parent tree, consider its parentage and fruiting habits. The tree should also be free from disease and insect pests. Air-layers from seedings will behave similarly to the parent tree in fruit type and time to bearing.

In making an air-layer, a branch 1 to 2 cm in diameter is selected. The distance from the growing point of the branch to the position where the air-layer is made may vary from 30 cm to 80 cm.

A ring of bark 3 cm to 5 cm long is removed from the branch. It is essential to scrape the soft material from the newly-exposed section down to the hard wood. This soft material is the growth section of the stem and even a sliver remaining will begin to grow again and prevent the formation of roots.

A sheet or sleeve of clear plastic material is then wrapped around the ringbarked area and the bottom of the plastic is securely tied with string 6 to 8 cm below the ringbark to form a bag.

Peat moss, which has been previously moistened and squeezed of excess moisture, is then placed through the top of the plastic bag and packed tightly around the ring. When sufficient peat moss has been placed to give a tight ball about 14 cm in diameter, the top of the plastic sheeting is then securely tied.

In north Queensland, small roots should be visible after approximately 4 to 6 weeks in summer and 6 to 8 weeks in winter. Roots may take longer to appear in southern districts. The air-layer is cut off immediately below the ball when the peat moss is well permeated by roots and the roots have darkened slightly from the original pure white.

Branches of the air-layer should be trimmed to form a good frame and approximately half the leaf area removed. The plastic sheeting is then very carefully removed and the air-layer is planted in a container and tied firmly to a stake. The roots are very subject to damage and must be treated carefully at all stages. The young trees should be grown in a sheltered area, with filtered sunlight, for approximately 2 to 3 months. They are then hardened off ready for planting.

When planted out, the young trees should be protected from winds and carefully watered until growth is vigorous. Air-layered plants are easily lost in the first 12 months in the

field. In north Queensland they can be established in April or in the spring. In south Queensland, spring is the better time for planting out.

Orchard management

The litchi tree can reach a crown diameter of 12·2 m after 25 years' growth, and this must be taken into consideration when planting a new area. A spacing of 12·2 m x 12·2 m provides for 67 trees per hectare. Temporary trees may be interplanted and systematically removed when approximately 15 years old. This practice will give 10 years' production at the higher density of 134 trees per hectare.

When branches of adjacent trees touch, they fail to bear fruit in these areas. The temporary interplant trees should therefore be pruned back as required until they are no longer profitable. The temporary trees can serve as a source of propagating material at this stage.

The litchi tree can withstand fairly strong winds, but flowering is markedly set back if they are hot and dry. The use of windbreaks is beneficial, and Bana grass can be used temporarily while permanent breaks of suitable trees are being established.

Litchi trees propagated from air-layers have a shallow root system and orchard cultivation should be kept to a minimum. Weed growth under young trees can be reduced by using mulches. Weeds are usually shaded out under older trees as they carry their branches to ground level.

At present, no pre-emergence herbicides are available for long-term control of weeds. Paraquat can be used for post-emergence weed control where required, but the spray material should not touch the green tissue of the litchi as damage will result.

Pruning is restricted to forming a good framework. At harvest, up to 20 cm of branch is removed with the fruiting cluster and this practice will stimulate new wood for the next year's crop.

Soil requirements

Litchi trees can be grown on a wide range of soil types from sands to heavy clays. The trees have a high moisture requirement and. without irrigation, do poorly in soils with a low water-holding capacity. They do particularly well on deep alluvial soils and respond to high levels of organic matter. Although trees will thrive under fairly wet soil conditions, good drainage is needed as they die after extended periods of water logging.

Water requirements

The litchi has a high moisture requirement and is suited to the more humid localities. It flowers in winter and carries the crop through the driest part of the year in Queensland.

Fruit set and development are reduced by moisture stress and it is unwise to consider growing litchis without adequate irrigation at this time of the year. Heavy irrigations as the fruit matures may cause the skin of the fruit to split.

Fertilizing

Litchis are established by air-layers and are very subject to fertilizer damage in the first year of establishment. Once the tree beings to grow, small amounts of inorganic fertilizer may be applied and irrigated immediately after.

Young litchi trees should be managed so that as much growth as possible is encouraged in the early years, as this forms the basis of the fruiting frame work of the tree. Growth is normally slow in the first 12 to 18 months after planting. However, after this period, plant development is rapid.

A suggested fertilizer programme is as follows—

PREPLANT.—Superphosphate should be applied at 150 g per plant in a trench to the side of the planting hole and at a depth of 15 to 20 cm. The fertilizer should not come in contact with the new plant as this can cause its death.

1ST YEAR. From the start of new growth, an application of 80 g of a 12% nitrogen, 14% phosphorus and a 10% potash fertilizer or similar mixture per tree is applied at intervals of 3 months with an irrigation.

2ND YEAR. As for the first year, plus an additional application of 80 g of a 34% nitrogen fertilizer or equivalent applied in March and again in November, but not with the mixed fertilizer.

3RD YEAR AND SUBSEQUENT YEARS UNTIL FLOWERING. Apply 225 g of a 12:4:17 NPK or similar mixture per tree for each year of age, split in four equal dressings throughout the year. Additional nitrogen fertilizer should be applied if required to maintain continued vigorous growth. Each application should not exceed 225 g of a 34% nitrogen fertilizer or equivalent.

FRUITING TREES. One month after fruit set, apply 220 g of a 12:14:10 or similar fertilizer mixture per tree per year of age. Immediately after harvest, apply 220 g of 12:4:17 or similar mixture per tree per year of age. In March, apply a further 110 g of a 12:4:17 or similar mixture per tree per year of age. Trees older than 12 years require about the same as 12-year-old trees.

Harvesting and marketing

The variety Kwai Mi is harvested first, followed by Brewster and then Wai Chi. Each of these varieties is picked over 2 to 3 weeks and harvesting of all three varieties is completed in 2 months.

Yields are variable but as a guide, a 10 to 12-year-old, well-grown tree can produce 70 kg of fruit in a good year.

Fruit maturity is determined by skin colour and taste. Fruit harvested too early is acid and this can reduce its acceptability on the market.

The fruit is borne in clusters of 15 to 30 per bunch and is harvested by breaking or cutting the branch about 10 to 20 cm behind the cluster. The fruit is clipped from the cluster in the packing shed. Portion of the fruit stalk is usually retained to avoid injury to the fruit.

The litchi is a rarity on the major markets and is highly priced. The fruit is marketed in 9 kg cartons, but some fruit is sold in punnets similar to those used for strawberries.

Pests and diseases

The erinose mite is common on litchi trees in north Queensland. The mite causes a puckering of the leaf surface, and a velvety growth is found on the lower surface of the distorted area. This growth progresses from a silvery to a dark-brown colour with age.

Erinose mite may attack young leaflets at any time of the year. It will also attack the flowers causing a loss in yield.

Trees should be examined during periods of new growth and, if infested, should be sprayed with wettable sulphur. Care should be taken to apply sprays before the flower buds break as spraying during the flowering period may damage the flowers.

Fruit fly larvae have been found in litchi fruit. However, the pest is normally of only minor importance.

No diseases of major importance have been recorded on litchis in Queensland.

Control of potato and onion pests

Entomology Branch Officers.

THE following tabulation summarizes the recommended pest controls for potato and onion crops in Queensland. Compilations of this kind cannot give comprehensive details on pest identification, cultural approaches to control or accurate data on timing and need for specific chemical usage. The summary is presented as a reference or guide and details where necessary should be sought from extension officers of the Department of Primary Industries.

Pest	Description of Pest	Damage to Crop	Control—Pesticide, unless stated otherwise dosage rates are active constituent	Remarks
Potatoes				
Potato moth *Phthorimaea terrella*	Adult. An inconspicuous greyish-brown moth with wingspread of 12 mm. Readily observed at dusk Larva. Measures up to 12 mm long. Greenish or pinkish body colour depending on food source	Tunnels in leaves, stems and tubers. Tubers may be infested in both field and storage. Most active during warmer periods	Field: Azinphos ethyl, 440 g/ha Chlorfenvinphos, 275 g/ha Storage: Rotenone, 250 g of 0·75% dust/bag	Hilling the soil up and around bases of plants protects tubers from infestation in the field Infestations may be minimized by eliminating volunteer potato plants and related weeds and avoiding growing tomato or tobacco crops adjacent to potatoes. Rotenone treatment will not prevent pest development in infested stored potatoes. Place only moth-free tubers in normal storage Cool storage will prevent infestation development in stored tubers
Aphids *Macrosiphum euphorbiae* *Myzus persicae*	Greenish-yellow to green, oval-shaped, soft bodied insects, 2–4 mm long, usually wingless, and found in colonies on the underside of the leaf	Sucks sap from leaves. Severe infestations cause the leaves to curl downwards, become yellow and die May transmit virus diseases which would be of major importance in seed production	Demeton-S-methyl, 275 g/ha Vamidothion, 550 g/ha Disulfoton, 2–3 kg/ha	Chemical control is usually not warranted except in seed production crops as natural control factors—parasites and predators—are capable of good population reductions within a few weeks under most conditions. Disulfoton granules applied at planting provide up to 12 weeks' protection which may be of value in seed production

Crickets *Acheta* sp. *Gryllotalpa* sp.	The mole cricket is brown and velvety in appearance, up to 40 mm long, with forelegs adapted for burrowing. The field cricket is similar, but darker in colour and up to 30 mm long	Causes excavations on the surface of the tuber	Investigations toward control methods are being carried out	Much of the damage appears to occur when tubers are held in the ground after maturity particularly when the soil is wet
Jassids *Austroasca viridigrisea*	Greenish, torpedo-shaped, agile insects up to 4 mm long	Suck sap from the leaves. The feeding punctures show as a series of small dots or stippling. Large populations may retard growth	Dimethoate 0·03% as high volume spray or 150 g/ha Disulfoton 2–3 kg/ha	Specific control is rarely required in well-grown crops. Disulfoton granules applied at planting provide up to 8 weeks' protection which may be of value in seed production
Leaf-eating Ladybird *Henosepilachna vigintioctopunctata*	Adult. Oval-shaped, yellowish-brown beetle, about 6 mm long, with 24–28 conspicuous black spots on the wing covers Larva. Up to 9 mm long, yellow in colour and covered with dark, many-branched spines	Feed on the green tissue between the veins of the leaves. In severe outbreaks, foliage may be completely destroyed	Carbaryl, 1 000 g/ha	
Onions				
Thrips *Thrips tabaci*	Immature thrips are small, creamy-yellow insects. The mature insect is darker in colour, about 2 mm long, with two pairs of narrow, fringed wings	Rasp the tissues and extract sap from the leaves. Damage shows as silvery-white stippling on the leaves	Methidathion, 0·03% Omethoate, 0·05%	With adequate irrigation and sound farming methods to ensure continuous rapid growth, onions can be produced profitably despite the presence of thrips

The commercial product names listed hereunder are examples of the particular insecticide available and should not be construed to indicate recommendation of a particular company's product in preference to another which may have been inadvertently omitted.

Common Name	Commercial Name*	Dosage		
		Active Constituent	Commercial Product	
				Strength of product
azinphos ethyl	Azphos, Chemothion 40, Co-thion E, Gusathion A, Kilathion A, Q-thion, Azinphos E40	560 g/ha	1 400 ml/ha	40% w/v
carbaryl	Bugmaster, Septene, Zevilon, Dicarbam	1 000 g/ha	1 250 g/ha	80% w/w
chlorfenvinphos	Birlane	275 g/ha	550 ml/ha	50% w/v
demeton-S-methyl ..	Metasystox (i)	275 g/ha	1 100 ml/ha	25% w/v
dimethoate	Rogor, Perfekthion	150 g/ha	500 ml/ha	30% w/v
disulfoton	Disyston	2–3 kg/ha	40–60 kg/ha	5% w/w
methidathion	Supracide, Ultracide	0·03%	75 ml/100 litres	40% w/v
omethoate	Folimat	0·05%	60 ml/100 litres	80% w/v
rotenone	Derris	..	250 g/bag	0·75 w/w
vamidothion	Kilval	560 g/ha	1 400 ml/ha	40% w/v

* Commercial names which include the common names are not shown.

Two Friesian bulls rate highly

TWO Friesian bulls at the Department of Primary Industries' Wacol Artificial Insemination Centre, Brisbane, have been classified as Very Good for breed types.

The Director of Dairy Cattle Husbandry (Mr. I. H. Rayner) said the bulls were Peel Valley Kriss King and Woodlin King Charon.

Peel Valley Kriss King, a privately-owned bull, had been awarded 88 points, a high score for a 3-year-old.

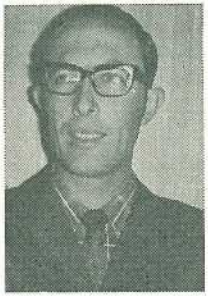
Woodlin King Charon (85 points), a son of the English proven sire Rurik Charon, was bred by J. and G. Wood from Meadow Glen Noble Fay 2nd, especially for the Department's proving scheme.

Meadow Glen Reflection Neil, one of the 1974 bull proving team, had been classified Good Plus, with 83 points. This 3-year-old sire had been recommended to the Department by the Queensland Branch of the Friesian Cattle Club as one that would help the breed.

Mr. Rayner said that the cattle had been judged by the official classifier of the Friesian Cattle Club.

Mr. Don McDougall, of 'Banchory', Umbiram, discusses this crop of snail medic with Mr. David Lloyd, Department of Primary Industries, Toowoomba.

Medics as fodder crops on eastern Downs



AUTHOR: L. R. LOADER, Agriculture Branch.

SELF-REGENERATING annual medic crops supply high quality fodder which some cattlemen of the eastern Darling Downs use as a cheaper alternative to oats in late winter and spring.

Innovators of this practice include Mr. John Gilmour, of Felton East, Mr. George Bassingthwaighte of 'Woodlands', Greenmount and Mr. Don McDougall of 'Banchory', Umbiram. All three are very pleased with their experience with snail medic.

Advantages

Some of the advantages of annual medics as fodder crops compared with late oats on the eastern Downs are—

- Lower fertilizer and labour costs.
- Their taproot system enables them to use subsoil moisture and permits grazing before follow up rain occurs.
- They add nitrogen to the soil.
- They can be made into higher quality hay.
- They regenerate annually from self-sown seed.
- Utilization, digestibility and protein content are greater than for oats.

