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Conserving wildflowers

by S.L. Everist,
Director,
Botany Branch.

Fortunately, the most colourful wildflowers grow in the poorest country and this has probably saved most of them from extinction. Until recent years the infertile sands, poorly drained soils, rocky slopes and crags have remained largely undisturbed and 'undeveloped' because it was not economical to use them for farming, grazing or even forestry.

Today, the best wildflower country in coastal Queensland is being progressively changed and increasingly threatened by three important social developments:

(1) mining of sand dunes
(2) sub-division for housing and industrial buildings
(3) clearing, fertilizing and establishment of sown pastures.

The wildflower areas that remain are also being subjected to increasing pressures by people in search of recreation, not intentionally but thoughtlessly. This is due to rapid increase in urban populations, the construction and improvement of more and more access roads, the development of trail bikes and beach buggies and an attitude of mind that says 'What harm will it do if I trample on the flowers and perhaps pick a few?'

We have not yet reached the point of inevitable extinction except in highly developed areas such as the Gold Coast. This area was once a veritable wildflower paradise but today, unless you know exactly where to go to the very few reserves and meagre 'undeveloped' blocks, you scarcely ever see a field of wildflowers. The same trend is taking place on the offshore islands, the Sunshine Coast and further north and is accelerating at a frightening rate. Even the Glasshouses, so rich in wildflowers, are showing the wear and tear of countless pairs of feet as people clamber over them in search of recreation.

Next time you feel inclined to pick a large bundle of wildflowers or trample roughly over dunes, rocky crags or through the wallum, spare a thought for the generations to come and try to leave behind the flowers that have given you such pleasure. Whatever you do, don't

'Go crook on life and call the world a cheat
And trample on the daisies at your feet'.

Our cover for this issue shows Boronia Keysii, one of Queensland's lesser known flowers.

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Len and Joan Dodt, with son, Malcolm.

. . . *a family business*

by CLAUDIA UNDERWOOD,
Husbandry Officer,
Dairy Field Services.

FOR the Dodt's of Gympie, providing a good service to local A.B. users involves the whole family.

FOR most people, 5 a.m. is an early start. But for the Dodt family of Gympie it is a daily routine. For the past 12 years Len Dodt has been the Manager/A.I. Technician of the Gympie Artificial Breeding Co-operative and all members of his family play their part in the business.

a call comes in

Joan Dodt takes a telephone call from a client . . .

. . . and then uses the two-way radio to contact Len, who is out on his rounds.

another goes out

Farmers from the surrounding district start phoning in at 5 a.m.—"Three for Len, thanks Joan—one HPV and 2 Coolangatta Airman. Thanks . . . Bye".

Joan Dodt is a familiar voice to the users of the A.B. Service as she takes the calls in her efficient, friendly way.

Len leaves on his round when enough calls have come in to make a start. The phone continues to ring until 8.00 a.m. and Joan relays the messages to Len via a two-way radio.

Their three sons, who start the day with their parents, help by answering calls, and relaying them to their father until it's time to leave for school.

On most Gympie dairyfarms, Len Dodt is a familiar figure as he makes his brief calls to inseminate cows waiting in the yards. Len's rounds usually begin before 6 a.m. and during the main breeding season he may not get home before dark.

His car can be seen, Monday to Saturday, hurrying from farm to farm. With the willing effort of his whole family he is able to provide a reliable, efficient service to members of the co-operative.

The Gympie Artificial Breeding Co-operative is now one of the largest dairy A.I. Co-operatives in Queensland with over 400 members; 300 of them use the service regularly. Each year Len inseminates more than 3 000 cows and travels over 30 000 miles.

Len and Joan Dodt, formerly successful Mary Valley dairy farmers, recall the early days of the co-operative when there were 80 members, only 30 of whom used the service regularly. A seven day service was provided meaning that there was no "day-off" in the Dodt household.

Len checks his semen supplies. The semen is being removed from the large transport unit to a smaller unit he uses for his everyday work.

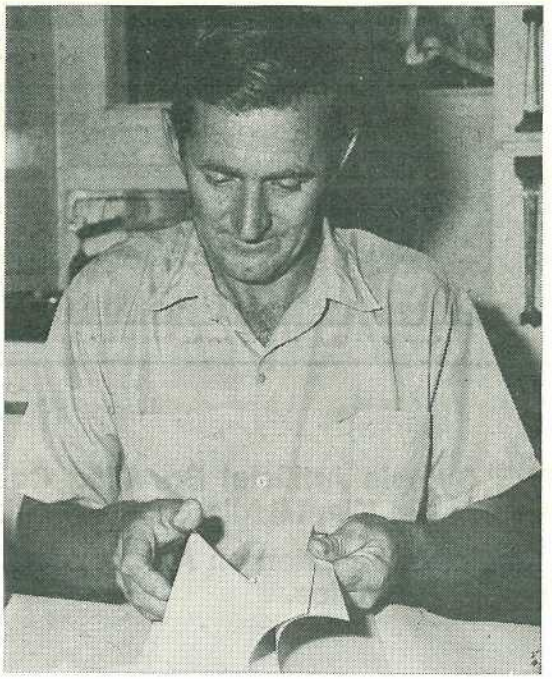
Len who was trained as an A.I. Technician at the Queensland Wacol A.I. Centre, remembers the early days when he used chilled semen and the semen frozen in a dry ice/water mixture. "It was not unusual to order 40 lbs. of dry ice" he said "and receive only 20 lbs. because of evaporation during the trip up from Brisbane. The only problem was that you'd already paid for the lost 20 lbs."

Semen today is stored in liquid nitrogen units at −196°C.

In his units Len has semen stored from over 200 bulls from almost 20 breeds. "This is the main advantage" says Len. "Farmers have a tremendous choice of bulls from my unit."

"We use semen from all over the world and operate a nominated service. However, 80% of the semen we use comes from the Wacol A.I. Centre—a tribute to the work the Department of Primary Industries is carrying out in bull-proving."

Record keeping—a time consuming but important part of a successful artificial breeding business.



There are thousands of bulls on A.I. Centres throughout the world from which Gympie dairy farmers can now select. Len Dodt spends many hours after his rounds keeping himself up-to-date on available bulls.

Detailed records must also be kept of all semen bought, semen in storage and that being used. Monthly returns must be furnished to the Department of Primary Industries on his performance and the bulls used. Here again, Joan plays her part, spending hours going through the records. As the Co-operative has grown so has their task. The neatly kept books tell their own story and indicate clearly Joan's dedication to her role in the Co-operative's success.

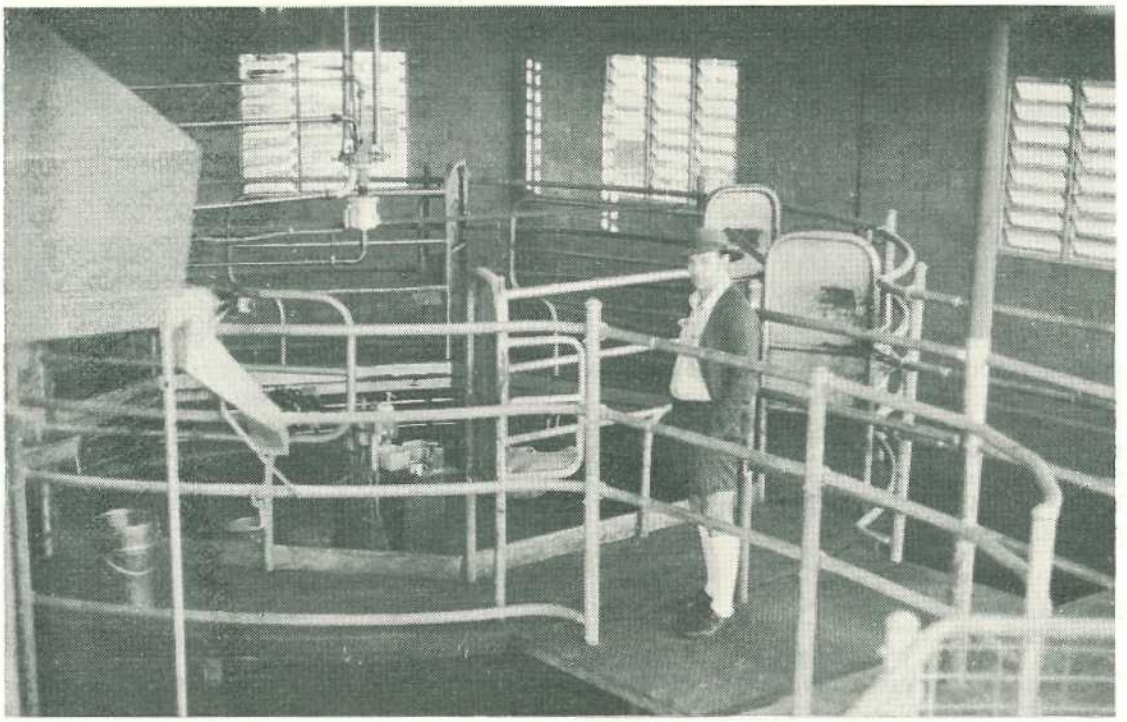
Next time you call your inseminator early in the morning, spare a thought for the dedication of he and his family to the job of getting your cows in calf.

Cattle grazing near Gympie—a herd typical of those Len Dodt services.

THE Gympie Artificial Breeding Co-operative services producers in the Kiaora, Kin Kin, Middle Creek, Imbil, Widgee, Bell's Bridge areas.

For information on A.B. services available in your area contact your local D.P.I. office.

He built it himself



The general layout of the circular platform and entrance race is depicted. Note the ideal ventilation in the bails with glass louvres.

Rotary dairy improves milking efficiency

by W. B. OLIVER,
District Adviser

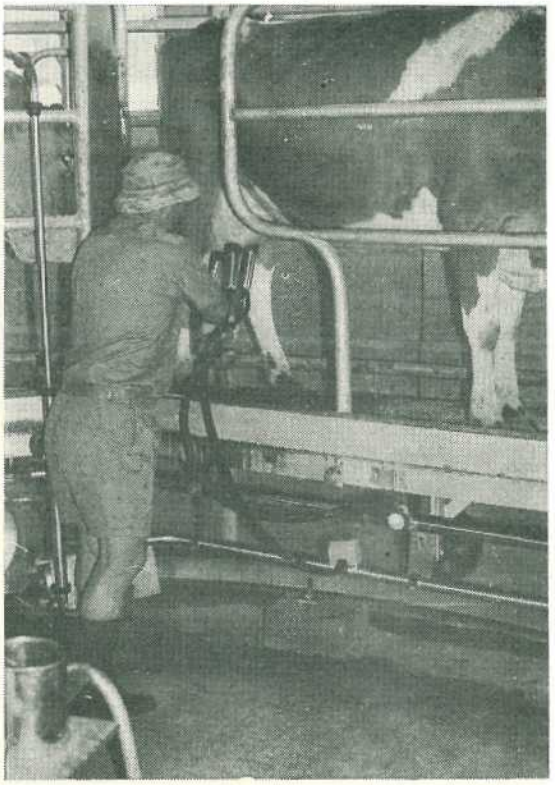
THE local construction of a "Circulating Dairy" by a South Burnett dairy farmer improved milking efficiency on his property by 75%.

The time spent feeding and milking dairy cattle is a major consideration on all dairy properties, particularly if labour has to be employed. During the last five years there has been increased interest in Australia in the use of a moving rotary platform to speed the milking operation and to minimize the physical effort required. There has also been considerable debate on the economics of this type of construction compared with the conventional herringbone design.

Mr. Vince Lakin operates a Guernsey dairy cattle stud at Mondure, via Wondai in the South Burnett. In 1967 when he purchased the 294-acre property there were 30 mixed grade cows which were milked in a 3-unit walk-through dairy. His immediate improvement plans included:

- establishing improved pastures
- cropping in winter and summer
- developing a Guernsey stud through a careful and selective breeding programme
- increasing his herd size to 70-80 cows.

As he aimed to operate the farm with no outside labour he was concerned at his rate of milking of the cows. His initial through-put was 34 cows an hour in the walk-through dairy using two operators, one to wash udders and the second to supervise feeding. This resulted in an effective through-put of only 17 cows per man hour.



The elevated platforms mean no stooping with cow preparation. The side-on stance of the cows means udders are handy for machine attachment. Note the low line milk pipeline under the moving platform.

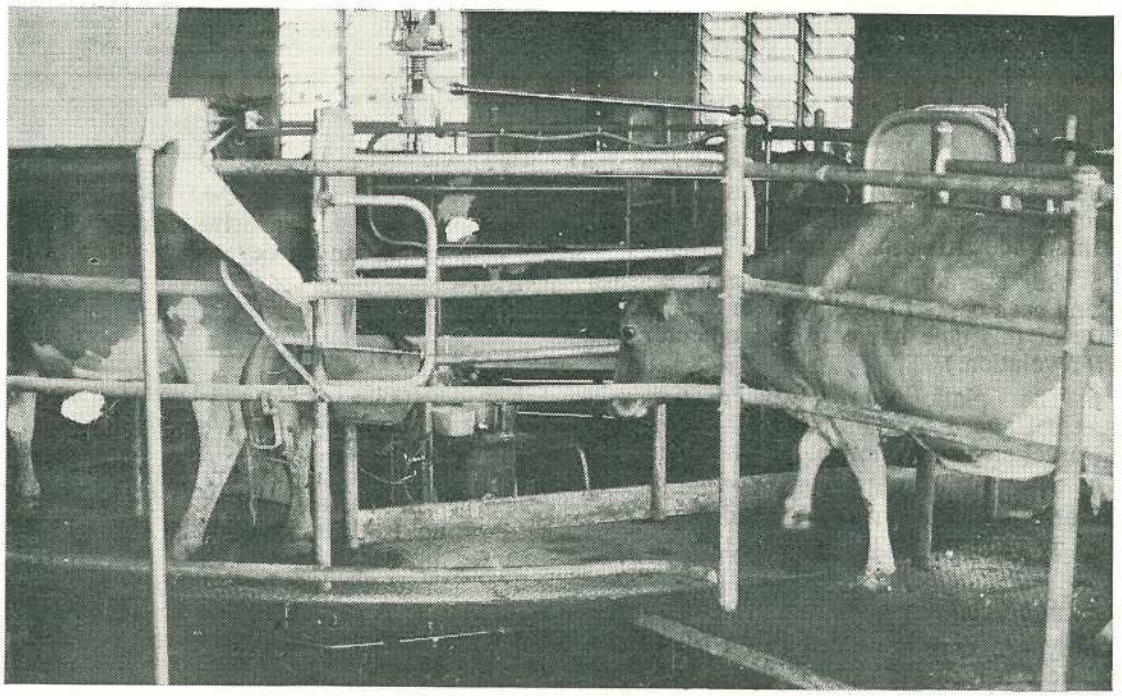
Shed design

From a study of overseas and Australian literature on modern dairy sheds Mr. Lakin considered a rotary dairy would suit his plans. In the design he planned for the cows to be standing sideways rather than end-on and to incorporate feeding in the bails. As he could only purchase imported designs of this type and no plans and specifications were available locally he decided to undertake his own construction.

Mr. Lakin carefully studied the general literature on small tandem rotaries operating in Britain and New Zealand. He wanted a dairy of this basic design to suit his farm and he had several improvements in mind. A fitter and turner by trade, with several years practical experience behind him, Mr. Lakin called upon his ingenuity and experience and designed his own 7-stall "Circulating Dairy". Construction of the platform and metal work was done by Sckarts Engineering at their Wooroolin works.

The job was started in January, 1973. However, the dairy was not completed until November, 1973 because of steel and cement shortages. The actual time of construction excluding these delays was as follows:—

Cement work	14 days
Platform Building and installation ..	10 days
Roof	7 days
Machine Installation	1·5 days
Electrical	2·5 days
Yards, Gates, Doors, &c.	28 days
Auto-Feeders	2 days
TOTAL	65 days



Cows enter the platform through a specal race locating themselves sideways on the circumference of the circle. Note the chute feed entry from the supply hopper to the stall bin in the top left hand corner.

Costs

The total cost to construct the building and install the rotary platform with stall fittings, feeding equipment, milking machine and bulk milk vat was $15 124. The individual costs are listed below:—

	$
1 800 litre Q.B.B. bulk milk vat	3 230.00
Alfa-Laval milking machines	3 207.40
Revolving platform, complete, installed	2 000.00
Roof, complete	1 970.00
Electrician	520.64
All cement bricks, labour, gravel (+ road)	2 884.49
Ceiling, louvre frames, louvre glasses	186.64
All water pipes and fittings	74.23
Pipe and material for all gates, doors and yard fence	371.22
Pressure pump	108.00
Backing gate drive	28.00
3 H.P. electric motor	132.00
Back hoe for excavation	88.00
Auto feeder, grain bin 20′ 4″ auger	323.50
TOTAL	$15 124.12

These costs are reasonable. A bare platform ready-made from South Australia would have cost $3 500 with a 6-month delivery period. Mr. Lakin's fully equipped motorised and installed platform cost only $2 000—a big saving.

Using his own labour for cementing, installing yards, gates, doors and painting also kept the costs down.

These costs would be comparable to the cost of a 6-7-a-side herringbone.

Major features

Mr. Lakin's "Circulating Dairy" has the following special features:—

1. The platform revolves at varying speeds —one revolution per 3 to 13 minutes. The speed can be easily adjusted according to circumstances.

2. The platform can be reversed.

3. The platform may be stopped at any time.

4. The automatic feed hopper is triggered off by a lever on each stall, and drops 3 lbs. concentrate to each cow. All cows receive the same amount but quantity can be easily changed. A grain mixture with minerals and vitamins added is usually fed.

5. An operator entry and exit passage behind each cow. (The only other commercial dairy of this type has only one operator exit per revolution.)

6. The platform revolves continuously (unless stopped by the operator) rather than the usual stop-start motion.

7. The one central switch to control the platform is at the operator's hand.

8. The noise level is extremely low.

Increased efficiency

Only one man is needed in the new dairy and he can milk the same cows twice as fast.

Bails	Through-put (Cows/hr.)	No. of Operators	Through-put (Cows/Man/Hour)
3-unit walk-through	34	2	17
7-unit circulating dairy	76	1	76

Labour is now an expensive farm input and the time saved can be devoted to other farm activities.

EDITOR'S NOTE:

For readers on the Darling Downs a second building of this design is being constructed on the property of P. J. Cuskelly & Co., Greenmount. Construction of this tandem rotary unit began in June and will cater for a milking herd of up to 100 cows. The unit will be operated by one man and takes the place of a four unit doubled-up walk-through building. Mr. Cuskelly is particularly impressed with the single automatic feed dispensing unit associated with the design.

FOURTH EDITION—FARM MANAGEMENT BOOK

The fourth edition of this handbook is aimed at providing a ready reference to technical and financial data which can be used by educational institutions, extension officers, farmers, graziers and others concerned with property planning and development.

The handbook has been completely revised and converted to the metric system. It brings together reference data from numerous sources and presents it, for convenience, in a single publication.

To obtain your copy of the Farm Management Handbook, send $2.50 to: Director of Economic Services, Department of Primary Industries, William St., Brisbane, 4000.

Downs farmers avoid crop losses

by N. G. GRAINGER, Standards Branch
and I. N. McCLEMENT, Agriculture Branch.

THE reports of crop damage believed to result from the drift of weedkillers has decreased significantly during the last 18 months. One of the reasons is that Darling Downs farmers are using farming practices that minimise the risk.

The increase in area sown to crops such as soybeans, sunflowers and cotton which are highly susceptible to weedkillers including 2,4–D amine and picloram (* Tordon 50–D), had contributed to an increase in the area of reported damage to these crops attributed to weedkillers drifting onto them.

The area of damage reported reached a peak of 1 776 ha (4 440 acres) in 1972–73 and many farmers were so disturbed at the results that new farming practices have emerged to reduce the problem.

ROW CROPPING

One of the most noticeable new practices has been the change from the broadcast principle of growing grain sorghum to that of row cropping. By planting grain sorghum in rows, varying from 50 mm (21 inches) to 1 metre (40 inches approx.) according to machinery available, grain farmers are able to control weeds by inter-row cultivation.

To control weeds within the row, a tank, pump and nozzles are mounted on the cultivation equipment and the weedkillers directed into the row. This method means lower requirements of weedkillers, lower production costs, and more effective control of weeds than overall spraying.

Directing the weedkiller onto the row means less chance of spray drift as compared with the high volume overall spray method.

Darling Downs grain farmers have been quick to adopt row cropping of grain sorghum. Department of Primary Industries trials and commercial practice have shown that under rain grown conditions, the row crop system will increase yield in below average rainfall seasons when compared with the broadcast system. Under good rainfall conditions, the two systems will yield equally as well.

CO-OPERATION

Co-operation amongst neighbouring farmers has also had a significant effect on the decrease in the area of crops damaged. Farmers have been encouraged to contact their neighbours to check the location of susceptible crops before spraying weedkillers.

This information, when passed on to agricultural pilots and ground operators engaged in weed control has enabled them to make sound judgements on precautions needed, such

* Registered Trade Mark

as what atmospheric and weather conditions are applicable for a particular spraying operation.

FORMULATIONS

Late in 1973, special controls on the use of certain formulations of chemicals were introduced on the Darling Downs to help reduce the incidence of crop damage.

By the declaration of Hazardous Area No. 2, 2,4–D ester formulations were banned. These ester formulations can be dangerous because plants sprayed with them can give off vapours of the weedkiller for a number of days after application.

Vapours can drift from sprayed plants onto susceptible crops up to several kilometres away resulting in damage similar to that from direct spray drift.

There are many factors farmers must consider before using weedkillers in crops to obtain the best results and at the same time reduce any risk of spray drift to neighbouring areas.

These considerations include:—

Spraying conditions and timing

The optimum time to spray weeds is when they are very young, and in their most susceptible state (under very lush conditions, the crop may also be susceptible). Spraying at this time allows the use of low chemical application rates—reduces the risk of damage to the crop being sprayed. It must be remembered that all weedkillers have some effect on crops and that rates and the timing of their application must be in accordance with the conditions stated on the manufacturer's label.

Drift

There are many factors which influence drift, the major ones being droplet size, wind, height and direction of discharge of the weedkiller.

The size of the droplet is determined by the nozzle design and the pressure applied. The smaller the nozzle opening and the higher the pressure, the smaller will be the droplet size. Minute droplets are more easily carried by wind than large droplets and remain suspended in the air to be carried for longer distances.

The aim should be to use fairly large droplets that result in an even coverage of the spray on the target plants.

When spraying near susceptible crops such as soybeans, lucerne, cotton and sunflowers, it would be preferable to have a gentle wind blowing away from the plants that could be damaged. Do not spray under windy conditions or completely calm in the early morning.

The further away the spray nozzle is from the target plant, the greater the dangers of drift. The nozzle should be as near to the target plant as possible without interfering with the spray pattern.

High temperature and low humidity increase the risk of drift problems and often the effectiveness of the spray. Suitable spraying conditions can exist in the early morning, late afternoon or evening.

EQUIPMENT

The type of equipment used will depend on the circumstances of the operator. It ranges from the hand operated sprays such as hand powered knapsacks through to boom sprayers and misters. Mist blowers and to a lesser extent high volume sprayers must be carefully controlled as a precaution against spray mist drifting onto susceptible plants. Under windy conditions, mist can be blown for many kilometres.

Regular checks on nozzles, pressures and worn parts are essential to ensure the best working conditions of the equipment.

The machinery should be properly calibrated to ensure that output is at the required rate.

D.P.I. INVOLVEMENT

Farmers are not the only ones that were concerned with the amount of damage reported in 1972–73. D.P.I. officers on the Darling Downs mounted a mass media campaign creating an awareness of the problem.

Working with producer groups and individual farmers, agricultural pilots and chemical company representatives much has been achieved in this co-operative venture.

Bull Vaccination for Vibriosis Control

by C. R. HASS, Veterinary Services Branch

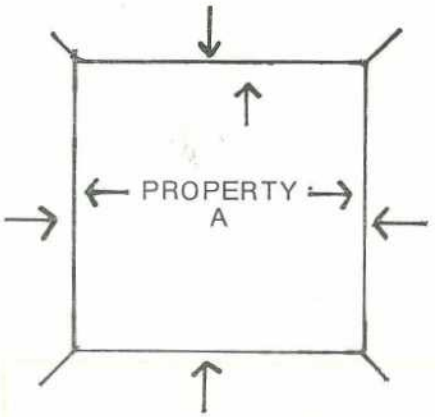
IN recent years a lot of time has been spent on evaluating the effects of vaccinating bulls to control vibriosis in a whole herd situation. This article looks at several property situations, and suggests vaccination programs for each.

THE results of all the work on vibriosis has proven that vaccination of bulls only will have a marked beneficial effect where vibriosis is a problem. However there are still circumstances where vaccination of cows and heifers is advisable as well.

It can be said that "Where there are bulls and cows together, there is vibriosis".

While this may not be true in every situation, it does indicate that it is extremely common and widespread. Vibriosis is an infertility disease spread from cow to cow by infected bulls.

The following diagramatic situations and notes on each cover most cattle property situations and shows which vaccination programme is recommended in each case.

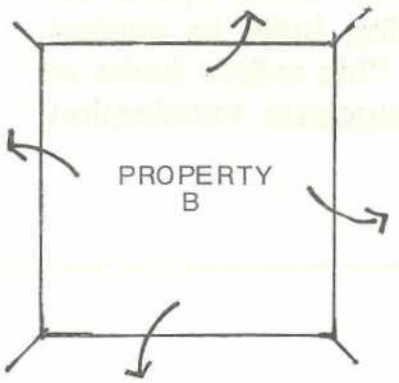


A. Securely fenced.

No animals out.

No animals in (except purchases).

Vaccinate—Bulls only. Two injections 6 weeks apart, the second to be about 4 weeks before mating. Single annual booster.



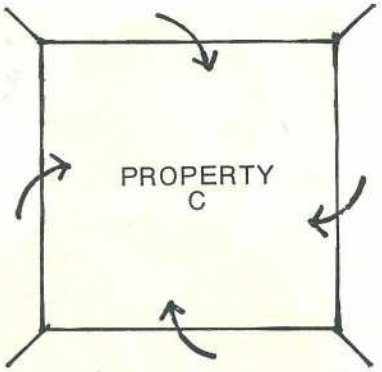
B. Bulls out and mate with neighbours infected cows.

Bull returns and spreads infection in own cows.

Vaccinate—(i) Bulls twice before mating (escape) and then once annually, or

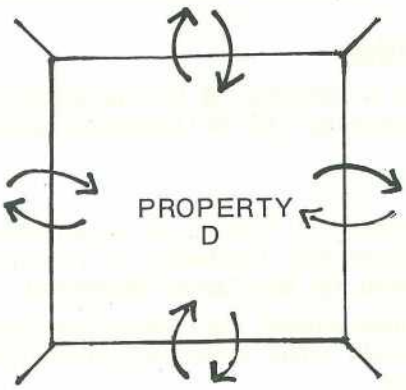
(ii) Vaccinate whole herd (bulls, cows, heifers) to protect against introduction.

Female vaccination—one injection and annual booster vaccination.



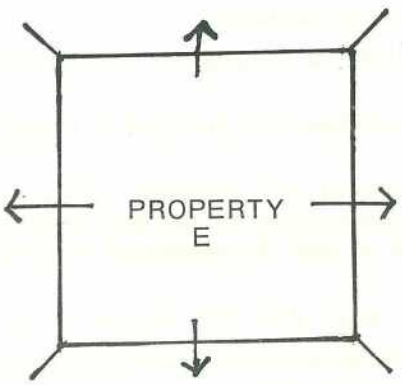
C. Entry of neighbours cattle—either or both sexes—introduce disease.

Vaccinate—(i) Bull vaccination only or (ii) Protect whole herd—male and female vaccination.



D. Free interchange between properties.

Vaccinate—All breeder stock.



E. Controlled mating. Cows only escape and mate with infected bull. Later returns to service and you put her to your own bull.

Vaccinate—Bulls only.

Remember, you may be doing yourself a favour by offering any left over vaccine to your neighbour for use on his own bulls.

From the above it can be seen that bull vaccination is a cheap and practical method of improving production in a herd.

Warning—Even though the vaccine has been produced for some years now, we still have the problem of it causing lumps under the skin at the site of injection in many cases. This is to do with the oily nature of the vaccine, and not necessarily the operators fault. However, all hygiene precautions should still be taken at the time of vaccination.

Further Reading:—Vibriosis, An Infertility Disease—Queensland Agricultural Journal, July 1971.

Of particular interest

Items of news recently released by the Minister for Primary Industries, the Hon. V. B. Sullivan, M.L.A.

Subsidy for Tickicides

The State Government has approved a new scheme to subsidise, at the manufacturing level, the cost of listed tickicides used for dipping, or spraying, cattle in Queensland against cattle ticks.

The scheme will operate from October 13.

This scheme will replace an earlier proposal approved by Cabinet in August which involved the bulk purchase of tickicides by the Government and distribution to producers in a similar way to the weedicides scheme administered by the Lands Department.

The cost savings will be somewhat similar under either scheme, but Cabinet considered that payment of subsidy at the manufacturing level would retain intact the present distribution chain, with all its associated services to graziers.

Subsidy payments will range up to $7.73 for a five-litre container.

During the past season, there has been a marked fall-off in on-property tick control measures, due to depressed cattle prices.

This will result, no doubt, in a build-up of tick populations with the onset of warmer, more humid weather.

While the cost of tickicides is not the only factor involved, it is regarded as being of considerable importance and Cabinet has adopted a recommendation of the Beef Industry Inquiry Committee, of which I am Chairman, that such a cost be subsidised to assist producers.

The cattle tick costs the Queensland cattle industry more than $33 million a year.

Departmental Stock Inspectors will be supplied with a list of the cost savings to apply on containers of the various brands of tickicides.

They should be contacted by producers with queries, or with complaints if they considered they were not receiving the correct amount of subsidy.

Stocks held by wholesalers and retailers for sale in Queensland at the start of the scheme also will attract subsidy to enable it to take an immediate effect.

I have met representatives of manufacturers, wholesales and retailers and they support the scheme.

Wholesalers and retailers have been asked to make a check of stock in hand and in transit.

Garlic growing

in the Lockyer Valley

by W. D. MILLS,
Agriculture Branch.

Garlic (Allium sativum L.)—a member of the Lily family (Liliaceae)—is the second most widely used of the cultivated alliums. The common onion (Allium cepa) enjoys the privilege of being the most commonly used.

WORLD botanical opinion agrees that the origin of *Allium longicuspis Rgl.*, the ancestor or wild race of our present day garlic, was in Central Asia. In pre-historic times, population movements, brought it to China and Japan, southern Asian countries and the Mediterranean. Historical records show the presence of garlic in Egypt as far back as 2500–3000 B.C.

Spanish, Portuguese and French explorers and traders, brought garlic into Western Europe from distant Asian countries such as China and India.

Once garlic was mainly grown and used in countries of the Mediterranean, where the local inhabitants had a long standing appreciation of the garlic bulb as a pungent condiment useful for flavouring a wide variety of foods.

Although statistically a minor crop by comparison with other agriculture and horticulture crops, it is now grown in most vegetable producing areas of many countries. A greater emphasis on production occurs in those countries whose original population has been blended with settlers from the Mediterranean.

As garlic is an extremely variable species, many strikingly different clones are known in cultivation. Some of these forms have been designated as botanical varieties of *Allium sativum L.*

Frequently it is difficult to apply scientific names to cultivated plants in a clear and uniform manner, especially in those plants which, like garlic, have emerged during a long period of cultivation to many distinct forms.

Within the species *A. sativum L.*, several single Latin form names have been used to designate botanical varieties, e.g. *A. sativum var. sativum, A. sativum var. ophioscorodon* (Link) Doll, and *A. sativum var.* pekinense (Prokh) Makino. These varieties are recognised as horticultural groups. Within these horticultural groups, there occur a large number of cultivars.

Most cultivars have been developed by vigorous selection of planting material. A minority have arisen as vegetative mutations during the long history of garlic cultivation.

All selection has been conducted with a two-fold purpose:— Firstly, to produce a clonal strain capable of good growth and production under specific local environment; and secondly, to comply, if possible, with local consumer demand.

The Lockyer Valley in south-east Queensland produces the bulk of the State's garlic crop. In 1973–74 the area under crop was slightly in excess of 60 ha. Favourable climate, fertile soil, availability of irrigation and access to markets make the Lockyer Valley an important area for the production of a wide range of agricultural and horticultural crops including onions and garlic.

What is Garlic?

THE garlic plant differs from the common onion in the following ways:—

(a) The leaf blades are not hollow and inflated, but flat and folded lengthwise, with a keel or mid rib more pronounced on the lower surface.

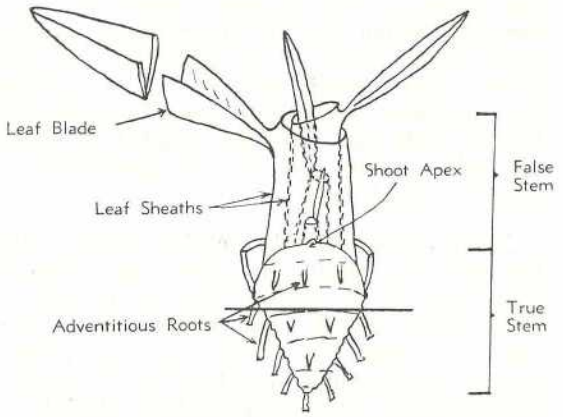
(b) The scape (seed stalk) when present is solid, not hollow.

(c) Small bulbs are commonly mixed with the flowers of the inflorescence. Flowers usually abort in the bud stage, and although there are reports of seed production in literature, there is no confirmation that the garlic plant ever produces viable seed.

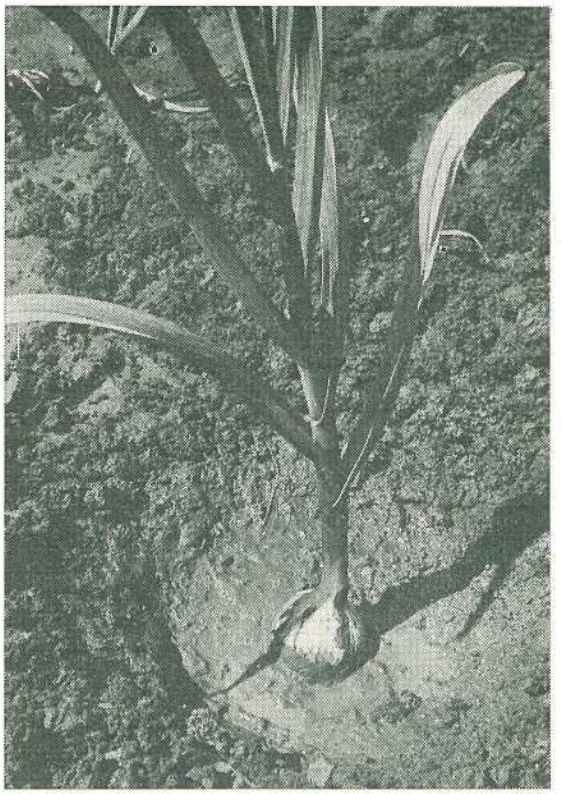
(d) In garlic, the foliage leaf bases never store food as do those of onion, but mature as slim, dry

scales. The sole storage organs of the bulb are the axillary buds at the base of the foliage leaves (cloves or small bulbs).

(e) At maturity, the main stem of the bulb, and roots and leaves attached to it all die. Only the cloves or small bulbs that develop from the axillary buds, which are cut off by an abscission layer, remain to carry the plant on for another season.



Adapted from the illustration p. 50. "Onions and their Allies"—Jones and Mann, published by Leonard Hill, London and Interscience Publishers, New York.



A typical garlic plant close to maturity. Several botanical features of the plant can be seen in this photograph.

(a) Broad flat leaves with a well defined mid rib. The leaf blade each side of the mid rib folds inwards lengthwise to give a distinct V shape to the leaf where it is attached to the false stem.

(b) Leaves are arranged alternately.

(c) The main bulb forms slightly below the soil surface, at the depth of placement of the originally planted seed clove. The white mark on the stem shows the actual level of the soil surface before its excavation to expose the rapidly developing bulb.

A clove consists of two mature leaves and a vegetative bud. The outermost of the mature leaves is the protective leaf. It is a cylindrical sheath with a small opening at the top and a minute, aborted blade. This sheath, which surrounds the whole clove, has a surface layer of tough fibres. When it matures it becomes thin, dry, and dead.

Within the protective leaf is a single storage leaf. This thickened sheath is the only storage structure of the clove and accounts for almost all of its bulk. Inside and at the base of this storage leaf are several very small leaves. These form the bud. The first of these is known as the sprout leaf. This leaf, when the clove starts to grow, does not produce a leaf blade. Its main function is to provide a clear passage from the clove for foliage growth.

Where growth occurs above the ground, this leaf is not of much use. Where growth

occurs below ground, foliage could not emerge without this leaf. It forces its way upwards through the soil covering the clove, to emerge through the soil surface. It stops growing after it emerges, breaking open to allow the green foliage leaves to emerge and develop.

After establishment, the young garlic plant continues to produce new foliage leaves and adventitious roots, and its stem slowly elongates and broadens.

The preceding diagram shows the arrangement of the stem, roots and leaves of the young garlic plant. As garlic is planted from bulbs, there is no primary root development. The main adventitious root system develops directly from the stem at the base of the bulb.

Once the stem is formed no part of it increases in diameter but as the stem grows upwards, it broadens and so assumes the shape of an inverted solid cone. Often as the stem continues to grow upwards, its oldest part, i.e. the stem which served the young plant, decays so that the lower surface of the bulb may become flat.

At the centre of the broad stem, on its upper surface, is the apex where new leaves are formed. Each leaf arises from the stem tip as a ring which tends to be higher on one side. This ring, as it grows upwards, forms a tube and the high side of the ring elongates into the leaf blade. The top of the stem expands outwards as well as upwards, so that the inside of the circular leaf bases is continually enlarging. This provides room for leaves which are forming. The shoot apex is always located at the bottom of the youngest tubular leaf. So each new leaf surrounds the successively younger leaves which follow it, as it is itself surrounded by older leaves that preceded its development.

Each leaf blade extends from the side of the plant opposite the leaf blade that preceded it, so that leaves are arranged in two ranks, alternate in position along the stem.

The leaf sheaths which project above the ground and to which the leaf blades are attached form a firm structure commonly called a stem. It is not a true stem and is more correctly termed a false stem to distinguish it from the true stem at the plant's base.

The root system of garlic, like that of the common onion, is not extensive. Garlic roots increase little in diameter once they are formed and for this reason new roots must continually arise from the stem, if the enlarging top of the plant is to be adequately supplied with food and water.

New roots do not grow from the old root area. They grow from the younger stem tissue above the site of the old root growth on the short vertical stem. They are often seen pushing out through the base of the older leaves. In a large garlic plant, the roots spread horizontally from the bulb base for 30–35 cm, growing downwards to a depth of 48–84 cm.

In a normal field situation, the main bulk of the plant's roots would be located in the surface 30 cm of soil. In heavy compacted soils, the root system may be more sparse. Garlic roots branch more freely than those of the onion. They spread more fully in and exploit the soil. New roots cannot grow into dry soil. So the bulb base must be situated in moist soil before there can be any elongation of newly initiated roots.

When environmental conditions favour bulb formation in garlic, the cloves are initiated from buds in the axils of the foliage leaves. These buds appear only in the axils of the younger leaves, i.e. leaves near the plant's centre. So there may be a dozen or so "sterile" foliage leaves, surrounding the bulb which have no cloves in their axils, but serve merely as wrapper leaves. Within these wrapper leaves, a series of successive leaves, from two or three to perhaps ten or more, bear cloves. The number and arrangement of cloves vary among cultivars. It is quite common to find several cloves developing side by side in the axil of one leaf.

The main garlic bulb when fully developed is composed of a large number of small bulbs or cloves. The main bulb forms slightly below the soil surface, approximately at the depth of the placement of the originally planted seed cloves.

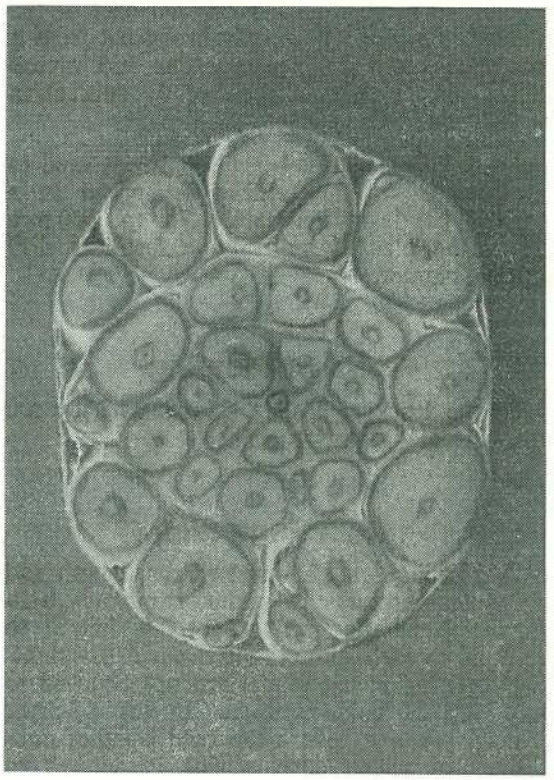
Because of the large number of easily separable cloves forming the main bulb, garlic is much better adapted to vegetative propagation than are most types of the common onion.

The pattern of growth is essentially the same for all cultivated *allium* species.

Bolting—Seed Stem Formation—Flowering. In onions, a period of hot weather, followed by a period of cold weather and then hot again, will trigger the flowering mechanism in onions that are bulbing. This does not occur with garlic. The factors controlling seed stem formation in garlic are not fully understood.

The fact that garlic plants are not induced to flower by exposure to fluctuating temperatures at bulbing enables a wide range of planting dates to be selected by growers for growing the crop.

Careful selection of clonal planting material not prone to seed stem formation is the only satisfactory way of maintaining this situation.



Transverse section of a mature garlic bulb showing the arrangement of cloves.

Preparation for Planting

GARLIC does well on a variety of soil types, similar to those used for growing onions. They range from light loams, clay loams, to heavy clays. For the best results, they should be of good physical structure, fertile and well drained. Soil reaction (pH) of these soils ranges from slightly acid to slightly alkaline (6.5 to 8.0)

Good land preparation is essential so the young garlic plants will have the best possible soil conditions for survival.

The final seedbed should be as weed-free as possible. Intense weed competition after planting the crop may seriously reduce its vigour.

A garlic grower should provide his crop with a firm seedbed of fine soil aggregate to allow smooth furrowing and easy insertion of cloves. Maintaining plentiful reserves of humus in the soil helps to provide such a seedbed.

The subsoil should be well worked and firm, but loose enough to allow rainfall to penetrate easily and the developing root system to expand.

The extent of land preparation depends on many factors including soil type, previous crop history, weather conditions, machinery and finance available.

A typical sequence involves ploughing, cultivation with disc or tine implements, or a combination of both, and harrowing to provide the desired degree of seedbed fineness.

Cultivation should become progressively shallower during the final seedbed preparation. Deep cultivation at this stage will cause loss of accumulated soil moisture and loosen the desirable firm base of the seedbed.

Long fallowing is not practised on the irrigable soils of the Lockyer district. High land values have made it necessary for each

irrigated acre of cultivation to produce at least two crops a year, or possibly five every two years, so the primary producer may show a reasonable profit on his capital investment.

Fertilizers

A well fed crop is usually a healthy crop. If it is necessary to improve soil fertility to suit the requirements of the garlic plant this may be done by the addition of fertilizer provided other agronomic factors are in harmony.

To gain the maximum benefit from fertilizer, it should either be applied and incorporated in the seedbed soil during final land preparation before planting or applied as a side-dressing shortly after emergence. The latter is the most common method adopted. It is a recommended practice only where irrigation is available to dissolve the broadcast fertilizer and wash it down into the plant's root zone where it can be utilized.

Usually the grey or grey brown alluvial soils on which most of the garlic in the Lockyer Valley is grown, have enough phosphorus and potassium reserves to ensure satisfactory growth. Nitrogen, being a very mobile element in the soil, is the only plant food likely to be deficient.

A limited number of recently conducted fertilizer trials with onions on these soils showed a trend toward confirming the above practice. Furthermore, no response to trace element application could be measured from these trials.

One or more side-dressings with a straight nitrogenous fertilizer are normal. Timing and application frequency are based on plant growth and vigour. Suggested times range from just after emergence, the 3 to 4 leaf stage, and just before bulbing. Nitrogen should not be applied once bulbs have started to enlarge as this may lead to excessive foliage growth at the expense of bulbing, and delay maturity.

On less fertile soils, a nitrogen/phosphorus/potash fertilizer mixture is normally used. Where a main crop application of mixed fertilizer is broadcast and incorporated by irrigation after the crop has emerged, it must be done as soon as practicable after emergence.

Additional nitrogen side-dressings may be applied if needed. On light soils more subject to leaching, a fertilizer mixture may be substituted for a straight nitrogen fertilizer.

Fertilizer Mixtures and Application Rates

Nitrogenous fertilizer—9 to 13·5 kg per hectare elemental nitrogen per application.

Mixed fertilizers such as 12:13·9:10 are applied at between 250 to 750 kg per hectare depending on soil fertility.

Method of Application

No fertilizer applicators are fitted to local planting machinery as they are usually of simple construction, and the cost of equipping them with fertilizer applicators would often amount to more than the original cost of the planter. Fertilizer is usually broadcast from a tractor-mounted spinner spreader and placed in the plant's root zone either by cultivation or irrigation.

On fully mechanised garlic planters used in overseas countries, fertilizer is spread in a narrow band approximately 75 to 100 mm below the planted bulbs by a fertilizer drill on the planter.

Time of Planting

In the Lockyer Valley, March to May are the normal planting months.

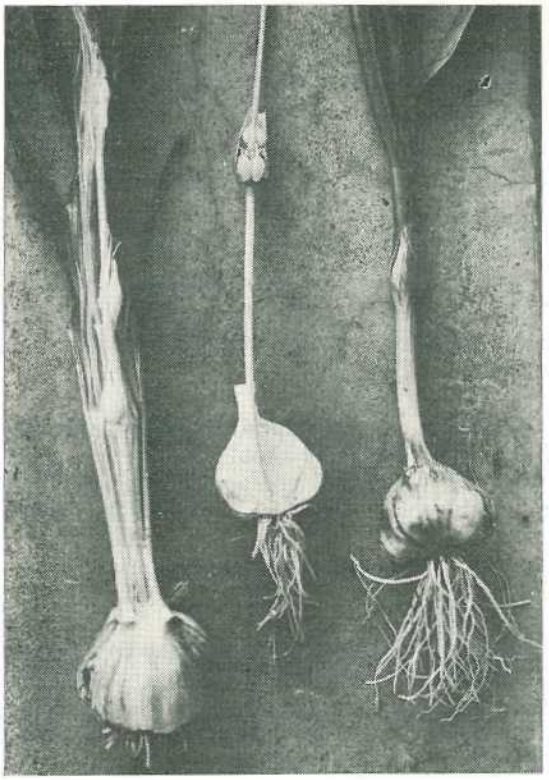
Bulb Formation

A combination of increased day length and rising temperatures in spring stimulates bulb formation in the garlic plant. A failure to respond to such stimuli may occur if the planting stock or young plants are not exposed to a period of cold weather. In the Lockyer Valley, planting before the cold weather conditions of winter/early spring is enough to provide the cold treatment necessary to stimulate bulbing.

Garlic Seed

GARLIC produces no true seed. Even though some garlic varieties may produce a scape or flower-stalk, topped with an umbel inflorescence, the flowers, very variable in number or absent altogether, rarely open, and wither as buds. Where they do open the flowers are sterile. Commonly present in the inflorescence are small bulbs, varying greatly in size and number.

In some instances, where the inflorescence develops within the false stem but is not exserted (a common feature of the locally grown cultivar), the small bulbs may be felt as swellings somewhere within the false stem a short distance above the bulb.



Commonly present in the flowers of garlic plants are small bulbs, varying greatly in size and number. In some instances where flowers develop within the false stem and are not exserted, these small bulbs may be felt as swellings somewhere within the false stem a short distance above the bulb. The illustration shows:—

(a) Garlic plant on the right undamaged with roots attached as it would be harvested direct from the field. A swelling indicating the presence of small bulbs in the false stem may be seen in the false stem above the bulb.

(b) A similar plant on the left has had the leaf sheaths, comprising the false stem removed to reveal the presence of a pronounced seed stem and bulbs.

(c) A similar plant centre has all the false stem removed—and the garlic bulb cut in half to reveal the position the seed stem occupies within the bulb. The outer covering of the bulbs on the seed stem has been cut to show more clearly their presence and position on the seed stem.

Preparation of Garlic for Planting

Single cloves of garlic in garlic planter storage bin ready for planting.

AS GARLIC does not produce viable seed, it is propagated vegetatively by planting cloves, the small bulbs comprising the whole garlic bulb. Growers using the cloves to plant a crop commonly refer to them as seed.

Planting material should not be selected from bulbs showing genetic tendency towards formation of a rough bulb condition, or other undesirable features.

The separation of bulbs into cloves for planting should be delayed until planting time, as whole bulbs store better than prepared cloves. To prepare the cloves, the tops of the bulbs are cut or torn off and the cloves broken out, usually by hand.

The thin, tough, paper-like layer surrounding individual cloves should not be removed. All cloves should be separated from each other, or double plants will develop, one from each clove, when planted in the field. The planting material should be thoroughly dry before breaking, to help with handling and clove separation.

Cultivars that produce well developed seed stems are not popular, as the seed stalk may reduce the size of the basal bulb by robbing it of food. The seed stalk may also leave an undesirable core in the trimmed bulb.

Clove Size

OVERSEAS research has established a direct correlation between the size of the clove planted and the size of the growing plant and the harvested bulb. The number of cloves per harvested bulb does not show the same relationship.

Where a wide range of clove size exists, grade planting material so spacing may be adjusted to clove size. Plant growth will then be more uniform.

In practice, the choice of clove size and spacing depend so much on the cultivar used, the bulb size desired, planting machine available, and the cultural practices followed, that each farmer must determine the most desirable planting material for his particular situation.

Of the locally grown garlic variety, cloves weighing in excess of 1 gram are the best type of planting material. Smaller cloves may be discarded, or planted more densely.

The small bulbs, produced in the false stem or inflorescence can also be used for propagation. These bulbs are similar in structure to the basal cloves. When planted, they produce small garlic bulbs of unsuitable market size.

When cloves from these bulbs have been replanted and their progeny replanted over a number of seasons, the average bulb size shows a tendency to increase with each generation. Selection of only the largest bulbs for replanting from each generation may help to reduce the time needed to grade up the progeny of small seed bulbs to a stage where they are of commercial use. As this normally takes many seasons to achieve, the commercial garlic grower considers it impractical to use this material to establish his crop.

WEIGHT OF BULBS REQUIRED TO PLANT 1 HECTARE

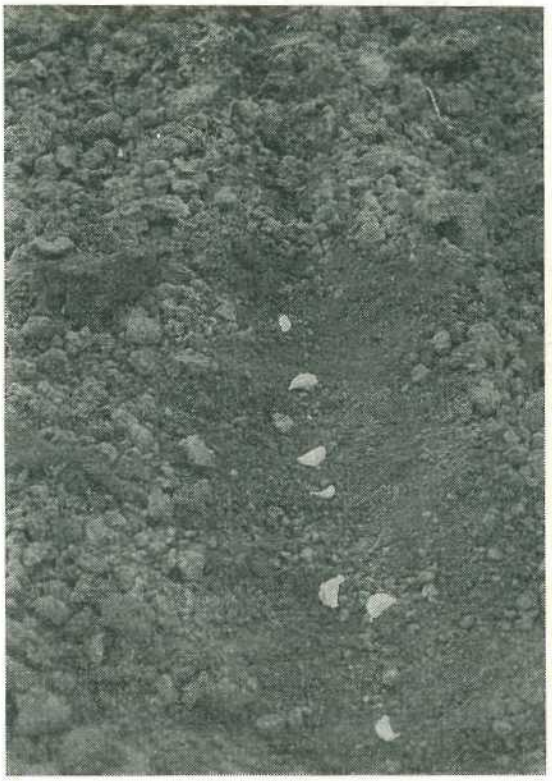
It is estimated that between 900 to 1100 kg of mature bulbs are needed to plant one hectare. This figure is flexible according to bulb size, variety and plant population per hectare.

Irrigation

The crop in the Lockyer Valley is grown entirely under spray irrigation. The normal procedure is to plant into the moist soil of a well prepared seedbed overlying good subsoil moisture.

After planting, maintain a moist environment around bulbs by light irrigations, to promote germination and establishment. Care should be taken not to over-water as a waterlogged environment may stimulate the activities of disease organisms responsible for causing bulb rots. Usually 18 to 25 mm per irrigation is sufficient. As growth proceeds, irrigation can be heavier and less frequent—approximately 50 mm per fortnight, dependent on seasonal weather conditions and soil types, heavy soils having a greater moisture holding capacity than sands. Plants should never be allowed to stop growing for lack of available moisture. The crop usually requires 300 to 375 mm of irrigation during the growing season.

Row and Plant Spacing



LEFT: these garlic cloves were originally planted by machine and then unearthed to show approximate spacing in the furrow. In hand planting, the furrow is opened by machine. The single garlic cloves are then positioned by hand in the furrow at a spacing similar to that illustrated.

RIGHT: a field of garlic showing a normal row and plant spacing arrangement.

ROW spacing ranges between 45 to 60 cm. Plant spacing ranges between 75 to 125 mm. Suggested plant populations range from 25 to 30 plants per m^2.

Experiments conducted overseas show that within the range of figures quoted for row and plant spacing, the average yield per unit area does not show any marked variation.

A minor yield drop and increase in average bulb size resulted from increasing row and plant spacing. Yield increased, but bulb size diminished when row and plant spacing was decreased.

In practice, the choice of row and plant spacing is very dependent on the cultivar used and the result of local experience using different combinations of these criteria.

Planting Methods

(i) *By hand*, placing cloves individually in shallow furrows opened by machine.

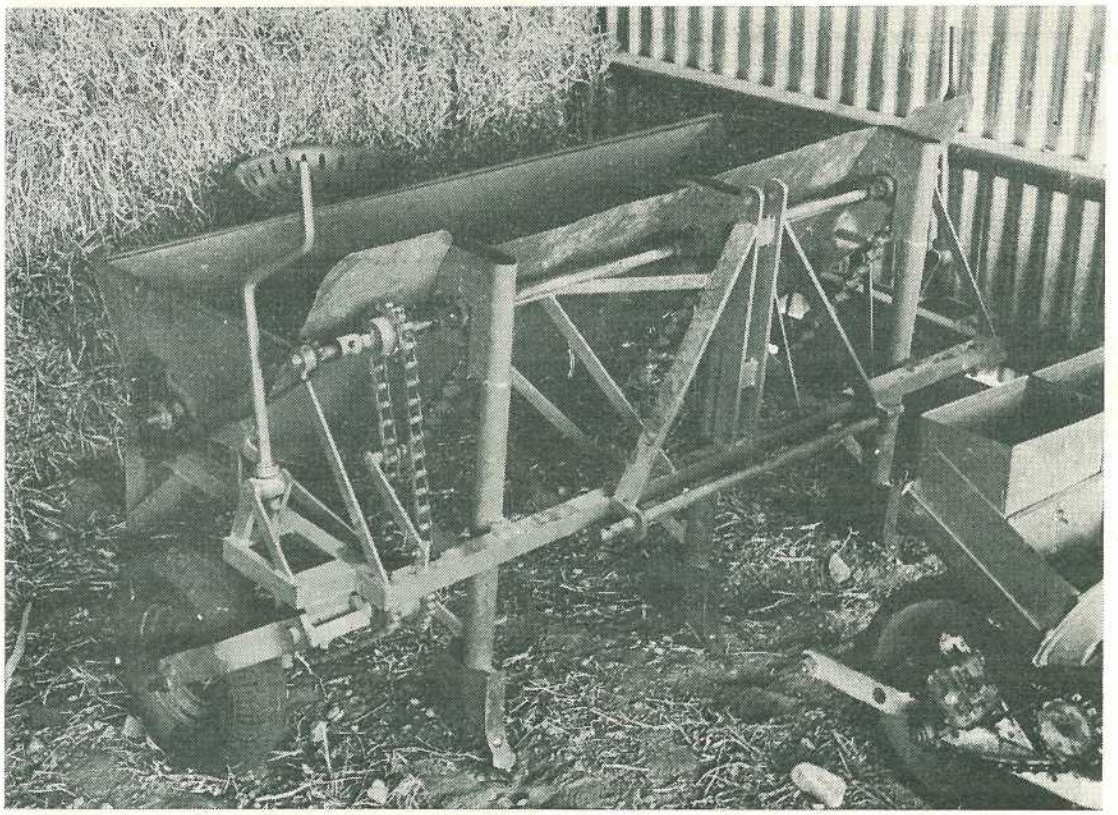
(ii) *By machine*. Although fully mechanised garlic planters are available, they are not generally used in the Lockyer district as they are not considered economical to use on small planting areas.

They employ the principle of an endless chain fitted with cups at regular intervals, similar to that used in cup type potato planters, moving up through a storage bin of cloves. Each cup gathers up a clove and drops it down a chute attached to a planting shoe. A tine attached to the toe of the shoe opens a furrow to receive the cloves. Small tines or discs following close behind the rear of the planting shoe cover the furrow behind the planter.

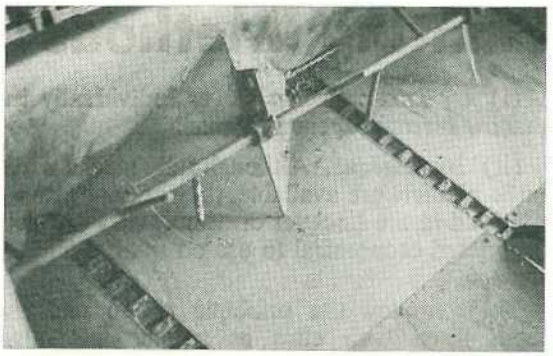
The types of machine most commonly used in the district are simple; either modified maize planters with the normal seeding mechanism removed, or custom built models, a product of a farmer's ingenuity. Basically, they employ a similar planting mechanism to the garlic planter, with the exception that the cloves are not transferred mechanically. They are moved from the bulk storage bin to the planting chute by an operator sitting directly behind it.

When the cloves are dropped into furrows either by hand or by machine, they come to rest in various positions. Research has shown that hand placing in an upright position has not significantly increased yield over random positioning by machine. Cloves planted vertically with the root end up, usually fail to establish a satisfactory plant.

Soil should be well firmed round the bulb, located just below the soil surface.



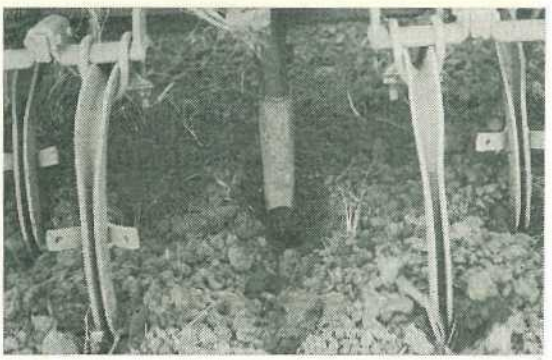
A three row mechanical ground driven garlic planter fitted with three point linkage.



Close up view of chains in storage bin. Also shown is a rotating agitator to ensure a free flow of cloves onto the chains.

A three row, manually operated garlic planter fitted with three point linkage.

Operator feeding single cloves of garlic into the planting chute. Storage bin on this machine is fitted as a conical shaped container attached to the frame of the machine in front of the planting chute, within easy reach of the operator.



A view of a planting boot and covering tines in a working position.

Weeds and Weed Control

AS GARLIC is planted at the same time of year in similar situations to onions, both crops encounter similar weed problems.

Garlic, like onions, because of its long growing period and general inability to compete with weeds, is a crop in which weed control is important right from planting to harvesting.

Early in the life of the garlic crop, weeds can compete for moisture, plant foods and light. Later, heavy weed growth may interfere with bulb development and ripening.

Control

Weed control can be achieved through a combination of sound farming practices, cultivation and herbicides.

Sound Farming Practices

These include not allowing weeds to set seed, and maintaining the garlic crop and other rotational crops and fallow in as weed free condition as possible. This task is made easier by planting garlic following a "clean weed" crop such as potatoes, wheat or barley, rather than a "dirty weed" crop such as pumpkins.

Some farmers grow garlic for several years on the same piece of land with the aim of reducing the weed problem in successive crops. This practice, however, has the disadvantage that it can lead to a build-up in the soil of disease organisms that attack garlic.

Cultivation

Weeds between the garlic rows can be controlled by means of tractor mounted "knife" cultivators or hand-pushed garden wheel hoes. Weeds within the rows can be controlled by hand chipping, but chipping can be a very expensive and time consuming operation.

Disadvantages of mechanical and hand cultivation include mechanical damage to the garlic, the risk of unfavourable weather conditions interfering with tillage operations and labour which can be both scarce and costly.

Herbicides

Herbicides can play a very important role in garlic growing, because of the problems and disadvantages associated with mechanical and hand weeding.

Herbicides used

Chlorthal (commercially available as Dacthal W75) is the only herbicide recommended and registered for use on garlic in Queensland. This pre-emergent herbicide should be applied as soon as possible after planting but before the weeds germinate. It should be applied as an overall treatment at 11 kg product/ha.

Dacthal W75 gives good control of the following weeds:—

GRASS WEEDS—Barnyard grass (millet), Crowsfoot Grass, Stink Grass, Summer Grass, Urochloa Grass.

BROAD-LEAFED WEEDS—Apple of Peru (Wild Hops), Blackberry Nightshade, Checkweed, Deadnettle (Mintweed), Dwarf nettle (stinging nettle), Fat Hen, Graft Pigweed, Green amaranth (Prince of Wales feather), Pigweed, Redshank, Stagger weed (Mintwood), Wireweed.

There are a number of other herbicides including Bromoxyml, DNOC, Ioxynil and CDEC which are under trial and may be of use in controlling other weed species.

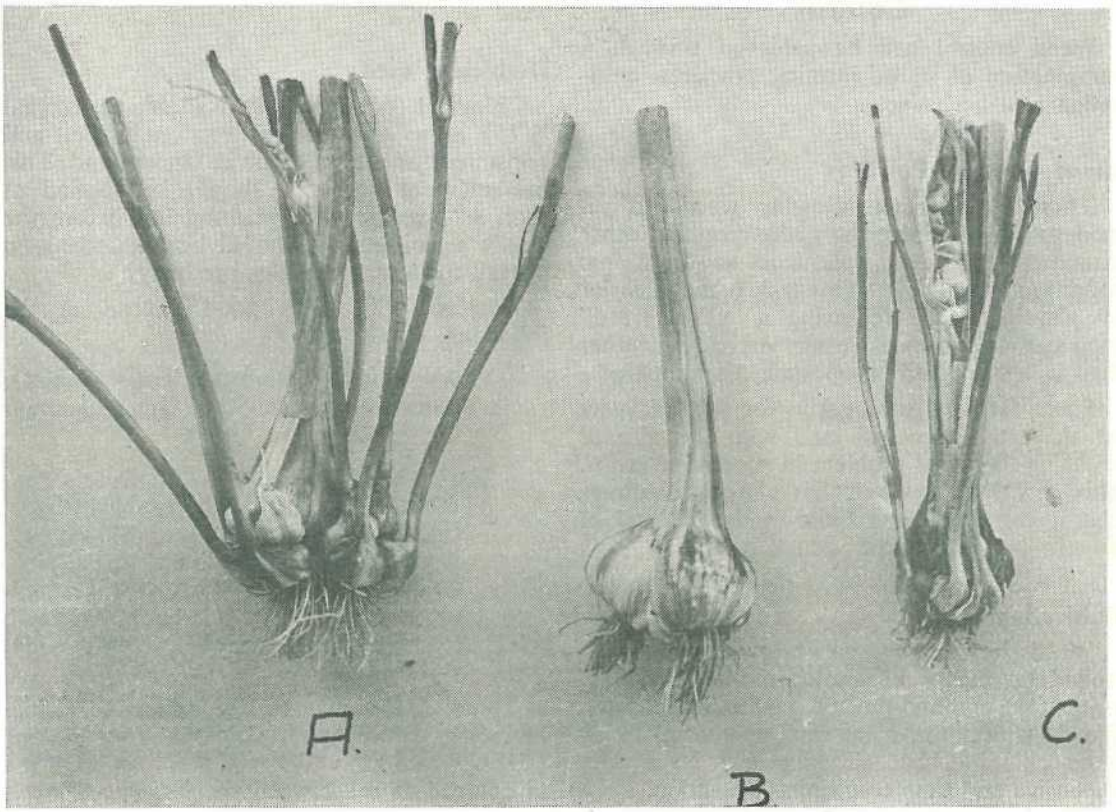
Maturity

As a maturity guide, a bulb may be considered fully developed when the top starts to brown off and die from natural causes, and fully mature when the tops have fallen over and dried off. The duration of a garlic crop, from planting to maturity is approximately 5 to 6 months.

In practice, the local garlic strain is not allowed to mature fully in the field. Bulbs are pulled when a grower considers them to be fully developed. The reasons for this are:

- When mature, the leaf scales of the original bulb die completely. Subject to warm moist soil conditions, these leaves are rapidly decomposed by soil microflora. As they disintegrate, they expose the cloves beneath, giving the bulb a rough, unattractive appearance. Bulbs with cloves exposed in this fashion lose their market appeal.
- Warm moist soil conditions may easily stimulate growth of cloves within the mature bulb, commonly referred to as second growth, making it unacceptable at market.

Examples of second growth occurring in mature garlic bulbs. (A) and (C) An example of well developed false stems on outermost cloves of the parent garlic bulb. (B) The base of the parent bulb has split in two, caused by the pressure of growing cloves within the outer leaves of the parent bulb.



Harvesting

GARLIC bulbs are not mechanically harvested, they are pulled by hand. If they are difficult to remove without damaging the tops, the roots may be cut by using a horizontal knife, attached to the toolbar of the tractor, set to run just below the garlic bulb.

Garlic bulbs pulled by hand and stacked in small heaps, ready for removal of tops and roots.

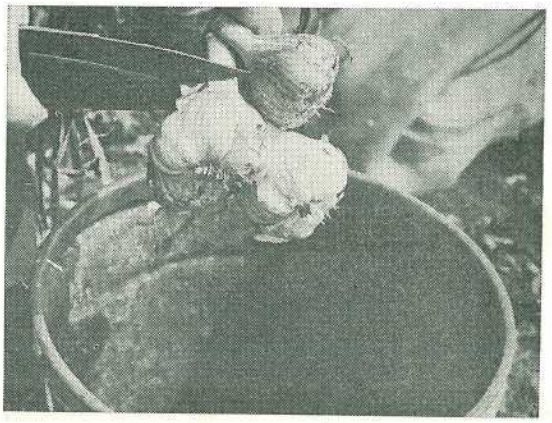
In small areas, the tops and roots are usually trimmed from the garlic bulb as they are pulled, using sheep shears. The tops are cut off about 1 to 3 cm above the bulb. When the tops have been removed, the bulbs are then left in thin layers on old potato bags to dry out thoroughly. If the bulbs are to be left in the field for any length of time, they should be protected against sunburn by a covering of dry tops. This works satisfactorily when weather conditions are dry and hot.

In areas where rain or dew could interfere with the drying process, bulbs may be removed from the field to continue their drying on well ventilated racks in sheds or on farm trailers. The advantage of trailers is that they may be moved from the protection of a shed into a suitable drying position during the day and back to the shed again at night or when rain threatens.

As an alternative to the above method, a farmer may prefer to pull his garlic bulbs and leave them to dry out thoroughly in small heaps in the field or in thin layers in a shed, before removing the tops and roots.

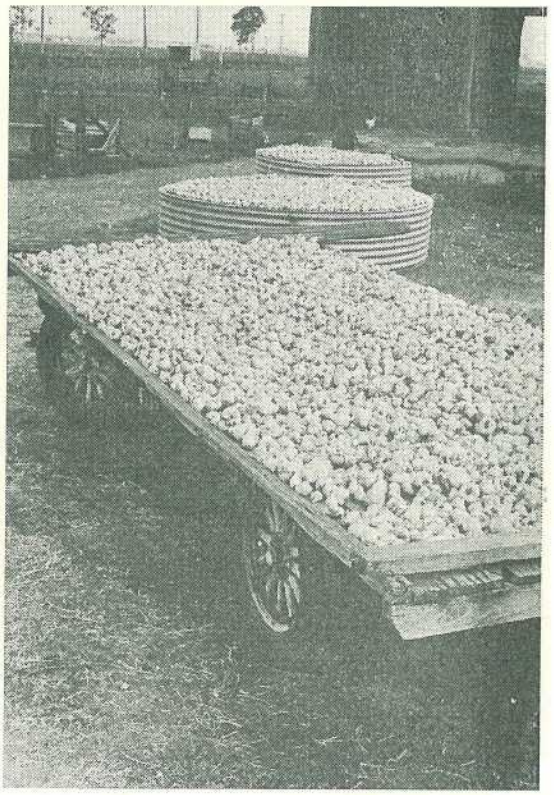
When dry, the tops and roots are more suited to removal by a "topping and tailing" machine, which also grades the bulbs. These machines do not work efficiently when garlic tops are green.

As machinery used in onion growing is often used in garlic growing, and the garlic area by comparison with onions is small, mechanical harvesting of garlic will not occur until onions are harvested mechanically.



ABOVE: removing garlic tops with sheep dagging shears after roots have been trimmed from the bulb in a similar manner. Severed bulbs are retained in 5 gallon drums.

BELOW: in areas where rain or dew could interfere with the drying process, bulbs may be removed to continue their drying on well ventilated racks in sheds or on farm trailers. The advantage of trailers is that they may be moved from the protection of a shed into a suitable drying position during the day and back to the shed at night or when rain threatens.



Grading of Garlic

NO specific regulations prescribed under the Fruit and Vegetable Act have been made governing the sale of garlic. However, those laid down for onions may easily be adapted for use in garlic.

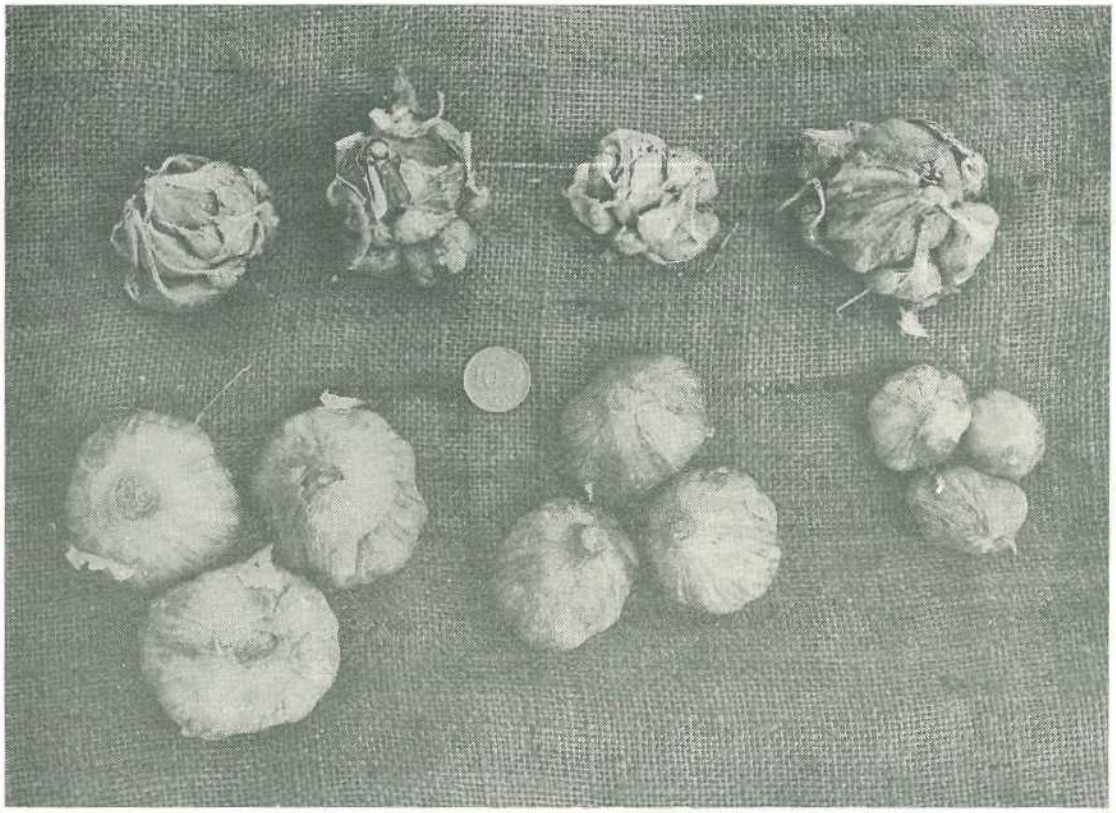
Commonsense should prevail in this matter. Bulbs graded to a similar size look more attractive when offered for sale than ungraded bulbs and are therefore more likely to obtain top market price.