Varieties

Four kinds of annual medics are commonly used on the eastern Darling Downs. They are common burr medic (*Medicago polymorpha*), snail medic (*M. scutellata*), Cyprus barrel medic (*M. truncatula* var. *truncatula* cv. Cyprus), Jemalong barrel medic (*M. truncatula* var. *truncatula* cv. Jemalong).

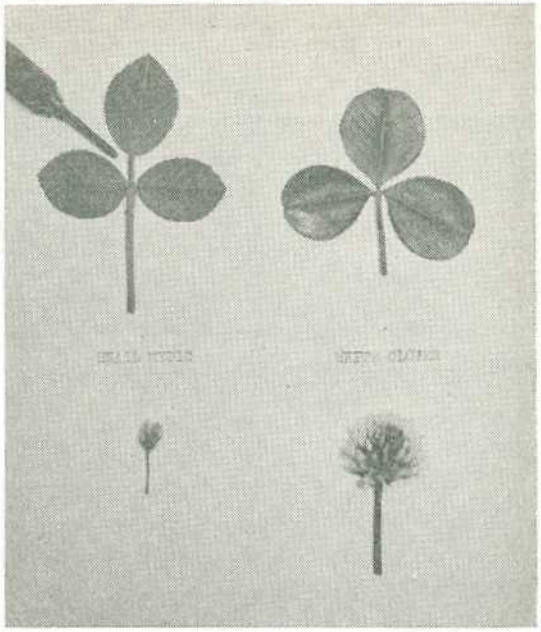
They are all free-seeding, winter-growing legumes and are very similar in most respects.

Common burr medic growing voluntarily with oats has long been recognized by dairymen as a good milk producer. It is naturalized in many districts of the eastern Darling Downs. The presence of numerous fine spines on the seed pods is a disadvantage because they cling to the coats of animals.

Snail medic has the largest seed of the varieties mentioned, giving it an advantage in establishment. It has a more upright growth habit than other medics, and this enables it to compete more effectively for light with winter cereals. This characteristic also allows earlier grazing in the autumn and facilitates cutting for hay. The seed pods are smooth and do not cling to animals' coats. Snail is, however, the most frost susceptible of the medics listed.

Bloat may be a problem in some years but Mr. Gilmour, who has been grazing snail medic for 7 years, said, 'I used to watch my cattle closely but now I don't worry about them.'

Jemalong has prostrate early growth, barrel shaped pods with short stout spines and small seeds. It is very cold hardy.



Leaves and flower heads of snail medic (left) and white clover (right). Medics can be easily distinguished from white clover by the longer stalk of the middle leaflet.

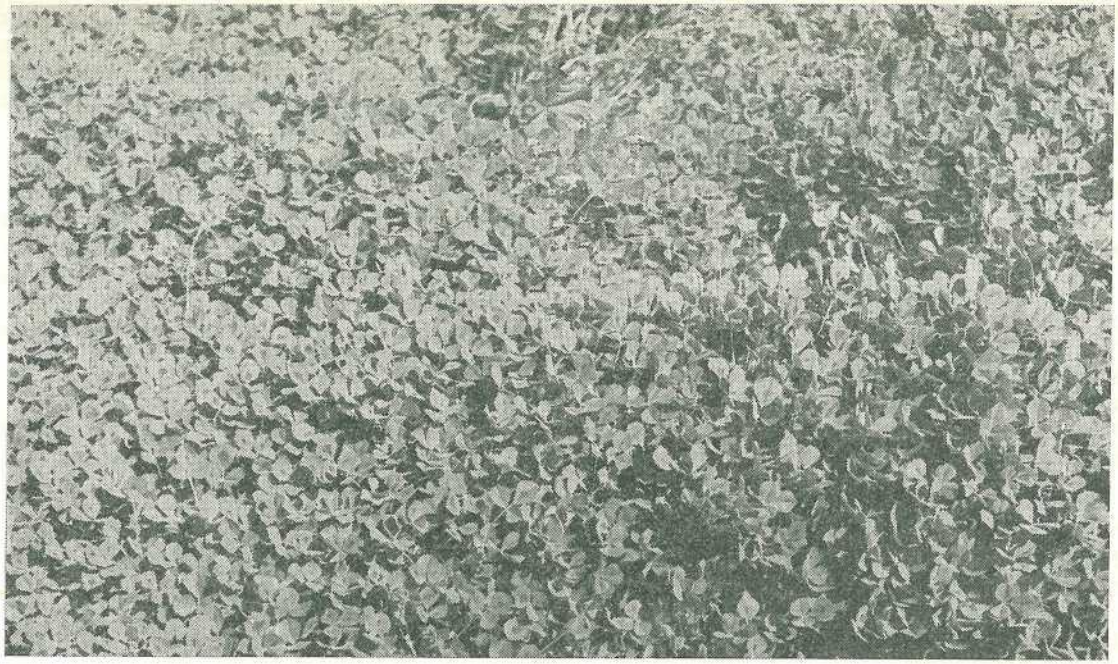
Cyprus appears most tolerant of harsh situations. It has spiny pods and small seeds similar to Jemalong.

Establishment

Medics are adapted to the neutral to alkaline soils which occur over most of the eastern Downs. Acid soils such as some red loams in the Toowoomba–Crow's Nest area are less suitable.

Medic seed is sown at 5 to 9 kg per ha into a weed-free seedbed at a maximum depth of 5 cm, alone or with a winter cereal planted at half the normal rate. Where medics or lucerne have not been grown previously the medic seed should be inoculated with the appropriate *Rhizobium*. If superphosphate is to be applied at planting, the inoculated medic seed should be lime pelleted.

It is preferable to graze the crop in the initial year, as mechanical harvesting may restrict seed set. Adequate seed is essential for regeneration in later years.



A dense sward of Jemalong barrel medic.

Grazing

Following germinating rain, the strong taproot will rapidly exploit subsoil moisture. Even if the winter is dry, at least one grazing is assured.

The first grazing may take place when the first pods have formed. This may be as early as July. With adequate rainfall, grazing can be obtained into December. Grazing should not be so early, severe or continuous that seeding is prevented.

Bloat can be a problem when grazing pure medic stands. The use of one of the commercially available bloat control preparations will reduce the risk of losses. Furthermore, when stock are given strips of medic with free access to roughage, the bloat risk is greatly reduced and the best feeding value is obtained from each fodder source. Such sources of roughage include stubble, standover pasture and regrowth from winter cereals.

Haymaking

Excellent quality hay can be made from medics. High palatability results in little wastage. Over 3 successive years, the crude protein content of Mr. McDougall's crops ranged from 19 to 22% of oven dried hay. Digestibility is also high.

When making hay, the crop should be cut when the first pods are mature. To facilitate cutting, a level soil surface and an upright type of medic such as snail are preferred.

Yields

Hay cuts from crops grown over several years on the three properties mentioned indicate that, under normal seasonal conditions, hay yields exceeding 4·5 tonnes dry matter per ha can be expected with a crude protein content between 19 and 22%. Yields of 8·5 tonnes of dry matter per ha of 17% crude protein have been obtained under experimental conditions. Under similar conditions, oats fertilized with nitrogen and planted in June yield on average 3·3 tonnes dry matter per ha of 14% crude protein.

Fallowing

Management during the summer is designed to conserve moisture. A ploughing around mid December and one or two cultivations before mid April are generally adequate. No re-sowing will be necessary if sufficient seed was set in the previous year.

Fertilizers

The most important nutrients for medics on the eastern Downs are phosphorus and sulphur. In areas where both nutrients are deficient, superphosphate can be used to supply both. Your local Agricultural extension officer should be consulted to determine the rates of superphosphate to be applied.

Gypsum, which contains about 15% of sulphur, may be used in areas where phosphorus is known to be adequately supplied. Annual autumn applications of 25 kg per ha of sulphur (170 kg per ha of gypsum) should be applied on all basaltic clay soils after the establishment year.

Weed control

Mechanical weed control is the cheapest and most effective. If a weed-free seedbed is prepared, infestation from weeds should be small. Strategic mowing or hand chipping may give adequate control.

Medics are susceptible to common weedicides such as 2,4-D and picloram. However, 2,4-DB at 3 to 4 litres per ha of the 40% product gives good control of some broadleaf weeds, while not severely damaging seedling medic.

Economics

Economic considerations are of great importance. Clearly the more cheaply one can produce suitable fodder the lower the cost of producing an animal product and the greater the profit.

The following table gives a comparison of the variable cropping costs of medics with a common alternative source of quality spring feed, June-planted oats.

It should be remembered that input data vary with numerous factors.

Yields of the crops compared depend on available moisture, which is governed largely by soil moisture at planting and winter and spring rain. Yield and protein figures used are the commercial ones quoted earlier.

Costs of establishing medics, including seed, weedicide and seedbed preparation, are averaged over 5 years and added to the annual maintenance costs. Although medic will regenerate indefinitely, a conservative 5 years was considered a phase in a rotational programme. Capital costs for both oats and medic are assumed to be similar.

TABLE 1

ANNUAL COSTS FOR JUNE-PLANTED OATS AND MEDICS COMPARED

Material Costs/Ha (1974 figures)	Oats	Medics
	$	$
Seed		
Oats. 45 kg/ha at $6.88/50 kg	6.20	
Medic. In establishment year 6 kg/ha at $0.77/kg (spread over 5 years)		0.92
Fertilizer		
Oats. 28 kg N/ha applied as urea at $4.64/50 kg	5.66	
Medic. 25 kg S/ha applied as bulk gypsum at $13/tonne		2.17
Fuel and repairs		
Oats. 1 ploughing $1.38; 3 cultivations at $1.16 and 1 planting at $1.38	6.24	
Medic. ½ of first year cost (as for oats) plus 1 ploughing $1.38; 1 cultivation at $1.16 and 1 broadcasting at $0.20 ..		3.99
Weedicide		
Medic. In establishment year, 3 litres/ha 40% 2,4–DB at $2.27/litre (spread over 5 years)	Nil	1.36
Total	18.10	8.44
Fodder cost/tonne dry matter		
Oats. 3 300 kg/ha	5.48	
Medic. 4 500 kg/ha		1.88
Fodder cost/tonne crude protein		
Oats. 14% crude protein ..	39.18	
Medic. 19% protein		9.87

Medics are by far a cheaper source of both dry matter and crude protein. Additional economic advantages of medics over oats not considered in the table include lower labour requirements and lower machinery depreciation costs.

Diseases of ginger in Queensland

Devastation of ginger caused by bacterial wilt.

by K. G. PEGG, MELDA L. MOFFETT and R. C. COLBRAN, Plant Pathology Branch.

GINGER is grown in Queensland on the coastal strip between Imbil and Caboolture, in an area known as the Near North Coast District.

The climate in the growing area is characterized by a mean maximum temperature of 26°C, a high atmosphere humidity and a mean annual rainfall of 1 719 mm. Rainfall is supplemented by irrigation to reduce sunburn and delay fibre development.

These growing conditions are very favourable for the development of soil-borne diseases.

Bacterial Wilt

Bacterial wilt was first recorded from the Near North Coast ginger growing district of south-eastern Queensland in 1965. Although the actual spread of wilt through the district has not been rapid, individual outbreaks have caused heavy losses. Therefore every effort should be made to restrict its spread in Queensland. This disease has also been reported from Hawaii, Malaysia and Mauritius.

Cause

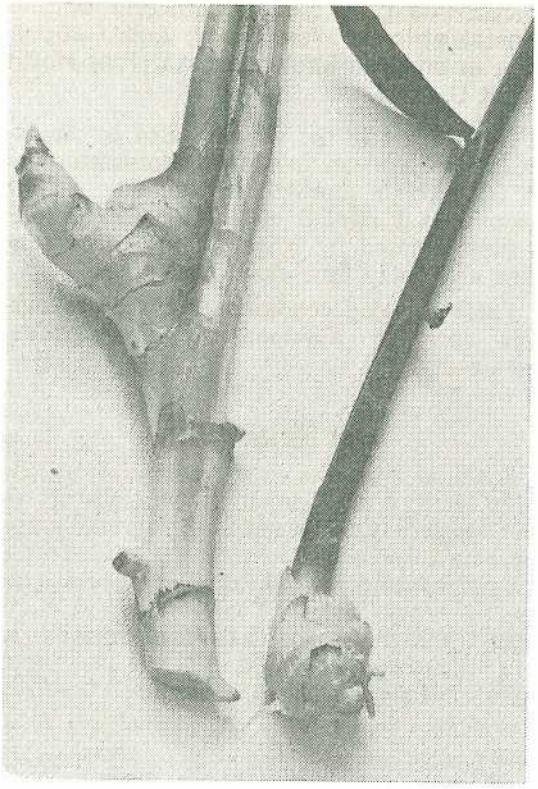
The bacterium *Pseudomonas solanacearum*, which is responsible for wilt of ginger, can be divided into two types known as biotype III and biotype IV.

Biotype III is responsible for the wilt of tomatoes which commonly occurs during the hot humid months of the year. It can also infect ginger, producing a slow wilt of little significance. Biotype IV is responsible for the very rapid, severe wilt which has caused heavy losses.

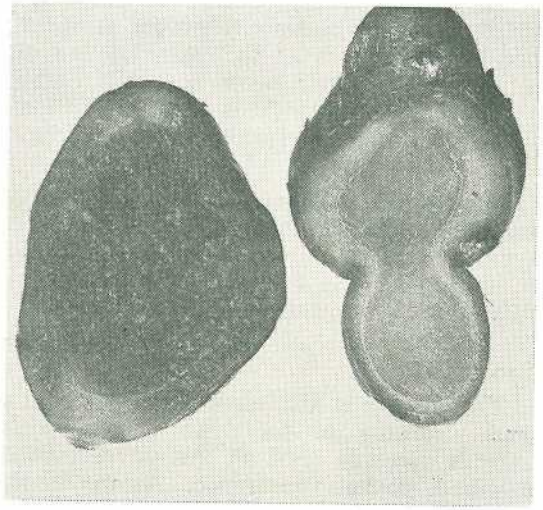
The two diseases produced by these biotypes cannot be distinguished in the field by leaf symptoms but a distinction can often be made by observing the disease incidence and its rate of development.

Symptoms

The disease is first recognized by a wilting and yellowing of the lower leaves which extends upwards until all the leaves take on a wilted, golden appearance. As the disease progresses, the stem becomes watersoaked and readily breaks away from the rhizome. The vascular tissue of the stem darkens to a



Watersoaking of a stem caused by bacterial wilt infection (left) compared with a healthy plant (right).



Cross-section of a healthy rhizome (left) and one infected with bacterial wilt (right). Note the white, milky exudate.

black colour. These aboveground symptoms progress very rapidly from the first sign of yellowing of the leaves until the ginger plant collapses.

Diseased rhizomes are usually darker than healthy ones and have watersoaked areas with pockets of milky exudate visible beneath. When these rhizomes and diseased stems are cut transversely and a little pressure is applied, the white milky exudate flows freely from the cut surfaces.

Survival of the Bacterium

Although the length of time that the wilt bacterium can survive in the soil is not known, it has been established that it infects a wide range of plants. Tomato, potato, capsicum and egg plant are all susceptible. Tobacco and peanut can become infected but may not show any obvious external symptoms.

The organism is also able to infect a wide range of weeds in which it may or may not produce external symptoms. In this way, the bacterium can survive from season to season and is readily available for re-infection of healthy ginger rhizomes when these are planted in this ground.

Weeds occurring in the Near North Coast District which are known hosts of the wilt organism are blackberry nightshade (*Solanum nigrum*), thickhead (*Crassocephalum crepidioides*), cape gooseberry (*Physalis peruviana*), wild gooseberry (*Physalis minima*), blue billygoat weed (*Ageratum houstonianum*) and wild tobacco tree (*Solanum mauritianum*).

Spread of the Organism

The most common means of spreading this disease is by planting infected seed-pieces. Following the rotting of diseased rhizomes, the bacteria survive in the soil. When healthy seed-pieces are planted in this land, the result will almost certainly be a diseased crop. Any seed-pieces saved from this crop and replanted will almost certainly spread the disease, resulting in more ground becoming unsuitable for ginger growing.

It has been suggested also that insects feeding on diseased ginger foliage or rhizomes may carry the infection to plants on which they subsequently feed. Irrigation water and the

use of contaminated farm equipment are other means of carrying the bacteria from one area to another. During periods of flooding, infested soil and diseased plant material may be carried long distances, thus spreading bacterial wilt to hitherto healthy areas.

Control

Because of the wide and uniform distribution of biotype III throughout the ginger-growing area and the relatively small loss it causes to the crop, control measures are directed mainly against biotype IV.

DISEASE-FREE PLANTING MATERIAL. Attempts, so far, have failed to control the bacterial wilt organism by chemical methods. Because of this, emphasis must be placed on cultural practices. The production of planting material or 'seed' free from any infection and planting this material in clean land are essential practices.

CROP ROTATION. Crop rotation is the most widely adopted cultural method for controlling soil-borne diseases. Growing a crop, or crops, with similar disease susceptibility in the same land increases the incidence of soil-borne diseases. This occurs, in the case of wilt, when ginger is grown on the same piece of land year after year.

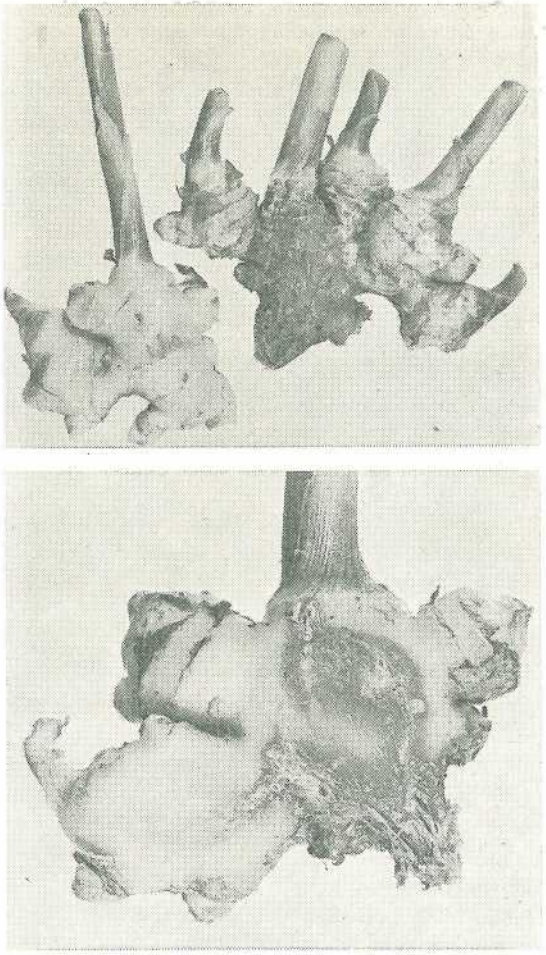
Rotations using tomato, potato, capsicum, egg plant and peanut are best avoided as these plants are hosts of the wilt organism. Cash crops such as bean, cucurbits and strawberry will provide a suitable rotation.

Where a cover crop is required, green panic is recommended. This will reduce the incidence of weeds and hence reduce, to some extent, the carry-over of bacteria from one season to the next.

If land is fallowed, weeds susceptible to bacterial wilt should be suppressed. The presence of volunteer plants provides a source of inoculum for the following season's crop. Consequently, all young volunteer ginger plants should be destroyed as soon as they appear.

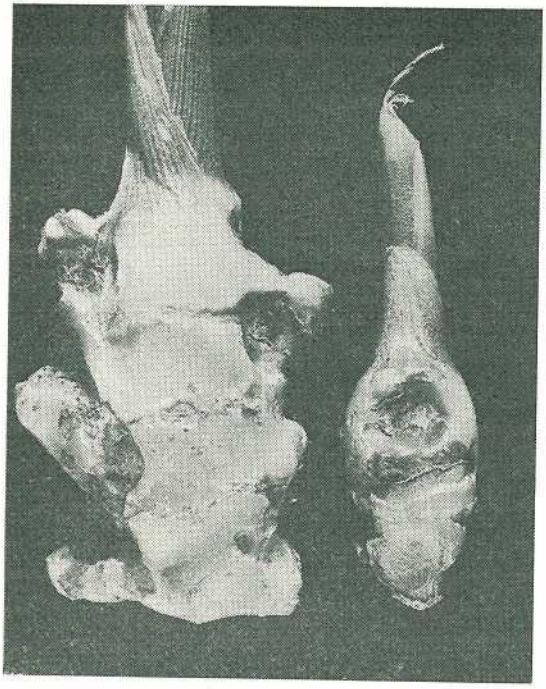
SANITATION. The planting of disease-free seed and crop rotation may be of little value unless measures are taken to dispose of crop residues and disinfect farm implements. All crop residues, particularly when the disease is known to occur, should be destroyed by burning if possible.

With the trend towards mechanization in the ginger industry, the danger of spreading wilt on farm implements is increased. All machinery should be disinfected before proceeding from one farm to another. This is particularly important when a machine is used on farms which are known to be infested.

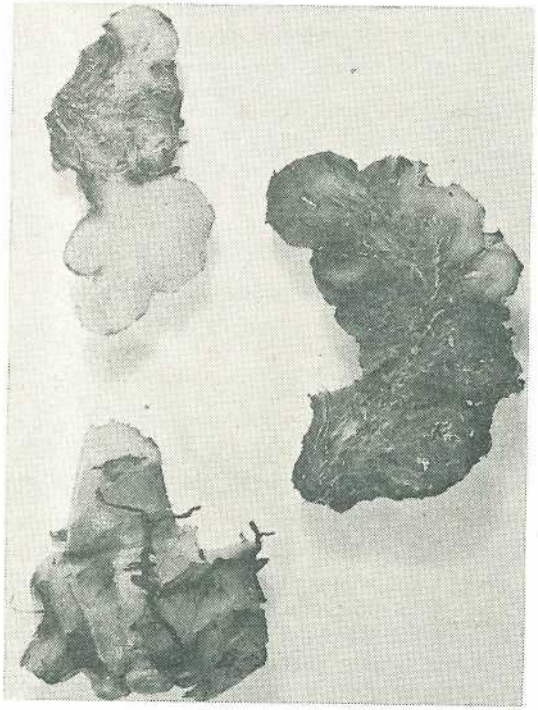


TOP. Fusarium rhizome rot. Left healthy, right diseased rhizome.

BOTTOM. Cross-section of a Fusarium-infected rhizome.



White fungus rhizome rot. Note the pitting at the scale levels.



Armillariella rhizome rot. Note the 'shoestring' on the lower rhizome.

All soil and plant debris adhering to the implements should be removed by thorough hosing with water. The implement should then be disinfected by prolonged steam cleaning or by spraying with a 12% solution of commercial formalin. The formalin solution must remain in contact with the implement for at least 1 minute. Because formaldehyde is corrosive, the implement should then be washed well with water.

The bacterial wilt organism is seed-borne. Growers should always bear in mind the danger of introducing seed-pieces from other areas. It is highly probable that the very damaging biotype IV was originally introduced from overseas in planting material. No ginger rhizomes should be brought into the country except through the quarantine channels provided.

Fusarium Yellows and Rhizome Rot

Rhizome rot was first recorded in Queensland in 1930. Investigations in 1942 revealed that the causal organism was a species of the fungus *Fusarium* which has been identified as *Fusarium oxysporum* f. sp. *zingiberi*.

Symptoms

Plants infected by this fungus are stunted and yellow. As the disease progresses, the lower leaves slowly wilt and eventually the above-ground shoots dry off completely. This collapse may take several months compared with the rapid collapse normally associated with bacterial wilt. It can be distinguished from bacterial wilt by the absence of the milky bacterial ooze when the rhizome or pseudostem is cut transversely.

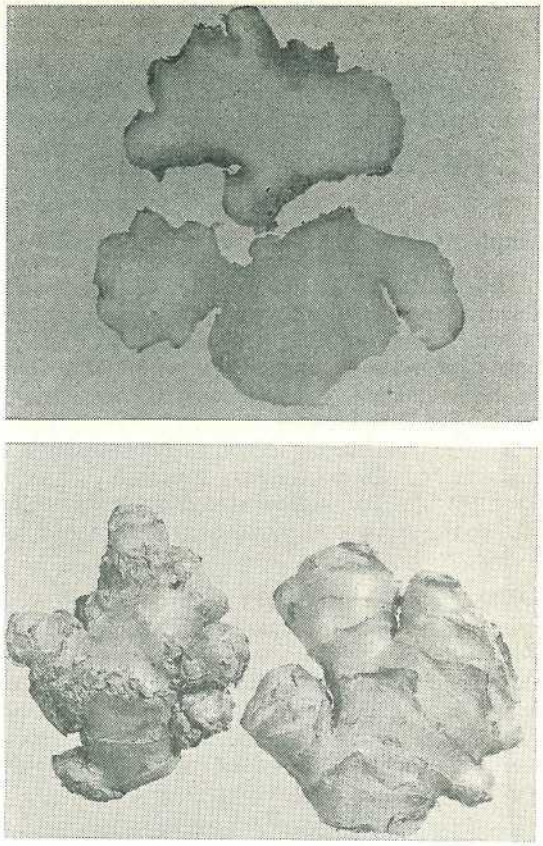
Rhizomes of diseased plants are invariably shrivelled in appearance and show a brown internal rot. In the final stages of decay, all that remains of the rhizome is the shell in which the fibrous tissue persists. If infected seed-pieces are planted, the rot may progress so quickly that either germination is prevented completely, or a weak, yellow shoot is produced which dies prematurely.

Survival and Spread

Once a ginger field becomes infested, the fungus can persist in the soil for many years. Infection of rhizomes occurs from such soil by way of cracks due to frosts or exposure to sun, growth cracks that sometimes develop in the neck region, or injuries caused by cultivating implements, nematodes, insects or waterlogging.

Ginger harvested from fields infested with Fusarium may be infected. If such contaminated ginger is stored, the fungus will continue to destroy the rhizome tissues to produce a dry type of rot. A superficial white, cottony, fungal growth may be present on the cut surfaces of the stored ginger pieces.

When these infected seed-pieces are planted, the fungus is able to grow into the developing ginger.



TOP. Cross-section of a healthy rhizome (lower) and one infested with root-knot nematodes (upper). Note the watersoaked areas.

BOTTOM. Ginger rhizome infested with root-knot nematodes (left). Note the cracked swellings on the surface. The rhizome on the right is healthy.

Control

SEED SELECTION. Control measures are based on rigid seed selection. The rhizomes should be closely inspected during cutting and all rhizomes showing signs of rot, cracking or injury must be rejected. If rot is encountered when preparing the seed-pieces, the infected rhizome should be discarded and the knife sterilized in 5% formalin.

SEED TREATMENT. As soon as possible after preparation, the seed-pieces should be dipped for 10 minutes in benomyl (Benlate* at 250 g per 100 litres). It is particularly important to reject all diseased seed-pieces. The fungicide will not control Fusarium rot if the rhizomes are already infected. Besides acting against contamination of the rhizome pieces, which can occur during the cutting up process, the fungicide will also guard against infection of seed-pieces planted in infested soils.

SOIL FUMIGATION. In trials it has been found that Fusarium rhizome rot can be effectively controlled by fumigating the soil with methyl bromide-chloropicrin (Fungofume*) or methylisothiocyanatedichloropropene (Di-Trapex*). Such fumigation has given inconsistent results against bacterial wilt.

In Queensland, fumigation on a broad acre basis is very expensive. The use of such fumigants could, however, be considered for restricted outbreaks of Fusarium wilt. Consequently, early detection and diagnosis of disease outbreaks are extremely important. As with bacterial wilt, growers should be especially vigilant where the land is subject to flooding.

* Registered trade name.

Rhizome, Root and Basal Stem Rot

A rhizome, root and basal stem rot caused by an undetermined white fungus is widespread and has been responsible for serious losses on some farms.

Symptoms

The fungus first infects the rhizome tissue beneath the scale leaves producing sunken lesions. Infection may progress to produce a deep brown rot of the entire rhizome. Roots are also attacked and killed. In severe cases, the fungus attacks and hollows out the base of the stem. Affected rhizomes become enveloped in a white fungus mycelium which generally fills the hollowed out stem as well. This is the most conspicuous symptom of the disease.

Where a mild attack has occurred no above-ground symptoms are usually visible. However, when the rhizome is severely attacked, the stems turn yellow and slowly dry out. When such plants are pulled, the stems invariably break from the rhizomes at ground level where the internal tissue at the base of the stem has been hollowed out.

Identity of Causal Organism

The identity of this fungus has not yet been determined because, so far, it has failed to produce any fruiting bodies. It is thought to belong to the group of fungi known as basidiomycetes, which also includes toadstools and puffballs. The fungus lives in the soil on decomposing organic materials from which it sends out white mycelial strands to infect any ginger in the vicinity.