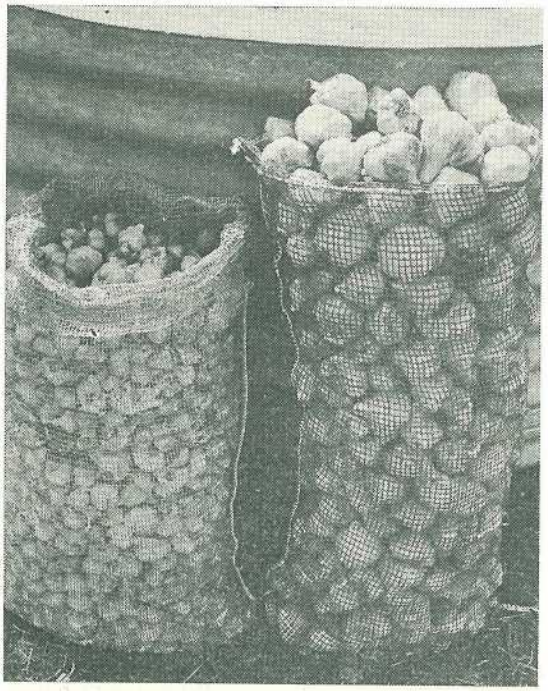
Bulbs may be condemned by Marketing Inspectors if they are obviously diseased or show the presence of numerous green shoots.

Grading may be conducted by hand, or more commonly by using onion grading machinery. Three grades, consisting of large, medium and small bulbs, may be obtained if

An arrangement of bulb sizes to be found among an average harvested sample of ungraded garlic bulbs. Bulb size may be gauged by comparison with the 10 cent piece in the centre of the illustration, which measures 23 mm.

The line of bulbs along the top of the picture shows examples of what may happen to bulbs left too long in the soil after maturity before being harvested. The bulbs have lost their outer protective coating of leaves which gives them a very rough, unattractive appearance.





Two examples of hand graded garlic bulbs are shown. The part filled bag contains small bulbs, and the bag beside it a mixture of medium and large bulbs.

so desired. However, it is probably a more common practice simply to separate the larger bulbs from the smaller ones.

Very small and rough unattractive bulbs showing exposed cloves are usually classified as factory grade. This grade attracts the lowest price, even though the bulb's culinary potential is little different from the more attractive garlic lines offered for sale.

Yield

Garlic yields are extremely variable, ranging from 1 to 2½ t/ha.

Marketing

Dry garlic bulbs are packed into open mesh onion bags. These are then generally sold on the open market, through produce merchants.

Hand grading dry garlic bulbs before bagging, removing the obviously small bulbs from the medium to large ones. This is a very practical method of grading where small quantities of garlic bulbs are being handled.

Where large quantities of garlic bulbs are involved, onion grading machinery is normally used to perform the task.

Garlic Diseases

GARLIC and onion are attacked by a similar range of plant diseases. The following are brief summaries of the most important ones. More detailed descriptions may be found in the D.P.I. Plant Industry Advisory Leaflet No. 1084, *"Onion Diseases in Queensland"*, by Mr. I. K. Hughes, Research Plant Pathologist.

Downy Mildew

Peronospora destructor

It is a foliage destroying fungus disease. In most instances leaves turn yellow before they die, and at this time they are usually coated with a grey or violet down. These are the reproductive parts of the fungus, which produce the seedlike spores that spread the fungus to other healthy garlic leaves. Most active during cool moist weather, downy mildew may be contained by regular spraying with dithiocarbamate fungicides.

White Rot

Sclerotium cepivorum

A fungus disease that commonly causes a fatal root and bulb rot in the growing plant. It is characterised by white wefts of fungus forming on the damaged tissue and soil surrounding the bulb. Embedded in this growth are small, dark brown, round, fruiting bodies of the fungus, known as sclerotes. Mainly spread by these bodies this disease is most likely to occur under cool wet conditions.

Pink Root

Pyrenochaeta terestris

This soil borne fungus occurs naturally in Queensland soils. It is able to feed on living or dead plant material. Most active during warm weather, it slowly kills plant roots, producing symptoms of wilting, stunting or death, depending on severity of attack. Pink root does not cause bulb rot, but secondary rot producing organisms may enter damaged root tissue near the base of the bulb and then destroy it.

Fusarium Wilt

Fusarium oxysporum

A fungus disease that has only recently been identified in Queensland. It is generally more active under warm than cool weather conditions and is usually introduced to an area on infected planting material. Once introduced it is capable of surviving in the soil for many years.

The fungus may attack plant roots and progress upwards to the base of the plant, or attack it direct, through injury caused by other fungi, e.g. Pink root. Most infections to the base, occur near the middle, as this is the area of oldest root growth. From here a rapid spreading, brown coloured, soft rot quickly kills the plant. The first noticeable field symptom is yellowing of individual leaves usually in the centre of the plant.

Chemical treatment of the soil to eradicate these soil borne fungal diseases (white rot, pink root, fusarium wilt), cannot be economically justified and therefore cannot be recommended.

Areas known to be badly contaminated with these diseases should not be used for garlic or onion growing for at least five years. Care should be taken not to retain affected bulbs as planting material.

To minimise mechanical transfer of inoculum throughout a field or to new areas, plant lucerne or some other perennial crop.

Storage Rots

Garlic bulbs usually have a much lower moisture content than onion bulbs when stored. Storage rots are usually only troublesome when garlic is improperly cured and stored under bad conditions.

Quite a range of fungi may attack the bulbs, but the use of chemical dusts on commercial produce detracts from its market appeal and therefore cannot be recommended. Bulbs should therefore be thoroughly dry, free of disease and stored in well ventilated sheds.

Mosaic Virus

It is widespread in garlic plantings in Queensland. All attempts should be made to select planting material free from this disease.

Symptoms can be observed, on close examination of the leaves, as an indistinct yellowing and mottling. Symptoms are more pronounced on young leaves.

So far little attempt has been made in Queensland to control the virus and the crop losses due to the disease have been accepted.

In our next issue

* **Stories featuring Queensland primary producers:** multiple suckling of calves; a home-made mobile field bin drier; how artificial breeding is being used in a grading up program.
* **Silage:** A comprehensive guide to silage in Queensland.
* **Berken:** a new mung bean.
* **Beef Carcass Judging:** two judges talk about changes in the approach to beef carcass competitions.
* **Tobacco:** How to control tobacco pests in the field.
* **Green Panic:** A comprehensive article on this pasture species.

Insect Pests of Garlic

GARLIC and related crops such as onion and leeks are usually infected by onion thrips, *Thrips tabaci* Lind., (in the Lockyer Valley.) Excessive populations of these pests are capable of reducing yields.

Immature onion thrips are small, creamy-yellow, elongate insects which live and feed within the shelter of the leaf bases until the prepupal stage is reached, when they move to the soil and pupate. On emergence, the adults return to the plants to feed and deposit eggs. The entire cycle from eggs to adults takes up to a month. The mature insect is darker than the immature stages, about 2 mm long, and carries two pairs of narrow fringed wings. Although called onion thrips, they may be found on a wide variety of plants, including numerous weeds.

Thrips feed by rasping the tissues and extracting sap, and large numbers can cause severe injury to young garlic plants. The bulk of feeding occurs on the newly formed leaves, and as these grow, the feeding punctures expand and elongate to give the typical symptoms of onion thrips activity—small whitish spots and streaks. Following intensive pest activity, the leaves present a silvery-white stippled appearance as they age.

Seasonal conditions are important factors influencing thrips numbers, and the pests appear to breed most rapidly when a mild, dry winter is followed by a hot, dry spring. Usually, however, winter temperatures experienced in the Lockyer district restrict thrips breeding and the early crops are harvested during the spring before appreciable plant injury occurs.

Thrip damage is also dependent to a certain extent on the vigour of the plants. Garlic grown under poor conditions does not have the same ability to withstand the ravages of the pests, and appears to carry larger numbers of thrips than those crops given better conditions.

With adequate irrigation and sound farming methods to ensure continuous rapid growth, garlic can be produced profitably despite the presence of thrips.

Insecticides recommended for thrip control are Methidathion (Supracide, Ultracide) and Omethoate (Folimat).

Acknowledgement

The author acknowledges information provided by Department of Primary Industries Officers, and garlic growers of the Lockyer Valley, which has been used in the compilation of this article.

Further reading

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Farm pump wins design award

A revolutionary new system for pumping water has won the W.A. Industrial Design Council's Good Design Label.

The Brilin Mk II Hydraulic Windmill Pump is one of the most advanced systems on the market.

Its completely non-corrosive construction combined with an original operation principle have made the pump a winner on farms and stations throughout Australia.

The panel of judges who awarded the Good Design Label were so impressed that they were unable to find any faults with the Brilin Mk II.

They described the Brilin II as "good value for money as the overall cost of ownership, maintenance and replacements would be lower".

"A real advantage is that the pump can be used in offset or curved bores", they said.

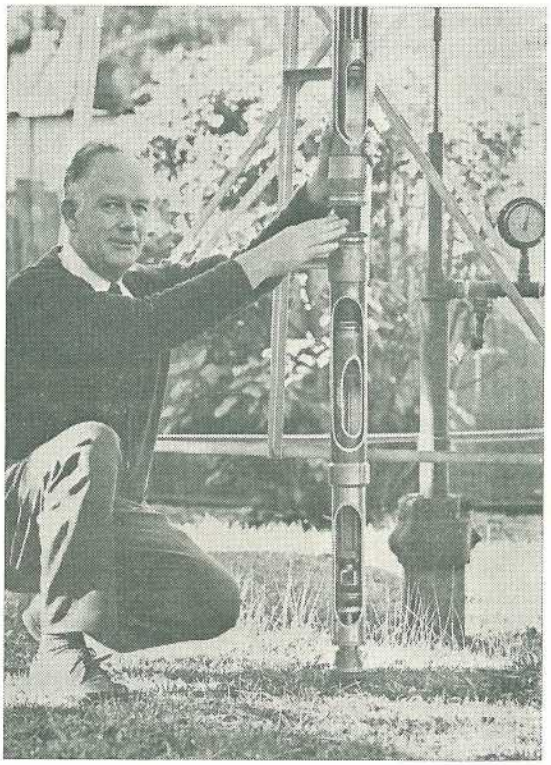
Designed and manufactured by Len Nichols of Innaloo and his son David, the Brilin Mk II uses an operation which has been described as a breakthrough in pump design.

With fixed pistons and moving cylinders it is a complete reversal of the traditional principle.

Constructed of sturdy corrosion-proof materials such as polythene piping, brass tubing and rods and aluminium bronze castings, the Brilin II gives maximum pumping efficiency while saving hours of costly maintenance.

Many farmers and graziers have had over two years faultless service from the Brilin—a recommendation as valid as the Good Design Label.

Mr. Len Nichols demonstrates the unique mechanism of his pump.



A new stem-rot resistant cowpea cultivar

by G. S. PURSS,
Plant Pathology Branch

IN 1963 the cowpea cultivar Caloona was released. At that time it was resistant to the race of the stem-rot fungus, *Phytophthora vignae* known to be widely distributed in Queensland. It was developed as a resistant line of the popular Poona cultivar which had been devastated by stem rot during the 1950's.

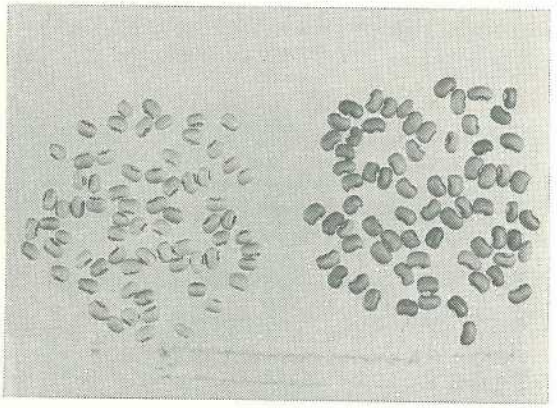
Since 1963 there has been a gradual build-up of races of *Phytophthora vignae* capable of attacking Caloona. Damage from these races became particularly evident in most districts in Queensland during the wet seasons in 1972–73, 1973–74 and 1974–75.

A plant breeding programme aimed at improving the stem-rot resistance of Caloona was started in 1963. The resistance of the imported cultivar Chinese Red has now been successfully incorporated and the new line, called Red Caloona is ready for seed increase by commercial producers. The cultivar has been tested widely in disease nurseries and no stem rot has been seen in it. No race of the fungus has been detected to which Red Caloona is susceptible in the field.

This cultivar is basically identical with Caloona with one notable exception—the seed is slightly larger and has a distinct reddish colour. These latter characteristics have been developed on purpose so that seed of the new cultivar can be readily distinguished from that of Caloona and Poona.

Farmers who found Caloona a suitable cultivar for grain production, green manure and for grazing purposes are now advised to use Red Caloona as soon as seed becomes available.

Red Caloona on the right survived stem rot in this disease nursery. Caloona is on the left.



Red Caloona on the right has a slightly larger and a reddish coloured seed when compared with Caloona on the left.

Weed control in Maize on the Atherton Tableland

by J. KILPATRICK and D. HAWTON, Agriculture Branch.

THE control of weeds in maize on the Atherton Tableland has been a major problem since the industry started at the turn of the century.

Although mechanical cultivation is the traditional method of weed control, recently there has been an increase in the use of herbicides. As growers gain confidence and experience it is expected that the use of herbicides will become the most important method of weed control.

In the dryer areas of the Tableland mechanical cultivation can still provide good weed control. It must be done carefully and skill is needed. High demands on time and labour often make it an uneconomic proposition when compared with a chemical alternative.

When weed control is not carried out because of prolonged wet weather or other causes, this can be the result. Note the high canopy of wild hops in the background. The weeds reduced yields and increased stalk and cob rots. The crop was a financial loss.

Commercial maize crops on the Atherton Tableland can be placed into three main categories:—

- Maize which follows a legume-based pasture.
- Maize which is grown on the same ground each year under a monocrop system.
- Maize which is part of a rotational annual cropping programme. For example, a maize/peanut/potato rotation.

Each of these situations presents factors favouring particular weed control methods.

FACTORS TO CONSIDER

- In monocrop maize or in a cash crop rotation nitrogen fertilizer is needed. This may either be applied at planting or incorporated after maize emergence. Post-emergence incorporation is favoured if "aqua-ammonia" is the nitrogen source used.

- When choosing a method of applying fertilizer remember that if atrazine is to be used for weed control the soil should not be disturbed to any substantial depth after herbicide application. The tines used for fertilizer incorporation will dilute the atrazine with too much soil and will bring fresh soil and weed seeds to the surface.

- The time the wet season starts will affect the rate of weed growth. A season that starts early (i.e. in November) may be prolonged. Long wet seasons such as the one experienced in 1973–74 allow weed growth to continue after the maize has ripened. This prolonged weed growth can cause severe harvester impedence.

- Tall growing broad-leaved weeds are more of a problem in the wetter, southern maize growing areas than they are in the dryer, northern areas of the Tableland. Where these weeds are known to be a problem atrazine is the best chemical to use. In the dryer areas of the Tableland, cultivation and/or the use of 2,4–D may be all that is necessary for satisfactory weed control.

The following herbicide guide suggests weed control methods which should be used in the wetter or dryer areas of the Tableland, in early or late seasons and in situations where nitrogen is applied at planting or after maize emergence:—

HERBICIDE GUIDE FOR WEED CONTROL IN MAIZE ON THE ATHERTON TABLELAND

Planting Date	No Fertilizer or Fertilizer Applied at Planting	Fertilizer Incorporated After Maize Emergence
Early season (before late December)	Use a split application of atrazine. Use 1·4 kg per hectare at each application. The first half should be applied pre-emergence (overall) and the second half five to six weeks after planting (as an inter-row spray).	Use a split application of atrazine. Use 1·4 kg per hectare at each application. Apply first half as a 50 cm band directly over the row at planting. Apply the second half of the atrazine as an inter-row spray soon after the fertilizer has been incorporated.
Late season (late December onwards)	*Weedy Areas*— Use atrazine at 2·8 kg per hectare pre-emergence. *Dryer, Less Weedy Areas*— Apply 2,4-D (1 130 ml/ha) post-emergence. Alternatively, inter-row cultivation may be used together with a band spray of 2,4-D (1 130 ml/ha) applied over the rows if necessary.	*Weedy Areas*— Use a split application of atrazine as described above. *Dryer, Less Weedy Areas*— Apply 2,4-D (1 130 ml/ha) as a band spray (over the row) or overall when the maize is between 8 and 30 cm high prior to incorporating the fertilizer. Alternatively, use a 50 cm band spray of atrazine (2·8 kg/ha) pre-emergence. Cultivations or 2,4-D (1 130 ml/ha) (using drop nozzles) can then be used to remove any weeds not controlled by the action of incorporating the fertilizer.

N.B.—2·8 kg per hectare is equivalent to 2·5 lb. per acre. 1 130 ml per hectare is equivalent to ·8 pints per acre.

How Much Water to Use ?—For atrazine applied pre-emergence through a boom spray at least 90 litres of water per hectare (8 gal/acre) should be used. For 2,4-D applied post-emergence through a boom spray at least 170 litres of water per hectare (15 gal/acre) should be used, where the weed cover is thin. Where the weed cover is thick this volume should be increased to 280 litres per hectare (25 gal/acre). If the chemicals are applied by air at least 56 litres per hectare (5 gal/acre) is recommended.

Recommended Chemicals.—Atrazine is a wettable powder in an 80% W/W formulation (numerous brand names available). 2,4-D AMINE is a liquid in a 50% W/V formulation (numerous brand names available). WETTING AGENT should be a nonionic type at a rate of 280 ml per 450 litres of spray (½ pint/100 gal).

Research into weed control

THREE main areas have been investigated.

The first assessed the degree of competition between maize and its major weed pest on the Atherton Tableland, wild hops (*Nicandra physalodes*). The second line of research compared the efficiency of two herbicides (atrazine and 2,4–D) at different rates and at varying times of application. Cultivation and control treatments were also included. Thirdly, the persistence of atrazine residues was studied.

Climatic conditions during the two seasons when these trials were carried out differed greatly.

The 1972–73 wet season arrived very late and a lower than average rainfall was received (maize planted 3-2-73).

In contrast the 1973–74 wet season began in November and rainfall was the highest since records were first kept (maize planted 20-12-73).

The most important findings of the research programme were as follows:

- During a late season, such as 1972–73, early wild hop growth is vigorous and significant crop losses will result from competition if weeds are not controlled.
- Severe reductions in maize grain yield can be caused by as few as five wild hop plants per square metre. Losses of 1·4 tonnes (valued at $84) per hectare were measured.
- In an early season like 1973–74 the wild hops get away to a slow start providing only poor competition at the early stages of maize growth. During the prolonged wet season only the experimental treatment "uncontrolled wild hops" (a mean of 39 per square metre) yielded significantly less grain than the "weed free" treatment. However, all weed populations certainly would have presented problems during harvest and would have reduced the quality of the grain sample.

The conclusion was that the growth rate of weeds early in the season determines the size of their effect on maize yield.

Both 2,4–D applied post-emergence (after germination of the crop and weeds) and atrazine applied pre-emergence (before germination) are satisfactory methods for controlling weeds in maize on the Tableland during late seasons.

2,4–D is not a suitable pre-emergence treatment for weed control in maize on the Atherton Tableland. In one experiment it caused a very marked stunting of the corn and a reduction in grain yield. In another experiment it did not control weeds at all.

During early seasons, when there is a strong possibility of extended wet weather causing excessive weed growth late in the season, a split application of atrazine is most suitable. Half of this should be applied pre-emergence, followed five to six weeks later with the other half.

This method will not only prevent a yield reduction due to weeds, but will also prevent them from impeding harvesting.

Atrazine used at the recommended rates is unlikely to leave residues toxic to following susceptible crops. The natural breakdown of atrazine in the soil is speeded up by hot wet weather.

If the season is exceptionally dry and cold, ploughing to 23 cm or deeper is a good safety measure prior to planting a susceptible crop (e.g. oats or vegetables).

This is the second maize crop following a legume based pasture. No fertilizer was applied. Good weed control was obtained with atrazine. The crop yielded over five tonnes per hectare.

This weed free crop is ready for harvesting. It is growing on land used for annual cropping. Potatoes preceded the maize. A pre-emergence application of atrazine helped to provide these ideal harvesting conditions. The crop yielded six tonnes per hectare.

These points are important

IN making a decision about which weed control technique to use, consider the following:—

- Atrazine will give effective control of all broad-leaved weeds growing from seed. This chemical also inhibits many weed grasses.
- 2,4–D controls a wide range of broad-leaved weeds but is relatively ineffective on grasses.
- Atrazine generally presents no spray drift hazards. 2,4–D can cause problems in this respect.
- Atrazine has a good residual control value for a number of months, but 2,4–D at the recommended rates has none.
- If used too late during crop growth, maize yields can be reduced by 2,4–D. Under no circumstances should it be used just before or following tasselling.

BEST results are obtained from both recommended herbicides only if the following details are followed.

- For atrazine to work efficiently, a fine and moist seedbed is needed at the time of application.
- When applying the chemical through a boom spray, use flat fan nozzles.
- Make sure each nozzle has the same output over a given period.
- The atrazine forms a suspension in water which must be constantly agitated while spraying is in progress.
- If spraying is necessary after the crop is 30 cm high, use drop nozzles to avoid putting chemicals on to the growing crop.
- Only low pressures are needed to apply herbicides. 200 kilopascals is ample (30 lb per sq. in.).

Remember, both research and commercial practice have shown that good weed control in maize can be obtained on the Atherton Tableland.

Any use of herbicides should be a planned part of the production of the maize crop, and not left as an emergency measure.

Internal Parasites of Horses

a guide to life history and treatment

Recent trends at horse sales, for all classes of horses, have emphasised that far from being on the way out, the horse is once again coming into its own.

The increased numbers of the thoroughbreds being sold at the yearling sales indicate the soundness of the racing industry. Specialist breeds such as the Arab and Quarter-horse, colour breeds such as the Appaloosa and Palomino, ponies of all descriptions and just plain horses are all demanding greater prices and greater attention from all sectors of the population.

Working horses are in strong demand while horses as a source of recreation are increasing in popularity.

by T. R. DOYLE,
Veterinary Services Branch

THE health of the horse deserves full consideration, for one of the everpresent problems besetting the horse is that of unwanted tenants in his basement—or at least—affecting his plumbing.

In Australia there are three major groupings of internal parasites affecting horses. Other parts of the world are less fortunate—they have more.

These are the nematodes or roundworms, the bot flies (representatives of the insects) and the cestodes, or tapeworms.

The internal parasites of major importance to the health, or otherwise, of the horse are the nematodes.

These can be conveniently divided into four groups—the strongyles or red worms, the round worms, the stomach worms and the pinworms.

Red Worms

(*Strongyles sp.*)

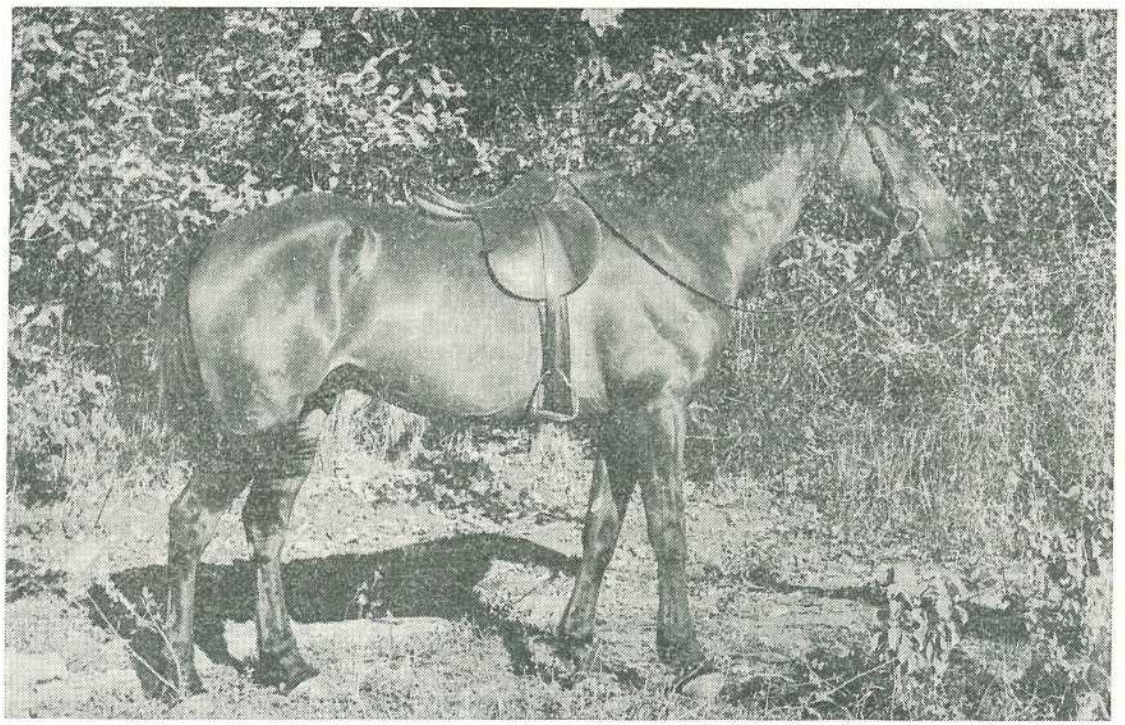
The most important parasites of the horse are the strongyles.

These include the large strongyles, commonly called red worms or blood worms and the smaller strongyles.

The large strongyles, *Strongylus equinus, S. edentatus* and *S. vulgaris* vary from about 20 to 50 mm in length and are relatively stout.

These occur in the caecum and large intestine, as do the smaller strongyles of the sub-family Trichoneminae. These are of the order of 10–20 mm in length and relatively thin—most of them being reddish brown due to the ingested blood.

This regularly wormed and well cared for hack advertises his health and freedom from worms with his stamina and glistening coat.



The life cycle is direct. The eggs hatch within a day or two of deposition on the ground in the manure under favourable temperature conditions (25–26°C). Development is retarded as temperatures drop and stops at freezing point. In five to six days after hatching the sheathed infective stage is reached. This stage is relatively resistant to adverse conditions by virtue of its sheath and doesn't feed but crawls up blades of grass and weeds until it is eaten by the horse.

After being eaten by the host the larva undergoes a further moult in the intestinal tract. At this stage there is some divergence in the life cycle of the various species.

All undergo a migration within the body of the horse of up to about eight months, before returning to the large intestine. *S. equinus* and *S. edentatus* migrate within the abdominal organs and tissues causing local areas of damage but usually no major problems by their migration phase. *S. vulgaris,* however, often causes trouble by its migratory phase. During this phase it is found within the arterial system of the horse and its presence there often leads to fatalities.

Two forms of damage to the arterial system occur.

(1) Verminous Aneurism—in which the wall of the artery is weakened and may burst if subject to stress such as the extra pressure generated when the horse is worked hard leading to death from internal blood loss (e.g. race horse dropping dead after a race).

(2) Thromboembolism—in which a clot of fibrin forms around the larvae to such an extent that the lumen of the vessel is blocked. This most commonly occurs in the anterior mesenteric artery which is the main blood supply to much of the intestinal tract, leading either to severe colic with a partial block, or to severe colic followed by death if a complete block of the vessel occurs without time for collateral circulation to develop adequately.

Apart from the danger of damage to blood vessels, with its possibility of fatal results, the adult red worms are active blood suckers. They attach to the lining of the intestine and by their sucking action destroy part of the lining, which often leads to ulceration as well as the obvious blood loss.

Others of the strongylid group which are not actively blood suckers feed in the surface layers of the intestinal lining—causing an inflammation which means the horse can not absorb feed as efficiently. Both these types of activities are extremely detrimental to the welfare of the horse, leading to growth rates and performance well below that normally expected of a healthy animal.

The signs of ill thrift (the horse is not doing well), with a rough coat and general listlessness generally associated with a wormy animal are most commonly caused by members of the strongyle group which, in heavy infestations can cause anaemia, as well as the upset to digestion and absorption of food caused by damage to the intenstinal lining.

Diagnosis of strongylosis, as with most types of worm infestation, can be confirmed by examination of a faecal sample for worm eggs.

Roundworms

Ascarids

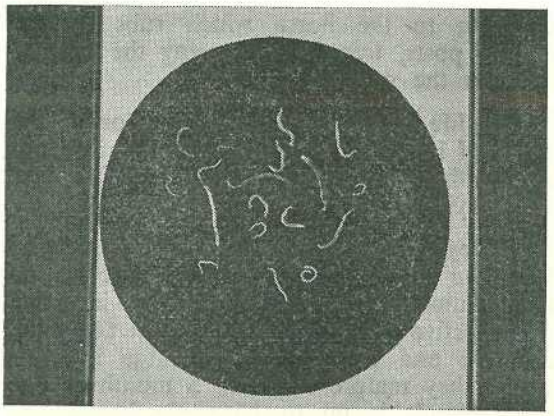
Ascarids or roundworms, *Parascaris equorum,* are probably the most spectacular of the worms as the adult female reaches a length of up to 50 cm (20″).

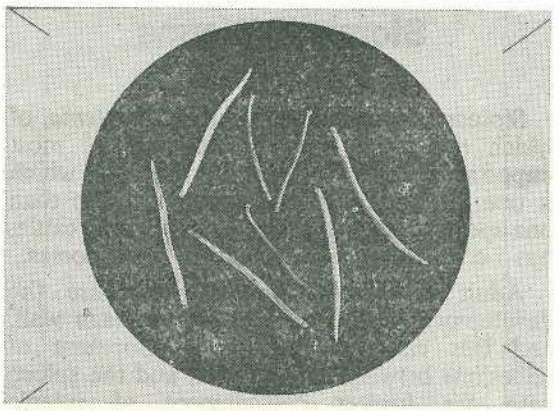
The life cycle is direct, infective larvae develop within the egg within about three to six weeks after egg laying. Infection is achieved through horses, usually foals or young stock, grazing contaminated pasture.

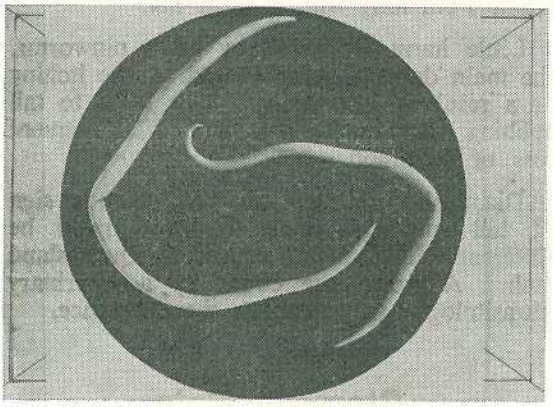
The larvae hatch out in the stomach or small intestine of the host, penetrate the wall and find their way—via the venous system—to the lungs. Here they undergo two moults before being coughed up and swallowed to reach the adult stage in the small intestine about 12 weeks after the egg is ingested by the horse.

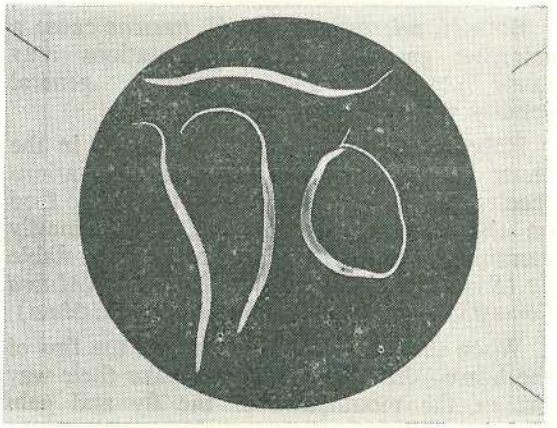
The most serious effect of Ascarids is on young foals where the migration of larvae through the lungs causes a severe pneumonia. This becomes complicated by enteritis and general digestive upset when the adult stage is reached in the intestine. Heavily infested foals will become unthrifty and fail to go ahead.

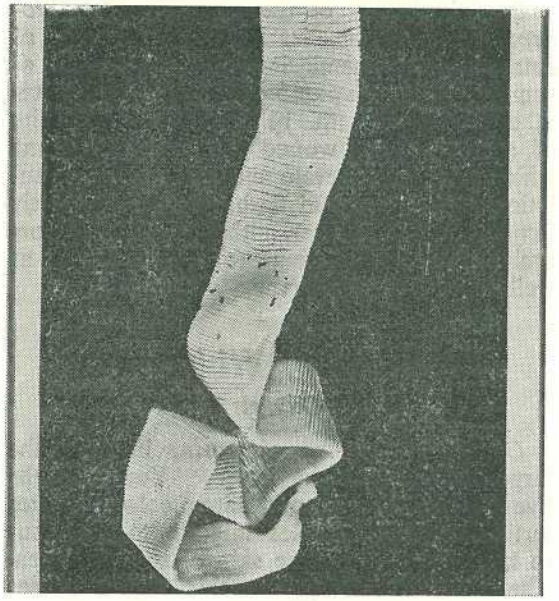
Diagnosis is by examination of faecal samples for the eggs—apart from the obvious clinical signs of poor condition, pot belly and general listlessness.











Top left: Redworms, Small strongyles (Trichonemes).

Top right: Redworms, Large strongyles (Strongylus spp.).

Middle left: The Large Roundworm (Parascaris equorum).

Middle right: Pinworms (Oxyuris equi).

Below right: The Large Tapeworm of the Horse (Anoplocephala magna).

Stomach Worms

Habronema sp.

Stomach worms of the genus *Habronema,* of which there are three species, are of most importance, while *Trichostrongylus axei,* which is one of the few worms found in more than one species, occurring also in sheep and cattle, has occasionally been recorded from horses.

Adult *Habronema megastoma* cause the development of tumours in the stomach wall, and this can lead to the development of adhesions between the stomach and the spleen with the further development of splenic abscesses on some occasions.

Both *H. microstoma* and *H. muscae* cause a catarrhal gastritis. Heavy infestations may cause ulceration and emaciation, general debility and colic may be seen.

Habronema larvae which are passed in the faeces of the horse are picked up by various species of flies when the developing larvae feed on the excreta. Among the flies primarily incriminated as intermediate hosts are the stable fly (*Stomoxys calcitrans*), the house fly (*Musca domestica*) and the bush fly (*M. vetustissima*).

When the adult flies feed around the lips of the horse—*Habronema* larvae make their way out of the mouthparts of the fly and gain entrance to the horse's mouth.

One side effect of the presence of *Habronema* larvae in the flies is the development of cutaneous habronemiasis—otherwise known as summer sores or swamp cancer at injured sites other than the mouth. Flies attracted to the site of a minor skin wound may deposit larvae which initiate the development of fibrous granulation tissue or proud flesh, causing the fairly familiar swamp cancer, although other factors are thought to contribute to swamp cancer as well as *Habronema* larvae.

Pinworms or Whipworms

Oxyuris

Oxyuris equi—the pinworm, inhabits the large intestine of the horse. Young adults live in the caecum and large colon. After fertilization the females migrate to the anus to lay their eggs on the skin of the anal area. The presence of eggs in this region causes irritation to the horse which rubs its tail against posts, trees, etc., causing the eggs to drop to the ground.

The life cycle is direct. Infection is the result of ingestion of eggs containing infective larvae; this stage is reached three to five days after laying.

The eggs are characteristic and can easily be identified by a veterinary parasitologist on examination of faecal samples. After ingestion the infective larvae are liberated in the small intestine and migrate to the large intestine where they mature in about 5 months. The adult female is up to 15 cm in length and shaped like a whip, the male is smaller only about 1 cm long with a short tail.

Little harm is caused by adult pinworms, the main damage being caused by the itching as a result of egg laying. This leads to tail rubbing and restlessness and a subsequent loss of condition.