Control

As the fungus persists in crop residues in the soil, control can be achieved by early land preparation. This ensures that cover crops, weeds and other organic matter are given ample time to decompose. Although this may not eliminate the fungus entirely, it will reduce it to such a low level that it will not cause a problem. Where the disease is serious, clean cultivation for an extended period should be adopted.

The most serious outbreaks of this disease have been encountered in land previously cropped to sugar-cane where a quantity of undecomposed sugar-cane trash has remained in the soil. However, the disease has not been confined to sugar land and may occur in any soils with undecomposed crop residues.

Rhizome Rot

When ginger is grown in recently cleared forest country, *Armillariella mellea* sometimes appears, causing a rhizome rot. An attack by this fungus causes a yellowing of the stems, very similar to that shown by plants infected with Fusarium rhizome rot. However, when infected rhizomes are examined, black, string-like threads can be seen adhering to them. These threads are fungal structures and, because of their presence, *Armillariella mellea* is often called the 'shoestring fungus'.

This fungus is a common parasite of forest trees, and the removal of all roots and stumps before planting newly cleared land will reduce the chances of infection.

Rhizome and Stem Rot

The fungus *Sclerotium rolfsii* is sometimes found causing a rhizome and stem rot. This fungus is visible in the form of white, cottony threads on the host surface. It eventually forms small resting bodies called sclerotia which resemble cabbage seed. The disease has not been severe enough to warrant special control measures.

Big Bud

The disease of ginger caused by the tomato big bud mycoplasma organism is recognized by a cessation of plant growth with the leaves becoming bunched at the top of the stem. In advanced stages, the plants yellow and are easily detected.

The disease is spread by a leafhopper which can acquire the disease from the wide range of weeds and crop plants susceptible to this organism.

Incidence of this disease is generally low, but infected plants should be removed from plantings being kept for seed.

Bacterial Soft Rot

Bacterial soft rot is caused by the bacterium *Erwinia carotovora* which is present in most soils. Field infection is not a problem as the disease occurs only in waterlogged soils. However, bacterial soft rot has been responsible for serious losses in stored ginger. This disease consists of a soft rot of the rhizome accompanied by an offensive odour.

If ginger is to be stored for any length of time, take the following precautions—

1. Minimize mechanical damage and bruising of the rhizomes at harvest.
2. Do not harvest ginger for storage until the pseudostem junctions have callused.
3. Dry the rhizomes before harvest.
4. Store ginger in a cool, dry, well-ventilated shed.
5. Do not store rhizomes in bags that have previously been used for potatoes, carrots, onions, cabbages or cauliflowers.

Nematodes

The root-knot nematodes *Meloidogyne javanica* and *M. incognita* are important and widespread pests of ginger in Queensland. They occur in virgin ground, have many alternative hosts and are readily spread in planting material.

Their economic importance has been demonstrated in field trials. Heavy infestation of seed pieces reduced yields in fumigated soil by 57%. Treatment of infested soil with DD before planting nematode-free seed pieces increased yields by 80%.

Symptoms

Heavily infested plants are stunted, have chlorotic leaves with marginal necrosis and swollen, distorted roots.

Infested rhizomes have brown, watersoaked areas in the outer tissues particularly in the angles between shoots. Nematodes continue to develop after the crop has matured and induce breakdown of rhizomes held for planting in the following season.

Control

Plant nematode-free seed-pieces in nematode-free soil.

In recent years, the supply of nematode-free planting material has not been sufficient to satisfy the requirements of the ginger industry. Although hot water treatment kills nematodes in rhizomes, the subsequent yield is not comparable with that from untreated, nematode-free rhizomes. When combined with soil fumigation, however, hot water treatment is a practical and relatively inexpensive method of reducing root-knot in planting material for the following season.

Producing Planting Material

Nematode-free planting material is produced in this way—

1. Select an area where ginger was not grown in the previous season, an area that has not had a history of severe nematode infestation and is of sufficient size to produce the planting material required for the following season.

2. Begin land preparation in late autumn so that by August the soil is brought to a suitable tilth for fumigation with DD or EDB 15 at 330 litres per ha. Apply the fumigants by tractor-mounted equipment at a depth of 20 cm in rows 30 cm apart. Allow at least 2 weeks between fumigation and planting.

3. Select planting material as free from nematodes as possible and treat in hot water at 48°C for 20 minutes. Cool the rhizomes in a shallow layer before cutting and dipping in benomyl. Seed should be planted within 1 week of hot water treatment.

The hot water tank described in Advisory Leaflet No. 924 Division of Plant Industry, Department of Primary Industries, Queensland, (Hot water tank for treatment of banana planting material), is suitable for treating ginger.

4. Grow under a sawdust mulch. If sawdust is not available, sprinkle granules of ethyl 4-methylthio-m-tolyl isopropylphosphoramidate (Nemacur*) over the soil between the plants at the rate of 11 kg per ha in mid November and mid January.

Hold rhizomes from the crop for planting in the following season. Remove those with external symptoms of nematode infestation.

Crops for Processing

Crops for processing are produced in this way—

1. Use planting material produced on the farm by the programme outlined previously or obtained from an area with no more than a light infestation of nematodes.

2. Apply DD or EDB 15* at 330 l ha^{-1} two or more weeks before planting.

Factors In Nematode Control

Attention to the following points will give a higher level of nematode control—

CROP ROTATION. Do not grow cowpeas, field peas, or tomatoes in rotation with ginger as these crops increase root-knot nematode infestations. Land which is to be left idle for 12 months or longer can be sown with green panic (6 kg per ha). The cover crop should be slashed before seeding.

SOIL FUMIGATION. i. Do not plough in large quantities of organic matter such as sawdust or green manure crops before fumigating as these materials absorb fumigants and reduce their efficiacy.

ii. Fumigate when the soil has been prepared to a fine tilth to a depth of at least 25 cm. The most favourable level of soil moisture is reached when the land can be worked freely with implements after rain or irrigation. Do not fumigate when heavy or prolonged rains are forecast.

iii. Roll lightly after fumigation to break down the clods and improve nematode control in the surface soil.

iv. Cultivate several days before planting to reduce fumigant residues in the soil.

Disease Control-Summary

Fungal and Bacterial Diseases

1. Use only planting material from a disease-free source.

2. Discard all seed-pieces showing any signs of cracking, injury or rot.

3. Treat seed-pieces with benomyl.

4. Implement crop rotation. Rotate ginger with crops that are not susceptible to bacterial wilt.

5. Keep ginger land free from weeds at all times.

6. Prepare land early to allow organic residues to decompose.

7. Remove all stumps and roots from newly-cleared land.

8. Disinfect farm implements.

9. Destroy all crop refuse, particularly when disease is known to be present.

Nematodes

1. Use nematode-free planting material.

2. Fumigate the soil before planting.

3. Treat seed-pieces in hot water and plant in fumigated soil under a sawdust mulch to produce the following season's planting material.

Rice Marketing Board appointments

THE Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) has announced appointment of the following to The Rice Marketing Board for a three-year term, commencing 11 November 1974—

DISTRICT No. 1 (Ayr and Thuringowa Shires): Wayne Louis ACE, Clare; David Henery Clarke DUNN, Ayr; Lynsday George Russell HALL, Clare; John Raymond HOEY, Brandon; Kenneth Norman Sweetenham LEWIS, Ayr; Kevin Patrick McNEE, Clare. DISTRICT No. 2 (All that part of Queensland not included in District 1): Irene Maree DAVIES, Ingham.

Mr. Sullivan said that the nominations received for each District did not exceed the number of persons to be elected and that the persons now appointed were elected unopposed.

Spaying permits planned sales

AN expected surplus of female cattle in Queensland will mean that many more cull females than usual will go to the meatworks.

Spaying offers cattlemen a way of ensuring a turn-off of fat, cull females. It does this by avoiding unwanted pregnancies where control of bulls is not complete.

The increase in the number of female cattle is being brought about by a drop in deaths, better reproduction and an expected surplus of breeders.

Spaying is a simple operation that involves removing both ovaries so that the animal is permanently sterile. It used to be widely practised when properties had little fencing and when fat was still popular and there was no market for boner cows. Spayed animals do not grow faster but spayed heifers do tend to lay down more fat.

In recent years, with a big demand for breeding stock, markets for lean beef, and property development, comparatively few cattlemen have had their surplus females spayed.

However, as improved management reduces deaths in breeders and increases branding rates, the number of surplus females on a property increases. It may become necessary to hold surplus females until they can be sold for slaughter.

Even on reasonably well-developed properties, control of bulls is not fully effective, especially from November to April. It follows that segregation of cull cows and heifers from bulls is difficult to implement. Spaying cull females reduces management problems when these animals are to be raised to slaughter weight.

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by T. H. RUDDER and P. L. CORLIS, Beef Cattle Husbandry Branch.

Maiden heifers

In a herd that has branding rates of 70 to 85% and low death rates, between 40 and 50% of the heifer calves are not needed for breeding.

The four main outlets for selling surplus heifers are—

1. Sell as breeders to other graziers, either as maiden heifers or mated and sold pregnant. This market depends largely on a reputation for having good cattle. It is also more reliable when breeder numbers are being increased.

2. Selling surplus heifers on the live cattle export market. At present there are two possibilities: heifers that are 4 to 6 months of age, and heifers 3 to 4 months pregnant. This is an opportunist market for specific lines of cattle and a grazier should not budget on this market.

3. Segregating surplus heifers for fattening. Sometimes it is possible to complete the growing and fattening process before heifers calve after being served by roaming bulls. Experience gained in breeder herd management observation indicate that frequently 40 to 60% of heifers will be either in late pregnancy or will have calved before the desired time for sale. This means that these heifers will either go into the breeding herd, or be limited to a cow-and-calf market.

4. Spaying heifers at approximately 15 or 27 months, depending on whether property management is to have them calve at 2 years or 3 years. The advantage of this approach is that it ensures that surplus females do not become pregnant and time of sale is reasonably predictable. The disadvantage is you cannot take advantage of any opportunist market for breeding cattle.

Before deciding which course to take, you must consider each of the above possibilities. Naturally, each possibility is not mutually exclusive, for example, you may decide to mate half of the surplus heifers for sale as breeders and to spay the other half.

Cull breeders

Normal culling rates of breeders are 12 to 17 (excluding mortalities) per 100 breeders mated. In general, there are two categories of cull breeders—

One is those cows diagnosed as non-pregnant 2 to 3 months after the end of the mating season. This can vary markedly in weight and condition. This variation will depend on age of cow, type of country, season, and whether rearing a calf or otherwise.

Where non-pregnant cull breeders can be sold within about 6 months of pregnancy diagnosis there seems little point in spaying. However, where it is considered desirable to retain these cows for more than 6 months for fattening, spaying offers an advantage. You can predict turnoff with a greater degree of accuracy. This decision depends on—

1. The age of the cow. Young cows often have the potential to produce an extra 90 kg carcass weight in the next 12 months.

2. The weight and condition which will vary according to the type of country and seasonal conditions. Mature cows in poor condition are capable of producing an extra 50 to 70 kg of carcass weight.

The second category of cull breeder is cows which are culled for physical defects, temperament, unsatisfactory reproductive history and age. These cows are often pregnant when the decision to cull is made. These cows are usually allowed to rear this calf and are sold after the calf has been weaned.

If your selection for culling has been soundly based, this group has only one market—slaughter. They should have no useful breeding life left.

The decision whether to spay or not will depend on the considerations outlined in the previous section.

Time to spay

Spaying is usually carried out a month or so after the first rain in late spring to about April. The condition of the cattle is probably more important than the time of the year.

Provided the cows are in store condition or better, the operation will have little effect when done by a competent operator.

Professional operators charge approximately 65c a head depending on the distance travelled relative to the number involved.

With maiden heifers and the second group of cull breeders, spaying in the December to April period fits in with the reproductive cycle of most herds. If it is considered necessary to spay the first category of cull breeders, it may be preferable to do this in May to July depending on when joining is terminated.

Economic implications

It is difficult to make general statements about the economics of spaying because of the variable situations between properties. The application of the practice must be evaluated as it affects the particular property.

The factors which should be considered are—

1. Where cull females are retained for fattening during the next summer, spaying is primarily a means of ensuring turn-off. Cash flows can be more accurately predicted when the danger of cull females calving is eliminated.

2. Using standard models to calculate beef herd production, there appears to be little difference in income between selling cull breeders in fat condition or in store condition. The value of the extra beef produced from the heavier cull breeders is cancelled by the decrease in beef produced from steers through the need to reduce breeder numbers to accumulate the culls for the extra season. However, in practice, it is doubtful whether one can determine stocking rates with the degree of precision suggested in this approach.

Spaying merely helps to ensure that surplus females, destined for slaughter, can be sold according to plan. Heifers and cows that are spayed do not grow or fatten at a significantly faster rate, but sale will not be delayed by unwanted pregnancies.

The application of this practice should be carefully evaluated according to existing markets and the development and nutritional level of the particular property.

It should be noted that the sale of cull females should be made with due regard to the amount of fat demanded by the market.

Agriculture in the South Burnett—2

by R. G. WILSON, J. M. ROBINSON, A. HODGE, Agriculture Branch;

R. R. FANNING, Dairy Division;

W. J. EDWARDS, Beef Cattle Husbandry Branch; and

D. B. PRESTON, Pig Branch.

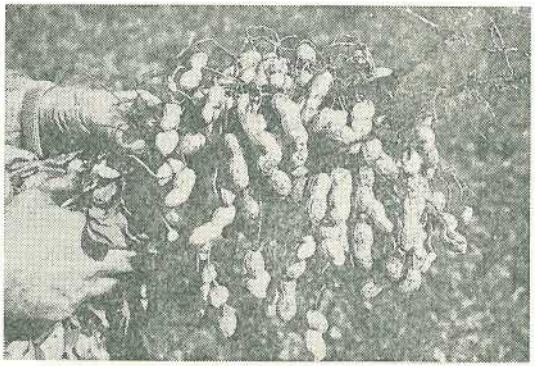
Agricultural Crops

The South Burnett district is a predominately summer crop area. Winter crops have shown a marked decline in area over the past 5 years of poor seasons. The summer crop area has correspondingly increased. Peanuts, sorghum, maize, navy beans and soybeans are the main summer crops grown. Sunflowers and millets are minor crops.

The major winter crops are wheat, barley and oats and small areas of safflower, linseed, potatoes, and onions are grown.

Corkwood (Duboisia) is a perennial. The leaf is harvested mainly in the summer months, and the cropping life of a plantation is normally only 6 to 10 years.

Areas of the important crops, average yields, and development since 1964-65 to 1972-73 are shown in Table 3.



TOP. Checking the maturity of peanuts before harvesting.

CENTRE and BOTTOM. Two methods of harvesting peanuts. The centre picture is of threshing and bagging. The bottom one is of bulk handling. The thresher is being emptied into a bulk truck.

TABLE 3

AVERAGE YIELDS AND AREAS OF CROPS

Crop	Area 64–65 (ha)	Area 72–73 (ha)	% Development (+ or −)	Average Yield kg/ha
Peanut	13 400	28 000	108 +	1 019
Sorghum	8 480	14 000	65 +	1 816
Maize	16 000	4 800	70 −	1 695
Navy beans	1 000	6 400	540 +	510
Soybeans	880	4 800	545 +	740
Wheat	6 400	3 800	41 −	1 345
Barley	7 600	5 600	27 −	1 289
Corkwood	2 000	2 400	20 +	
		2 000 plantation		400–560
		400 native stands		224

PEANUTS. With a gross value of approximately $5 million, the peanut (*Arachis hypogaea*) is the most important crop in the district.

The main peanut growing area is on the red volcanic loam soils. These soils are found in a belt up to 16 km wide running from Kumbia through Kingaroy to Tingoora in the north. Other areas are found at Blackbutt and Yarraman in the south and the tableland area at Murgon with pockets at Brigooda, Durong and Boondooma.

In recent years, peanuts have been grown on the better class forest soils adjacent to the red soil areas. Recent production has expanded to the poorer class sandy soils found at Gordonbrook, Corndale and Cushnie West.

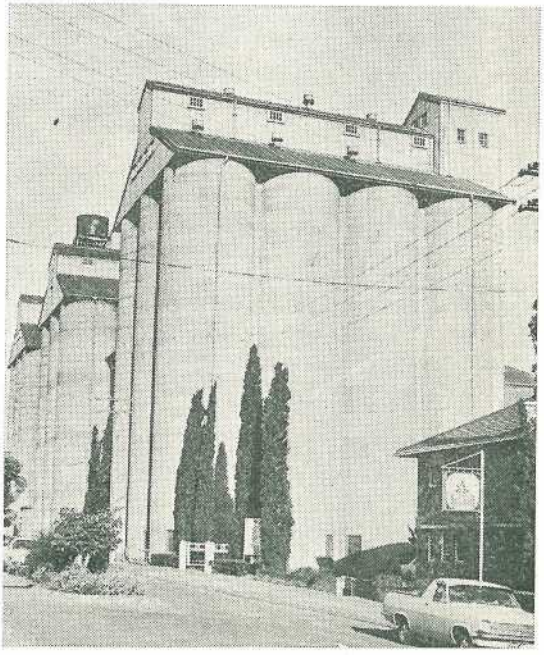
The two main varieties grown are Virginia Bunch (70%) and Red Spanish (30%).

Virginia Bunch is grown on the good scrub soils and better class forest soils as it does not tolerate low fertility and acid conditions. Red Spanish, although it requires a good soil, tolerates lower fertility and more acid soil conditions. It is quicker in reaching maturity and can be planted later than Virginia Bunch.

Planting extends from October to January, with the main planting in November. Harvest centres around April-May.

The peanut industry is highly mechanized, with much specialized machinery used for planting, inter-row cultivation, cutting, pulling, threshing, drying, handling and spraying.

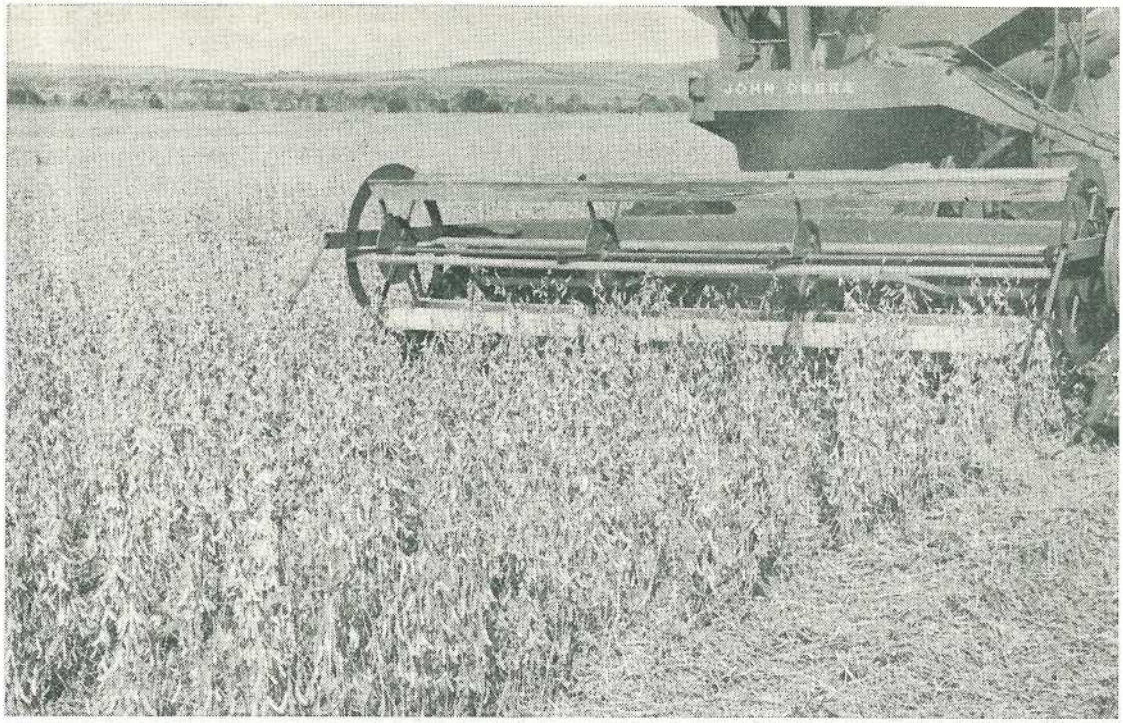
The crop is marketed through the Peanut Marketing Board with headquarters at Kingaroy. In this complex of silos and buildings, the peanut crop is cleaned, shelled and graded for sale. The Peanut Marketing Board has depots and facilities to handle the crop at Murgon and Gayndah. In the district, some privately-owned dehulling plants clean, shell and grade peanuts for the interstate trade.



Peanut silos at Kingaroy.

Growers returns vary from 15.4c to 24.2c per kg, depending on quality and quantity.

NAVY BEANS. The navy bean (*Phaseolus vulgaris*) is grown for the canned baked bean trade.



Direct heading a soybean crop. The area under soybeans in the South Burnett is expanding.

The area grown has been increasing steadily every year since the introduction of the new Queensland-bred bush type varieties in 1966. Price increases in 1972 and 1973 guaranteed by the Navy Bean Marketing Board have been a further incentive to growers. Some 6 400 ha were planted during 1972-73.

The main growing areas are on the good, friable soils of average fertility and good internal drainage. These are found around Kumbia, Kingaroy and Wooroolin.

Kerman, Gallaroy, Selection 46 and Selection 45 are the main varieties used at present.

The crop is marketed by the Navy Bean Marketing Board. The beans are cleaned and graded at the Board's premises in Kingaroy before sale to the canning industry.

At present, the navy bean industry does not supply all the Australian market and efforts by the Board have been successful in increasing local production almost up to supplying the home market. Storage is available to hold any surplus as carry-over for years when production does not meet Australian requirements.

SOYBEANS. Until recently, a few growers were producing soybeans (*Glycine max*) in the South Burnett for the edible bean market. Because this market was limited, the area planted remained static for almost 20 years.

With the expansion of the stock-feed industry and the increased demand for oil seeds, the soybean area has increased considerably since 1970-71.

Soybeans require moderately acid to moderately alkaline soils of reasonable fertility. Very heavy, poorly drained, cracking, clay soils are less suitable.

Varieties grown are Semstar, Leslie, Bragg, Hood, Hampton Hill and Semmes. Each variety has its own individual characteristics, and it is important to pick the variety most suited to the area and planting time.

Planting is from mid November to end of December. As soybean growth is determined largely by day length, the most favourable planting time is the last week in November and the first week in December. The crop matures in 120 to 145 days. Harvesting is by direct heading. The crop is sold normally under contract to various firms and organisations dealing with oil seeds.

MAIZE. Maize (*Zea mays*) has declined markedly in popularity in the last 10 years because the main buyers obtain their requirements on the Darling Downs and northern New South Wales. In the last few years disease has affected many varieties.

Maize also ties up ground for almost 9 months as the quicker maturing varieties have not been successful. This decline has slowed somewhat because of the general grain shortage and the need to have a rotation in peanut culture.

Maize can grow on a variety of soils in this district but grows best on the better scrub and forest soils. Planting extends from October to December, with the peak in late November and early December. The crop is harvested with mechanical harvesters in June or July. Grain is sold to stock feed firms or to other farmers. It may be retained on the property or sold for breakfast food on a limited market.

GRAIN SORGHUM. This is the main summer grain crop grown in the South Burnett. The area has increased some 65% since 1964-65, with approximately 14 000 ha planted during 1972-73 season.

The main reasons for this large increase in the area planted to grain sorghum are the failure of winter grains through poor seasons and the demand for export grain and stock feed both locally and outside the district.

Grain sorghum grows satisfactorily on a wide range of soils from the fertile, red-brown, volcanic loams, both scrub and forest, to the poorer, marginal, shallow forest soils. Excellent crops are grown on the alluvial flats found throughout the South Burnett.

Hybrid varieties are mainly planted because of their ability to yield more grain. Many commercial grain sorghum varieties are on the market, and these give the farmer a wide choice to meet the requirements of individual situations.

Some of the main grain sorghums grown in the South Burnett are—Late varieties: Alpha, XQ5161, E57, F64A (irrigated TX671, NK275). Mid-season: TX610, TX626, NK220Y, NK212. Early maturing: NK133, Pacific 007, NK233.

Planting time ranges from September through to January. Grain sorghum crops are generally harvested from March through to May. Grain sorghum is sold in the open market. There is a demand for good quality grain free of weed seeds for export to Japan.

WINTER CEREALS. Production of winter cereals, principally wheat, has declined considerably over the past three years. Reasons for the decline are:—

1. A series of very dry winters resulting in very poor yields and, in some crops, total loss.
2. Rising production costs making it uneconomic to grow winter cereals on small farms.
3. Introduction of the wheat quota system.
4. The reliable summer rainfall makes the district more suitable for summer crops.
5. Summer crops provide more attractive returns and generally enjoy more reliable market outlets.

Barley is the most important winter cereal. It is grown mainly for stock feed but some areas are grown solely for the malting trade.

A large percentage of the barley planted is grazed during the winter and, should the season turn favourable for a grain crop, the area is closed and the grain is harvested during the early months of summer.

Barley is grown on a wide range of soil types, preferably on the more fertile loams. Strongly acid soils are avoided.

As barley is a very quick maturing crop, it has an important place in crop rotations with peanuts. The main variety grown today is Clipper.

Wheat is grown throughout the South Burnett with large areas centred in the Boondooma-Durong districts, mainly on the brigalow soils.

Mid-mounted disc cutters and a rear-mounted side-delivery rake for cutting and windrowing navy beans before threshing.

Many wheat crops are grown for stock feed only. Larger growers deliver their wheat to Wheat Board silos situated at Wooroolin and Jandowae. Wheat quotas have reduced the number of farmers growing small areas. With a world-wide shortage of grains, more interest could soon develop in this crop.

Oats are grown mainly for grazing on both dairy farms and cattle properties. Only small areas are retained for grain.

FORAGE CROPS. Lucerne is the main grazing crop of the area. Surplus growth is made into hay for on-farm storage. Some irrigated properties have very modern hay making equipment and storage facilities which enable them to supply the outside market in drought.

Hybrid forage sorghum is the main forage crop.

Pearl millet (*Pennisetum* spp.) or bulrush millet is being grown on an increasing area because of their freedom from prussic acid. Sudan grass, sweet sorghum, millet and cowpeas are grown on a lesser scale. Lablab bean is grown mainly by dairy farmers as a feed to carry animals into the winter.

The main winter forage crop is oats. Barley is often grazed once and then allowed to seed. Field peas, vetches and tares are of minor importance.

Surplus summer and winter forage crops are often conserved.

SEED PRODUCTION. Until 1971, the South Burnett was a major seed producing area. Maize and sorghum seed under the Queensland Certified Seed Scheme were grown by 15 growers. Over-production, fierce competition from other companies producing new varieties, isolation and diseases have reduced the number of growers and area grown.

Certified seed from outside the South Burnett is cleaned and graded at Kingaroy and Wondai.

Pastures

NATIVE PASTURES. A long history of burning and mismanagement has effectively modified the botanical composition of native pastures so that they are now dominated by inferior species. The widespread use of urea and molasses licks during the winter months has lessened the area burnt since 1970. Excellent summer seasons have helped to improve the composition of the sward and better species of grasses and legumes are increasing.

Carrying capacity on native pastures ranges from one beast to 2 ha on the better areas, to one beast to 5 ha on the poorer forest country.

SOWN PASTURES. Lack of winter rain and the frosts make summer-growing grasses and legumes the main sown pastures in the South Burnett.

The largest area of sown pasture in the South Burnett is under Rhodes grass. This grass grows on a wide range of soils of medium to good fertility.

Green panic is the next most popular and grows on the light to gravelly soils and the red scrub soils. It is very productive in elevated areas. Paspalum has colonized much of the wetter areas along creek flats and watercourses. Kikuyu grass grows prolifically on elevated light-textured acid soils. Paspalum and kikuyu have spread more by natural means than by intentional propagation.

Panicum coloratum has proved a useful grass on heavier clay soils that are subject to waterlogging and could prove useful on other black soil flats. Setaria has shown promise in many areas but depends more on good management than the other improved pastures. Buffel grass in the drier western areas around Durong has provided much feed under all conditions.

The improved varieties of sown grasses are proving better than the original introductions, for example, Katambora Rhodes, Sabi and Gatton panics and Molopo buffel.

Lucerne is sown in some pastures as the legume component. In more acid situations Siratro is used. Lotononis is another useful legume. Generally introduced tropical legumes have proved unsuitable because of the severity of the frosts.