Diagnosis is based on the obvious sign of tail rubbing—which, however, must be differentiated from that caused by Queensland Itch. A worm egg count by a veterinary parasitologist will establish the difference.

Stomach Bots

Gastrophilus sp.

Next in order of importance are the bots. Bot flies belong to the same grouping of the insects as such other common pests as blowflies and houseflies.

Three species occur in Australia. They are the nose bot *Gastrophilus haemorrhoidalis,* the common bot *G. intestinalis* and the throat bot *G. nasalis.*

Adult bot flies are fairly large hairy flies, superficially resembling bees, but with only one pair of wings. They should be familiar to anyone who regularly handles horses since most of their short adult life, only about three days, is spent buzzing around horses, attempting to lay their eggs on either the neck, mane or legs of the horse. Usually the horse doesn't approve of the flies' presence and can become quite upset about it, much to the discomfort of the horse handler.

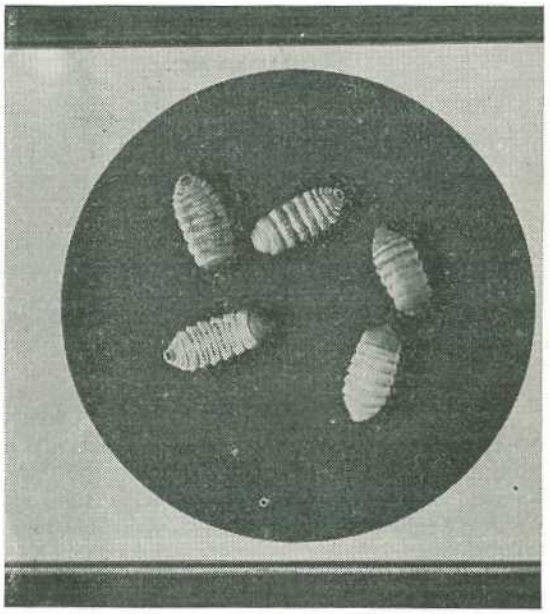
The commonest site to find bot eggs is on the inside surface of the front legs between the knee and the fetlock. The bright yellow eggs, each individually glued to a hair, are often deposited in sufficient numbers to give quite a patch of colour to the leg. After about five days the eggs are ready to hatch. This occurs in response to the friction caused by the horse licking at the eggs. On hatching the larvae adhere to the lips and tongue, then burrow into the tongue. They emerge from the tongue in about three to four weeks, spend a short time attached to the mucosa of the pharynx then pass down to the stomach where they mature.

The eggs of *G. nasalis* are attached to hairs around the lips and jaws and migrate to the mouth by themselves. They undergo a similar phase within the mouth and after about a month pass to the stomach. Bot larvae spend of the order of eleven to 12 months before maturing, when they are passed out with the faeces.

The degree of damage caused by bot fly larvae is a cause of some debate. At knackeries heavy infestations are routinely seen in clinically normal horses. However the lavae are equipped with strong mouth hooks and cause considerable damage to the stomach lining. This in itself is probably of little significance as most digestion is carried out in the large colon of the horse. Mechanical blockage of the passage of food to the small intestine in extremely heavy infestations would lead to unthriftiness and there have been confirmed cases of death as a result of perforation of the stomach wall by the larvae and subsequent peritonitis.

Control of bots by daily removal of eggs is only practicable for horses individually cared for and used daily. Routine control by regular treatment in conjunction with treatment for worms is the recommended approach.

Bots (Gastrophilus sp.).



Note the bot fly eggs attached to the hairs on the inner aspect of the knee.

Tapeworms

Anoplocephala sp.

There are three species of horse Tapeworms recorded as occurring in Australia. These are: *Anoplacephala magna, A. perfoliata,* and *Paranoplocephala mamillana.* All occur in the small intestine with *A. perfoliata* being sometimes found in the large intestine and *A. magna* occasionally in the stomach. In size they vary. *A. perfoliata* averaging 8 cm x 1·2 cm, *A. magna* reaching a size of 80 cm by 2 cm and *P. mamillana* being the smallest—from 6–50 mm x 4–6 mm.

In common with the rest of the cestodes, the horse tapeworms have an indirect life cycle. The intermediate host in this case is a small mite which lives in the grass and so is readily available.

Light infestations of tapeworms are not obviously harmful, but larger burdens are recorded to be the cause of such signs of ill-health as digestive disturbances, unthriftiness and anaemia.

Treatment is rarely carried out, and provided the horse is otherwise well cared for, including regular treatment for its other internal parasites, such treatment would not normally be necessary.

Treatment

Treatment for gastro-intestinal parasites is best carried out routinely and on a broad basis to deal with all parasites involved.

Regular worming of working horses in spring and autumn should be a feature of the management of any property on which horses form an essential part of the work plant. People keeping horses for pleasure would be well advised to follow this same routine.

Where horses are used more intensively such as in the case with race horses and performance horses it is wise to treat for *Strongyle* infestations at more regular intervals—e.g. at 6–8 week intervals—as these blood suckers are a drain on the animal, preventing optimum performance.

Where horses are kept in stables or small yards regular cleaning up of yard and stable and stacking manure in a heap helps to minimise infection. The heat generated in the stacked manure effectively eliminates this source of infection by killing eggs and larvae present.

Many chemicals are available and in many different forms for treatment of the various species of parasites. At least twenty proprietary forms can be found, and horses may be subjected to a variety of indignities in an effort to relieve them of their non-paying guests.

These include additions of chemical to the feed, balling, use of powder gun, and use of a stomach tube.

For complete coverage of intestinal parasites twice yearly treatment, via stomach tube, of a Thibendazole, Piperazine and Trichlorphon mixture—is an effective programme, as this ensures safe delivery of the full dose to the individual horse.

If a horse will take the drugs in its feed, this is by far the simplest means of administration, however many horses are particularly sensitive about the state of their dinner and refuse to take anything even suggestive of medicated food.

For those adept at passing a ball, this is also an effective means of administration, while a powder gun is a relatively simple devices to use.

Summary

The main points as far as horse health and internal parasites are concerned are:

- Parasites are present in horses.
- If untreated they lead to ill-thrift, sub-optimal performance, and there is the possibility of death due to their effect.
- Treatment is necessary at least twice per year.
- A variety of proprietary compounds are available. The number increases yearly. The dose rate, and spectrum of activity of the particular drug are printed on the package, so use in accordance with this and don't rely on memory.
- If in doubt—your local veterinarian can make the necessary recommendations.

SOYBEAN VARIETIES for 1975-76 season

SOYBEAN varieties recommended for planting in Queensland in the 1975–76 season are listed on pages 566 and 567.

December is the main planting time for soybeans. The crop has critical requirements for cultivation, nutrition, moisture and pest control.

Plant maturity is decreased by shortening day length and the planting rate should be increased with later plantings.

The plantings rates quoted refer to desirable plant stands; the lighter rate for early sowing and the heavy rate for late sowings.

Under irrigation on the Darling Downs, the variety Hill is the only variety recommended for very early or very late plantings.

Semstar is highly susceptible to bacterial pustule and wild fire and this variety should be avoided where possible.

Compiled by
S. R. WALSH,
Agriculture Branch.

Soybean Varieties for 1975–76 Season

REGION (DISTRICT OR SHIRES)	PLANTING TIME	VARIETIES	PLANTING RATE plants/hectare
Far North Queensland—			
Mareeba, Atherton	Dec.–mid Jan.	Ross	300 000
North Queensland—		IRRIGATED	
Ayr, Millaroo, Bowen	Dec.–mid Jan.	Gilbert, Ross, Improved Pelican (Approved seed only in quarantine area)	250 000–300 000
Capricornia			
Central Highlands—			
Emerald	Mid Dec.	Daintree	200 000–250 000
	Mid Jan.	Wills, Davis	300 000–375 000
	Mid Jan.–mid Feb.	Davis	375 000–500 000
Central Coast—			
Rockhampton	Dec.–early Jan.	Davis	250 000–300 000
		For trial	
		Wills, Bragg, Hampton	
Callide-Dawson—		IRRIGATED	
Biloela	Dec.	Davis, Bragg, Hampton, Wills	250 000–300 000
	Early–mid Jan.	Davis	350 000
		RAINGROWN	
	Dec.	Davis, Bragg, Wills	200 000–250 000
	Early–mid Jan.	Davis	300 000
Burnett—			
North Burnett—			
Monto, Eidsvold	Dec.–early Jan.	Bragg, Davis, Wills	250 000–300 000
Central Burnett—			
Gayndah, Biggenden, Mundubbera	Late Nov.–early Jan.	Bragg, Davis, Wills	250 000–300 000
South Burnett—			
Kingaroy, Nanango, Goomeri, Murgon, North Rosalie	Late Nov.–early Jan.	Bragg, Davis, Hampton, Hill, Semstar	250 000–300 000
Near North Coast—			
Gympie, Kilkivan, Cooroy, Eumundi, Pomona	Mid Nov.–mid Jan.	Semstar, Davis, Wills, Hampton	250 000–350 000
West Moreton—		IRRIGATED	
Lockyer, Brisbane and Fassifern Valleys, Beaudesert	Dec.–early Jan.	Davis, Bragg, Hampton, Wills, Hill	300 000–400 000
		RAINGROWN	
	Nov.–early Jan.	Bragg, Davis	250 000–300 000
	Nov.	Hill	300 000–350 000
	Late Jan.	Hill	350 000–400 000
Darling Downs—			
Northern Downs—		IRRIGATED	
Wambo, Chinchilla	Nov.–Dec.	Davis, Bragg, Wills, Hampton, Hill	300 000–400 000
		RAINGROWN	
	Late Nov.–early Jan.	Semstar, Hill	150 000–200 000
Central Downs—		IRRIGATED	
Jondaryan, Pittsworth, Rosalie (South), Crows Nest, Millmerran (east of Condamine River)	Nov.–Dec.	Davis, Bragg, Hampton, Hill	300 000–400 000
		RAINGROWN	
	Nov.–Dec.	Hill, Semstar	200 000–300 000
	Early Jan.	Hill	250 000–300 000

REGION (DISTRICT OR SHIRES)	PLANTING TIME	VARIETIES	PLANTING RATE plants/hectare
Darling Downs—*continued*			
Central Downs—			
Millmerran (west of Condamine River)	Nov.–Dec.	IRRIGATED Davis, Bragg, Hampton, Hill	300 000–400 000
	Nov.–Dec.	RAINGROWN Semstar, Hill	200 000–300 000
Southern Downs—			
Clifton, Cambooya, Allora, Glengallan	Nov.–Dec.	IRRIGATED Davis, Bragg, Hill	300 000–400 000
	Nov.–Dec. Early Jan.	RAINGROWN Hill, Davis, Bragg, Semstar Hill	200 000–300 000 250 000–300 000
Granite Belt—			
Stanthorpe	Nov.–Dec.	Hill	300 000–350 000
Inglewood	Late Nov.–Dec. Early Jan.	IRRIGATED Bragg, Wills, Davis, Hill Hill	300 000–350 000 300 000–400 000
		RAINGROWN Not recommended	
Near South-West—			
Balonne	Dec.–early Jan.	IRRIGATED Wills, Bragg, Davis, Hampton	300 000–400 000

Wool Carpets for Children's Ward

THE children's ward of the Wagga Wagga Base Hospital will be the first public hospital ward in Australia to be fully covered in premium quality wool carpet.

Several years ago, the Australian Wool Corporation assisted the hospital management by providing a carpet strip in the children's ward. This carpet has stood up extremely well to hospital wear and its performance over seven years has been so outstanding that it was decided to extend the carpeting to cover the entire ward.

Wool carpets have proved most economical in institutional usage. They cut down on cleaning costs, are more comfortable for the staff to walk on and their sound absorption qualities reduce the noise level in hospital wards. They are also resistant to fire and this is an added safety plus in an installation of this type.

The Flying Beekeeper

By C. Roff, Chief Adviser in Apiculture.

Small aircraft such as the Cessna 172, Cherokee 180 and Beechcraft Bonanza have already proven useful for such rural activities as transport, mustering, inspections of drying or boggy earth tanks and fences, and spotting bushfires. Now another use can be added to the list—that of surveying honey flora to help beekeepers.

Beekeepers usually select apiary sites by assessing honey flora during drives, often unplanned, along roads and tracks.

This method has shortcomings since false impressions are often gained from tree-fringed roads and properties. In many cases the nearby country masked by these trees is cleared and has little beekeeping potential. Even in forest areas it is difficult to determine extent; also, suitable areas are missed because beekeepers cannot "see" sufficient country.

The aerial view of honey flora in relation to land development confirms that permanent site beekeeping is not economically sound and that a migratory system utilizing all of the vegetation groups must be practised.

Much ground travel is useless, while motor vehicles are a significant cost factor in beekeeping.

With aerial surveys, the situation and extent of areas of honey flora can be marked onto a suitable map, a decided advantage if new country is being investigated.

The best height for survey flights is at about 350m.

Normal charter rates, including a pilot range between $37.50 and $47.00 an hour. Beekeepers who are interested in this type of survey should contact their local aero club or air charter service.

In these surveys, time and wasteful ground crossings are saved, and a more effective honey flora assessment is made. The survey can be made more economical if two or three beekeepers share the cost.

Ground surveys, however, are still required for bud assessment and apiary site positioning; but these are organised more efficiently when information from an aerial survey is available.

GOT A FARMING PROBLEM?

Advice from the D.P.I. is free. Contact your Local D.P.I. office if you think we can help you—it is listed under "PRIMARY INDUSTRIES" in your telephone directory.

Strip Grazing–
advantage or disadvantage

by E. M. OTTOSEN, G. W. BROWN and M. R. MARASKE,
Dairy Cattle Husbandry.

High costs of establishment and maintenance of tropical grass–legume pastures are an important issue on any dairy farm. How best to utilize these pastures for milk production is a major problem faced by all dairy farmers.

Improved pasture species allow marked increases in carrying capacity. Increases in stock numbers result in higher milk yields. Many farmers consider that as well as increasing stock numbers, various forms of grazing management may increase production from a given area of pasture.

The most common methods used by farmers are rationing (strip grazing) of pastures, or continuous grazing by allowing cows free access to the paddock. The farmers' use of such ideas depends on areas of land available coloured by the experience passed on from previous generations.

To try to solve this dilemma, short term trials were conducted at Kairi Research Station on the Atherton Tableland to compare strip grazing and continuous grazing on dryland tropical pastures.

The aims

These trials were aimed at finding out whether milk yield was increased by strip grazing when compared with continuous grazing. Three levels of tropical grass–legume pasture were compared. Pasture was graded on the basis of moisture free weight of green pasture per hectare.

The experiment

Cattle used were non-pregnant Friesian cows approximately two hundred days into their second or third lactation. They were introduced into an improved dry land pasture of glycine–green panic that has been equally divided. One half was grazed in ten equal strips using a front and back electric fence, while the other half was continuously grazed.

Daily measurements were taken on milk yield, fat, and solids-not-fat, with starting and finishing weights for each trial. Three comparisons were made on each of the three grades of pastures.

Strip grazing reduces milk yields

Results of the trials showed that there was no significant difference in solids-not-fats and butter fat between the two trial groups. However milk yield was lower in cows on strip grazed pasture, particularly in period I, when they were grazing the best pasture. The milk yields and comparisons for the three periods are shown in Table I.

TABLE I

Period	Milk Yield		Fat		Solids-Not-Fat	
	Strip	Continuous	Strip	Continuous	Strip	Continuous
	Kg/cow/day		(%)		(%)	
I	11·5	12·3	3·8	3·8	8·51	8·57
II	10·6	10·9	3·6	3·7	8·59	8·50
III	10·6	10·6	3·4	3·8	8·44	8·42
Mean	10·9	11·4	3·6	3·7	8·50	8·50

Pasture use

Pasture yield and the legume content are shown in Table II. Cows in strip grazed areas tended to eat all pasture available on any one day while continuously grazed cows consumed relatively more grass than legume. At the start both paddocks contained 24 per cent. legume, but at the end of the experiments strip grazed areas contained only 16 per cent. legume as compared to 38 per cent. legume in continuously grazed areas. In both paddocks it was calculated that 60 per cent. of the pasture on offer was eaten by the cows.

TABLE II

Period	Amount Pasture Available			
	Kg D.M./Ha.		% Legume	
	Strip	Continuous	Strip	Continuous
I	2 273	2 614	24	24
II	1 616	1 694	..	..
III	1 553	1 544	16	38

After the experiments both grass and legume regrew without any difference caused by the previous grazing methods.

Weight change

Cows always gained weight quickly when changed from continuous to strip grazing. This was probably due to changes in rumen content of pasture.

Reasons for reduced milk yields

From the changes in body weight of cows on entering strip grazing experiments and from changes in legume content of the two pastures, it can be concluded that cows strip grazing were forced to reduce their selective grazing and eat pasture plants closer to ground level. This meant these cows consumed a more fibrous diet of lower nutritional value, and milk production fell or was not increased.

In period III when pasture yield was lowest there was no difference in milk yield of the two groups of cows. Experiments in temperate countries have shown that when pasture is very short some form of rationing such as strip grazing may give more efficient use of pasture and so higher milk yields.

The results in Table I suggest the same would happen with tropical pastures only if pasture on offer was lower than in period III. However pasture on offer in period III was regarded as very low and much lower than yield on improved pastures on most Atherton Tableland dairy farms. So improved pasture for cows would have to be in very short supply before strip grazing improved the milk yield of cows grazing tropical grass–legume pasture.

Conclusion

If pasture on offer is high, restricting cows by strip grazing will reduce their milk yields. At moderate to low levels of pasture yield there will be very little difference in milk yield due to changing grazing methods. Unless pasture on offer is extremely low it would seem other management decisions, such as changing the number of stock carried, would have a greater effect on milk output.

Research Highlights from the 1974–75 Annual Report of the Queensland Wheat Research Institute

The mid-season wheat variety, Oxley, released from the Queensland Wheat Research Institute in 1974, was the highest yielding hard wheat in the 1974 trials of the Department of Primary Industries. Over 12 trials it averaged 17% more grain than Tarsa and 15% more than Festiguay.

☆ ☆ ☆

A report has been compiled for advisory and farm use, summarizing the existing D.P.I. data on wheat yield in such a way as to provide a probability analysis of wheat yield expectancies for a given site in a given year.

☆ ☆ ☆

Glasshouse pot trials and field trials indicate that phosphorus deficiency may be limiting wheat production on many soils of the western wheat growing areas.

☆ ☆ ☆

The experimental fungicide RH-124 again proved very effective in controlling leaf rust. Low volume aerial application appears commercially feasible.

☆ ☆ ☆

Yield differences of 30% have been detected in wheat plots in the cropping phase of a trial at Norwin (previously a pasture grazing trial). It is possible that the major factor involved in these differences is the disease common root rot (*Cochliobolus sativus*). High levels of disease have been found in continuous wheat plots, whereas lower levels occur in plots previously under pasture.

☆ ☆ ☆

Triallate (Avadex BW) has been used to control wild oats in a number of trials; when applied to populations of up to 159 wild oats/m^2, wheat yield was increased by up to 67%.

☆ ☆ ☆

A comparison of opportunity cropping with continuous wheat and sorghum systems was undertaken for the Darling Downs region using past climatic records. The results show that more crops are possible with an opportunity cropping system and that such a system has both economic and conservation advantages in the eastern Downs.

Report on Boar Performance Testing

THE following boars were "Approved". Average boars score 50 points for Economy and 50 points for Carcass. Points scores can be compared only with those of boars of the same breed.

LARGE WHITE BOARS

Breeder	Ear Number	Q.A.R. Number	Points Score		
			Economy of Production	Carcass Quality	Total
MURCHISON BETTAFIELD PARTNERSHIP, M.S. 1401, Biloela, 4715	SIRE: Colley King David 2 DAM: Bettafield Jewel 2734				
	4,046	706	80	32	112
N. J. COTTER, P.O. Box 23, Goomeri, 4601	SIRE: Sedgenhoe Major Morgan DAM: Olaroy Pride 138				
	374	707	108	66	174
K. N. MATHIESEN, P.O. Box 138, Gayndah, 4625	SIRE: Naiken Field Marshall 337 DAM: Naiken Cleopatra 470				
	83	708	85	50	135

LANDRACE BOARS

A. B. & B. D. ROBIN, M.S. 1889, Dalby, 4405	SIRE: Wodalla Murray 2430 DAM: Blaxland Alley 35				
	327	705	34	77	111
	SIRE: Caminda Count 974 DAM: Bettafield Dora 1946				
	384	709	46	57	103

Guide to Soils and Plant Nutrition

by N. G. CASSIDY,
M.Sc., F.R.A.C.I., M.A.I.A.S.

IN this issue of the *Queensland Agricultural Journal* we begin a serialisation of a book by a distinguished agricultural chemist who spent many years working with the Department of Primary Industries.

Although Mr Cassidy is now retired, it would surely be a great loss if the wealth of knowledge and experience he has accumulated had not been made available to those who work in the field of agriculture.

For as well as serving as Senior Chemist with the D.P.I., Mr. Cassidy worked for 10 years as Government Chemist of Fiji. Before that, he was Acting Officer-in-Charge of the C.S.I.R.O. Irrigation Research Station at Griffith in N.S.W.

For this reason, the Q.A.J. welcomes this opportunity to publish this book which, because of its simplicity of style, will make this complex subject more easily understood to those who are not specialists in this field.

Mr Cassidy says of this guide: It is not a book for experts. Instead, it is intended for:

- farmers, graziers and horticulturalists in a modern world;
- gardeners, and park superintendents who appreciate the value of science;
- all undergraduates in agriculture, forestry and botany;
- graduates who are wholly committed to other disciplines but who need a ready reference book: entomologists, pathologists, veterinarians, geneticists, etc.;
- plant lovers everywhere.

Some of the more technical terms are explained in a short glossary on page 580.

The Texture of Soil

ALL soils are the result of the weathering of rocks and dead plant material; yet soils have many different textures.

In the field, soil texture is described through the sense of touch. A small quantity of dry soil is worked between the fingers while slowly mixing in water, until the mass reaches its greatest cohesiveness.

Sand particles have a gritty feeling. Silt is soft and velvety to the touch. Clay gives a feeling of stickiness.

A thin ribbon of moist clay can be bent into a circular shape. This becomes progressively difficult as the clay content decreases. When sand, silt and clay are all present in significant amounts the soil is a Loam. So Loams occupy a central position between the extremes of course sand and heavy clay.

For many (but not all) purposes the loam is the ideal soil. It holds adequate amounts of both water and air, and it is easy to cultivate. It is less likely to become very cold or very hot, and there is a good chance that it will contain sufficient plant foods. Nevertheless plants as diverse as rice and rose bushes prefer heavy soils, while citrus and carnations are examples of plants that prefer sandy soils.

Mechanical analysis

A wide range of soil textures has been recognised: but a simple sequence, with increasing "heaviness" as regards cultivation, would read:—

Coarse sand → sand → sandy loam → loam → silt → silt loam → clay loam → clay → heavy clay.

In the laboratory, the process of *particle size analysis* reveals the exact amounts of sand, silt and clay that are present in a soil.

This is a distinction of size, based on sieving and on the rate at which particles settle through a column of water.

The sand fractions are first sieved off and the silt and clay are then separated by sedimentation in water. Silt particles will settle 10 centimetres (4 ins.) in a few minutes, but clay takes hours.

The International Society of Soil Science defines four grades.

—	Maximum Diameter (m.m.)	Method of Separation
Coarse sand	2·0	Passes 2 m.m. sieve
Fine sand ..	0·2	Passes 70 mesh sieve
Silt	0·02	Settles 10 cm. in 4·8 min.
Clay ..	0·002	Settles 10 cm. in 8 hrs.

Properties

Although the separation is on a size basis, there is a difference in quality between the different grades. The sands tend to be silica or rock particles that are not very much weathered. The clay consists of minerals that have resulted from rock-weathering, and these have definite chemical and physico–chemical properties. Silt tends to be intermediate in properties just as it is in size.

For mineral soils, organic matter is ignored. It would normally constitute under 5% of the total soil.

Both sand and silt particles may differ geologically or chemically in going from one soil to another, but their physical effects on soil texture do not alter much. On the other hand clay particles are vitally altered by differences in their chemical composition. Clay is, therefore, important both to the physical texture and to the chemical properties of a soil.

In spite of the small size of clay particles, they are not amorphous (formless) substances, but are shown by X-ray diffraction to consist of finely-crystalline clay minerals.

Soil Structure

THIS subject takes account not only of the separate particles in a soil, but also of the ways in which they may become arranged, under various external influences.

Structure is the architecture as distinct from the primary building materials. The proportions of sand, silt and clay, though important, may not be as important as the method of arrangement. Further, the kind of clay may also affect the result.

The structures of the soil that are visible to the eye are described by such terms as **Platy, Prismatic, Columnar, Blocky, Granular, Crumb.** The individual, natural, soil units of structure are known as **Peds.** One system for describing soil structure in detail is given in the U.S. Soil Survey Manual.

Kinds of structure

The structure of a particular soil is not necessarily a permanent arrangement, especially if the soil is subject to cultivation. Aggregates of soil particles can be formed by some treatments and broken down by others. If there are no aggregates, it is single-grain structure as in pure sand or in **dispersed** clay.

The presence of organic matter promotes good structure. So does cultivation or ploughing at the right moisture content.

Cultivation when the soil is too wet, particularly when compaction or shearing occurs, will usually lead to poor structure.

Beating rain will destroy a weak structure: mere slaking with water will show up a total lack of structure, as in sodium-affected soils.

Good and bad structure

For good structure it appears that a particle size of about 5 mm is best. Tests have been made using clods (not necessarily natural peds) of given sizes. The soil was a clay and the crop was cotton. Best emergence, early maturity and maximum yield were all obtained with soil clods of 3 to 6 mm size. Results were inferior with both smaller and larger size clods, ranging from less than 1·5 mm up to 100 mm.

Compaction

Soils with a wide range of particle sizes are most subject to **compaction,** because large and small particles naturally pack together most effectively. This is common knowledge in making pisé (adobe) or mud buildings. A fairly clayey raw material is necessary, but sand is mixed in before puddling with water. Very sandy soils and very clayey soils cannot be compacted easily.

Dry soil and soil in a wet slurry do not compact easily. This is important in building earth dams. The right moisture content and the right compacting pressure must be used in this operation, where adequate compaction is needed.

In field operations the furrow wheel of the tractor and the down-pressure of disc implements are the commonest mechanical causes of compaction. After heavy flooding in the Lower Burdekin canefields of Queensland during 1940 the scallop marks of disc implements showed where the compacted subsoil had lost contact with the surface soil, often resulting in total loss to topsoil.

Density

The Mass of unit volume of soil can be used as a measure of loss of structure due to compaction. Most of the mineral matter has a relative density (or specific gravity) of 2·65, but the existence of air space within the soil brings the apparent specific gravity (commonly known as **Bulk Density**) to a value of 1·4 or less. In practice a compacted soil may reach a value of 1·7 or more. At this density, neither water nor roots will readily penetrate the soil.

X-ray analysis

X-ray analysis of clays shows that the minute particles are crystalline and that they have a laminated or plate-like structure. They are in fact alumino-silicates, arranged in parallel planes and the distance between these planes can be measured. This micro-structure varies somewhat from one clay mineral to another. In all cases the basic framework or lattice of aluminum, silicon and oxygen can unite with the chemical elements calcium, magnesium, potassium, sodium (cations). These particular plant foods thus become available to the growing plant.

Shearing action

Other reactions also occur. Water molecules may penetrate between the parallel planes, and this causes the clay to swell. When drying occurs, the particles contract in some cases; this may trap potassium ions so they are no longer available to the plant.

Apart from these internal changes in the clay particles, there can be external mechanical movement between one particle and another. For example, a shearing (sliding) motion by a ploughshare, or by a garden trowel, may cause the particles to slide over each other. When this happens the particles thus pack closely together because of their platy nature. This process restricts the amount of air and water in the soil and results in poor soil structure.

When such action takes place under moderately wet conditions the water that has been squeezed out of the structure can soon dry up. This leaves the soil substance in a dense and dry state, and it may set almost like a cement. If the action should take place in a wet slurry, a shearing motion is not possible and the result is not severe.

For these reasons a soil should be worked only when it is just moist, and not when it feels wet.

Air

When soil is subject to compaction by a heavy weight bearing on it, the amount of air remaining in the soil may be inadequate. This can happen when a tractor has passed over wet soil. On the other hand, if soil is disturbed and then not compacted at all, as in a shallow seed-bed or around a transplanted tree, the plant may die because moisture can escape too quickly from the loosened soil. Judicious compaction by a light roller, or by trampling with the feet, will correct this condition.

The best cure for soil that has set hard because of shearing or compaction stress, is repeated wetting-and-drying. Wetting causes swelling: then with partial drying, air again enters the system, and the compaction is corrected.

Pore space

The amount of **pore space** or void volume in between the particles of clay, silt and sand is an important consideration, while the size of the individual pores is also important.

The larger or non-capillary pores (greater than 50μ)* allow water to enter and to move freely through the soil mass. This movement is known as **permeability.** When water enters from the soil surface and moves vertically downwards, this is measured as the Infiltration Rate, in centimetres per hour. A porous soil such as a krasnozem may have a rate as high as 7 cm per hour. Infiltration Rate is closely related to amount of organic matter and non-capillary porosity.

The existence of pores or voids in a soil or similar material is known as **porosity.** It is measured as a per cent. of the total volume.

The distinction between these two ideas is shown by the following paradox.

Gravel has the highest permeability to water but only a moderate porosity (35%). Clay

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*μ (micron) one-thousandth of a millimetre.

Major soil types of the world

1. PODSOL

A layer of organic matter on the surface, and sufficient rainfall to cause leaching, are necessary to produce this soil. Iron moves out of the surface soil (resulting in a whitish layer) and is transferred to the subsoil. The podsol in our picture was formed from a very sandy parent material.

2. LATOSOL

Latosol is the fully-weathered soil of the wet tropics and subtropics. With fertiliser it could safely produce tree crops, but under row crops, such as sugar cane, it is vulnerable to erosion.

3. LATERITIC HILL

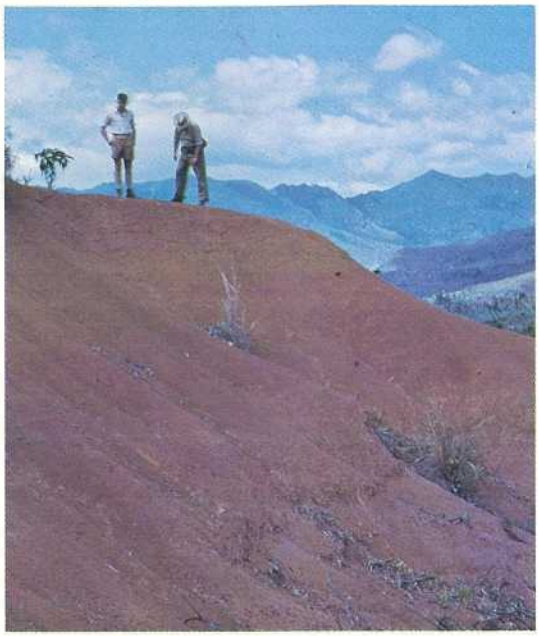
The end-point of weathering: a sterile ironstone-capped material of no economic value.

4. RED EARTH

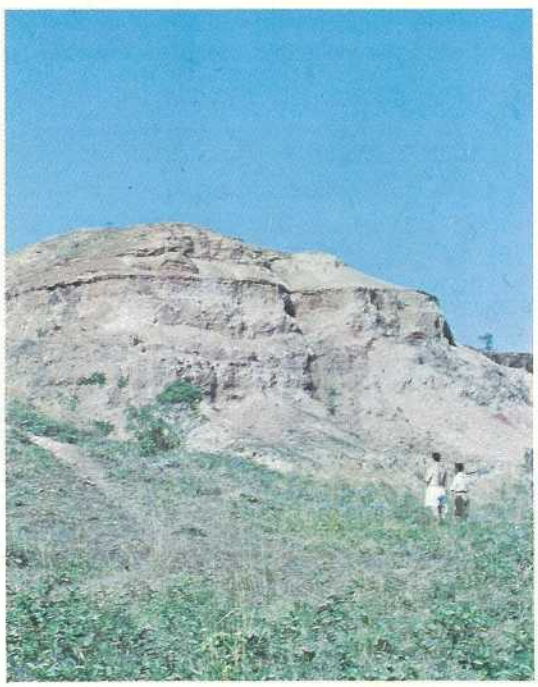
Often formed on basaltic rock under good rainfall and subtropical climate. A fertile and well-drained soil.

major soil types

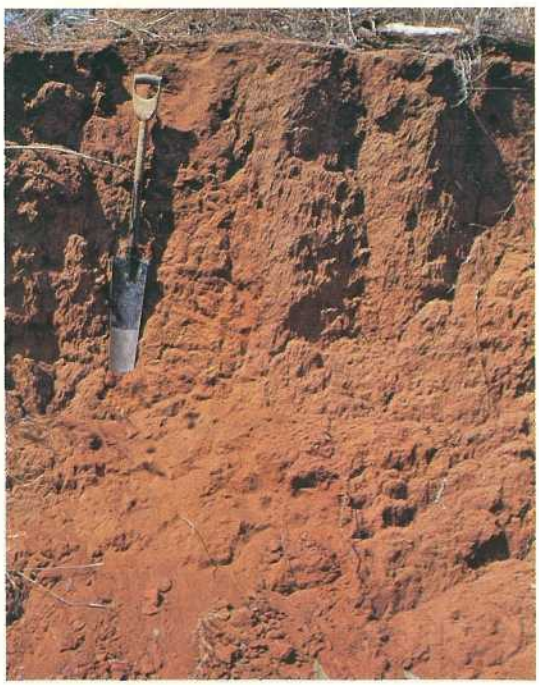
1. PODSOL



2. LATOSOL

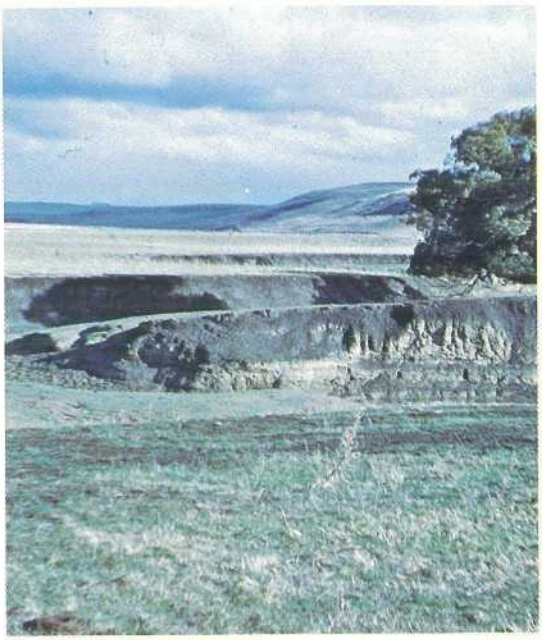


3. LATERITIC HILL

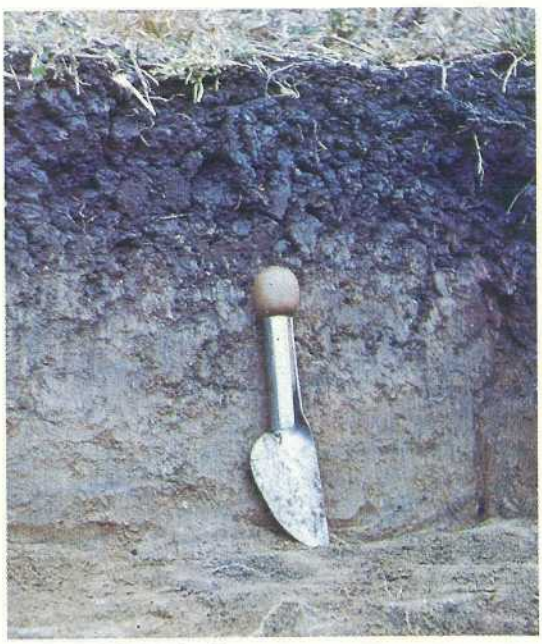


4. RED EARTH

major soil types



5. BLACK EARTH



6. RENDZINA

7. GLEYED SOIL

COLOUR CHART

Major soil types of the world

5. BLACK EARTH

A soil of wide, flat plains, receiving only moderate rainfall. It is a deep soil and is generally a heavy clay. Swelling and shrinking are marked characteristics. A fertile soil because it is fully developed but only weakly leached.