IRRIGATED PASTURES. About 300 ha of flood or spray-irrigated pastures are established in areas adjacent to the main waterways. Lucerne is the main component of these pastures, clover being used in the wetter areas. Ryegrass and prairie grass are the main grass species used.

Medicinal Crops

Corkwood (*Duboisia leichhardtii*) grows naturally on the poorer scrub soils. The leaves of this shrub contain the alkaloids hyoscine and hyoscyamine. There has been a trend to growing corkwood in plantations which are mainly in the Proston and Speedwell areas. The leaf is harvested, dried and sold to merchants who, in turn, sell to world markets, mainly Germany and Japan.

Horticultural Crops

Although good quality horticultural produce can be grown there is no significant horticultural industry in the South Burnett. This is mainly because of the distance from the larger markets. Throughout the area, semi-retired farmers with larger gardens sell their surplus to fruiterers in the towns.

An area of disease and insect free bananas at Cloyna supplies larger growers on the coast with suckers.

With the increasing interest in health foods, two farmers are growing 'organically grown' beans and zuccinis for sale in Brisbane.

Weeds

In the South Burnett, as with any agricultural area, there are weed problems. The weeds present are as diverse as are the many soil types and cropping systems in the area.

Weeds pose little problem in relatively dry seasons, but wet conditions can lead to large increases in their populations.

Small areas are infested with perennial weeds, such as nutgrass (*Cyperus rotundus*) and Johnson grass (*Sorghum halepense*). Johnson grass is spreading slowly throughout the district, and is, to date, mainly confined to roadsides. The major problem weeds therefore are annuals. Species such as thornapple (*Datura* spp.), wild gooseberry (*Physalis minima*), and summer grasses are very common throughout the area.

In recent years, the character of the weed problem involved has altered. This has been, in part, a result of increasing areas of crops grown per labour unit, great increase in the use of herbicides which are grass-specific, and the increased cost and decreased availability of labour for hand chipping.

Crop rotations involving winter cereals help control summer weeds, but the erratic nature of the area's winter rainfall makes winter cropping fairly unreliable. Summer grain crops tend to encourage growth in weed populations in areas where weeds are present.

Forestry

State Forest and Timber Reserves cover more than 80 000 ha of the South Burnett. They are concentrated on the Blackbutt, Brisbane, Bunya, Coast and Cooyar Ranges. Much of this area is fairly steep and is suitable only for forests.

The great natural reserves of hoop and bunya pine and prime hardwoods have been greatly depleted over the years. Production from the natural forests is about 54 000 m^3 of hoop and bunya pine and 54 000 m^3 of hardwoods per year.

Three nurseries in the South Burnett produce planting stock for 400 ha of new plantations each years. The main tree planted is the hoop pine (*Araucaria cunninghamii*) and to a lesser extent *Pinus patula* and *Pinus radiata*. About 12 000 ha have been planted to plantations.

Production from the young plantations is 540 000 m^3 of sown logs and pulp a year.

In the South Burnett, the plantations support one wage earner to 20 hectares. The timber industry employs a total of 600 men.

Mineral Deposits

Mining does not play an important part in the South Burnett at present.

COAL. Recent prospecting in the area at Neumgna, Tarong and Kunioon has shown coal suitable for open cut mining.

KAOLIN. Large deposits of kaolin are found in the Parishes of Taabinga, Tarong and Kunioon. At present this deposit is being worked on a limited scale.

LIME. A small deposit is found at the junction of the Barambah and Barkers Creeks. This lime is used in the manufacture of glassware.

At other times in the South Burnett the following minerals have also been mined: gold, manganese, vermiculite, silver-lead, molybdenite, felspar, bentonitic clay and building-brick clays.

Basalt is used extensively in road-building.

With the exception of kaolin which lies below good agricultural land, any future development of mining would not greatly affect the agricultural community.

Rural Research

Rural research in the district is directed mainly towards plant nutrition, varietal testing, plant population/arrangement and herbicide-fungicide trials as well as soil protection measures and plant disease.

The recently established J. Bjelke-Petersen Field Station is sited near Kingaroy. Experimental work here covers all aspects of crop production.

Economics

Financially, the region is prosperous. Rural income in 1969-71 was $29 to $31 million of which some 70% was derived from agriculture, dairying and minor industries such as poultry and bees. About 25% came from pastoral pursuits and the remainder from forestry, mining and others.

Tuberculosis-Free Cattle Herds (As at 16 December, 1974)

ANGUS

Corden, E. B., Netherby, Warwick
Crothers, H. J. "Mooreenbah", Dirranbandi
Mayne, W. H. C. & Sons, "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Franz, E. L. and E. L., "Amabar" A.I.S. Stud, Amamoor, via Gympie
Henry, Mrs. K. & Sons, "Tara", P.O. Box 4, Cambooya
H. M. State Prison Farm, Numinbah
Klein Bros., Kapleton A.I.S. Stud, Ma Ma Creek, via Grantham
Lawley, E. D. & Sons, Arley A.I.S. Stud, Maleny
Marquardt, C. R. & J. L., Cedar Valley A.I.S. Stud, Wondai
Martin, J. P. & R. J., Kentville, via Forest Hill
Middleton, C. W., Airton Vale, Cambooya
Mitchell and Mulcahy, Rosenthal
O'Sullivan, P. W., "Navleigh", M.S. 371, Greenmount
Phillips, J. & Sons, "Sunny View" A.I.S. Stud, Kingaroy
Pagel, E. E., and Hayes, E. M., Trafalgar Stud, Tarampa, via Lowood
Queensland Agricultural College, Lawes
Ross, W. & Co., M.S. 23, Rosewood
Schelbach, N. N. & Co., Allanview Stud, Warwick
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Siebenhausen, J. & S. C., "Meniton", M.S. 195, Pittsworth
Thompson, W. H., "Alfa Vale", Nanango
Vohland, A. R., Bevallan, Stoneleigh, M.S. 150, Pittsworth
Weier, L. G., Prairie Plain A.I.S. Stud, M.S. 765, Allora

AYRSHIRE

Goddard, B., Inverell, Mt. Tyson, via Oakey
Scott, J. N. & Son, "Auchen Eden", Camp Mountain

BRAFORD

Bowden, W. H., "Brendale", South Pine Road, Strathpine
Thompson, M. A. K., "Glen Kyle", Buderim

FRIESIAN

Behrendorff, E. C. & N. G., Inavale Friesian Stud, M.S. 786, Boonah
Evans, P. J., M.S. 28, Dragon St., Warwick
Guppy, N. J. & H. M., Bli Bli Road, Nambour
Hickey, K. A. & M. R., Bunya
Lobley, N. E., "Neloby", Mt. Pleasant, via Dayboro
McWilliam, A. A., Oatlands Stud, M.S. 918, Toowoomba
Martin, R. J. and E. L., Kentville, via Forest Hill
Norgaard, M. J. & B. F., Yarrabine Friesian Stud, Yarraman
Panzram, J. & K., Blenheim, via Laidley
Queensland Agricultural College, Lawes
Stumer, A. O., Brigalow, Boonah
Vonhoff, A. R. & D. G., M.S. 918, Toowoomba

GUERNSEY

Dionysius, R. L. & L., Warana Stud, M. S. 1796, Proston
Erbacher, J. P. & M. M., "Leafmore", Hodgsonvale
Gibson, A. & D., Mooloo, via Gympie
Hopper, G. T. & H. W., Ellendean Guernsey Stud, Maleny
Scott, Cecil & C. A., "Coralgrae", Din Din Rd., Nanango
Smith, Mrs. E. P., Remleigh Guernsey Stud, Imbil
Wilson, R. A. and M. R., "Okeden", Proston

HEREFORD

Hill, W. W. & P. C., "Mathalla", Dirranbandi
Panorama Stud Pty. Ltd., M.S. 765, Allora

JERSEY

Conochie, I. S., Brookland Jersey Stud, M.S. 461, Kalbar
Forsyth, D. E., Kobarnie Stud, Mulgildie, Q., 4629
H. M. Prison Farm, Capricornia Stud, P.M.B. 11, Rockhampton
H. M. State Farm, Palen Creek
Lau, J. F., "Rossallen", Goombungee, Toowoomba
Mahaffey, H. W. & V. N., "Goombooran", via Gympie
McDonald, R. G., "Buffelvale", M.S. 807, Mundubbera
Paulger, S. & S. M., "Advale", Kenilworth
Perkins, M. J. & E. M., Byee Jersey Stud, M.S. 692, Sth. Nanango
Postle, R. S. & G. C., "Yarallaside", Pittsworth
Queensland Agricultural College, Lawes
Scott, P. E., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Snare, A. E. & Son, Laidley Park Stud, Laidley, 4341
Spressor, O. W., Carnation Jersey Stud, Mt. Walker Rd., Rosewood
Todd, J. R., Aberfoyle, Laravale, via Beaudesert
Vohland, A. R., Bevallan, Stoneleigh, M.S. 150, Pittsworth
Waite, H. M., M.S. 182, Laidley
Westbrook Training Centre, Westbrook

POLL HEREFORD

Anderson, J. H. & Sons, "Inverary", Yandilla
Christensen, B. L. & M. O., "Elavesor", Rosevale
Morris, H. J. & D. I., Gaiview Stud, Clifton
Nee Nee Pastoral Co., Dirranbandi, 4392
Stiller, N. L., "Vine Veil", Guluguba

POLL SHORTHORN

Leonard, W. & Sons, "Welltown", Goondiwindi
Pointon, R. B. & S. C., "Wywurri", M.S. 780, Kingaroy

BRAHMAN

Queensland Agricultural College, Lawes
The Cherokee Group Brahman Cattle Co., Tanby

SANTA GERTRUDIS

Barbara Plains Grazing Co., Barbara Plains, Wyandra
Central Estates, Comet Downs, Comet

SHORTHORN

Pointon, R. B. & S. C., "Wywurri", M.S. 780, Kingaroy

DROUGHTMASTER

University of Queensland, Veterinary School, St. Lucia

Beef from dairy cows

Typical A.I.S. cows from Messrs Taylor Brothers' herd. The large ear tags permit easy identification at suckling.

by W. J. HALL, Beef Cattle Husbandry Branch.

MOST dairy breed cows are capable of producing more milk than can be efficiently handled by one calf. This article discusses two systems of calf-rearing developed on Messrs Taylor Brothers' property, 'Bringalily'. The systems are designed to use fully the dairy cow's milk potential.

The 526 ha (1 300 ac.) property is situated in the Millmerran Shire, West of Toowoomba, and before clearing was predominantly brigalow-box. It relies mainly on grain, beef and pig production, but transport costs make it difficult to market the grain, most of which is consequently fed to pigs and beef cattle.

Dairying was given up some years ago. The calf rearing projects were developed to provide another means of converting grain into beef.

Management Systems 1971-72

The herd of 46 Australian Illawarra Shorthorns was mated to a Hereford bull in January-February and calved in September and October. At calving, each cow was given one or two foster calves to rear plus its own calf. The number of calves per cow depended on the cow's previous potential and her existing body condition. At 8 to 12 weeks of age (depending on size of calf) the foster calves were weaned and new calves were fostered on to the cow. The system is illustrated more clearly in Table 1.

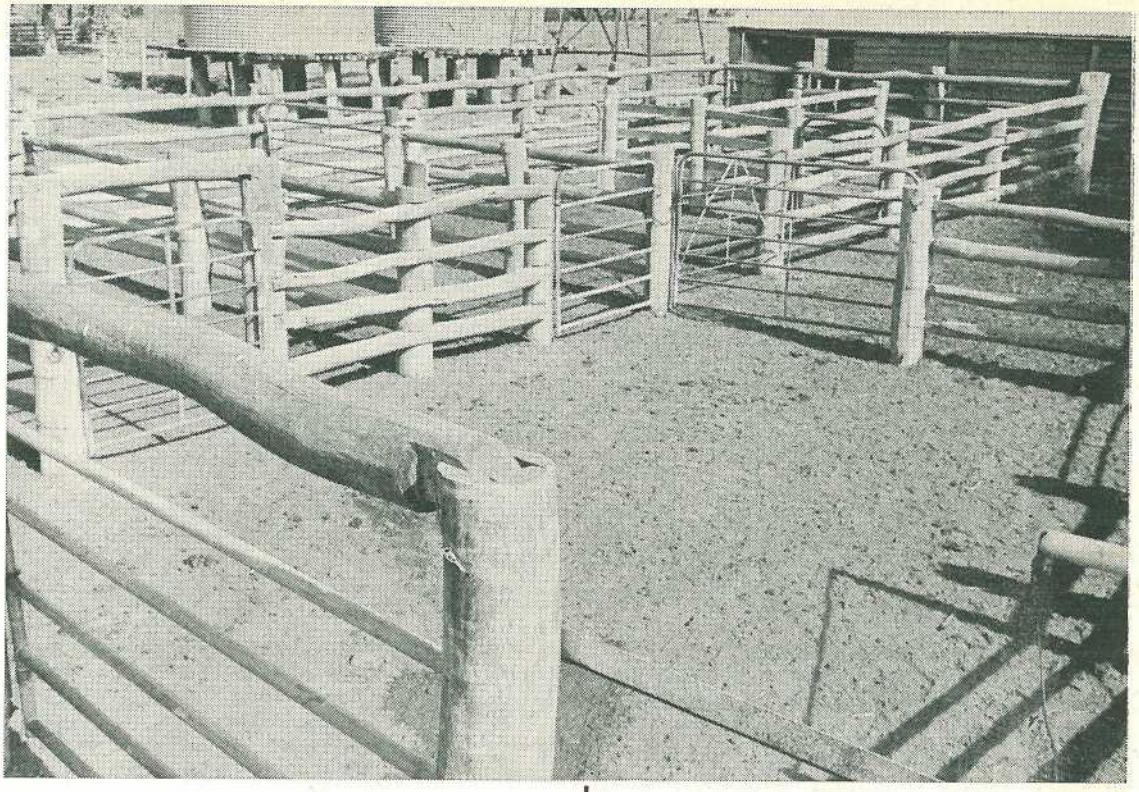
TABLE 1

Calving	Months after Calving 1	2	3	4	5	6	7
Cows own calf (A)	———	———	———	———	———	———	Weaned (A)
Plus two (B & C) foster calves ..	———	———	———	———	weaned (B and C)		
	one foster calf (D)	———	———	———	———	———	Weaned (D)

In one lactation, most mature cows reared three foster calves plus their own calf to 7 months.