6. RENDZINA

A shallow black soil formed directly on alkaline material such as limestone, coral or marl.

7. GLEYED SOIL

A profile that is always damp or wet, shows blue tonings: e.g. mangrove mud. During occasional drought, yellow mottling may appear.

COLOUR CHART

This is shown against a soil profile for colour matching.

has the highest porosity (50–60%) but the lowest permeability. This is because only the larger pores contribute to permeability.

Capillary rise

The smaller or capillary pores will retain water; just as a very fine (capillary) glass tube with open ends will hold a column of water. Such a column needs to be less than 1 mm in diameter. This is the manner in which water is held by a wetted soil that has had time to drain. The large (non-capillary) pores fill with water that is eventually drained away, leaving air to take its place. When there is free water underneath a soil, the capillary rise of moisture towards the surface can reach a height of one metre.

Dispersion

The state of clay particles in a soil will affect its structure. In a **dispersed** clay the particles stay separated from each other, and in water they remain suspended (do not settle). This gives the liquid a permanent muddy appearance. This is a sign of poor structure.

If this condition is reversed (**flocculation**) the clay settles rapidly. This is a sign of good structure. When the excess water is removed the particles will come together as a structure of clumps with good pore space between them.

Dispersion of clay can be caused by chemical means (sodium in large amount) or by physical means (working the soil when it is very dry or fairly wet). In either case dispersion of the clay has a depressive effect on the Infiltration Rate of a soil. For example, laboratory measurements showed the following:—

Soil	Dispersion of (Silt + Clay)		Infiltration Rate of Soil
		(%)	(Units)
Burdekin (alluvial)	Normal	40	4·4
	[21% Na (sodium)]	89	0·2
Bundaberg (krasnozem)	Normal	10	6·2
	Dry-worked	21	2·4

Ploughs

The bad effect of a grinding action on dry soil is well know during drought, when roads and tracks become reduced to fine "bull dust". This condition represents total loss of structure.

Farm implements do not all have the same action on soil. A moldboard plough lifts and inverts the soil slice and has a gentle action on the soil. A disc plough compresses the subsoil more than the moldboard plough. A rotary hoe on bare soil has the worst action, because it tends to beat any existing structure out of the soil.

The Soil Profile—Soil Examination

A particular soil can only be examined properly by digging a hole or pit, having one side vertical and facing towards the light. Ideally the hole should go down till rock or rotten rock is reached.

The **profile** is the vertical face that is then exposed for observation.

A soil profile usually shows two or three parallel layers of soil that differ from each other in colour, and often in texture. These layers are known as **horizons** and the letters A, B, C may be assigned to them from the top downwards. In observing the soil colours, some allowance may be necessary for darkening of colour where one part of the profile is moister than the rest.

Horizons

The components of a very simple profile are as follows:—

In undisturbed (virgin) soil, the thin layer at the surface contains much organic matter and is dark brown to black. This arises from pieces of vegetation which have fallen on the soil and decomposed to various degrees. (Horizon A_0).

All other horizons of the soil have developed from the bottom (parent rock).

The next lowest layer is the true surface soil, and represents the final stage of rock decomposition, modified by the effect of organic matter from A_0 above. This is the main Horizon A.

Another layer (B) is usually present under A. It has been derived more directly from the lowest Horizon C. The middle layer Horizon B is often affected by the washing downwards of fine clay or of soluble mineral matter from the surface. For this reason there may be a definite change here in colour and in texture.

Podsols

When rainfall is fairly high and there is a thick organic layer present, a soil develops that is common throughout the world. This is the **podsol** soil type. It develops by organic matter dissolving iron out of the topsoil and carrying it in colloidal (ultra-microscopic) form into the subsoil.

The sequence presented is then a blackish band; a bleached, whitish horizon, and a reddish horizon containing much of the original iron.

Because the topsoil has lost something it is an eluvial horizon. The subsoil has gained, and is known as an illuvial horizon.

In warm climates a top organic horizon may be no more than 1 cm thick, but in cooler climate organic accumulations may be much greater. The A and B horizons may be of the order 10–30 cm thick.

The Podsol, under Northcote's system of soil classification is clearly a U or uniform-texture profile, with no clearly defined **textural** change.†

Soil colours

Much can be learned from the colours that are seen in a soil profile. A dark brown to black colour at the surface indicates that decomposing organic matter or **humus** is present. A thickness of this layer greater than 2 cm (when an undisturbed site is examined) means considerable organic matter.

A red colour indicates oxides of iron, and a low degree of hydration. Yellow colours also indicate iron oxides, but hydration, or permanent union with water, is likely to be greater. Wherever iron oxides are present there is also likely to be aluminium oxide.

Grey colours are a sure sign of **gleying** i.e. long periods during which there is too much water and too little air in the soil. Only plants such as rice, inferior grasses, or cannas can be expected to survive.

Bluish colours show permanent water-logging and the lack of any drainage outlet. This generally means that the material is a heavy clay or it has been rendered impermeable by sodium ions. Mangrove mud typically shows blue colours.

Reddish-brown colours mottled with yellow indicate an alternation of poor drainage with an improved condition during drier periods. This often occurs in vertical root channels in the profile. Such **mottling** indicates that crops such as citrus and bananas will not thrive.

Hardpan

An examination of a soil profile will show the depth to which roots have penetrated. If penetration is unduly shallow, especially if main roots have turned through a right-angle, it could be caused by a compacted layer (**hardpan**) in the soil. A hardpan will always hinder the penetration of water and of plant roots.

Soil colour is also an important characteristic in classifying a soil. This is described in detail by the Munsell Soil Color Chart. It comprises fine gradations of all the colours likely to be encountered in soils.

The Northcote System of soil classification has been developed in Australia and is now widely used. It consists in describing what can be seen or readily determined in the soil profile itself.

Another feature of a soil profile may be the presence of **concretions** or nodules. These are particles separate from the main texture of the soil. They may vary in size from a millimetre to several centimetres.

In red soils the concretions tend to be spherical, and composed of iron with aluminium and/or manganese.

In black-earth soils nodules of limestone (with some magnesium) are common.

† The Northcote system is based on readily observable physical features and has no relevance to theories of soil genesis.

Soil Genesis

IN order to understand the ways in which soils are formed, it is important to consider world-types of soil.

Many soils are formed *in situ,* that is to say at the place where they now exist and from the rock that lay underneath that site. This is true of Lateritic soils (**latosols**). Here moisture and warmth have been such that although much organic matter has been produced, it has not accumulated on the surface as in the Podsol, but has been largely oxidised away. This means that there has been no removal of iron from the soil. On the contrary the good conditions for leaching have resulted only in the removal of silica and cations such as calcium, magnesium, etc. leaving a very ferruginous (iron-bearing) material behind. Because the conditions are very favourable for rock-weathering the profiles are very deep ones, and strong red (iron) colours are typical.

The profiles show a thin A_0 horizon which is darker than the A horizon proper, which continues down to considerable depth without appreciable change. Depths of one to several metres are the rule. Finally the C horizon appears as much-decomposed or rotten rock. A recurring circular pattern ('onion-skin' weathering) is often apparent at places in the profile. Mottling with mauve colours are also to be expected at depth in these profiles.

Laterite

This represents the extreme of this kind of soil formation, where weathering of the original rock has proceeded as far as it can go under continuous warm and moist conditions. It typically occupies high terrace formations having a hard ironstone cap (duricrust). A pallid zone, sometimes many metres thick, of whitish kaolinite may occur at depth. It is possible to cut laterite into blocks of crude building material. When latertic soil is too poor for row crops it is vulnerable to erosion. Then there is a case for the use of permanent tree crops if economic ones can be found.

Red earth

When the weathering has not proceeded quite so far the **red earth** of the tropics and subtropics results. It is a fairly fertile soil with good structure, and so can grow a great variety of crops. When the weathering has been still less, a fertile red loam, the **krasnozem,** is formed. It is one of the most productive of all soils. It may be formed on all kinds of rock except very siliceous ones.

Black earth

Another world-type is the **black earth.** It is formed under conditions which are not conducive to deep and continuous leaching although there is deep weathering. The reason may be relatively low rainfall or it may be some other factor which prevents continuing seepage through the soil. Organic matter can accumulate but there is no loss of iron from the profile. Instead of this, solution of calcium and magnesium takes place: but dry periods cause precipitation of these as limestone nodules lower down the profile. The more soluble calcium sulphate passes down further and may eventually appear at 4–5 metres as fine crystals of gypsum. It is a soil of the wide, flat plains. Black earth and red loam types of weathering may often occur side by side where a slight change in topography is sufficient to alter the intensity of leaching. This is particularly noticed in shallow soils on limestone. The black, very shallow soil (**rendzina**) may alternate with the red, rather shallow **terra rossa**, just a few metres away.

Gleyed

Many other variations of soil-type are possible. For example **gleyed** types have the characteristics which were discussed in the section on the **soil profile.**

Alluvial soils are produced by transport from existing soils, wherever flooding occurs.

It should be noted that whenever moisture and warmth are adequate, rock weathering will take place. Soil-development will continue only when the conditions for *leaching* are sufficient.

How it happens

The principal mechanisms of soil genesis are:—

- The fragmentation of rocks by expansion and contraction, caused by heat and cold.
- Oxidation of iron, and solution of chemical compounds, when abundant water and oxygen are present.
- Removal of iron in combination with acidic organic-matter.
- Removal of calcium, magnesium, potassium, sodium under the influence of water containing carbon-dioxide gas.
- Re-depositing of above substances at lower levels in the profile as the water present decreases.
- Erosion of surface soil.
- Transport of alluvial material during floods.
- Further weathering of old soil profiles in a new geological era or a period of changed climate.

It is by various combinations of these processes that soils of widely differing kinds are formed. Krasnozems are usually to be found in the tropics and subtropics, but they are also to be found in Tasmania where the cooler climate is off-set by an easily-weathered basalt.

Clays

Temperate-climate clays usually contain one or more of the minerals montmorillonite, illite, beidellite vermiculite. Montmorillonite is very sticky when wet.

Tropical clays contain mainly kaolinite, halloysite and oxides of aluminium or iron. None of these minerals produce very sticky clays. Indeed tropical soils may contain as much as 80% of clay without reacting as heavy clays. This applies to krasnozem and lateritic (red loam) soil types which are quite porous to water and therefore "out of character" as clays.

Soil clay normally carries a preponderance of the element calcium attached to each clay particle. When, as the result of the presence of salt, calcium is partly replaced by sodium, clay becomes impermeable when wet, and the soil as a whole changes its character.

All this means that the more-sophisticated laboratory method of assessing the amount of clay may not be as significant as the manual touch method. In such a case the actual property sought, such as the rate of infiltration of water, must be measured directly.

Glossary of Terms used in this Section

DISPERSION: DISPERSED. Complete separation into individual particles, as for example, clay. (Deflocculated.)

FLOCCULATION: Opposite to dispersion. The aggregation or clumping together of separate particles.

LATOSOL: A highly developed and strongly leached soil, typical of the tropics.

PED: A natural aggregation of soil particles. The most favourable are crumbs 2–5 mm in size, but much larger prisms or even columns are possible.

Identifying insects . . .

Earwigs

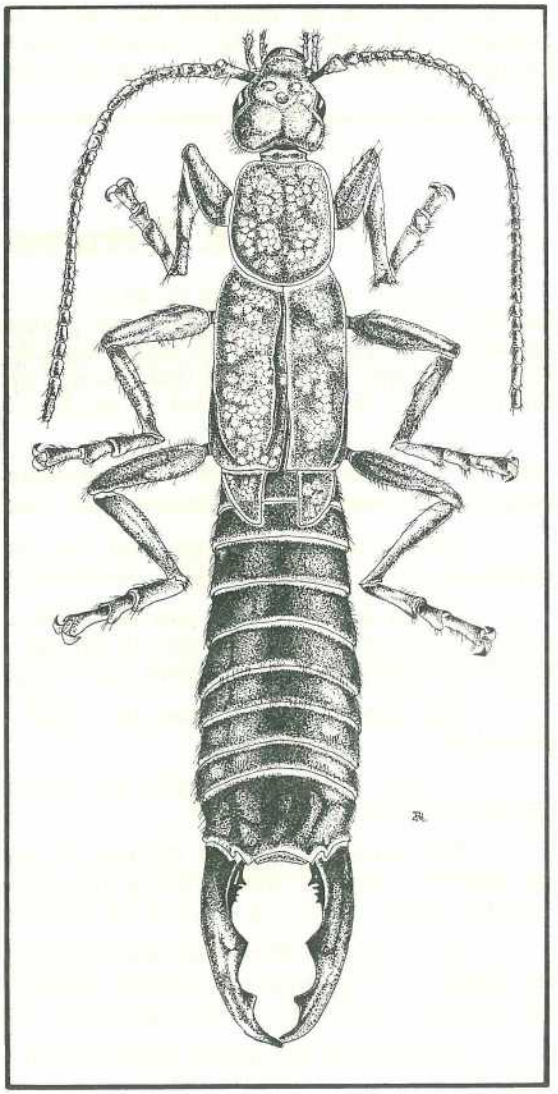
(Order *Dermaptera*)

by I. D. GALLOWAY,
Entomology Branch.

EARWIGS form a small but quite distinct Order of insects known as the Dermaptera. They are elongate, flattened insects, characterized by a mobile, telescopic abdomen terminating in a pair of horny forceps. These forceps usually guarantee that an earwig receives a certain respect from the casual observer especially as when alarmed or molested in any way the abdomen is raised and the forceps opened in an almost threatening manner.

In addition to offence and defence the forceps are also used for the capture of prey and occasionally help in folding the hind wings. Many earwigs are completely wingless but where wings are present they are very complex and must be folded into a compact packet which can be tucked beneath the abbreviated wing covers.

Earwigs are frequently found living under bark, stones or decaying vegetable matter in the bush, and though essentially nocturnal are often attracted to light. In their feeding habits earwigs are practically omnivorous. Their diet consists of a wide range of living and dead plant and animal matter.



Adult of the black field earwig
(Nala lividipes (Duf.))

The large oval eggs of earwigs are usually laid in the bottom of a small burrow in the soil excavated beneath some debris. Showing a quite remarkable degree of maternal concern the female stands guard over her eggs throughout incubation.

For the first week or two the newly hatched nymphs are also protected but after this time they must fend for themselves to escape the growing cannabalistic tendencies of their once attentive mother.

The young earwigs resemble pale wingless miniatures of their parents. Growth occurs through a series of moults, with wing pads, in such species as are winged, being developed after several moults.

Despite their sinister appearance and an unfounded reputation for crawling into the human ear, earwigs are considered to be relatively harmless. In Queensland only one species, *Nala lividipes* (Duf.) has been implicated as an agricultural pest. This particular earwig has been reported causing losses to some field crops in the South Burnett, the eastern and northern sections of the Darling Downs and the Lockyer Valley. The adult is a small elongate insect approximately 12 mm long and shiny black in colour with fully developed wings.

Stock Returns—Brand Returns

Amongst the measures to assist the cattle industry weather the present depression in the industry, the Government deferred the payment of stock assessments due and payable on 31st January to the 15th June 1975, in the hope that conditions would improve in the interim period. However, it was not intended that assessments be waived altogether as they provide the basic finance for the services provided by the Division of Animal Industry within the Department.

The majority of owners have accepted their obligations in this regard and have paid their 1975 assessment. Others in more straitened circumstances have lodged their returns and requested deferment of assessments until conditions improve.

Owners in the latter situation who have not yet lodged their 1975 stock return are requested to do so under similar conditions.

In this regard owners are reminded that both State and Federal Governments have made low interest loans available to provide carry-on finance through the Rural Reconstruction Board and Stock Assessments may be paid with such loan moneys.

The Stock Return form for 1976 has been amended to simplify administrative procedures.

Owners should ensure that all relevant sections are completed and that the form is signed before being submitted.

The envelope in which the form is mailed will have the property index number above the address. Owners should retain this envelope for record purposes and ensure that the property index number is entered on the Stock Return.

Brand Return Forms are also required to be lodged in January of each year to enable the Registrar of Brands to establish which brands and/or earmarks are not required and take the necessary action to cancel registration where returns have not been submitted.

These forms are posted together with stock assessment forms to stock owners who have lodged previous years returns and are also available from the local office of this Department.

YOU CAN'T BEAT A DRUM

IT'S amazing how many workers think they can beat a drum, which has held paint, flammable liquids, etc. They believe they can cut it open with an oxy welding torch without bothering to properly purge it first.

Here are two recent cases where the worker didn't beat the drum—

(1) Worker was cutting a 4 gallon drum with an oxy welding torch when the drum exploded. He received injuries to both thighs and was off work for over 2 weeks.

(2) A 44 gallon drum which had previously held road marking paint some 12 months previously was being cut in two by a worker using an oxy acetylene torch. The bung had not been removed and with the application of heat there was a rapid build up of gas.

Road marking paint contains 64% volatile toluol in solvents and here the paint had formed a skin over the dregs. The intense heat caused the release of toluol gas and the explosive mixture subsequently ignited hurling the top of the drum 153 feet. Unfortunately a bystander was in its path and he was killed almost immediately. The worker cutting the drum was also injured.

The Welding Rule under the Factories and Shops Acts states in clause 30:—

"Before welding or cutting is performed on containers, drums, barrels, or tanks the occupier shall arrange for tests to be made to establish that there is not danger of fire or explosion."

Appendix B of the Australian Standard C.B. 19—Fire Precautions in Cutting and Welding Operations—describes the recommended procedures for cutting or welding containers, which have held or might have held flammable or explosive substances.

The cleaning and purging procedures for small containers can be carried out by steaming, boiling, or purging and these methods are described in the Code.

In view of the risks involved when drums have to be cut open, it is far more preferable to use mechanical means e.g. non-sparking hand tools as opposed to a welding method.

From Occupational Safety News Bulletin

SMALL pesticide containers represent the majority of such containers to be disposed of in Australia, and care should be taken as far as their disposal is concerned.

They should be disposed of either at a public dump or buried at least 18 inches deep at a private disposal site.

First remove the caps or lid, punch holes in metal containers, crush glass containers.

Do not make rafts from them and contaminate waterways, and do not convert them into feed containers.

By courtesy Agricultural and Veterinary Chemicals Association.

for the sheep man—

A medicine chest is handy

by C. I. YOUNGER,
Sheep and Wool.

Plant and chemical poisoning can cause big losses on sheep properties, although usually losses are small and sporadic. Losses can be reduced or avoided if a medicine chest containing a suitable antidote is kept on the property. This chest need only be small and relatively inexpensive.

PLANT poisoning is the most common cause of poisoning. Most sheep graze on natural pastures and learn to avoid some of the more common local poison plants. However, if strange sheep are introduced from another district they often take readily to plants so carefully avoided by locally bred sheep. The effect of the poison is hastened if the sheep are hungry.

The commonly used insecticides and anthelmintics are safe if used according to the manufacturer's instructions. However accidents occur and it is wise to have an antidote handy when animals are poisoned by these chemicals.

While it is better to avoid letting sheep be poisoned there are times when this is beyond the control of the grazier. Some poisons have no known antidote, but in many cases sheep can be saved if given correct treatment early—as soon as symptoms begin to develop.

The medicine chest should be kept in a safe and convenient spot away from the reach of children and could contain the following:—

- *Calcium borogluconate* is a spectacular cure for hypocalcaemia—a disease commonly known as milk fever. It is an effective antidote for oxalic acid poisoning as well. Pigweed, roly-poly and soda bush can contain oxalic acid.

Calcium borogluconate is available in both powder and liquid form—the liquid form is commonly used as no preparation is necessary. All proprietary lines have the directions on the packets and the bottles. The drug is

easily administered by a subcutaneous injection into the unwooled part of the leg of the affected animal.

• *Methylene blue* is used against nitrate poisoning. Most young, quick growing cereal crops contain nitrate. Native plants such as mint weed and urochloa can also cause nitrate poisoning. The nitrate becomes nitrite in the body and rapidly deprives the red blood cells of oxygen.

Dissolve nine (9) grams of common salt (*sodium chloride*) in 1 litre of boiled water, then dissolve six (6) grams of methylene blue in the salt solution. The dose rate is 10 mls into the jugular vein or under the skin. Repeat the treatment in half an hour if response is slow.

• *Sodium thiosulphate* (photographic hypo) is very useful in cases of prussic acid poisoning which can be caused through grazing such plants as the varieties of sorghums, blue couch and boonaree.

Sixty grams of photographic hypo should be dissolved in 500 ml of water. Give 120 ml of the solution as a drench and repeat every half hour as needed.

• *Magnesium sulphate* (Epsom salts) is used mainly as a purgative for animals. The adult sheep dose rate is 90–120 grams dissolved in 300 ml of water and for lambs 30–60 grams depending on size.

• *Sodium bicarbonate* (baking soda) is used for digestive upsets. When being fed grain, sheep should be brought on to the grain gradually, otherwise a condition known as acidosis develops. Wheat grain brings on this condition quickly, but other grains such as sorghum, maize, barley can also produce the disease.

Fifteen grams of sodium bicarbonate in 500 ml of water given as a drench will be beneficial.

• *Vinegar* is an antidote for urea poisoning. This can be caused by an excess intake of urea through gaining access to soft or moisture-affected urea blocks. Affected sheep can die very quickly.

When animals are exhibiting early symptoms, 300 ml of vinegar is given as a drench. This should be followed up with a drench of about 120 grams of molasses dissolved in water when the animal starts to recover.

• *Glycerine* is useful in cases of pregnancy toxaemia. Ewes close to lambing and on a falling plane of nutrition are susceptible to this malady. The trouble is accentuated when the ewe is carrying more than one lamb and where there is a period of sudden starvation such as prolonged yarding.

About 120 ml of glycerine mixed with an equal quantity of water and given as a drench twice a day is effective—if given early. The treatment is continued until the sheep recovers. Upon recovery it is important to keep the animal well fed.

• *Antiseptic.* A suitable antiseptic should be kept for the treatment of wounds. There are many suitable antiseptics available. The one purchased will depend largely on the owner's personal preferences.

• *Hypodermic syringe and 16 gauge needles* are used to inject the calcium borogluconate and the methylene blue into sheep. Remember that some syringes are graduated in ccs and others in mls—these can be taken as being the same.

• *Forceps.* These are useful to help in swabbing wounds and removing splinters, burrs, grass seeds and other foreign bodies.

• *Trocar and canular* are instruments which are used for piercing the swollen paunch in cases of extreme bloat. The trocar and canular are plunged in together at the highest point of the bulge and directed towards the elbow on the other side. The trocar is pulled out and the hollow canular allows the gas to escape.

The above represents an inexpensive medicine chest but it could save the sheep man a lot of money if these materials are on hand when needed.

Keep the containers labelled. Have a corresponding list on the inside of the cabinet door. Under this list jot down what each is for.

The cabinet must be locked and kept out of the reach of children at all times.

Errata

The article "Feeding Horses" in Vol. 101—No. 1 (January-February, 1975) should be amended as follows:—

Page 10—Amend paragraph 2, lines eight and nine to read—

"should be between one part calcium to one part phosphorus and two parts calcium to . . ."

Page 18—Table 4 should read—

TABLE 4
AVERAGE NUTRITIVE VALUES OF VARIOUS FEEDS
(As-is Basis)

Feedstuff	D.M. (%)	D.P. (%)	T.D.N. (%)	Calcium (%)	Calcium (g/kg)	Phosphorus (%)	Phosphorus (g/kg)
Hays							
Oaten	90	3·0	50	0·20	2·0	0·20	2·0
Wheaten							
Lucerne	90	10·0	50	1·20	12·0	0·20	2·0
Grassy lucerne	90	5·0	46	0·80	8·0	0·20	2·0
Pasture	90	2·0	45	0·4	4·0	0·2	2·0
Green fodders							
Grazing oats, wheat, barley in growing stage	25	2·0	14	0·08	0·8	0·06	0·66
Young leafy pasture ..	15	2·0	10	0·07	0·7	0·05	0·5
Immature pasture	30	2·0	16	0·13	1·3	0·07	0·7
Mature pasture	40	1·0	16	0·01	0·1	0·05	0·5
Grains							
Oats	90	8	72	0·06	0·66	0·20	2·0
Barley	90	7	77	0·05	0·5	0·35	3·5
Maize	90	8	80	0·01	0·11	0·30	3·0
Grain sorghum	90	8	80	0·03	0·3	0·30	3·0
Wheat	90	8	78	0·04	0·44	0·40	4·0
Protein-rich concentrates							
Linseed meal	90	26	76	0·40	4·0	0·75	7·5
Peanut meal	90	37	80	0·15	1·54	0·60	6·0
Cottonseed meal	90	33	75	0·20	2·0	1·20	12·0
By-products							
Wheat bran	90	11	63	0·09	0·9	1·00	10·0
Wheat pollard	90	11	73	0·09	0·9	0·65	6·5
Molasses	75	..	60	0·86	8·6	0·07	0·7

WHEAT

W. Bott and N. J. Douglas—Q.A.J. May-June 1975—Vol. 101 No. 3

Since the preparation of these articles changes have occurred in both pesticide recommendation and wheat quality classifications. The following amendments are required:—

p. 315-317 "Insect pests on Wheat in Queensland"

D.D.T. is no longer acceptable for use on wheat and the alternative recommendation for trichlorphon applies to control of **armyworms** and **cutworms.**

Azinphos-ethyl should not be used for **blue oat mite** control, but the recommendation for methidathion applies.

p. 331-332 'Grading and Classification."

The former class—F.A.Q. (Fair Average Quality)—has now been replaced by Australian Standard White (A.S.W.) as a class in its own right.

Hard No. 2 and Hard No. 3 become No. 1 Hard and No. 2 Hard respectively. Specifications remain essentially the same. "Off grade" has been renamed "General purpose."

p. 322 "Diseases of Wheat—Loose Smut"

"Oxycarboxin" should read—"carboxin (registered trade mark—Vitavax)."

Building a Veterinary crush

This article by P. L. CORLIS Beef Cattle Husbandry Branch, gives valuable information on building a crush to help carry out veterinary procedures on a property.

IF common veterinary procedures are to be carried out on the property, it is essential to have an adequate means of restraining the beast.

There are numerous veterinary procedures carried out on a property over the course of a year. Some of these are dehorning, spaying, pregnancy diagnosis, artificial insemination and treating injuries.

It follows that the need to restrain animals with a minimum of effort and labour frequently arises on many properties.

The purpose of this article is to describe a veterinary crush which meets the above requirements. While there are many variations which can be included according to the particular view of the person concerned, this article attempts to outline the essential requirements.

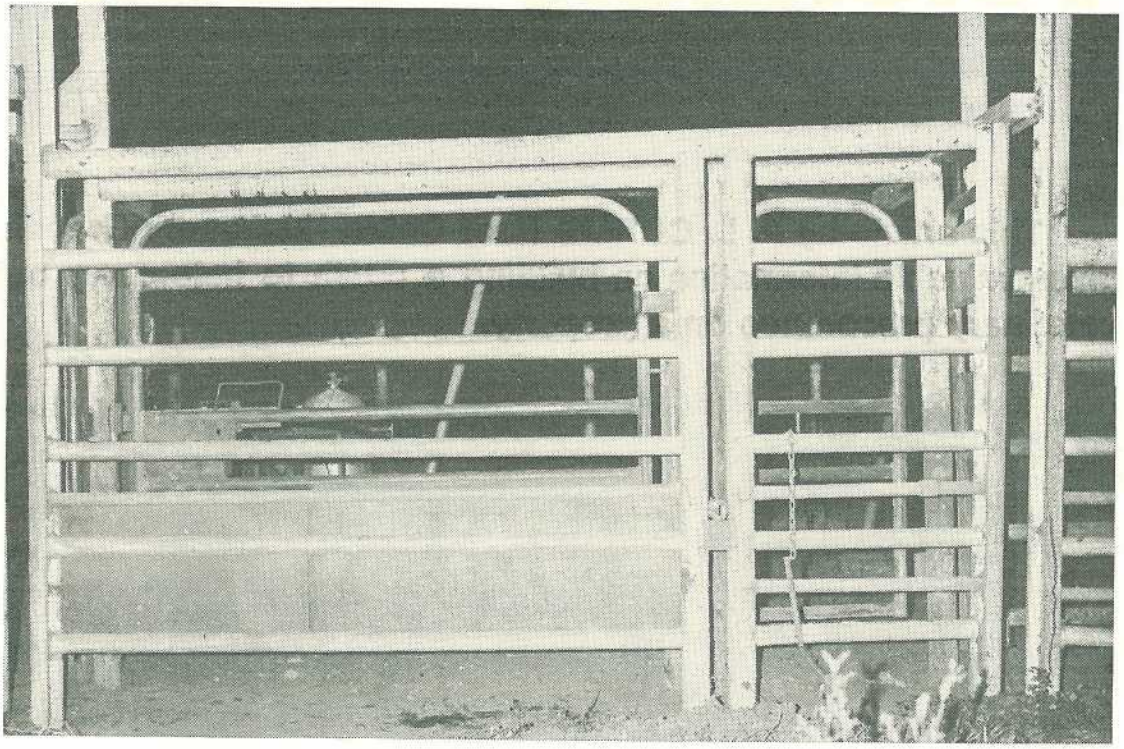
The crush illustrated in this article was constructed by R. F. Maynard, "Greenfields", Jambin.

Site

In tick infested country the veterinary crush should be located in the crush leading to the dip. Firstly, cattle are used to using this crush and will enter the crush with little trouble.

Secondly it is a waste of money to build a separate crush and forcing yard for veterinary purposes because the current practice of running a property with a minimum of labour the two crushes would not be used concurrently.

Working side of Crush Showing Strong Construction and Sheeting of Lower Half to Prevent Legs getting caught.



Measurements

In the veterinary crush illustrated as a model for this article the following measurements were used:—

Distance from Entrance to Dip	3·35 m
Length of Gates in front of Head Bail ..	2·13 m
Overall length of crush	3·32 m
Length of Animal Compartment	2·13 m
Length of Operator Compartment ..	0·81 m
Width of crush	65 cm (internal measurements)
Height of crush	1·54 m
Rail spacing	20 cm

Of these measurements the following are considered to be essential and should not be altered significantly:

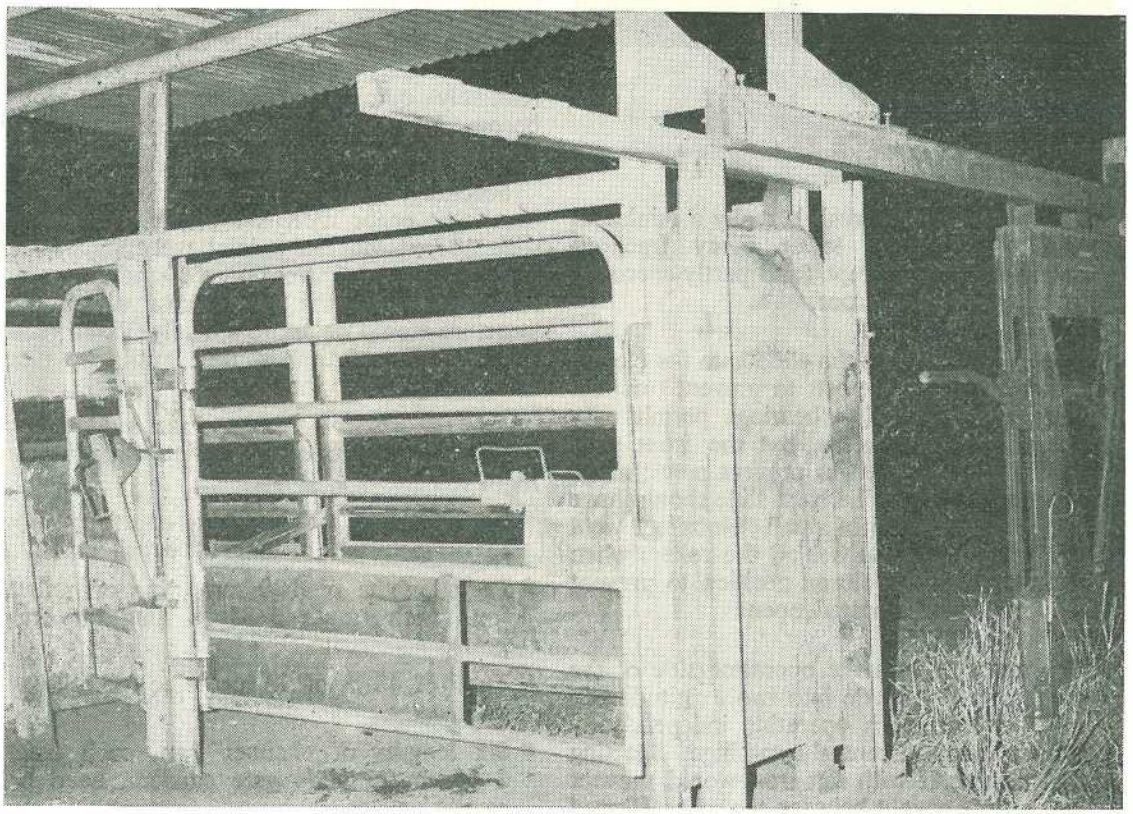
The width of the crush should not be altered. If it were wider cattle would not be properly restrained. If it were narrower large animals would have difficulty fitting through.

The length of the animal compartment should not be altered because this size accommodates the majority of cattle with the minimum of effort.

With reference to the other measurements, the following comments are valid.

- The distance from the head of the dip to the front of the crush is minimal as is the length of the gates on each side of the crush. One must have adequate room for dehorning or any operation involving the head of the animal. Also these gates are useful for drafting purposes. This is shown in Diagram I.
- The rail spacing should be regarded as a maximum. At this spacing, it is unlikely that cows will get their heads through. If the spacing were increased there would be time wasted extracting heads from between the rails.

Illustration of Head Bail Construction.



An Efficient Self Locking Kick Bar.

- The height of the crush is really a minimum level. If it were lower many fractious animals would attempt (and partly succeed) to jump over the front.

- It is important that the slide gate fits closely between the guide posts to prevent twisting. The race type roller bearings permit easy operation of the gates, but the front slide should have a catch to prevent a restrained beast opening it. The back slide should have a stop in the form of small "blobs" of weld on the channel iron behind the rollers when the gate is in the closed position to prevent the gate being vibrated open.

- The main gate on the operating side of the crush could be made into two longitudinally split sections, each operating independently from a common central cup hinge. Sheeting the lower half with flat iron would prevent legs getting caught between the rails. Hinged cleats should be fitted to secure the two sections when it is desirable to use the two gates as a single unit. Reasons for this approach include operations such as cross-branding, flank spaying, veterinary examination of bulls, etc.

- The floor of the crush should be concreted with a very rough surface to prevent animals slipping. An earth floor becomes gouged out by animals, thus trapping rain water and becoming boggy during wet conditions.

- There are two main methods of rear restraint; the kick bar type illustrated in this article, or a chain britchen. Although some operators prefer a chain, a properly constructed kick bar appears more efficient. It is generally quicker in operation, and there seems a lower frequency of cattle falling backwards.

Materials

The materials used in the construction of the crush being described are iron. It is essential for metal constructions used on the coast to be treated for rust.

While timber can be used, it has serious disadvantages. Firstly, timber deteriorates relatively quickly. This means that joints become loose, especially in the corner of gates, and efficiency is reduced.

Secondly, the strength is inferior to iron, so breakages occur more frequently. It must be remembered that an animal weighing 450 kg can exert a lot of stress on a restraining structure. Although the initial cost of an iron structure would be approximately 36% greater than for one of timber, iron would be more satisfactory in the long term.

For the crush being used as a model for this article the following major materials are required.

- Six lengths of 100 mm pipe or railway iron, each length 2·9 m long for crush posts.
- Four lengths of 100 mm pipe or railway iron, each length 3·81 m long for crush posts.
- Total of 48 m of 50 mm pipe for rails and slide gates.
- Six lengths of channel iron, each length 3·05 m for slide gate carriers, head bail carrier.

TOP VIEW

MEASUREMENTS ARE TAKEN FROM CENTRE OF RAILWAY IRON POSTS.

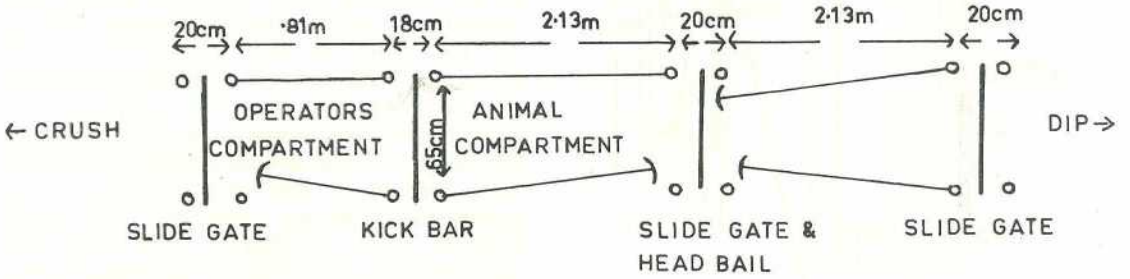


DIAGRAM I
PREGNANCY DIAGNOSIS CRUSH

SIDE VIEW :— OPERATING SIDE

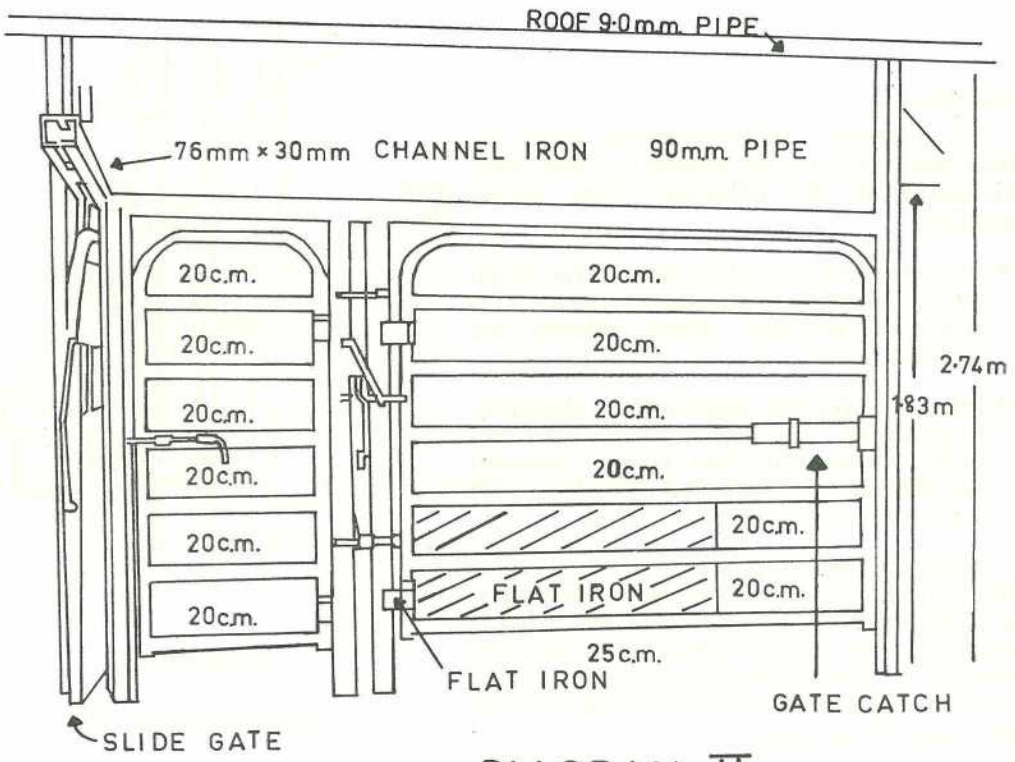


DIAGRAM II

Swinging Gates 50mm. Pipes

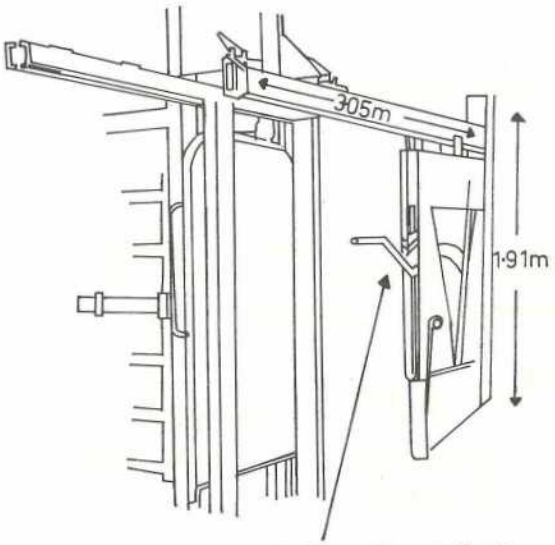


DIAGRAM III

- Diagram IV shows a well constructed kick bar. When pushed into position behind the beast the angle of the flat iron automatically pivots the pin around point A, and into the spot B, and thereby locking the kick bar in position.

- A chain must be suspended above the height of an animal's head, dropped behind the animal and pulled into position and locked. All this must be done before the animal starts to back out of the ideal position. Generally the chain is too loose and tends to slip towards the animal's hocks, increasing the danger of the animal falling backwards. This method of rear restraint often overcomes the problems associated with small animals when compared with kick bar restraint. The dimension of the animal compartment (2·13 m) is designed for animals in the 450 kg liveweight range. Smaller animals in the 330 kg liveweight range are restrained by pushing the slide gate inwards and securing it.

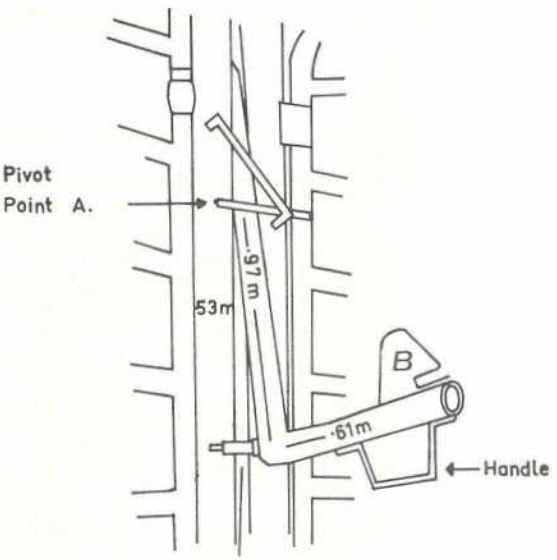
Construction

The diagrams and photographs show the basic construction of the veterinary crush. Some discussion on the following points appear justified.

- The gate catch is a sliding tongue type which can be fastened and unfastened quickly. This action is desirable where animals are confined.

- Installation of the head bail is shown in Diagram III. The bottom of the head bail slides between the two guides cemented into the floor and is locked in position with a pin to secure it when being used.

There are many variations of home made head bails which can be constructed. However, a ready constructed commercial bail from a reputable firm can be substituted. They are stronger in construction than the home made wooden ones and can be removed quickly from the front of the crush.



Kick Bar

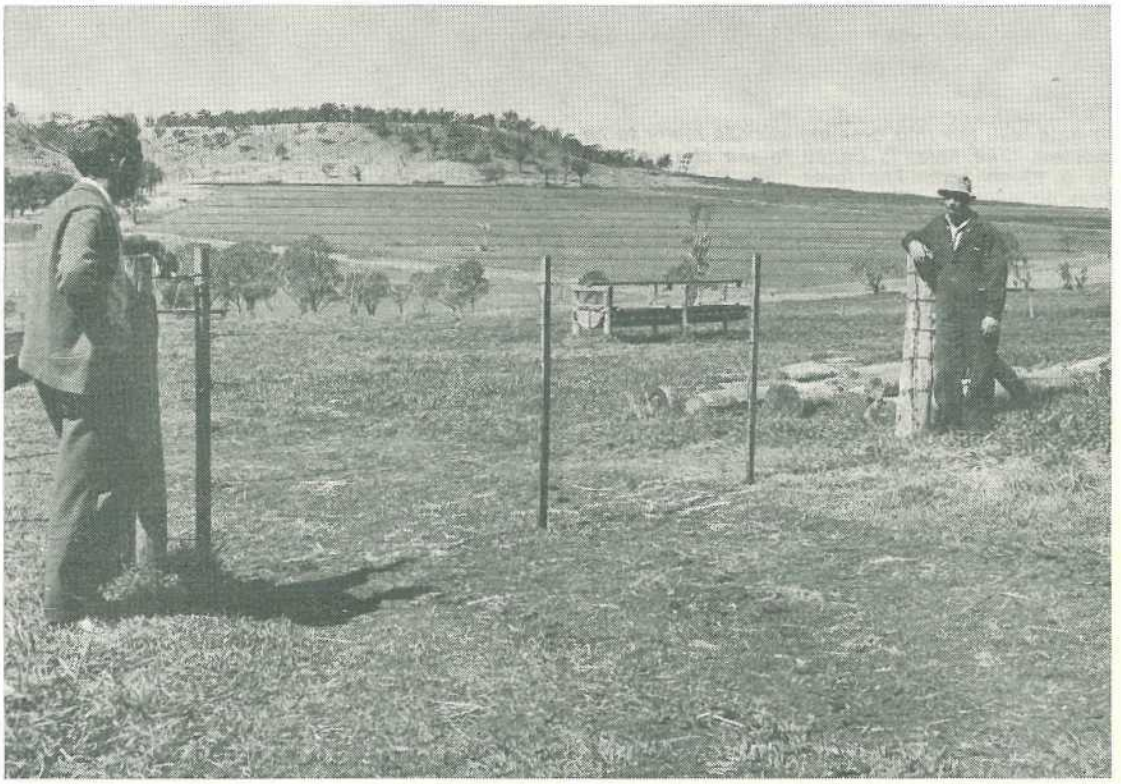
DIAGRAM IV

An effective farm gate

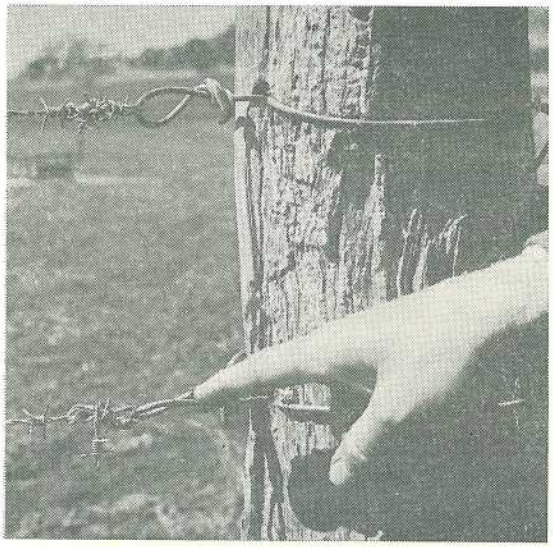
by R. T. GILLILAND, Dairy Field Services.

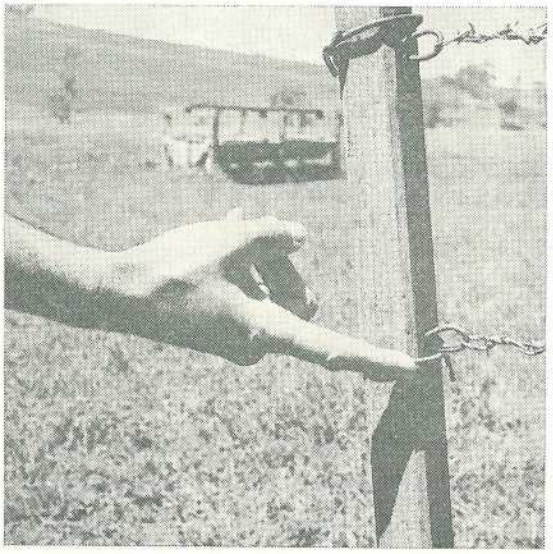
A simple but effective gate can be a means of avoiding frustration, particularly when stock are moved through it regularly.

The photographs were taken on Mr. and Mrs. Allan Stenzel's farm at Greenmount, but there are a number of Eastern Darling Downs farmers who are using this type of gate with minor modifications.



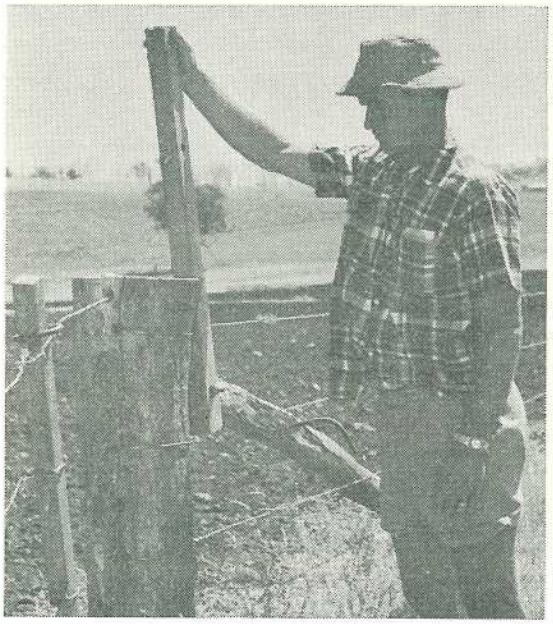
This gate is 6m wide but it is possible to make gates up to 14m wide using this design and by adding extra droppers. The droppers stop the wire tangling when the gate is being opened and closed.



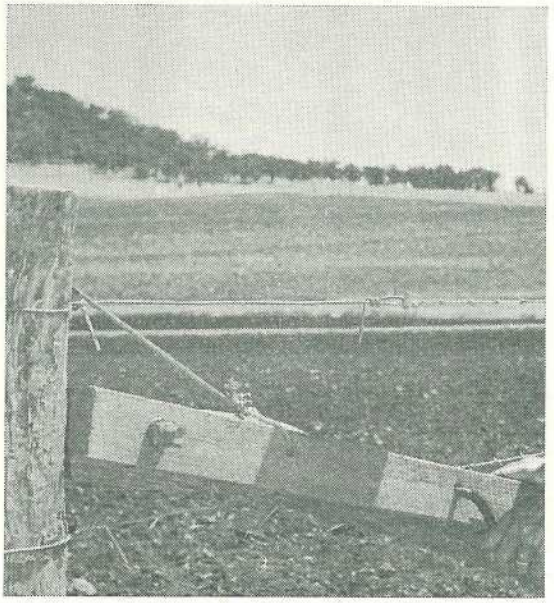


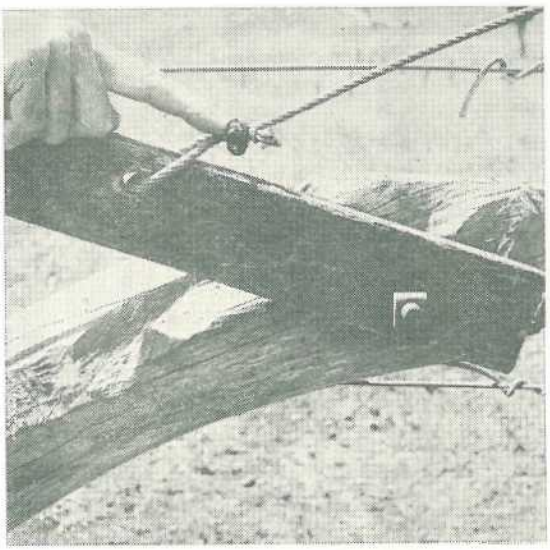
A wire loop has been used to attach the wires to the gate stick and to the gate post. Links from an old chain, preferably galvanised, could be used instead. The chain could be attached to the post and the stick with plain wire.

The gate with the ring over the stick is ready to be tightened. The lever is bolted to the strainer stay with a 13mm bolt. The lever here is a piece of 75mm by 50mm timber about 1m long.



The lever in the closed position with locking pin in place. The pin is a short length of 10mm rod.





The fastener is made of 10mm wire rope fitted at one end with a wire ring. The rope is threaded through the post and the other end is attached to the closing lever. D clamps are used to fasten the wire rope. The clamps make adjustments easy if the gate becomes slack.

Air-conditioning Option for Range Rovers and Land Rovers

BRITISH Leyland is offering air conditioning as an optional extra on Range Rovers and Land Rovers.

A combined development by British Leyland and Spencer, Abbot and Company of Birmingham has resulted in a roof-mounted Frigiking TC660 air conditioning unit.

Roof-mounting enables the cooling condenser to be included in the roof unit, not in front of the radiator, and so avoids hindering engine cooling and leaves the forward area free for winches and power take-off drives. Accessibility for service is good with no dashboard congestion.

The controls are ceiling-mounted within reach of all passengers. One of the first customers to have air conditioning fitted to his Range Rover was the Shah of Iran—and with 80 per cent of Range Rovers and 75 per cent of Land Rovers being exported, British Leyland anticipates great interest from equatorial countries.

British Information Service.

Navy Beans, French Beans and Soybeans

Summary of insect control recommendations

Prepared by Entomology Branch Officers

THE following tabulation summarises pesticide recommendations for bean crops. The summary is presented as a reference guide and details where necessary should be sought from Extension Officers of the Department.

Pest	Description of Pest	Damage to Crop	Control Pesticide dosage rates are active constituent	Notes
Bean fly .. .. .. *Melanagromyza phaeseoli* (Tryon)	Small, elongate, cream-coloured larvae up to 3 mm long, feed internally. White to brown pupal cases 2·5 mm long are found under the bark or in cracks in the bark. Adults which are 2·5 mm long, shiny black and active are found on or around the plants	Eggs are laid in leaves resulting in small yellowish spots concentrated near the leaf stalk. Larvae tunnel towards the base of the plant destroying tissue just under bark. Damage results in collapse of plants, in calloused areas of bark on stem and petioles or in cracking of bark at or near ground level. Damaged plants may be broken off by wind	Dimethoate 350 g/ha Promecarb 300 g/ha Diazinon 300 g/ha	Not a pest of soybeans. In coastal and other areas where beanflies are prevalent, applications are normally required at 3, 7 and 14 days after plant emergence. Further applications every 7 days until flowering, may be required if large numbers of bean flies are present. In these areas from May until September and in many inland areas control measures are seldom needed
Spider mites .. .. *Tetranychus* spp.	Minute, greenish, yellowish, orange or reddish spider like mites up to 0·5 mm long (just visible to the naked eye). Feed on the lower surface of the leaf	Moderate population levels result in mottled and yellowish leaves. High populations or sustained infestation may cause shedding of leaves	Dicofol 550 g/ha Dimethoate 350 g/ha Tetradifon 220 g/ha Sulphur spray 3 000 g/ha or 90–99% dust Cyclosulfyne 350 g/ha	Control measures should be applied only if the pest is observed in damaging numbers. Resistance to dimethoate and tetradifon are widespread in the Granite Belt and North Coast districts. In these instances growers should use dicofol. If dicofol resistance is also present alternative miticides are recommended
Green loopers .. .. *Plusia* spp.	The large, green larvae which grow to 40 mm in length are characterised by their looping movement. The moth, with a wing span of 32 mm, is golden brown in colour with conspicuous silver spots in the forewings	Feeding is confined mainly to the leaves but attack on the pods sometimes occurs	Methomyl 400–500 g/ha Endosulphan 750 g/ha	Control measures should be applied only if the pest is observed in damaging numbers

Cowpea aphid .. .. *Aphis craccivora* Koch	The small (up to 2·5 mm long), globular, greenish black insects are normally found clustered on undersides of leaves, around growing tips, on flower stalks and on pods	Removal of sap and physical damage results in yellowing and retardation of growth. Plants may become coated in sticky honey dew excreta	Dimethoate 350 g/ha	Control measures should be applied only if the pest is observed in damaging numbers. A pest of minor economic significance on coastal green beans
Green vegetable bug .. *Nezara viridula* L.	Adult bugs are 12 mm long, green and shield shaped. The young bugs are somewhat different in appearance and are vividly marked with green, red-yellow, orange and black	Both adult and juvenile bugs suck on the seeds causing abortion or distortion of the seeds and distortion of the pod	Endosulphan 750 g/ha Methomyl 500 g/ha	A pest of minor economic significance on coastal green beans. Control measures are regularly required in soybeans crops. Other species of shield bugs are found in these crops but green vegetable bug is the only one of major economic significance
Jassids .. .. .. *Austroasca* spp.	Small bright yellowish green insects about 3 mm long, hopping or flying when approached	These sucking insects distort young foliage, cause silvering and yellowing of foliage and reduce the growth rate of plants	Dimethoate 350 g/ha	Control measures should be applied only if the pest is observed in damaging numbers. A pest of minor economic significance on coastal green beans. Not a pest of hairy soybean varieties
Bean blossom thrip .. *Taeniethrins nigricornia* Schmutz	Adults are small (1·5 mm long) elongate insects coloured black to brown, and very active. Immature stages are yellow to red and wingless	The thrips feed on the sap which flows from ruptured surface cells. Thrips feeding in flowers may result in flower shedding or in russetting or distortion of pods. The leaves may be discoloured (silvered or russetted) and distorted by upward puckering while stems may be distorted and excessive bunching may occur	Dimethoate 350 g/ha Methomyl 250 g/ha	Not a pest of soybeans. Control measures should be applied only if the pest is observed in damaging numbers. Some flower shedding may be tolerated as flower production always exceeds the plants requirements. Pod russetting and distortion is not as significant in the production of dried beans as it is with green beans. Sprays are required at flowering in green bean crops when 6 or more thrips are present per flower
Bean pod borer .. .. *Maruca testulatia* (Geyer)	Larvae are up to 15 mm long and varying from greenish yellow to bright green but are characterised by several rows of dark spots along each side of the body. The moth, which has a wingspan of 26 mm, is rather inconspicuous. The forewings are yellowish brown with translucent spots	The larvae feed on flowers and tunnel in pods. Damage is associated with webbing and deposits of excreta. Only the small entry hole is evident	Methomyl 400–500 g/ha	Not a pest of soybeans. Control measures should be applied only if the pest is observed in damaging numbers. The pest causes most damage in autumn crops and when present 1 or 2 applications during the period from flowering to pod set may be required

Pest	Description of Pest	Damage to Crop	Control Pesticide dosage rates are active constituent	Notes
Corn ear worm .. .. *Heliothis armigera* Hubner	Larvae grow to 40 mm long and vary considerably in colour. The moth is solid bodied with a wing span of 40 mm. The forewings are reddish pink to buff coloured while the hindwings are creamy yellow with large marginal smoky areas	The larvae feed on the flowers and pods but unlike the bean pod borer the damage is not associated with webbing. Larvae make large entry holes in pods when tunneling and also feed externally on pods	Methomyl 400–500 g/ha Endosulphan 750 g/ha	Growers should anticipate the necessity of application of 1 or 2 sprayings for control of this pest in all summer crops of green beans during the period from flowering to pod set. The level of damage which is tolerable is greater in dried than in green beans crops and 1 application at late flowering is usually sufficient

Withholding period: To ensure that spray residues diminish to an acceptable level the following periods should be observed between the last application of the pesticide and harvest and/or grazing or feeding of crop residues to livestock.

	Days
Dimethoate	7
Promecarb	28
Diazinon	14
Dicofol	7
Tetradifon	3
Sulphur	Nil
Cyclosulfyne	7
Methomyl	1
Endosulfan	7

QL5–
a new Queensland-bred Grain Sorghum inbred line

by D. S. FLETCHER, L. van SLOBBE and R. G. HENZELL, Agriculture Branch, and the late R. F. MOORE.

A MALE parent (restorer) line, QL5, has been released by the Queensland Department of Primary Industries. It was bred at Hermitage Research Station by the late R. F. Moore and Messrs. D. S. Fletcher and L. van Slobbe.

Pedigree. QL5 was selected from the cross KS19 x Tx414. KS19 is the male parent of Q5161 and Tx414 was the male parent of Texas 626.

Grain Yield. Hybrids based on QL5 combine the high-yield of Texas 626 under moderate to good conditions with the superior yield of Q5161 under poor to moderate conditions. In a series of trials at Biloela, Kingaroy and Hermitage hybrids based on QL5 outyielded Q5161 and Texas 610 by an average of 7·5 and 7·0% respectively. The yield advantage of the QL5 hybrids over Q5161 and Texas 610 was in general evident over the whole range of conditions experienced in the trials.

Standability. QL5 has also some of KS19's lodging resistance although its hybrids with AKS4 do not stand as well as Q5161 (AKS4 x KS19). QL5's hybrids have superior standability to that of Texas 626 and Texas 610.

Maturity. Its hybrid with AKS4 is of medium-late maturity flowering about the same time as Q5161.

Head Characteristics. The head is semi-open, with awnless florets, bearing large, dense, yellow endosperm grain with a red pericarp. It produces a hybrid with AKS4 which has grain with a bushel weight intermediate between that of Q5161 and Texas 610.

Disease Resistance. QL5 is susceptible to sugarcane mosaic virus, exhibiting a moderate mosaic reaction when infected. It is susceptible to race 1 of head smut (*Sphacelotheca reiliane*) although not as susceptible as R7078, the male parent of Texas 610. It has moderate resistance to rust (*Puccinia purpurea*) and leaf blight (*Helminthosporium turcicum*).

QL5's lodging resistance and grain yield capabilities should ensure that this line will be of use to the grain sorghum seed industry and to the grain grower.

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Talking about metrics—

End now in sight for milk, butter changeover

from MCB Newsletter,
the official organ of the Metric Conversion Board

The dairy industry took another important step in its changeover to the metric system with the introduction in South Australia of the metric butter pack. From 1st July butter was to be sold in packs of 500 g and 250 g, replacing the old 1 lb and ½ lb sizes.

South Australia is the first Australian State to bring the new butter sizes onto the market.

The new measures are more convenient for use in recipes which are now being given increasingly in metric terms in newspapers and magazines. To help housewives convert their favourite recipes to metric quantities the Australian Dairy Produce Board has prepared a guide to metric measurements to coincide with the introduction of the new butter sizes.

After the appearance of the 250 g and 500 g packs, it is likely that for a short period, some stores will still carry stocks of butter measured in pounds and ounces. However the metric packet will bear a distinguishing symbol to eliminate confusion between old and new stocks.

All other states are expected to follow South Australia's lead with the new butter sizes towards the end of the year. Weights and Measures authorities have already indicated that it will be illegal to pack butter, and a number of other commodities in other than rounded metric sizes from 1 January 1976.

The program to change to metric sizes bottles and cartons for the sale of milk and cream is also being carried out on a State basis.

Here are the details of current progress:—

- In New South Wales and the Australian Capital Territory the changeover has already been completed (apart from some small areas such as the far north coast, Albury and Broken Hill).
- In Victoria the first 600 ml milk bottles are to appear in August and September and the pint bottle will be gradually phased out before the end of the year. The introduction of metric packaging will not mean any price increase, and during the phase-in period 600 ml of milk—a little more than a pint—will be sold at he same price as a pint. Metric sizes for cartons will be introduced after the new bottles.
- In Tasmania the changeover is being carried out area by area to reduce the cost of the program. As the manufacture of imperial bottles ceases the natural wastage will

steadily reduce stocks. Supplies of remaining pint bottles will be transferred from converted areas to overcome shortages in regions still to change over. The State's milk supply will be completely metric towards the end of August.

- Plans for the conversion in Queensland are now being finalised and it is expected the changeover will take place between November and March.

- In South Australia the major change is in Adelaide where all milk bottles and most cream containers have already been converted to metric sizes. The change in milk cartons has also started but has been delayed temporarily by mechanical problems. Country areas are expected to follow suit later.

- In Western Australia the sale of milk in 600 ml bottles will be phased in from September to November to reduce wastage. Cartons will be converted in early December.

Industry officials in a number of states have appealed to householders to search for and return as soon as possible all the pint bottles they have collected. This will allow the bottles to be used for as long as possible, and will help to reduce the cost of conversion.

Brand Directories

NEW editions of the Horse and Cattle Brands Directory and Sheep Brands and Earmarks Directory are now available.

The price for the Horse and Cattle Brands Directory, compiled to 30th June 1971, is $45. Due to steep increases in labour, printing and paper costs, it has not been possible to approve the sale of this directory at a lower price—this price is set almost at cost.

Superseded copies of the Horse and Cattle Brands Directories are still available to the public. These are priced as follows:—

- to 31st December 1962 . . . . $1.50
- to 30th June 1967 . . . . $5.00

The Sheep Brands and Earmarks Directory, compiled to 31st December 1974 is priced at $5.00.

All prices include postage.

Any person who wants to buy any of these Directories should forward the required amount and advise the relevant details to the Registrar of Brands, Department of Primary Industries, William Street, Brisbane, 4000.

Plicatulum finds a place in coastal pastures

by W. J. BISSET, Agriculture Branch.

In infertile poorly drained areas this new grass is filling an important role.

THE common paspalum grass (*Paspalum dilatatum*) naturalized in the better rainfall areas of Queensland is notorious for its prolonged flowering season and the prevalence of ergot on the seedheads.

Plicatulum, a later introduction of *Paspalum,* is free from these drawbacks and thrives on poor coastal country. This article describes plicatulum and discusses its strengths and weaknesses.

Plicatulum, known botanically as *Paspalum plicatulum,* is a tufted grass growing to a height of 1·2 m. Leaves are folded and usually about 40 cm long but may reach 85 cm. Seedheads have more branches than those of paspalum. Seeds are dark brown, shiny, oval, flat on one side and strongly convex on the other side and about 2·5 mm long.

The grass occurs naturally in the tropics and subtropics of the Americas. It is widespread in Florida, Venezuela and parts of Brazil. It is found on the margins of wet forests as well as in open country and is considered a useful component of the better natural pastures in Venezuelan lowlands. Plicatulum is also favourably regarded as browse for game and provides seed for wildfowl.

Plicatulum will grow on much poorer soils than paspalum. It will also tolerate poor drainage, surface waterlogging and complete submergence for several days. It is best suited to infertile low lying coastal areas from Maryborough north where mean annual rainfall is greater than 1 000 mm.

The main commercial areas are in the northern wallum (Maryborough to Gladstone) and around Mackay. Plicatulum will also grow well on poor country in the wet tropics (Ingham to Cooktown) and parts of Cape York Peninsula.

CULTIVARS

Seed is freely available of two cultivars, Rodds Bay and Bryan.

Rodds Bay cultivar originally came from Guatemala and is named after the C.S.I.R.O. Rodds Bay field station near Gladstone. It was released for commercial use in 1963 and has been widely planted.

Another cultivar, Hartley, from Brazil, was released at the same time as Rodds Bay. It has since dropped out of favour and is now unavailable.

Bryan was collected from Puerto Rico (Central America) in 1956 by the late Dr. W. W. Bryan of C.S.I.R.O. Division of Tropical Agronomy. It is thought to have originated in Venezuela. This cultivar was first tested in the northern wallum where it showed superiority over Rodds Bay and Hartley in yield of seed and dry matter, frost tolerance and spring growth. Bryan was readily accepted by local farmers and, by 1974, when it was officially released, had become more popular than Rodds Bay.

Identification

There has been considerable confusion in the identification of the cultivars. Commercial seed sold as Hartley has been subsequently found to be either Bryan or Rodds Bay. The cultivars cannot be distinguished by the seed but differences are obvious at particular growth stages of the plant.

Leaves of Rodds Bay are narrower than those of Hartley and Bryan but the range of widths overlaps.

In the seedling stage the young shoots and leaves of Rodds Bay are erect while those of Hartley are prostrate and the leaves have wavy margins towards the base. Seedlings of Bryan are intermediate in these characters.

New leaves and stems on mature plants in spring are erect in Rodds Bay but drooping in Hartley and Bryan. As growth advances this difference disappears.

The degree of hairyness of the leaf blades and sheaths on mature stands provides a reliable means of distinguishing the cultivars.

In Hartley, both surfaces of the leaf blade and also the sheath, are entirely free from hairs. In Rodds Bay and Bryan the bottom 8 cm or so of the inner surface of the blade has a band of hairs near each margin which clasp the stem.

Rodds Bay and Bryan are easily distinguishable by the presence or absence of hairs on the outer surface of the leaf sheath. In Bryan there is a distinct collar of dense hairs at the junction of the sheath and blade. From this collar a zone of fairly dense hairs extends for at least 2 cm down the sheath, tapering towards the midrib. In Rodds Bay the collar is absent and the sheath is entirely glabrous, or very occasionally has just a few hairs in the upper portion.

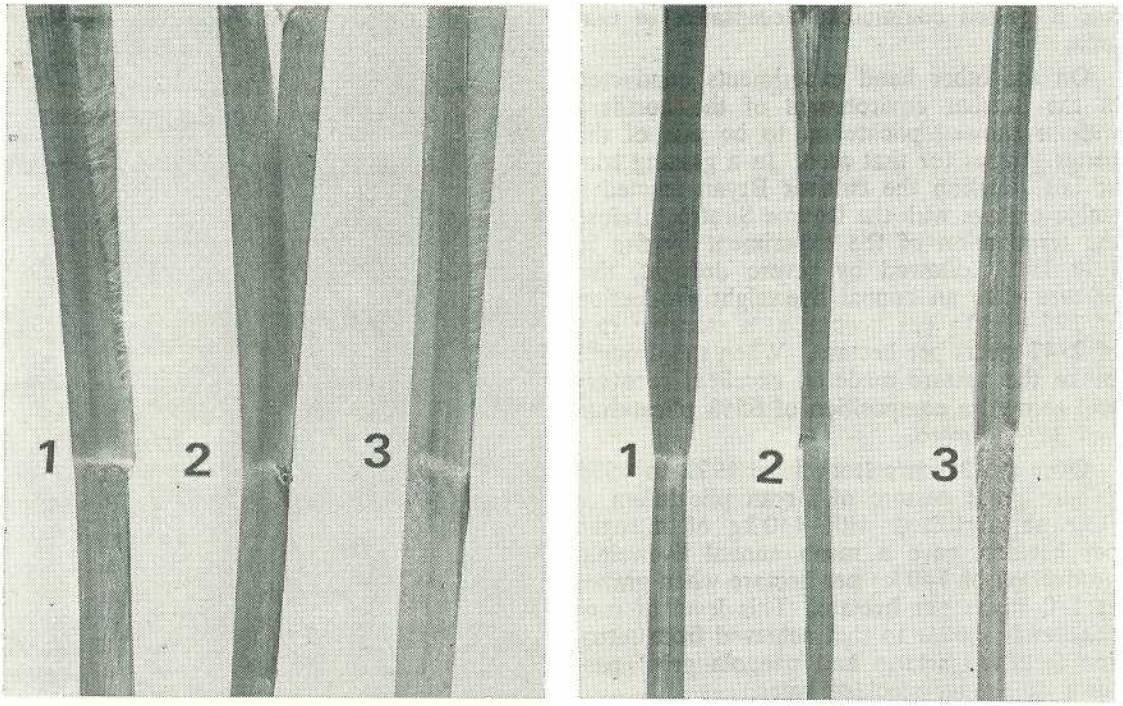
A specimen tussock of plicatulum.

The leaf hair characters are not reliable in seedlings or new shoots. For instance, the seedlings of Hartley have their leaves entirely clothed in short hairs.

Hartley flowers 2 to 3 weeks later than Rodds Bay and Bryan. The seedheads of Bryan have, on the average, more branches than those of Rodds Bay and Hartley. However, as the degree of branching is also influenced by growing conditions this character cannot be relied on.

PERFORMANCE

Plicatulum is a summer growing perennial; top growth is killed by frost. In contrast to paspalum, which flowers throughout the summer, plicatulum does not flower until early April, so it is much more productive. This is



Leaf sheath and basal portion of blade, side view (left) and rear view (right), of cultivars Rodds Bay (1), Hartley (2) and Bryan (3). Note (a) the complete absence of hairs on Hartley; (b) the marginal hairs on the inner surface of the blade of Rodds Bay and Bryan which clasp the stem; (c) the collar of dense hairs at the junction of the blade and sheath, together with the sheath hairs, in Bryan. The small hairs shown on the undersurface of the blade in Bryan are not always present. The leaf hair characters are not reliable in seedlings and new shoots.

shown by the results of cutting trials carried out by C.S.I.R.O. in the northern wallum. Over a 3-year period the mean annual dry matter yields per hectare for the Bryan, Rodds Bay and Hartley cultivars were 11 340, 9 470 and 10 560 kg respectively. The yield for paspalum over the same period was 5 670 kg.

Although responsive to nitrogen, plicatulum will produce better than other grasses under conditions of low soil nitrogen supply. It does not become sodbound and legumes combine well with it. The grass is persistent but not aggressive. It is free from ergot and has no other special diseases or pests.

The main weaknesses of plicatulum are lower nutritive value, nitrogen content and palatability compared with other tropical sown grasses such as Nandi setaria (*Setaria anceps*) or green panic (*Panicum maximum* var. *trichoglume* cv. Petrie). The difference is more marked in winter because of the late flowering habit of plicatulum. Paspalum is more frost tolerant and grows faster in spring.