The Taylor Brothers bought the foster calves (at least a week old) at the Toowoomba saleyards and gave a routine injection of sulphamethazine to each one. Their aim was to buy healthy calves of approximately 40 kg liveweight. The breed of foster calf was usually A.I.S. or Friesian x A.I.S.

Cows grazed separately from their calves, being brought together twice a day for suckling. Fostering and suckling was carried out in small yards, 4·6 x 3·6 m (15 ft. x 12 ft.) usually with five cows and 10 to 15 calves per yard. Apart from strict supervision at the first two feeds, no problems were encountered in getting the cows to accept the foster calves.



Yard facilities at the Taylor Brothers' property.

Cows were drafted into their respective pens before the calves were let in and the whole operation took Mr. Taylor and one son approximately 70 minutes. After 2 or 3 weeks, the calves tended to move from cow to cow in their yard, 'draining every last drop of milk'.

Cows grazed crop or pasture with grain supplements to overcome any deficiencies in paddock feeds.

First-year Results

In the 1971-72 season, the 46 cows reared 46 of their own calves to 7 months and 99 foster calves to 8 to 12 weeks. However, a disadvantage of the system was that the cow's own calf grew faster than the foster calves, for example, in September 0·95 kg per day against 0·52 kg per day. After 12 weeks, when the first batch of foster calves was weaned and the new foster calves presented, the cow's own calf was larger and capable of bullying its way to a greater share of the milk. This bullying action of the cow's own calf was observed usually at feeding time.

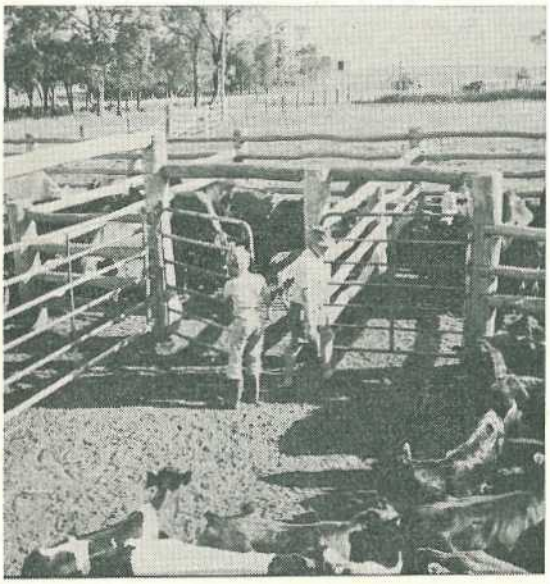
Performance after weaning was not particularly satisfactory mainly because of the very dry conditions and a delay in commencing supplementary feeding.

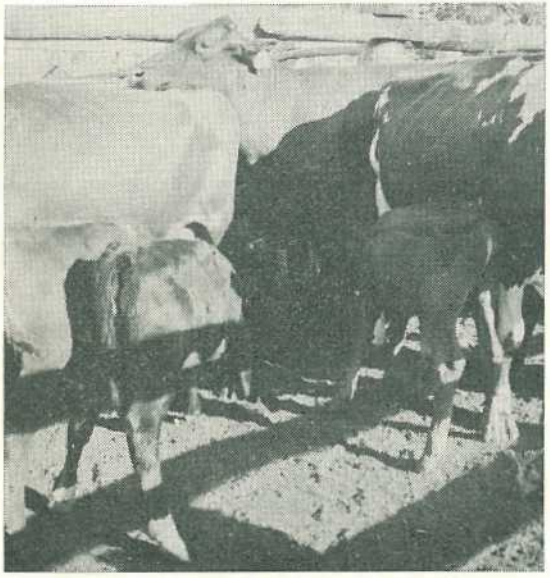
The cows and calves grazed separately throughout the project. Mr. Taylor felt that this had three advantages—

1. Mustering the cows and calves separately was simpler and much quicker than mustering them together.
2. When the cows and calves ran together, the calves pestered the cows for milk so much during the day that it interfered with the cows' normal grazing pattern.
3. The cows were more likely to exhibit heat (oestrus) early in lactation, because the continual stimulating effect of multiple suckling was limited to 30 minutes morning and afternoon.

This last point has not been proved conclusively, but the results here support this theory. Despite the fact that cows were losing weight during the mating period, of the 46

cows mated, 41 conceived within 6 weeks and only 3 were not in calf after 12 weeks. This adds support to the work reported by Cheffins and Marlowe (*Queensland Agricultural Journal, September* 1972; Vealers in S. Burnett).





TOP. Mr. Brian Taylor and his son drafting calves.

BOTTOM. After 2 or 3 weeks, the calves tended to move from cow to cow in the yard, 'draining every last drop of milk'.

System in 1972-73

To remove the bullying effect of the cow's own calf, it was decided to remove this calf at birth and foster it with another cow, thus making all the calves foster calves. Despite the small extra labour requirements of this change, Mr. Taylor found it extremely worth while. The foster calves improved their performance over the previous year and it also allowed us to make a limited comparison of breeds.

TABLE 2

MEAN LIVEWEIGHT GAIN PER DAY (KG) BETWEEN 9–10–72 AND 12–1–73 OF ALL FOSTER CALVES

Breed of Calf	September Calvers	October Calvers
Hereford x A.I.S.	0·67	0·49
A.I.S.	0·74	0·47
Friesian x A.I.S.	0·62	0·52

Differences between breeds are not significant, but the difference between September and October calvers is quite noticeable. The higher growth rate of the calves suckling the September calvers appears to be a reflection of nutritional conditions and therefore the milk supply to the calves.

Cows and calves were run separately and again no oestrus problems were identified. Artificial Insemination was tried for the first time by Mr. Taylor. The first service non-return rate was quite satisfactory. At the close of the lactation, 57 cows had reared 200 calves.

The system is relatively flexible. Should feed supplies become limiting, weaning can take place and the calves can 'grow out' to become a source of store steers at a later date. Should seasonal conditions be good, the calves can remain with the cows and be turned off as vealers. Taylor Brothers have evolved a system that requires a high level of managerial skill but moulds in ideally with a grain-beef enterprise situated relatively close to a supply of dairy calves.

Brucellosis-Tested Swine Herds (As at 16 December, 1974)

BERKSHIRE

Clarke, E. J. & Son, "Kaloon Stud", Boonah
Cochrane, S., "Stanroy", Felton
Crawley, R. H., Rockthorpe, Linthorpe
H. M. State Farm, Numinbah
H. M. State Farm, Palen Creek
Handley, Est. J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
Kimber, E. R., Tarella, M.S. 805, Mundubbera
Ludwig, A. L., "Beau View" Stud, Cryna, via Beaudesert
Neuendorf, W., M.S. 794, Kalbar
Queensland Agricultural College, Lawes
Research Station, Hermitage
Rosenblatt, G., Rosevilla Biloela
Westbrook Training Centre, Westbrook

LARGE WHITE

Ashwell, J. & B., "Green Hill", M.S. 465, via Cambooya
Ballon, E. E. & E. Maclagan
Barrier Reef Islands Pty. Ltd., Hayman Island
Batterham, P. & N., Raby Park, Inglewood
Beutel, G. R. and Son, Brookdale Stud, M.S. 786, Boonah
Bool, A. R. and B. E., Rossvale, Crow's Nest
Briskey, R. G. and M. J., Wallingford, Pittsworth
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Cauley, J. R., M.S. 918, Toowoomba
Cauley, T. P., M.S. Jondaryan 444, Rosalie
Clegg, J. A. & M. A., "Karoma" Stud, Mundubbera
Coleman, C. J., Merriland Stud, Britannia Station, Charters Towers
Corney, F. D. and E. C. W., Pagel, Tara
Cotter, N. J., "Olaroy", Goomeri
Craig, K. F., "Echoes", Bancroft, via Monto
Crawford, B. P. & B. J., M.S. 757, Kingaroy
Dean, G. F. & A. M. Home Cr., Wooroolin
Department of Aboriginal and Island Affairs, Cherbourg
Diete, E., Ingoldsby, 4343
Duckett, R. and L. M., Fairview, Capella
Duncan, C. P., "Colley", Flagstone Creek, Helidon
Duncan, J. A. & B. L., Ma Ma Creek
Dunlop Meats Pty. Ltd., Coondulla, Robertson Pk., Murray Upper
Eagle, D. R. & J. A., "Walugra", 134 Hogg St., Toowoomba
Fisher, J. & L., Lyndhurst, Jimbour
Flegler, T. C., Wongabeena, Dalby
Fletcher, L., "Par-en-eri" Stud, M.S. 806, Mundubbera
Forster, I. S. & D. E., 112 Drayton Rd., Toowoomba
Fowler, K. J. & B. D., "Kenstan", M.S. 195, Pittsworth
Fowler, K. P., Northlea Stud Farm, 156 Hogg St., Wilsonton, T'ba
Franke, K. H. and B., "Delvue" Stud, Cawdor
Freeman, W. A., "Trevlac", Rosewood
French, A., "Wilston Park", Pittsworth
Gosdon, T. C. & E. A., "Naumai", Dalby
Graham, T., Dunleigh, Highfields
Grayson, D. G., Wodalla, Killarney
Harwood, L. B., Cobar, Tara
H. M. State Farm, Numinbah
Head, G. A., M.S. 825, Ipswich
Hinchcliffe, D. F. & R. K., "Oakview", Milman, 4702
Hockings, J. & M., "Quambi", Kumbarilla
Hudson, R. F. & V. D., "Rondel", Hogg St., Wilsonton, Toowoomba
Jones, K. B. & I. R., "Cefn" Stud, Clifton
Kajewski, C. & D. I., "Glenroy", Glencoe, via Toowoomba
Kanowski, A., "Exton", Pechey
Kimber, E. R., "Tarella", M.S. 805, Mundubbera
Kruger, V. F. & B. L., "Greyhurst", Goombungee
Kuhl, V. and C. A., "The Mounts", M.S. 222, Oakey
Le Gros, W., "Elourea Stud", Marburg
Little, R. S., P. M. & G. W., "Glengarry", Jimbour
Maranoa Stud Piggery, Mitchell
Marsden, M., "Fernflat" Canaga
Mathieson, K. N., "Iderway", Gayndah
Philip, R. J. and M. M., Boolarong Stud, Elimbah
Postle, R. S., G. C. & Son, "Yarallaside" Stud, Pittsworth
Queensland Agricultural College, Lawes
Quilter, P. E., Paga Paga Piggeries, Postman's Ridge
Radel, V. V., "Braedella" Stud, Coalstoun Lakes
Robin, A. B., Blaxland Rd., Dalby
Rosenblatt, G., Rosevilla, Biloela

LARGE WHITE—continued

Research Station, Biloela
Ruge, A. F. & V. M., "Alvir" Stud, Biggenden
Ruge, G. H. & I. E., "Al-Lester" Stud, Woowoonga, Biggenden
Sharp, D. W. & L. J., "Arolla", Lavelle, Q., 4357
Smyth, R., Barambah Rd., Goomeri
Ward, R. J., "The Plateau", Mulgildie
Whiteman, J. H. & A. B., Long's Bridge, via Warwick
Willdo Farming Co., Southbrook
Willet, L. J., "Wongalea", Irvingdale
Williamson, K., Cattermul Ave., Kalkie
Withcott Stud Piggery, Rowbotham St., Toowoomba
Wolfenden, C. B. & J., Rossmoya

TAMWORTH

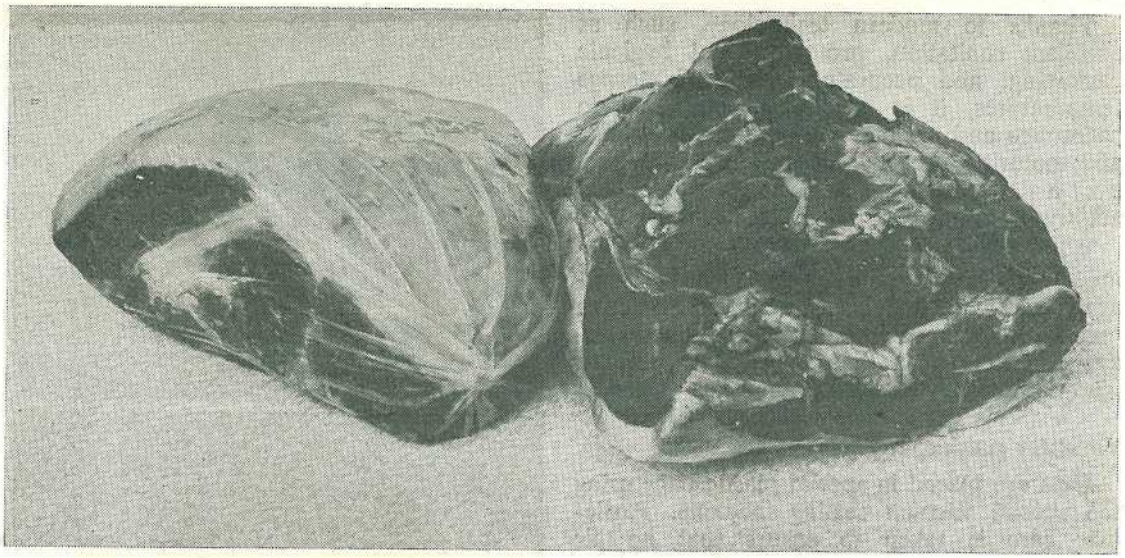
Kanowski, S. E., Pinelands, via Crows Nest

WESSEX SADDLEBACK

Douglas, Mrs. W. S. & Son, "Greylight" Stud Goombungee
Smith, C. R. & Son, "Belton Park", Goombungee