EXPERIMENTAL RESULTS

In C.S.I.R.O. grazing experiments conducted over 8 years at Beerwah (southern wallum) plicatulum (Rodds Bay cultivar) showed great persistence in combination with legumes under both rotational and continuous grazing at stocking rates of one beast to 0·4 to 0·6 hectares. However, the annual liveweight gain of 232 kg per hectare was less than those from pastures based on paspalum (272 kg) and pangola grass (290 kg). The plicatulum pasture was as good as the others from September to December, but inferior from January to August. The cattle lost weight on the plicatulum pasture in winter but maintained it on the others.

Because of these results plicatulum was not recommended for the southern wallum. Nor

has it gained commercial acceptance in that area.

On the other hand experiments conducted in the harsher environment of the northern wallum showed plicatulum to be one of the better grasses for that area. In a grazing trial at Isis Junction the cultivar Bryan formed a stable pasture with the legume Siratro. Before the termination of the experiment by fire in July 1968 followed by severe drought, this pasture gave an annual liveweight production of 275–330 kg per hectare at a stocking rate of 2·47 steers per hectare. When the drought broke the pasture made an excellent recovery and showed a composition of 65% plicatulum and 35% Siratro.

Over the 3 years from June 1972 to 1975 a pure grass pasture of Bryan plicatulum at Beerwah, fertilized with 440 kg of nitrogen per hectare, gave a mean annual liveweight production of 740 kg per hectare when grazed at 5·0 steers per hectare. This level of production is similar to that achieved from nitrogen fertilized setaria and pangola grass pastures at similar stocking rates.

ESTABLISHMENT

Plicatulum seedlings are slow starters, which emphasizes the importance of good land preparation and correction of nutrient deficiencies. Sowing is best done in early summer because seedlings which emerge after January will not flower until autumn of the following year. The general sowing rate is 2 to 3 kg per hectare where plicatulum is the sole grass and is sown with a legume. Sowing depth is 10 to 15 mm and rolling after sowing is beneficial.

On the infertile soils where plicatulum is commonly grown superphosphate at rates of from 250 to 625 kg per hectare is required for establishment. As well, potash and nitrogen have to be considered. Local recommendations for establishment and maintenance fertilizer application should be followed.

COMPANION SPECIES

Grasses

It is unwise to mix plicatulum with more palatable grasses such as Nandi and Narok setarias because these will be eliminated by selective grazing. There is no such objection

A pasture of Bryan plicatulum and Siratro in March. Note absence of seedheads.

to a mixture of plicatulum and Kazungula setaria because these have similar palatabilities. This mixture is often used around Mackay because it is cheaper than setaria alone. Under wet conditions the plicatulum establishes more vigorously than Kazungula but after a few years the latter becomes dominant. On the other hand it is possible to achieve plicatulum dominance in April by heavy grazing or slashing early in the wet season.

Legumes

Legumes commonly sown with plicatulum are Siratro (*Macroptilium atropurpureum*) and lotononis (*Lotononis bainesii* cv. Miles) in the northern wallum, Siratro and stylo (*Stylosanthes guyanensis*) around Mackay, and stylo further north.

The recent succession of very wet years has shown that many areas where plicatulum can

grow are poorly suited to Siratro because of bad drainage. The ability of plicatulum to tolerate low levels of soil nitrogen is a real advantage here. Where legume growth is poor or absent strategic application of nitrogen fertilizer could have a place but the high cost would require maximum utilization of the treated pasture.

MANAGEMENT

As with most sown pasture grasses grazing in the season of sowing should be sufficiently lenient to allow the grass to establish firmly and set seed.

Once the pasture is established the key to management lies in the long period of leafy growth in spring and summer and the poor quality of mature growth in autumn. For this reason it is better to utilize plicatulum in spring and summer rather than save it for autumn grazing or haymaking. The mature growth present after seeding is poorly accepted by cattle. It can, however, be a worthwhile source of roughage for supplementing with urea and molasses during winter.

The residue of old growth may be slashed in spring to make the new growth more accessible. Burning is not recommended as it destroys mulch which keeps the soil cool during dry springs and later provides valuable organic matter. Plicatulum will, however, survive burning.

SEED PRODUCTION

Plicatulum lends itself well to seed production. Since flowering and seeding are concentrated into a short period in autumn the pasture can be grazed normally until early February. Most seed harvesting is carried out on commercial grass-legume pastures as a cash sideline.

The high carriage of the seed above the foliage simplifies harvesting, which is done by header harvesters. The harvested seed is

A plicatulum pasture in October showing new growth and remnants of previous season's growth.

easily dried on trays in the open, or indoors by machinery. Average commercial yields in the northern wallum in 1974 were 55 kg per hectare from Rodds Bay and 82 kg per hectare from Bryan. Individual crop yields of 90 and 135 kg per hectare respectively have been reported.

Rodds Bay and Bryan contain around 800 000 seeds per kg, whilst Hartley contains about 950 000. Minimum legal seed standards are 60% for purity and 40% for germination.

In recent years seed has been exported to Central Africa, Pacific Islands and even South America.

THE PLACE FOR PLICATULUM

Plicatulum has not gained acceptance in the better drained coastal country. Here the setarias, Rhodes and guinea grasses grow better and are preferred by cattle. The emerging pattern seems to be that plicatulum is essentially a grass for the infertile poorly drained areas.

In the northern wallum and Mackay lowlands Kazungula setaria is used in similar situations for grass-legume pastures with plicatulum being preferred in the wetter sites. In an average rainfall year cattle are claimed to do better on Kazungula whereas plicatulum has more new growth in dry springs. Where pastures are destocked because of excessive wetness plicatulum does not grow as densely as Kazungula. Better legume compatibility also favours plicatulum. Where the legumes are set back by overwet conditions their chances for recovery are greater with plicatulum.

In the wet tropics there are several other grasses commonly used for the worst drained sites:—signal (*Brachiaria decumbens*), *Setaria splendida*, para (*Brachiaria mutica*) and pangola (*Digitaria decumbens*). Consequently plicatulum may have less scope here.

Although Bryan has eclipsed Rodds Bay in the northern wallum it is not necessarily superior for other areas. In D.P.I. observation plots on sandy granite ridge country north of Bundaberg Bryan showed inferior drought tolerance to Rodds Bay. This suggests that Rodds Bay would be better in marginal moisture situations.

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Tobacco pest control in seedbeds

by R. H. BROADLEY,
Entomology Branch

Tobacco seedlings are particularly vulnerable to insect attack. This article describes the major insect pests of tobacco seedlings and details measures for their control.

TOBACCO seedlings normally spend eight to ten weeks in the seedbed, during which time they are particularly vulnerable to insect attack. Poor quality transplants usually cause subsequent field problems, so pest control should be a major concern to every grower who produces his own seedlings.

Growers may feel that the relative isolation of their seedbeds precludes any chance of insect attack, but this is incorrect. All the major insect pests of tobacco are capable of flying several kilometres, and green seedbeds probably act as an attractive focal point during the dry growing season.

SEEDBED PESTS

Stemborer

This species is considered to be the prime insect pest of tobacco seedlings at the current time. There are two main reasons for this. Firstly, the eggs are minute and difficult to locate on the plant, so it is not easy to detect the beginning of an infestation. Secondly almost the whole of the life of the larva and pupa is spent within the plant tissues, which act as a barrier to successful control.

An infestation is not usually noticed until galls have been formed on the plant stems by larvae feeding inside the pith—that is when the damage has already been done. Other symptoms besides gall formation include extensive suckering, formation of a rosette arrangement of the leaves at the apex of the plant, shrivelling of older leaves, shrivelling of tip leaves, dark discolourations in the stem, and small lateral leaf mines near leaf midribs.

Stemborer affected plants are more prone to wilting under hot conditions than are healthy plants. These symptoms should be used as criteria for rejecting seedlings when they are being pulled at transplanting time. A general rule which can be helpful is to reject the plants from the outside edge of the seedbed, as these are more likely to be attacked than those further towards the centre.

About ninety per cent. of the stemborer's eggs are laid on the leaf surface, with the remainder being laid on the leaf stalks or stem. After hatching, the larvae spend thirty to sixty minutes wandering about looking for an entry site into the leaf tissue. After this is accomplished the larvae take a tortuous route through the leaf tissue, lateral veins, midrib and leaf stalk to the pith in the stem. Those larvae which hatch from the few eggs laid on the stem penetrate directly into it. Once outside the stem, the larvae are well protected from insecticides.

The stemborer larva is most vulnerable before it has entered the leaf tissue, and if a chemical barrier can be maintained on the leaf surface its chances of survival are slim. To provide this barrier, methomyl 0·025% a.c. spray should be sprayed every six days, with initial applications starting four to seven days after seedling germination. This insecticide does not produce phytotoxic symptoms in seedlings when used on a regular basis.

Leaf miner

This field pest can also be a serious pest in seedbeds, though infestations are often patchy. The larvae are green pinkish or grey, with dark flattened heads, and are capable of moving vigorously when disturbed. If the seedlings are too small to be able to support a larva through its full growth period, the larvae travel between plants through tunnels made by binding sand and debris together with silk.

As the plants grow larger, the leaf miner larvae make mines in individual small leaves and stems. Stem infestation can cause the death of the terminal shoot. This causes suckering, and makes the seedlings unsuitable for transplanting into the field. Large seedlings are not as adversely affected by leaf miner activities, merely displaying irregular blister-like areas where the green tissue between the upper and lower leaf surfaces has been eaten out.

Corrective action may include spraying with 0·05% a.i. azinphos-ethyl or 0·025% a.i. Methomyl. Care must be taken with azinphos-ethyl as this insecticide will produce distortion of young seedlings if used at greater than recommended strength or as a routine spray. Methomyl has proved to be effective against leaf miner and does not have any phytotoxic effects on young seedlings. It is a good substitute for azinphos-ethyl and can be used with safety. Leaf miner will breed on a large range of weeds and cultivated plants commonly found growing on farms. Attention to field hygiene therefore, is an important factor in maintaining seedbeds free from this pest.

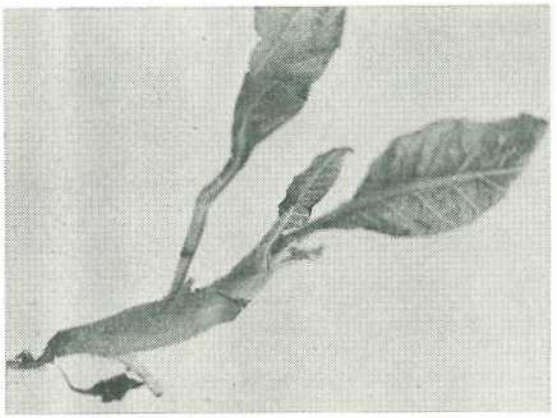
Looper

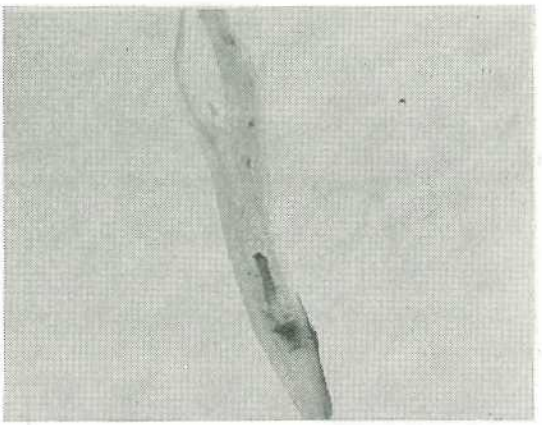
This species derives its name from the way the larva arches its body as it moves. Like the seedling leaves, loopers are light green in colour, and therefore well camouflaged. Often irregular feeding damage is the first sign of their presence. The flattened, elliptical eggs are laid singly on the lower surfaces of the leaves at night by the female moth. After hatching the young larvae begin feeding on the leaf undersurface, in the vicinity of the empty egg-shells. Because mouth parts of newly emerged larvae are so small, they are capable of eating only partially through the leaf. This makes the tissue semitransparent, and results in what is commonly termed a "window effect". When mature, larvae move through the foliage from plant to plant and are capable of destroying whole leaves. Normally the midribs and leaf stalks are not eaten.

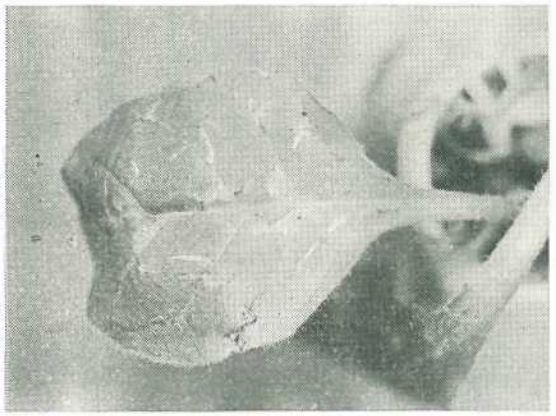
Remedial action may be taken by spraying the seedlings with one of following chemicals—0·025% a.c. methomyl, 0·05% a.c. aminocarb, 0·025% a.c. phosfolan, or 0·05% a.c. monocrotophos. Loopers are usually easy to control.

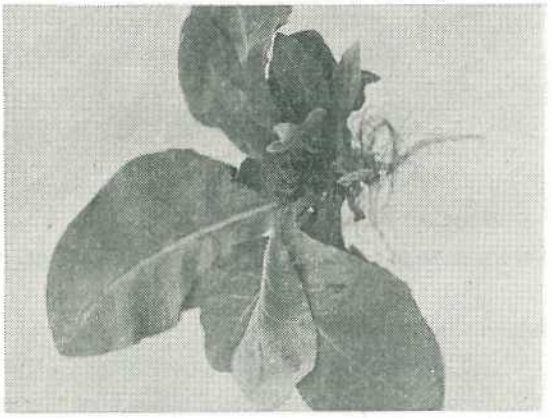
Budworm

Two species of budworm, similar in appearance and behaviour, are known to attack tobacco in north Queensland. Their upright, pearly eggs are found on both leaf surfaces. Larvae may be found anywhere on the plant. They vary in colour and may range from green, resembling loopers, to almost black.









Top left: This seedling shows the typical results of stemborer infestation of the stem—galling and terminal leaf distortion.

Top right: Dissected seedling stem showing stemborer larva and its mine in pith.

Below left: Seedling leaf showing the mines typical of a severe infestation by young stemborer larvae.

Below right: Stemborer infested seedling showing the suckering which occurs after the growing tip has been destroyed by larvae in the stem.

Potentially, budworms are capable of causing more damage to the plant than the tobacco looper or cluster caterpillar because of a tendency of large larvae to feed on stems and tips of the seedlings rather than on the leaves. Seedlings with the hearts eaten out are unsuitable for transplanting.

They can be controlled by spraying with 0·025% a.c. methomyl, or 0·05% a.c. monocrotophos.

Cluster caterpillar

This insect is aptly named, as grubs are normally found clustered together on a plant or in a restricted area of the seedbed. Eggs are laid by the female in a cluster of several hundred and covered with fluffy brown scales from her abdomen. Larvae hatch almost simultaneously and begin feeding on the lower leaf surfaces. Damage is usually easily detected and is characterised by a skeletonization of the leaves. The control is 0·025% a.c. methomyl, 0·05% a.c. aminocarb or a 0·025% a.c. phosfolan spray.

Severe damage to the leaves of tobacco seedlings, caused by cluster caterpillar larvae.

Budworms damage to the heart of a young tobacco plant can be seen clearly in this photograph.

Ants

Various species may be troublesome. Seed harvesting ants carry surface-sown seed to their granaries, while other species cut and remove the leaves of the seedlings soon after germination. Many species have the ability to re-build mounds on the beds after they are prepared and sown.

Loss of seed is usually prevented by covering the surface of the bed to a depth of not more than six millimetres with clean river sand that has been passed through a fine mesh sieve. This sand may harbour nematodes and fungi, so it is important that it first be sterilised with methyl bromide.

If the sand mulch is not effective, nests should be sought out and sprayed with 0·05% a.c. endrin. If these cannot be found, treatment of ant "trails" is also effective. Endrin is a relatively persistent insecticide and should be used as little as possible.

Cutworms

Cutworms are smooth brown grubs that are seldom seen because they hide in the ground by day and feed by night. The cutworm adult is an inconspicuous night-flying moth. The name "cutworm" derives from the larval habit of feeding on the base of the plant stems, which may be severed, so that young plants are seen lying on the soil surface the next morning. This is one of the potential causes of patchiness in seedbeds. Cutworm larvae sometimes invade a seedbed from surrounding vegetation, but usually emerge from eggs laid amongst the seedlings. They can be controlled by spraying the seedbed with 0·025% a.c. methomyl, preferably in the late evening.

Brown vegetable weevil

As its name implies the brown vegetable weevil is primarily a pest of vegetables, but it occasionally causes problems in tobacco seedbeds. Both adults and larval stages injure seedlings by chewing and ring-barking the base of the stem. Adults are greyish brown, approximately eight millimetres long, and have a V shaped mark in their backs. Larvae are small, green and have no legs. A 0·05% a.c. azinphos-ethyl spray is an effective control.

Grasshoppers and Locusts

Long horned and short horned grasshoppers sometimes attack tobacco seedlings after moving from adjacent grassy areas. Control can be effected by removing the hoppers by hand or by applying a 0·025% a.c. methomyl spray.

GENERAL CONSIDERATIONS

The choice of an insecticide spray schedule for tobacco seedbeds is dictated by the need for preventative measures against the tobacco stemborer, namely the 0·025% methomyl spray at six-day intervals. This schedule will also control leaf miner, cluster caterpillar, budworms, loopers and grasshoppers. It is normal to find several of these species in the seedbed at the same time.

The June–July winter period of the year, when seedlings are normally grown in North Queensland, is generally unfavourable for insect development, because of relatively low temperatures. This fact, together with the small seedbed area to be sprayed, places the grower in a good position to achieve effective insect control, providing recommendations are followed. However, it is essential that spraying be started without delay. The grower should not wait for the appearance of signs of damage to the seedlings.

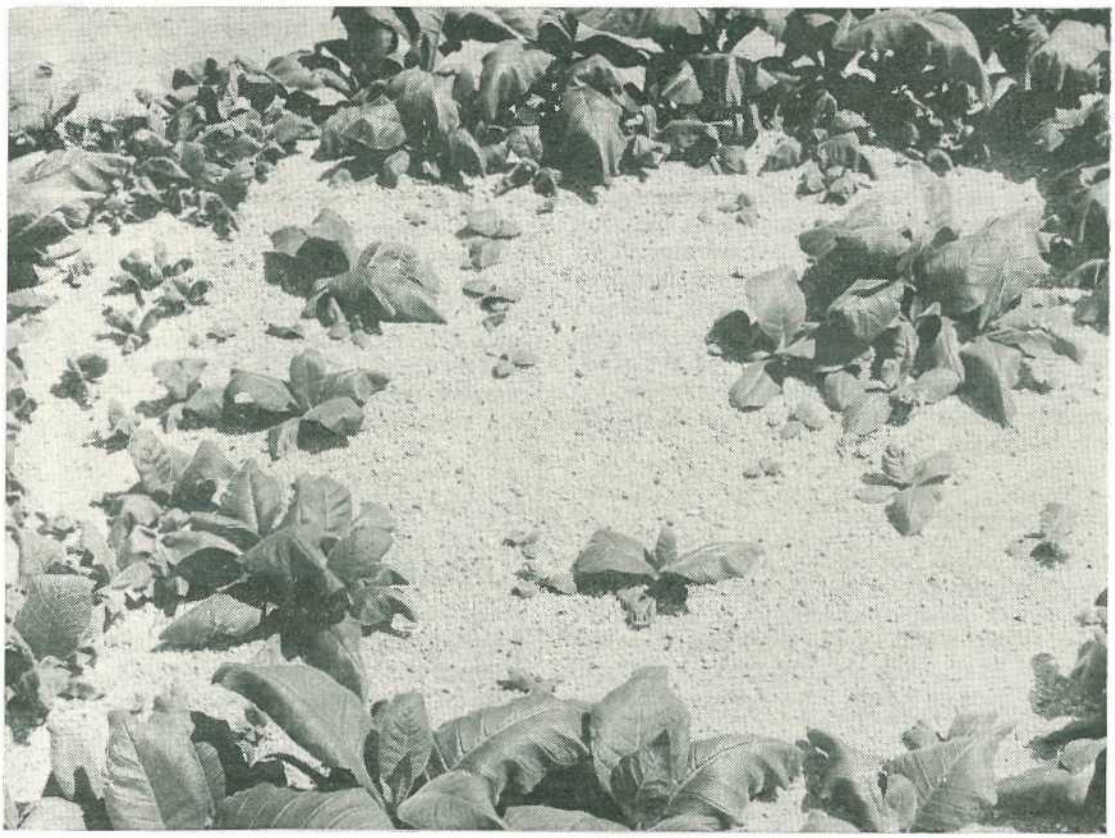
Growers can reduce the survival chances of pests by removing volunteer plants and crop residues which may harbour leaf miner, budworms, cluster caterpillar, and especially stemborer. Some weeds, such as wild hops, nightshade, wild gooseberry and thornapples are also hosts for these pests and it may be worthwhile removing them from the farm if they are in large numbers. Insect control in the vegetable garden may also be warranted, as potatoes, eggfruit, tomatoes, capsicum and cape gooseberry are hosts for the tobacco leaf miner.

ABANDONED SEEDBEDS

It is common to find abandoned seedbeds during the middle of the main tobacco season. Seedlings are kept for emergency uses and then neglected by growers because the growing crop demands all their attention. If they remain unsprayed these seedlings form a substantial hazard to the young plants in the field. Insects such as leaf miner and stemborer that are

Insecticides must be used in seedbeds with caution, or damage and leaf distortion, as shown in this illustration, can result.

Patchy seedbeds caused by the death or retardation of seedlings are another result of mistakes in insecticide usage.



allowed to increase in numbers without check will definitely be a problem to any plants growing in the vicinity of the seedbeds.

Therefore, seedbeds should be destroyed as soon as possible after transplanting and replacement of misses. Alternatively the seedlings should be sprayed as long as a potential need is felt for them.

SPRAYING PROCEDURES

- Make sure that the spraying equipment is clean and not contaminated with chemicals that are likely to have phytotoxic effects on the sensitive young plants. Hormone weedicide sprays should not be carried in the knapsack used on seedbeds. In fact it is good policy to keep a knapsack solely for insect pest control.
- Use the correct chemicals at the recommended rates. With some chemicals there is little margin for error and plant distortion can result. Azinphos-ethyl should be treated with particular care in this regard. Some additives such as wetting agents are also capable of damaging young plants when used in large quantities. Most insecticides have these wetting agents included in the original formulation, so there may be no need to use them at all.
- When spraying seedlings it is important to try to cover the under-surface of the leaves, since this is where most larvae are found. This is particularly important when short lived insecticides like methomyl are being used. Special attention should be directed to the plants on the borders of the bed as these are most likely to be infested with stemborer. The problem of obtaining good coverage is greatest when the seedlings are large.
- Fresh stocks of insecticides are less prone to cause problems, than those which have been stored on the farm for several months. Some chemicals break down in time, and this must be taken into consideration. There could be a loss in the efficiency of the insecticide, and the breakdown products may harm the seedlings.
- All insecticides are poisonous. They should be stored behind locked doors, in their original containers, and adequately labelled. On no account should they be placed in soft-drink or milk bottles.
- It is important to wear protective clothes while spraying. These can then be discarded if insecticide is accidentally spilt on them.
- Surplus pesticides and their containers should be destroyed in such a fashion that water contamination and other hazards will not result.
- The best time for spraying is in cool calm conditions, preferably in the late afternoon since the pests are active at night. Under windy conditions much drift of insecticides away from the seedbed will occur, causing risks to the person spraying, contamination dangers, and poor coverage, as well as simply wasting insecticide.
- Do not water the beds for at least an hour after spraying, as some insecticide will be washed from the leaves.
- If a grower maintains a schedule of a methomyl spray every six or seven days, beginning four to seven days after emergence, he should have no problems. If difficulties in pest control in seedbeds are experienced the local Departmental advisory officer should be contacted.

The scientific names of the pests mentioned in this article are:—

Ants:—Mainly *Pheidole anthracina* For.

Brown vegetable weevil:—*Listroderes costirostris* Schonherr.

Grasshoppers:—*Acrididae* and *Tettigoniidae.*

Tobacco looper:—*Plusia argentifera* Guen.

Tobacco budworms:—*Heliothis armigera* (Hubn.). *Heliothis punctigera* Wallengr.

Cluster caterpillar:—*Spodoptera litura* (F.).

Tobacco stemborer:—*Scrobipalpa heliopa* (Lower).

Cutworm:—*Agrotis munda* Walker.

Tobacco leaf miner:—*Phthorimaea operculella* (Zell.).

TOBACCO PEST CONTROL

MATERIALS AND DILUTION RATES

Chemical (common name)	Chemical (trade name)	Percentage active ingredient in formulation	Recommended spray concentration	Amount of commercial product to use in 15 litre (3¼ gallon) knapsack	Pests controlled
methomyl ..	Lannate ..	90% wettable powder 22·5% liquid	0·025%	4 grams 17 mls	Stemborer Leaf miner Looper Budworms Cluster caterpillar Grasshoppers Cutworms
azinphos-ethyl ..	Azphos Benthion Chemothion Co-Thion E Gusathion Kilathion Thionex	40% 44%	0·05%	19 mls 17 mls	Leaf miner Brown vegetable weevil
aminocarb ..	Matacil ..	22%	0·05%	34 mls	Looper Cluster caterpillar
phosfolan ..	Cyolane ..	25%	0·025%	15 mls	Looper Cluster caterpillar
monocrotophos ..	Nuvacron Azodrin	40% 60%	0·05%	19 mls 12 mls	Looper Leaf miner Budworms
endrin	Endrin	20% 30%	0·05%	37 mls 25 mls	Ants

HORSE SHOEING SCHOOL IN DECEMBER

Over recent years a number of successful and well patronised horse shoeing schools have been conducted at the Queensland Agricultural College.

In the light of a continuing demand for courses of this nature, arrangements are in hand for the holding of a further school on December 6th and 7th this year.

A number of vacancies currently exist for enrolment into this course. Persons interested in enrolling into this course should contact the Registrar, Queensland Agricultural College, Lawes or the organizer, Dr. David Keenan, Department of Animal Industries, Queensland Agricultural College, Lawes.

The major insect pests of tobacco

by I. C. CUNNINGHAM and R. H. BROADLEY, Entomology Branch

THERE are six major pest species which attack tobacco in Queensland. If left unchecked each of these is capable of causing serious economic losses.

These pests are the tobacco stemborer, the tobacco leaf miner, cluster caterpillar, the tobacco looper and two species of budworms. A sound working knowledge of the biology and habits of these insects can be combined effectively with the use of the correct insecticides to minimise crop losses.

Research on the habits of the most serious tobacco pests, the tobacco looper and the tobacco budworms, has enabled the Department of Primary Industries to provide an insect pest prediction service which warns growers in the Mareeba-Dimbulah district of build-ups of these pests in time for them to spray before much damage is done. To make best use of the service growers should have an understanding of these pests and know how to identify them.

Tobacco Looper

Tobacco looper and green looper are pests of tobacco in Queensland with the former being much more important. The common name "looper" is derived from the way the larvae arch their bodies when they move. This type of movement, and the presence of only two instead of the usual four "false" legs at the rear of the body distinguish looper larvae from all other tobacco leaf eating larvae. Another typical feature of older larvae of the tobacco looper is a pair of white stripes running along the back.

Life History and Habits

Eggs. The slightly flattened white eggs are round in outline, about half a millimetre in diameter and can be seen with the naked eye. They are usually laid singly on the undersurface of the larger leaves, mostly within a centimetre of the leaf edge. They incubate for three to five days, gradually becoming darker in colour until the larvae emerge.

Larvae. The newly hatched larva is about two millimetres long and has a black head and a thin, almost colourless body, bearing prominent black hairs. It immediately begins feeding

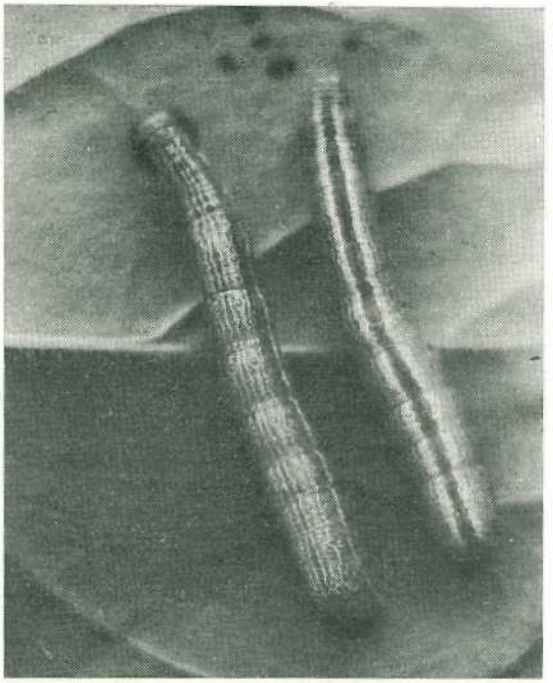
on the lower surface of the leaf. During its first few days of growth the larva eats a number of areas of up to three millimetres diameter, leaving the transparent upper epidermis intact, so that the leaf acquires a windowed appearance. Subsequent growth stages of looper grubs are not restricted to the lower leaf surfaces. Many move to leaves in the middle of the plant where, if large numbers are present, only the stems and larger leaf midribs will be spared.

One looper grub will eat approximately 110 sq cm, the size of an ordinary postal envelope. Ninety percent of the total leaf area destroyed is eaten during the second week by the last two grub stages. During the first week a grub will eat an area approximately the size of a 20c coin. So to avoid losses in yield and quality grubs must be controlled before they have been feeding on the plant for more than one week.

During growth, the larva sheds its skin five to seven times. After the second of these moults it has attained the typical looper shape with the head and body being green in colour and the dark hairs being less noticeable. The average time taken from hatching of the egg until the larva is full-grown at about 4 centimetres in length is approximately two weeks. The fully grown larva selects a pupation site which may be in a fold in a leaf, near a leaf junction, or under debris on the ground. Here it covers itself in webbing and remains inactive for a few days before changing to a pupa.

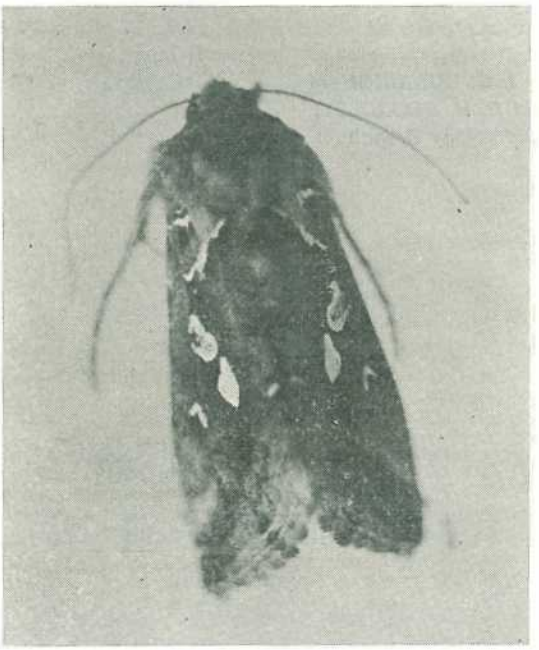
Pupae. The pupae are two to three centimetres long. At first they are green or white in colour, but over the next seven to ten days they change to colours ranging from pink and grey to dark brown. The adult moth then emerges through one side of the webbing.

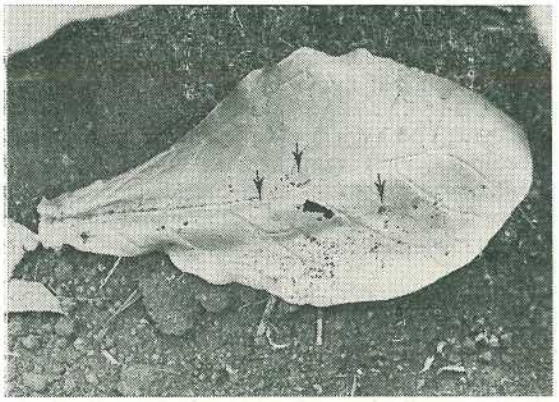
Adults. The moth is predominately bronze-brown in colour, the forewings having small but prominent silvery markings. It is about two centimetres long with a wingspan of about three centimetres. Under laboratory conditions the average lifespan of female moths is thirteen days. During this time they mate on average two to three times. The preferred time for mating is between midnight and dawn. The moths feed on nectar the first night after emergence with the first mating taking place



ABOVE: larvae of the tobacco looper (right) and the vegetable looper are similar in external appearance.

BELOW: the characteristic silver markings on the forewing of the tobacco looper moth can easily be discerned in this photograph.





Young looper larvae are capable of eating only partway through the leaf tissues and thus leave a transparent leaf skin or "window" in the leaf (see arrows).

during the following night. Egglaying begins on the third night. Some moths lay more than six hundred eggs on this night. Most eggs are laid between dusk and ten p.m. In the laboratory, moths lay an average of about 1 400 eggs each; the highest number recorded for one moth being 2 200.

Budworms

Tobacco budworms are well-known in Queensland on a variety of weeds and crops other than tobacco. Depending on the crop attacked they are called corn ear worm, tomato grub or cotton bollworm. The name "budworm" is derived from the insect's habit of eating the buds or growing terminals of tobacco.

Budworms will feed on any part of the tobacco plant above the ground. On large expanded leaves the damage caused is proportional to the number of larvae present, and a high population can strip leaves to the midribs and main veins. In some cases larvae will attack the midribs causing wilting, sunburning, or fracturing of the leaf. Sometimes the stem is attacked, too, causing collapse or reduced growth of the plant above that point. Budworms prefer to feed on the flowers when these are available but pose little threat to a flowering crop, except when high populations are present at topping, as they sometimes transfer from the discarded flowers to the lower leaves.

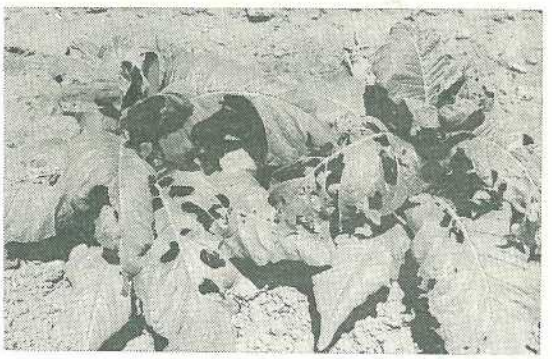
The most severe losses occur when the growing point and the small developing leaves are damaged. As a damaged leaf expands the area of missing tissue becomes correspondingly greater. If the growing point is destroyed the plant produces suckers, which must be removed as they appear, leaving one to replace the former growing point. If all suckers are removed the remaining leaves become thick, enlarged and late maturing, making the plant an uneconomic unit. So budworm attacks on immature plants can result in loss of leaf tissue (even to the extent of loss of entire leaves) and in a depression in leaf quality.

Life History and Habits

The globular eggs are slightly smaller in diameter than those of the looper, and are pearly-white in colour with a brown circular band appearing as the embryo develops. On immature plants most eggs are laid on the leaves of the upper half of the plant, excluding the small tip leaves. Approximately equal numbers are laid on the two sides of the leaves, and the eggs are scattered over the entire surface on each side. When the buds and flowers appear they become the preferred egglaying sites, and few eggs are then laid on the leaves.

Larvae. The newly hatched larva is watery-white in colour. It is thicker in the body than the newly hatched looper and the body hairs are much less pronounced. In the Mareeba–Dimbulah district the larvae pass through six growth stages marked by moults over a period of two to three weeks, before reaching maturity.

Damage caused by budworms.



During this time they gradually acquire more body colour and the hairs become more distinct. The full-grown larva is about four centimetres long and is predominantly green, brown or black in colour.

Pupae. When fully grown the larva burrows seven to ten centimetres into the soil near the base of the plant, forms a smooth-walled chamber, and pupates.

Adults. After ten days or longer the moth leaves the pupal cell and makes its way to the surface. It is rather drab, being light brown with indistinct black markings. Budworm moths have similar habits to those described for looper moths.