LANDRACE

Ashwell, J. & B., "Green Hill", M.S. 465, Cambooya
Ballon, E. E. & E., Maclagan
Barrier Reef Islands Pty. Ltd., Hayman Island
Batterham, P. & N., Raby Park, Inglewood
Bertolotti, F. E. J. & N. I., "Mascotte", Wallumbilla
Bool, R. A. and B. E., Rossvale, Crow's Nest
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Cauley, J. R., M.S. 918, Toowoomba
Cauley, T. P., M.S. Jondaryan 444, Rosalie
Clegg, J. A. & M. A., "Karoma" Stud, Mundubbera
Coleman, C. J., Merriland Stud, Britannia Station, Charters Towers
Crawford, B. P. & B. J., M.S. 757, Kingaroy
Crowle, N. & D., Cooranga North, 4408
Dean, G. F. & A. M. Home Cr., Wooroolin
Diete, E., Ingoldsby, 4343
Duckett, R. and L. M., Fairview, Capella
Dunlop Meats Pty. Ltd., Coondulla, Robertson Pk., Murray Upper
Fisher, J. & L., Lyndhurst, Jimbour
Flegler, T. C., Wongabeena, Dalby
Fletcher, L., "Par-en-eri" Stud, M.S. 806, Mundubbera
Forster, I. S. & D. E., 112 Drayton Rd., Toowoomba
Fowler, K. J. & B. D., "Kenstan", M.S. 195, Pittsworth
Fowler, K. P., "Northlea", 156 Hogg St., Wilsonton, Toowoomba
Fowler, N. E. P. & M. P., c/- Kewpie Enterprises, Kingaroy
Gosdon, T. C. & E. A., "Naumai", Dalby
Graham, T., Dunleigh, Highfields, 4352
Grayson, D. G., "Wodalla", Killarney
Harwood, L. B., Cobar, Tara
Hinchcliffe, D. F. & R. K., "Oakview", Milman, via Rockhampton
Hockings, J. & M., "Quambi", Kumbarilla
Hudson, R. F. & V. D., "Rondel", Hogg St., Wilstonton, Toowoomba
Jones, K. B. & I. R., "Cefn" Stud, Clifton
Kajewski, C. & D. I., "Glenroy", Glencoe, via Toowoomba
Little, R. S., P. M. & G. W., "Glengarry", Jimbour
Maranoa Stud Piggery, Mitchell
Marsden, M. "Fernflat", Canaga
Marsh Pastoral Co., Brymaroo
Nielsen, L. R., "Sunny Hill", Ascot, via Greenmount
Peters, L. A., "Moonlight", Bongeen
Philip, R. J. and M. M., Boolarong Stud, Elimbah
Quilter, P. E., Paga Paga Piggeries, Postman's Ridge
Radel, R. M., Turua Stud, Biggenden
Robin, A. B., Blaxland Rd., Dalby
Rosenblatt, G., Rosevilla, Biloela
Ruge, A. F. & V. M., "Alvir", Biggenden
Sharp, D. W. & L. J., "Arolla", Lavelle, Q., 4357
Trout, L. B. and L. J., "Caminda", Crawford, Kingaroy
Whiteman, J. H. & A. B., Long's Bridge, via Warwick
Willdo Farming Co., Southbrook
Willet, L. J., "Wongalea", Irvingdale
Williamson, K., Cattermul Ave., Kalkie



A cut of meat ageing in the bag (left) and a cut just removed from the bag.

Aged beef

by W. R. RAMSAY, Senior Meat Quality Officer.

IT has been known since early times, that whatever the age and condition of a beef animal, its meat will improve in both tenderness and flavour if the carcass is hung, unfrozen, for several days after slaughter.

This process has become known as 'aging.'

Until recently, however, keeping meat for any length of time at temperatures above freezing was a chancy business. While the natural processes that improved the meat in flavour and tenderness were occurring, so also were drying and shrinkage, bacterial action, and oxidization of the fat which produced rancidity.

It was inevitably a race between the desirable ageing process and undesirable spoilage processes. Too often the spoilage won.

It is a very different story today, although modern meat technology uses this age-old principle.

Thanks to modern technology, such as excellent sanitation, protective and hygienic packaging, and accurate control of storage temperatures, it is practicable and safe to encourage and prolong the natural tenderizing and maturing process that will occur in beef over a period of time, without the use of any additives.

With this technology, the Australian meat industry is now producing conveniently packaged beef cuts and slices of superior eating quality, which have considerably extended storage life at chiller temperatures as well as many other commercial advantages.

Vacuum packaging

Cuts are placed in special plastic bags using the special vacuum sealing machine. Particular care is taken to ensure that no air bubbles remain in the pack and that the bags are properly sealed.

A hot water spray quickly shrinks and tightens the plastic around the meat like a new skin, then a blast of cold air removes any water from the pack.

Meat matures and tenderizes

Hygienically prepared and sealed in under vacuum at chiller temperature, the beef is protected from external influences that could lead to any undesirable changes.

The vacuum pack prevents drying and practically all shrinkage or loss of moisture, and thus weight, from the meat.

Conditions inside the pack, provided it is held at the correct temperature, are ideal for the natural enzyme action to continue maturing and tenderizing the meat.

Packaged in this manner, beef cuts have at least two and a half times the storage life of carcass beef held in the air for ageing at chiller (refrigerator) temperature. This allows more time for natural maturing and tenderizing; and more time for transport, handling and marketing.

Using the chilled form

Prolonged shelf-life of vacuum-packed, chilled beef is assured, provided good temperature control is maintained and the vacuum seal on the package is not broken.

Knobs of various types of sausages (top). Continental-type sausage.

When dealing with whole cuts—

- Store cuts with the fat surface uppermost.
- Maintain the beef at chiller temperatures (31° to 35°F or — 0·7° to 1·7°C) in storage until immediately before use or freezing.
- Sealed in the vacuum pack, the beef will appear darker in colour than normal, a result of oxygen having been excluded during storage. On removing the plastic, there may also be some odour, but this will quickly disappear.
- Some dark fluid may collect in the original bag. This is normal and quite harmless.
- Prepare the beef in the normal way. When first sliced it may appear a dark, almost purple colour, but this will quickly change to the normal bright red of fresh meat once the surface is open to the air (oxygen). The beef is now ready for immediate cooking or freezing.

Frozen aged beef

Beef cuts can be aged in vacuum packs, and then frozen for extended storage.

The beef can be frozen in the original vacuum pack, or sliced and frozen. The rapid freezing (to below 0°F or — 18°C) locks in the qualities of tenderness and flavour achieved during the ageing process.

Using frozen aged beef

Allow frozen aged beef cuts in vacuum packs to thaw slowly by placing them in a refrigerator at normal refrigerator temperature.

It is advisable to use this product as soon as possible after thawing or to cook it directly from the frozen state.

Meat in inedible casings

Fresh butcher's sausages come in edible casings. Examples of these are pork, beef and breakfast sausages. Some other smaller meat products come in casings that are normally eaten. Examples of these are frankfurts, saveloys, cabana and cheerios.

The sausage products illustrated come in inedible casing. These are intended to be removed before eating.

Sometimes the casings of continental type sausages (salami and wursts) are in fact edible but, even then, sausage makers recommend that the casing be removed before eating.

Further information may be obtained from the Slaughtering and Meat Inspection Branch, Department of Primary Industries, William Street, Brisbane, Q. 4000.

Plastic bags for wrapping meat

PLASTIC bags may be used for wrapping meat, Mr. B. Parkinson, Director of the Slaughtering and Meat Inspection Branch, Queensland Department of Primary Industries, said last month.

Mr. Parkinson said that, under the new meat regulations, unused white or brown paper, or plastic bags or sheeting were approved, but wrapping in newspaper was not allowed.

The ban on newspaper wrapping, which previously had applied to Brisbane only, now extended throughout the State.

Mr. Parkinson said that the prohibition on the use of sawdust in butcher shops now overcame an unhygienic practice which had continued for many years.

The fact that most of the trade had ceased voluntarily to use sawdust before the new regulations were gazetted proved it was not needed. It had not been used in export meat premises for many years.

Meat prepared in the absence of sawdust kept longer, he said.

Mr. Parkinson said that his Branch was satisfied with the standard of butcher shops in Queensland.

However, the same situation did not apply to slaughter-houses conducted by many country butchers and the new regulations were aimed at improving conditions in them.

In his view, anyone arguing against the need for improved standards in country slaughter-houses either would have a vested interest or be completely ignorant of what went on in one.

Mr. Parkinson added that he believed the general public, if given the opportunity to inspect slaughter-houses, would fully support the new standards now being implemented.

Look at what's happened to ice cream

COOL and refreshing, the perfection of a home-made sherbet, parfait, mousse or bombe is unlimited.

Flavoured in many imaginative ways and whipped until creamy and smooth in texture, these ices can outshine ice cream cornets or sticks, wafers or bricks, so conveniently purchased from supermarkets today.

Whatever ice is made, always have your refrigerator freezer at its coldest point. Use milk and a variety of full cream powdered milks, reduced creams, economical evaporated milk and caramelized sweetened condensed milk as the beginning and watch what happens to ice cream in this family-styled selection.

In the following recipes, a standard 8-oz. measuring cup and 20 ml. tablespoon are used.

Almond marshmallow log.

Almond marshmallow log

1 teaspoon gelatine
1 cup boiling water
1 cup full cream powdered milk
¼ cup sugar
1, 4 oz. can reduced cream
1 teaspoon lemon juice
1 teaspoon vanilla essence
½ cup flaked almonds
1, 4 oz. packet raspberry marshmallows, chopped

Dissolve gelatine in boiling water. Beat in powdered milk and sugar, then reduced cream, lemon juice and vanilla essence. Pour into two, 3-cup ice cream trays. Freeze till the mixture is the consistency of thick cream.

Remove and place in a chilled bowl. Beat, gradually increasing the speed till double its volume, approximately 5 minutes. Fold in remaining ingredients. Pour into a 5-cup fancy mould or loaf pan. Return to freezer. To serve, dip the base and sides only quickly into hot water, reverse onto a serving plate and remove pan. Decorate with whipped cream and flaked almonds. Serves six to eight.

Strawberry custard freeze

2 cups milk

3 egg yolks

½ cup sugar

1 teaspoon vanilla essence

⅛ teaspoon salt

1 cup cream, whipped

1 punnett strawberries, washed, hulled and mashed with

2 tablespoons of brandy or kirsch

In a double saucepan, mix together milk, yolks and sugar. Cook over boiling water, stirring till mixture coats back of spoon. Cool. Fold in vanilla essence, salt, cream and strawberries. Pour into one, 3-cup ice cream tray. Freeze. Serve with whipped cream and decorate with flaked toasted almonds or chocolate curls. Serves six to eight.

★ ★

Caramel cruncher

1, 14 oz. can sweetened condensed milk

Place can in saucepan of water. Boil for 2 hours to caramelize. Cool completely before opening the can.

1 pint milk, warmed to blood-heat

2 junket tablets, crushed and dissolved in 1 tablespoon water

2 chocolate coated honeycomb bars, chopped coarsely.

Stir dissolved junket tablets into warmed milk carefully. Allow to set. Beat caramelized condensed milk and junket together. Pour into two, 3-cup ice cream trays. Freeze until mushy. Remove, place in chilled bowl. Beat till double its size in volume. Fold in honeycomb. Return to trays. Freeze. Serve with hot chocolate sauce. Serves six to eight.

★ ★

Blackcurrant-peach parfait

1, 13 oz. can blackcurrant fruit juice syrup

2 tablespoons cornflour

1, 14½ oz. can undiluted evaporated milk, chilled icy cold

Blend blackcurrant syrup into cornflour in a pan. Bring to boil, stirring constantly. Boil 2 to 3 minutes. Chill thoroughly. Beat evaporated milk in a large bowl to form stiff peaks. Fold in blackcurrant mixture. Pour into two, 3-cup ice cream trays. Freeze. Serve in scoops with canned peach halves and whipped cream. Serves six to eight.

SWINE SALES STAMP DUTY

THE suspension of collection of swine sales stamp duty under the *Swine Compensation Fund Act* 1962–1969 has been extended to 31 December 1979.

Announcing this, the Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) said the present suspension period was due to end on 31 December this year. It had applied since 1 January 1970.

Mr. Sullivan said the fund balance at the present time was $262 144. He added that, because of the inclusion of swine fever under the compensation provisions of the Foot and Mouth Disease Expenses and Compensation Fund Act, the Swine Fever Compensation Fund Act was redundant.

But action to revoke it could not be taken until the balance in the fund had been expended on approved measures relating to control of diseases of swine.

This possibly could take some years and, in the meantime, it was essential that suspension of stamp duty on sales of swine be maintained.

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161–192	May	513–576	November
193–256	June	577–640	December

S. G. Reid, Government Printer, Brisbane

Top and root rot of pineapples

Recognition and spread

TOP rot and root rot, caused by the soil fungi *Phytophthora cinnamomi* and *Phytophthora nicotianae* var. *parasitica*, are the most serious disease problems of pineapples in Queensland.

Phytophthora cinnamomi causes heavy losses in autumn and winter in all pineapple growing districts of the state.

Phytophthora nicotianae var. *parasitica* is responsible for spring and early summer losses in the Mary Valley of South Queensland and is also important in autumn and winter in Central and North Queensland.

These fungi are water moulds and attack plants only when the soil is very wet.

Symptoms

The early symptom of top rot is a change in colour of the heart leaves to a yellow or light-brown with a reddish tinge. The leaf edges curve back and it is easy to pull these leaves from the plant.

Internally, the soft stem and leaf bases are rotted, and a pungent smell is present. The growing point of the stem has a cheese-like appearance.

With root rot, the leaves undergo a similar colour change to that caused by top rot. However, the outer leaves become limp and die back from the tips. By this stage, the root system has collapsed and plants are easily pulled from the ground.

Root rot may extend through the stem to cause top rot, but generally the fungi attack the leaf bases directly.

A general rot of green fruit may also result from attack by *Phytophthora cinnamomi*. Only fruit on or near the ground is affected, hence green fruit rot is seen only in ratoon crops.

Spread

Wet soil is vital in the growth and spread of the fungi causing top and root rot. The diseases are more common in pineapples grown on heavy soils which remain damp for long periods.

The fungi reproduce in water in the heart of the plant or in the soil. Surface run-off water, soil wash and rain splash carry the fungi to neighbouring plants. Serious losses generally follow heavy rains.

Tops and slips, particularly those planted in autumn, are more susceptible than suckers. This is because tops and slips have soft stem tissues which are easily invaded by the fungi.

In addition, the long stems of the suckers mean that a greater amount of tissue has to be invaded before top rot occurs.

Losses from top and root rot are more severe on flat or poorly-drained land. However, tops may be attacked even on reasonably well-drained soils if heavy rain falls soon after planting.

Compiled by N.T. Vock, Plant Pathology Branch. (Further information including recommended fungicides can be obtained from your nearest Plant Pathology office or by writing to the Director, Plant Pathology Branch, Meiers Road, Indooroopilly, Q. 4068.)

Diseases of pineapples - 1

TOP ROT IN THE FIELD. Left: diseased plant. Right: healthy plant.

TOP ROT. Cut section of a diseased plant.

GREEN FRUIT ROT.

ROOT ROT IN THE FIELD. Note the leaf collapse, tip dieback and small fruit.