Tobacco Leaf Miner

The tobacco leaf miner, also known as the potato tuber moth, can be a serious pest of tobacco in seedbeds and in the field, but in recent years has declined in importance in the Mareeba–Dimbulah district. This trend is associated with the change to growing irrigated tobacco crops during the dry spring.

At this time of year both cultivated and wild alternative host plants are not as numerous, resulting in a reduction in leaf miner numbers. As well, the eggs are laid on the soil making them vulnerable to wet soil conditions in irrigated crops. The leaf miner now occurs only sporadically through the district and its presence can usually be attributed to the practice of growing vegetable host plants such as potato and tomato in the vicinity of the tobacco crop.

Injury to plant by this pest results from the larval habit of feeding, by mining, in the mesophyll tissue between the upper and lower leaf surfaces. Mining within the leaf midribs and beneath the surface tissue of the main stem may also occur when there are heavy infestations.

The tobacco stemborer, another important tobacco pest in Queensland, damages the stems but may also attack leaves. The names leaf miner and stemborer, therefore refer to the more common type of damage exhibited by each species.

Life History and Habits

During the summer the full life cycle of the tobacco leaf miner takes about thirty days.

Eggs. The eggs are very small, and pearly in colour. They may be laid on the tobacco plant or on the soil. Most found on the plant are pressed firmly between the glandular hairs of the lower leaves.

Larvae. In the summer, the colourless or pale pink newly-emerged larvae eat their way out of the eggs after four or five days. After a short period of exploratory wandering, they chew a small piece of epidermis from the leaf, discard it, and begin mining. They pass through four growth stages in about two weeks during warm conditions. The final stage larvae which are one and a half centimetres long and vary in colour from pink to grey-green cause most of the damage.

Each irregularly-shaped mine may cover from six to eight square centimetres, and is usually situated near the base of the leaf and adjacent to the midrib or one of the main veins. As the mine is extended, the frass is packed into its corners. Initially damage occurs on the lower leaves with progressive development of attack higher up the plant. If one leaf provides insufficient food, the larva can construct a silken tunnel to pass from this leaf to an adjacent leaf or seedling. If heavy mining occurs there is a reduction in yield. Larvae sometimes destroy the supporting plant tissues in stems, dark bands on the lower stem being evidence of this. Plants affected in the stem may be blown down in moderate winds.

Pupae. The fully grown larva spins a silken cocoon on the plant, a soil clod or on rubbish on the ground. Particles of sand or debris may be incorporated into the cocoon, making it difficult to locate. Inside this cocoon the pupa is a light green at first, soon darkening to brown and finally to a very dark brown.

Adults. After about seven days adults emerge from the cocoons. They are inconspicuous mottled grey moths with a wing span of about one centimetre. Egg-laying begins at dusk each day and continues during the three weeks of adult life.

Alternative Hosts

The other crops in which tobacco leaf miner commonly breeds are potato, tomato, egg fruit and gooseberry. It is also found in weeds such as nightshade, tree tobacco, devil's apple, thornapple and false cape gooseberry.

Tobacco Stemborer

All stages of growth of tobacco plants are susceptible to damage by the tobacco stemborer, but seedlings and the newly transplanted crop are most vulnerable to the mining activities of the pest in the stem and leaf midribs. In the Mareeba–Dimbulah district the stemborer is potentially the most important insect pest of seedbeds.

In seedlings and young plants the activity of the larva causes a variety of symptoms including the formation of a stem gall, stem discolouration, a rosette appearance of the terminal leaves, wilting and shrivelling of the terminal leaves, and suckering.

These are the most characteristic symptoms of an advanced infestation, but affected plants are prone to suckering, and may be weakened sufficiently to facilitate the entry of disease organisms. They may also be blown over in strong winds. Often some leaves wilt, as the result of an infestation of their midrib or damage to the stem vessels supplying them with water.

Life History and Habits

The life cycle is completed in about twenty-eight days in summer months.

Eggs. The eggs are half a millimetre long, oval-cylindrical, and a pearly-white colour when laid, turning a lemon-yellow colour just before hatching. They are laid on the tobacco plant, and are difficult to detect because of their small size.

On tobacco seedlings most eggs are laid on both sides of the larger leaves in the middle of the plant. A few may be deposited on the leaf stalks and plant stems. When seedlings are closely grouped, as in a seedbed a greater number of eggs per plant are found on the perimeter plants. This probably explains why infested plants are more often found on the edge of the seedbed.

Larvae. The one millimetre long larva hatches after four to five days, and wanders on the leaf surface for thirty to sixty minutes before selecting a site for entering the leaf tissue. Once inside, it mines erratically until reaching a leaf vein. The larva then tunnels through the vein to the midrib, to the leaf stalk, and then to the heart of the plant and into the stem. As the species is cannibalistic only one larva is usually found in a seedling, but this is sufficient to cause serious damage. One to several larvae may be found in large field plants.

The passage of the larva through the plant may be traced by the gallery it forms, and the trail of frass left behind within the gallery. Some complete their development before reaching the stem. Fully-grown larvae are a uniform creamy-white colour and are up to twelve millimetres long.

Pupae. The completely developed larva enlarges the feeding tunnel to form a pupal chamber in the stem or in the midrib of the leaf, and before pupating prepares an exit from the chamber. This is a circular hole with only the epidermis of the plant left intact.

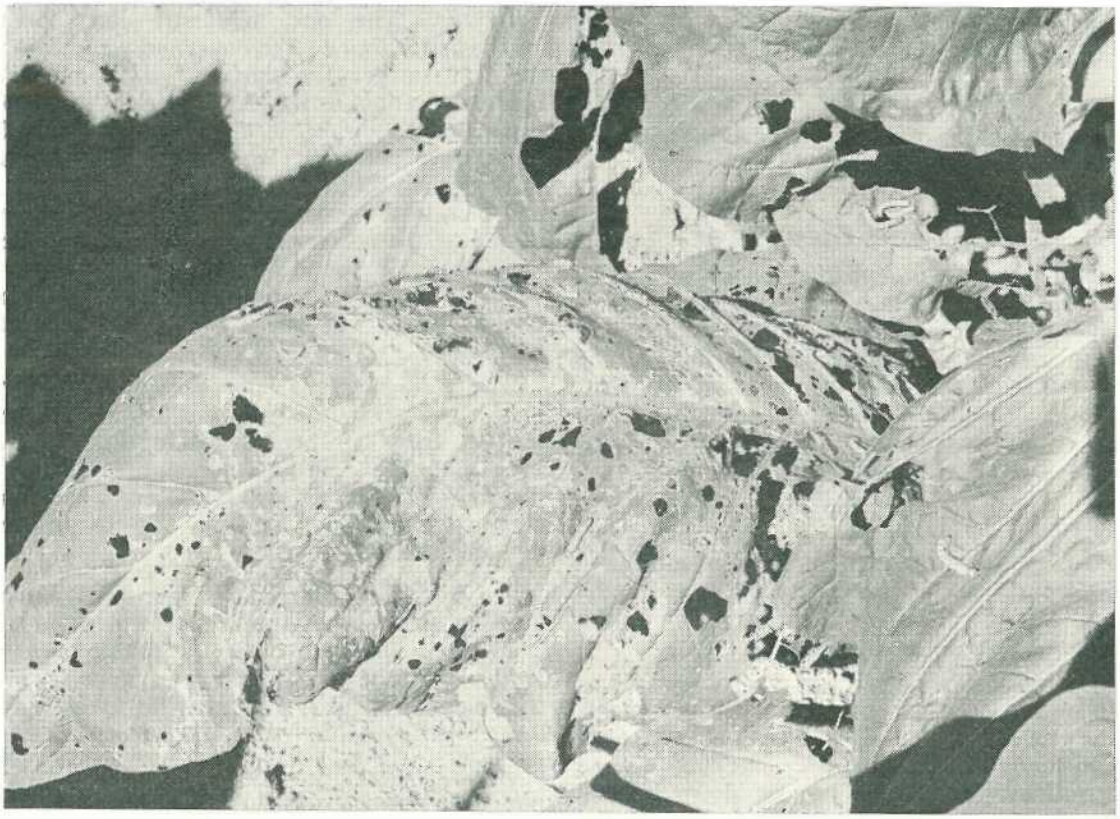
Adults. After the moth emerges from the pupa it forces its way through the tissue over the exit hole. It is small, with a wing span of about one centimetre, and coppery red-brown in colour. During the day the moths rest motionless on the crop, seedlings and other objects, but will fly if disturbed. More than 500 eggs have been recorded as being laid by one female during her lifetime. It is not uncommon for up to one hundred and thirty eggs to be laid during one night. The life span of the adults seems to be related to the prevailing climatic conditions and to the availability of nectar upon which they feed.

Alternative Hosts

Stemborer has a host range restricted to cultivated tobacco, some species of wild tobacco and the egg plant.

Comparison of Tobacco Stemborer and Tobacco Leaf Miner

The appearance of the larvae and adults of tobacco stemborer and tobacco leaf miner is quite similar. The type of injury caused by



This is typical of damage caused by cluster caterpillar larvae.

each pest may also be confusing. The stemborer will sometimes attack leaves, and the leaf miner may cause some stem damage. The names stemborer and leaf miner, therefore, refer only to the more common method of attack by each species.

The following may be used as a guide in distinguishing between these two tobacco pests:—

Tobacco Stemborer

Adult moth coppery red-brown in colour.

Tobacco Leaf Miner

Adult moth mottled grey in colour.

BUT

Prothoracic neck plates of stemborer larvae are usually light brown. Larvae are a uniform creamy-yellow colour. They show little colour variation.

Pupation occurs within the plant.

Damage. Stemborer larvae cause most damage to young tobacco seedlings, forming a gall on the stem. Larvae may also be found in the midribs of large leaves and in the pith of mature plants.

BUT

Prothoracic neck plates of leaf miner larvae are dark brown or black. Mature larvae vary in colour from pink to grey-green. Only sometimes are they light creamy-white.

Pupation occurs on leaf debris or on the soil at the base of the plant.

Damage. Leaf miner larvae usually damage the soft tissues of the leaf. Occasionally they will ring-bark the stems of mature plants.

Larvae of both species are similar in size and shape.

Looking Back—

SOME interesting items that appeared in issues of the Q.A.J. 75 years ago, in September and October, 1900.

• One of the highlights of the first Brisbane exhibition was a *novel machine for cane-planting, the invention of Mr Pryce Trevor, of Bundaberg. The machine is very light, and consists practically of a pair of light wheels with a pole, carrying a plough-share with a sort of double perpendicular mould-board underneath the bed of the machine.* A feature of the machine was that of *two men and two horses being able to plant as much ground as the latter can walk over in a day—about 5 acres.*

• A blow for early women's lib: An article urging agricultural education for women deplored the fact that: *many people who think it perfectly legitimate to keep a servant, shop, bar and factory girl hard at work, and for long hours, would consider it debasing to let their daughters pick strawberries, pluck and grade fruits, look after the dairy, poultry, apiary, etc. The only argument used to justify such a prejudice is that women are not fit for farming, that it is not an occupation suitable for them.*

• Work in Germany indicated that it should be possible for electricity to be used in agricultural production.

• An interesting exhibit at the Gympie Show, held on 12th and 13th September was a farm gate, of simple construction, *but very effective as it can easily be opened by anyone without dismounting from horse or cart.*

• Eight reasons were given why some Dairy Farmers do not succeed.

> *The cows do not get all they want to eat. They are not fed a proper ration. Neither winter shelter nor summer shade are provided for the cows. The poor cows are not weeded out of the herd. The percentage of poor cows is too large because good dairy bulls are not used. The cows are not milked for more than six months out of the twelve. The dairyman provides neither green food for summer nor hay or ensilage for winter. Too much of the butter is made during the hot months when price for butter is low. It should be made during the cold months when butter brings a better price.*

• 1900 was a good year for frogs. *The year's frog crop promises to be an unusually large one and the market price will not be exorbitant.* The article was reprinted from the Chicago Live Stock Journal.

• Pineapples were rated a most unpopular fruit—most people prefer apples, pears, passionfruit or melons. This despite the fact that pineapples were produced abundantly along the whole seaboard of Queensland. A suggested reason: *Probably if pineapples were a guinea apiece, everyone would want a slice, but at 1d. and 2d., pineapples become vulgar.*

• Handy hints given on *lifting out fence posts by means of a team of bullocks*—a problem that had apparently been causing some readers concern.

• A new way of hunting moths, and one that was rated quite successful: *At Aigle (Switzerland) little boys armed with glued rackets go at dusk into the vineyards and catch the night moths.*

• A criticism of the first Brisbane Exhibition: *A large portion of the grounds is taken up by side shows, Aunt Sallys, etc., which might with much advantage be devoted to the exhibition of useful objects connected with the greater industries of the colony.*

Brucellosis-Tested Swine Herds (As at 21 February, 1975)

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

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
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

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
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

THE FARM FAMILY

Preserving food

some tips for successful freezing

PRESERVATION by freezing is one of the best ways to store food.

In selecting foods to freeze, use only the best quality, as freezing does not improve quality. Seasonal foods may be bought at economical prices and preserved at the peak of their quality for year-round use.

Spoilage

Enzymes, yeasts, moulds and bacteria cause food spoilage at room temperatures, bringing about a deterioration in flavour, texture and appearance. This can be retarded or stopped by freezing.

Since quality deterioration will start again when the food thaws, it is important to shorten the time when frozen foods are held in a thawed condition. If some holding in a thawed condition is unavoidable, this should take place in the refrigerator at a temperature below 5°C.

Nutritive value

It is best to prepare vegetables and fruit for freezing as soon as possible to prevent loss of vitamins. Correct freezing will retain most of the nutritive value, but the food's quality must be sound before it is frozen.

Any loss in nutrition that does occur is mainly due to leaching during blanching operations. To keep these losses to a minimum, as little water as possible should be used in blanching. This same consideration applies in cooking. Also, do not blanch or cook for longer than is necessary.

Preparation

Vegetables and sea-foods should be thoroughly washed, and the edible portions of vegetables prepared as for normal cooking. Fruit should be washed and edible portions cut into pieces.

Most vegetables should be blanched in boiling water or steam for 1 to 2 min. (sometimes more, depending on size) to de-activate enzymes. This operation is necessary to retain the vegetables' quality.

After blanching, cool rapidly in iced water, then package the product for the freezing stage. Fruit is normally frozen in 20 to 50% sucrose syrup and in some fruits, vitamin C (ascorbic acid) is added (¼ teaspoon per cup of syrup) to prevent or reduce browning during storage and thawing.

Packaging

The quality of quick-frozen foods is influenced significantly by the packaging material used. The food must be held in a vapour-proof package, or moisture loss will lead to desiccation (freezer-burn). This spoils the appearance and toughens the texture.

The packaging material must also stop loss of flavour and odour constituents and prevent the entry of other odours or flavours. For oxygen-sensitive products, air must be kept out completely.

The best packaging materials are aluminium or plastic formed into rigid containers or flexible films. When freezing liquids or purees in rigid containers, leave room for a head-space. If this head-space is insufficient, expansion on freezing will make the container split.

Take care to label the pack before freezing. Try to keep the thickness of the pack below 5 cm.

Freezing

Freezing is carried out by placing the product in a deep freeze cabinet or in the freezing compartment of the refrigerator. Do not overload the freezer: restrict the load to 1·5 kg of food per cubic foot of freezer capacity. Do not stack packages close together during the freezing operation, as it is best to have air circulating between them.

Refreezing

The actual process of thawing and refreezing does not make food unsafe, but thawed foods spoil more rapidly than fresh foods and may quickly become unsafe to eat if not refrigerated.

Some foods may be refrozen if they have not completely thawed or if they have been thawed for a short time only and have been held in a household refrigerator.

However thawing and refreezing will usually cause a loss in quality and flavour. Refrozen vegetables may toughen and refrozen fruits become soft and mushy. If the flavour and texture of refrozen fruits make them unsuitable for eating uncooked, they may still be satisfactory for cooking purposes.

Because low-acid foods, which include meats and most of the vegetables, spoil rapidly after they have thawed and warmed to temperatures above 5°C, it is not advisable to refreeze them. Sea-foods and poultry should **never** be refrozen.

Acid foods, which include most fruits and fruit products, are likely to ferment after they have thawed and warmed to temperatures above 5°C. Slight fermentation of acid foods may change or spoil the flavour, but it does not make them unsafe to eat.

Storage

Frozen products should be stored at temperatures of –18°C (0°F) or below. Most vegetables, fruits and large cuts of meat may be stored for 12 months at –18°C without any great loss of nutritional value, colour or flavour. Smaller cuts of meat, poultry and pork may be stored for 6 months.

High quality storage life of most frozen sea-foods is shorter than this unless they are stored at lower temperatures. Commercial storage temperatures for these products are commonly around –25°C.

Thawing

No advantage is gained by thawing vegetables slowly. They should be immersed immediately in boiling water and cooked ready to serve. Because of a slight cooking during blanching and a partial softening of the food's texture in the actual freezing, frozen vegetables require a shorter cooking time than fresh vegetables.

Fairly thin cuts of meat such as steaks and chops may be cooked without thawing, but meats such as roasts and poultry should be thawed (preferably in the refrigerator) before cooking. Do not use hot water immersion to thaw meats.

Fruits should preferably be thawed in the refrigerator.

Precautions

A risk of food poisoning always accompanies incorrect methods of freezing. The following points should be very carefully noted:

1. In preparing foods for freezing, pay strict attention to hygiene. Cutting boards, knives, trays and containers should be thoroughly cleaned with hot water and detergent before use.

Products such as fruits, vegetables and sea-foods should be thoroughly washed as a first step in preparing them for freezing.

Strict attention must be paid to personal hygiene, particularly washing the hands. Remember that many micro-organisms are capable of surviving the freezing process. Because of this, they are able to continue to multiply, not only before the food is fully frozen, but also during and after thawing.

2. Foods that have been heated should be cooled as rapidly as possible to room temperature or below before freezing.

3. Do not attempt to freeze foods in large containers. The maximum size should be about ½ kg.

4. If frozen foods cannot be eaten immediately after thawing keep them refrigerated.

5. Do not overload the freezer during the freezing process. Normally the maximum load would be about 1½ kg of food to each cubic foot of the freezer's capacity.

6. Do not stack packages close together during freezing; leave some space so that air can circulate freely.

7. Do not refreeze low-acid foodstuffs that have thawed and warmed to temperatures 5°C.

For further information contact The Sandy Trout Food Preservation Research Laboratory, 19 Hercules Street, Hamilton, Brisbane.

Marihuana

ARGUMENTS about whether marihuana is harmful or not have raged for as long as the drug has been used. Each side has had its supporters, but recently quite a few people who previously regarded marihuana as "harmless" have changed their minds.

Much research into the effects (both long term and short term) marihuana has on the human body is still to be done, but results of recent studies in America seem to indicate that the drug may have a serious effect on achievement and motivation and could impair driving skills.

One psychiatrist who previously urged legalization of marihuana, recently described it as "the most dangerous drug sold illicitly in the United States".

His about face was caused by seven years of study of university students who used the drug for a prolonged period. His research indicated that the effects of marihuana seemed to follow a clearly damaging pattern. Regular users consistently lost their ability to think in sequence, part of their memory and their ability to reason clearly. They finally developed a kind of paranoid thinking in which they felt everyone was picking on them.

A number of students who tried to return to an academic career after giving up marihuana found they could no longer think as clearly as they once did, and that they had lost their desire to succeed.

One student found he could not complete mathematical problems that presented no difficulty before he used marihuana.

Other tests into marihuana carried out at the University of British Columbia in Canada indicated that the drug could affect driving skills.

In the tests 64 well-educated experienced drivers between the ages of 19 and 31 were asked to drive a complex test course. The subjects drove through the course and their score noted. They were then asked to smoke a marihuana cigarette ("joint") and undergo the test again. In almost all cases they did not perform as well after they had smoked the drug as they did before.

They did no better on the open road. Before smoking the cigarette they were able to negotiate a cross town course without any major problems. But, after they smoked marihuana, all experienced an elevation in heartbeat and seemed preoccupied or confused.

Many of the test drivers also seemed dangerously unaware of pedestrians and traffic around them.

Although the results of these tests are not universally accepted as being conclusive, they should at least make a person stop and think before taking that first puff of a marihuana cigarette.

From the Queensland Health Education Council.

Gardening notes

Growing Citrus in the Garden

by Officers of Horticulture Branch.

GIVEN the right kind of treatment, citrus trees make both useful and attractive additions to any home garden. This article has been prepared to provide Queensland home gardeners with the information needed to establish their trees well and keep them in good health and productivity.

CHOICE OF VARIETIES

The following varieties have proved suitable for home garden planting:

Oranges

The **Washington navel** is an early variety harvested between early April and June. It is less tolerant of adverse conditions than other oranges and requires adequate soil moisture particularly during the flowering and early fruit setting if it is to crop well.

The **Joppa** is harvested between April and late June. Its fruit is good for juicing and the tree is very hardy and a prolific cropper.

The **Valencia** is a late variety and is generally harvested from July to September. The fruit holds well on the tree for many months after maturity, and is good for both juicing and eating fresh.

Mandarins

The **Emperor** is a mid season variety and is picked between late April and early June. The fruit has a slightly rough orange yellow rind, and has a tendency to become puffy if left hanging on the tree. This hardy variety does well in coastal areas, but is susceptible to the disease known as Brown Spot.

The **Ellendale,** a late variety is harvested from June to late August. The fruit is fairly large with a close fitting, though easily peeled orange coloured rind. The Ellendale does particularly well in inland areas, but can be grown quite successfully along the coast. Under heavy cropping the variety is subject to splitting of the main limbs at the fork of the tree.

The **Hickson** is a mid season (May–June) high yielding variety producing fruit of good size and flavour. Hickson does well on the coast.

Lemons

The **Villa Franca** and **Improved Lisbon** are both true lemon varieties which grow into fairly large spreading trees. They produce a main crop during the summer and autumn months, although some fruit is available almost all the year round. The varieties grow well in inland areas, but in the more humid coastal areas they suffer from a scaling of the bark on the trunk which limits their productive life.

The **Meyer** lemon is a very suitable home garden variety. It grows into a smaller, more attractive tree than the Villa or Improved Lisbon varieties and is longer lived in coastal areas. It produces very heavy crops of fruit at an early age. Although a high percentage of the crop is harvested in early summer, some fruit can be obtained all the year round.

The Meyer is not a true lemon, but a natural hybrid between the true lemon and sweet orange. The fruit has a very high juice content, but has a much milder lemon flavour than the true lemons.

Grapefruit

The only variety of grapefruit which has proved satisfactory under Queensland conditions is the Marsh. It produces seedless or almost seedless fruit which is harvested during March, April and May. The earliest maturing fruit are prone to fruit fly attack and suitable control measures will be necessary.

Other Citrus

Cumquat trees with their dense foliage make fine ornamental shrubs, and the small orange like fruit make excellent marmalade or conserve. The common varieties are **Calamondin** which produces loose skinned round fruit and the **Nagami** which bears oval fruit. An attractive variegated calamondin is also available from some nurseries.

The fruit of the **Tahiti (or Persian) Lime** is similar to the lemon except that the skin is very smooth and the juice is more aromatic and has a higher acid and sugar content. The lime tends to be everbearing, but the fruit is very susceptible to stylar end rot disease and should be harvested as soon as it is mature. The lime is very susceptible to frost.

CHOICE OF ROOTSTOCKS

Citrus trees consist essentially of two different parts jointed together just above ground level. The seedling grown from a seed and later beheaded, develops the root system of the tree. This is known as the rootstock. The top portion called the scion is grown from a bud taken from a selected tree of the required variety and implanted under the bark of a seedling grown in the nursery.

The three commonly used rootstocks for home garden plantings are rough (bush) lemon, sweet orange and Emperor mandarin.

Rough lemon, the commonest rootstock, produces a quick growing tree which bears at an early age. It should not, however, be used for Ellendale and Hickson mandarins as trees on this stock decline at an early age. In these cases sweet orange or Emperor stock is preferred.

Trees on sweet orange rootstock grow more slowly and produce less fruit in their early years than those on rough lemon. The fruit, however is of good appearance and internal quality. All the commonly grown citrus varieties are compatible with this stock.

Emperor mandarin behaves much the same as sweet orange as a rootstock. It is a very suitable stock for mandarin scion varieties.

PLANTING SITE

Before a citrus tree is bought, a sheltered warm sunny site should have been chosen for it, as citrus trees exposed to strong prevailing winds will never grow so well. Care should also be taken to see that the tree is not planted in a shady site. Trees established under even partial shade tend to be weak and unsatisfactory.

Good soil drainage is essential for citrus trees. Avoid wet situations or hollows where the water is likely to accumulate.

In some situations where the soil is heavy and poorly drained it is an advantage to plant the tree in mounds raised a few inches above ground level to reduce waterlogging of roots in the wet season. Agricultural pipes or slotted PVC plastic pipe can be used to improve sub-surface drainage.

SELECTING THE TREE

The best tree to buy is one with healthy green leaves and bright clean bark and which has been grown in the nursery for 9 to 15 months after budding. Any trees with poor hard stunted growth or showing signs of scale or other insect pests or diseases should be avoided. Trees can be purchased as bare rooted or in pots, tins, or plastic bags.

PLANTING

The best time to plant is July and August.

Holes for planting trees should be sufficiently wide and deep to accommodate the root systems. For preference the whole area in which the trees are to be placed should be deeply dug over before planting.

If more than one tree is to be planted allow 5·5 to 7 m depending on the variety between each tree. Do not dig the hole into the heavy clay subsoil, as it will only hold water and become a source for waterlogging and root rots.

If the nursery tree is bare rooted, inspect it for broken or damaged roots. Prune off any damaged sections that are found. If the tree is bagged or potted remove the bag or pot completely before planting. Place the tree gently in position in the hole and throw in a few shovelfuls of soil. The tree should be set in such a way that after the soil has settled the tree will be just a little higher than it was when growing in the nursery. Fill the hole ⅓ to ½ full with soil and settle the soil in the bottom of the hole by using about 5 litres (about 1 gallon) of water.

Finish filling the hole and pack the soil firmly around and between the roots with the hands. To ensure that the soil is in close contact with all the roots water well again.

Re-water the young tree often enough to prevent the soil around the roots from becoming dry, but a word of caution—do not over water the tree as this could lead to root rot.

FERTILIZING

Newly planted trees should not be fertilized until they show signs of growing. The first application should be light, not more than 225 grams (half a pound) of a complete mixture with an analysis of approximately 10% nitrogen, 4% phosphorus and 6% potash i.e. a 10–4–6 mixture. Subsequent applications at the same rate are made at three monthly intervals during the first year.

Thereafter apply 450 gm (1 lb.) of a 10–4–6 mixture per tree for each year of age (up to ten years) in the winter (July) and 150 gm (⅓ lb.) of suplphate of ammonia or calcium ammonium nitrate or 110 gm (¼ lb.) of nitram (ammonium nitrate) per tree for each year of age in November and again in May. Each application should be well watered in.

For mature trees (over 10 years old) apply fertilizer as for a 10 year old tree.

As the young tree ages and the fertilizer rate is stepped up, increase the area of soil on which it is applied. Never apply fertilizer in a concentrated band. Always apply it over the whole ground area covered by the tree and out beyond the tree canopy for another 60 cm (2 ft.).

Zinc deficiency is common in citrus in Queensland. Affected leaves develop yellow areas in the tissues between the midrib and the main lateral veins. In severe cases new leaves are very small, narrow and pointed and in some cases almost wholly yellow.

Zinc deficiency may be corrected fairly readily by a foliage spray containing 10 gm of zinc sulphate in 10 litres of water (⅓ oz. in 2 gal.). The spray is best applied in late September when the spring growth flush is still expanding. This spray can also be used as an annual maintenance spray.

Copper deficiency sometimes occurs in young trees. The first symptoms are the development of long "S" shaped shoots bearing large coarse, dark green leaves. As the condition gets worse, shoots exhibit a reddish brown encrustation of gum and die back from the tips.

If copper deficiency occurs, it can be corrected by applying 85 gm (3 oz.) of copper sulphate (bluestone) to the soil around each young tree.

Boron deficiency sometimes occurs particularly in lemon. Affected fruit are often lopsided and lacking in juice and have a hard thick rind with brown discolorations. There are pockets of gum in the rind and around the seeds which are dark and often malformed.

Boron deficiency can be corrected by applying a foliage spray containing 30 gram of borax in 10 litres of water (1 oz. in 2 gal.) One application should supply the tree's requirements for several years.

Continued applications of acid forming fertilizers particularly sulphate of ammonia and most mixtures tend to make the soil more acid which adversely affects tree growth. When the soil is moderately acid (below pH 5·5) it is wise to apply a dressing of dolomite. The material is best applied in the autumn, and a rate of 225 gm (8 oz.) per square yard is satisfactory in most instances.

SOIL MANAGEMENT

Citrus trees will grow quite successfully with grass right up to their trunks, but they do grow best if the soil is kept free of grass and weeds for a distance of 60 cm (2 feet) around the trunk. This is most important when they are young.

The bare soil under the tree may be mulched to restrict weed growth. However, never let the mulching material come in contact with the trunk of the tree, as the moist conditions created are ideal for the onset of bark diseases which are often fatal.

PRUNING

Avoid pruning young trees unnecessarily as this only retards growth and increases the time required for the tree to come into bearing. Remove any shoots which develop on the trunk within 30 cm of the ground but let the rest of the tree make as much growth as possible. With time, the canopy of the tree will hang down to form a "skirt". Do not cut this off unless it is necessary for mowing as this is an important bearing surface of the tree. Annual pruning in orange, mandarin and Meyer lemon trees should only consist of the cutting out of dead wood, and any unwanted or long water shoots.

Bearing Villa and Lisbon lemon trees may however require more pruning. Their vigorous growth can lead to overcrowding of branches which makes pest and disease control difficult. When this occurs, the tree should be thinned by completely removing some branches. Very long leaders may also be cut back.

IRRIGATION

The newly planted tree should be watered often enough so that the roots are never allowed to dry out.

In bearing trees, irrigation in the flowering and fruit setting period is most important as dry trees will not set well. As this period from September to December is the dry season in Queensland, irrigation at least every month is required. In heat wave conditions watering may be required every fortnight. In the wet summer period and in winter, irrigation is required less frequently, but often enough so that the tree does not wilt.

At each watering apply sufficient water to wet the whole of the root zone. However, be wary of over watering, for, if the soil is kept continually saturated there is the danger of creating conditions suitable for the onset of trunk and root rots.

In our next issue: Lettuce all year round.

Save Money on Fruit and Vegetables

- Check over fruits and vegetables that are reduced for quick sale if you plan to use them immediately. Mellow ripe bananas to stir into biscuits or pudding, or apples to turn into sauce, are good value.

- Learn the difference between surface blemishes and bruises on fresh fruits. For example, russet or greenish patches on oranges aren't important, and because the fruit is less attractive, it may be a bargain. Bruises usually mean that part of the fruit is spoiled.

- Look over canned foods that are reduced in price because of torn labels or small dents. But if there is any sign of swelling, or leaking—don't buy.

WITH the current interest in handicrafts, many are finding they can turn spare time and talent into a profitable sideline. This article looks at some of the ways a country craftsman can develop local markets.

Crafts for Cash

FOR the craftsman living in a rural area, the problem of where to sell finished work is a very real one. Larger towns and cities have specialty shops and galleries which often rely exclusively on handcrafted goods. Add to this a larger number of art and craft shows, fairs and festivals, and you have a good market for handcrafts.

Often, however, some of the best craftwork is done in the more remote parts of the State, and there would be few people involved in today's rural scene who could not do with the extra money that the sale of handcrafts can bring in.

Living in a rural area does have one advantage. The local market is not likely to be flooded with work similar to your own—a problem that can face your city counterpart who suddenly finds that other craftsmen have copied his ideas and techniques.

OUTLETS

First look at local shops. It's quite likely that you'll find a proprietor who is willing to put some of your goods on display, and retain a commission on what is sold.

For most craft goods, this commission would be between 20 and 25 per cent. depending on the size of the individual pieces. Remember that, as far as the shopkeeper is concerned, space is worth money. Large items, such as large soft toys and the like, could involve a commission of up to 33 per cent.

You may find it a good idea to limit yourself to one, or at the most, two sales outlets in any one centre. This way, the proprietor is more likely to give better display space to your goods.

If you are supplying a store on a sale-or-return basis, you would be wise not to put in too much stock at the one time. After it has been on display for several weeks, your work will have a shop-soiled appearance, regardless of the care with which it is handled. This will leave you with items that are not saleable, or at the best, which have to be sold at marked down prices.

For this reason, a small selection, to which you can add new items to replace those you sell, will help cut down on this problem. Also, customers will develop the habit of coming back to the store regularly to check on anything new that may have been added to your range. This will help boost your sales.

If you are fortunate enough to have several possible outlets available in your district, check all of them carefully before you approach any to handle your work.

Look at features such as position, general layout of the store, and if possible, make several visits to check whether or not the stock moves, or tends to stay on the shelves.

SHOWS

Even in rural areas, many organisations are now running art and craft shows and exhibitions, and these can also provide a good outlet for your work.

Generally these involve the payment of an entry fee, and a commission (usually 20 per cent.) is charged on all sales.

Many shows give preference to the craftsman who is prepared to demonstrate the craft concerned. Usually this simply involves sitting beside the display, working on a piece of unfinished craft, and answering questions from the audience.

HOW MUCH TO CHARGE?

Putting a price on craft work can be difficult. Many craftsmen work on the basis of double the cost of materials, and add a commission cost.

It's usually wise to be slightly underpriced on your first efforts rather than put too much on them. If you find you are selling as quickly as you can produce the items, you can try small rises in price. Ultimately prices will level out, so that you're getting the best possible return, yet still moving your work.

Get rid of pests

ELIMINATING disease carriers such as flies, rats, and cockroaches depends largely on hygiene. Care in food-handling and storage, disposing of waste paper, boxes and other containers, as well as food scraps, are the most important measures.

To keep flies' breeding places to a minimum store manure in covered bins; keep yards clean; ensure the garbage can lid fits tightly; keep grease traps clean, and make sure lavatory pansteads are flyproof.

Similar measures will help keep rats and cockroaches at bay. Close openings around all pipes entering buildings; cover basement windows and openings under buildings with fine mesh wire, and place a concrete or metal barrier 61 cm (about two feet) below the ground buildings with floors at ground level.

To deprive pests of food, cover all food during preparation and at the table, ensuring that scraps are kept in a covered container until disposal. Avoid throwing domestic food scraps on the ground, particularly in fowl runs. (Scraps should be wrapped securely before disposal in the rubbish bin.) Ensure that lids of bins for poultry and animal food fit tightly, also that uneaten pet food is disposed of promptly.

Cupboard doors, especially those of food cupboards, should fit properly. Store groceries in tightly-sealed containers, and ensure cupboards are cleaned out regularly. Rubbish bins need cleaning and disinfecting after each removal service, and hot, soapy water is necessary to keep kitchen working surfaces clean.

Fly-screening is a worthwhile investment to supplement the clean-up campaign, and to protect the family from fly-borne infection—such as gastro-enteritis, poliomyelitis, the bacterial dysentries, and possibly, viral hepatitis.

Cockroaches also carry serious diseases, especially intestinal disorders; rats spread murine typhus, gastro-enteritis, Weil's disease, scrub typhus, bubonic plague, etc., etc. Free pamphlet information on these pests is available from the Queensland Health Education Council, P.O. Box 155, Fortitude Valley, 4006.

From the Queensland Health Education Council.

Beef dripping and stock

(by Mrs. TESS MALLOS, Australian Meat Board Food Consultant)

WITH bulk beef sales on the increase, much of the fat and bones normally disposed of by the butcher is now reaching the kitchen. Many who order beef in bulk issue instructions not to include fat and bones, even though the price paid includes these offcuts.

Admittedly, it does take a little effort to transform the fat and bones into useful culinary aids but, with prices of cooking fats and instant stock products increasing, this is an area where time and effort saves money.

Beef Dripping

To render fat

There are two methods to render fat:

1. Cut fat into small pieces and put in a large baking dish. Place in a slow oven, 150°C (300°F) and leave until all the fat is extracted and only crisp tissue remains. Strain, pressing tissue well to extract all fat.

2. Cut fat into small pieces and place in a large pan. Add 1 cup water and simmer for several hours until water is driven off and crisp tissue remains. Do not cook on high heat as the fat will colour or burn.

To clarify fat for dripping

Put strained fat in a large saucepan with at least an equal quantity of water. Bring to the boil then strain through a muslin or cheesecloth-lined strainer into a large, heatproof basin. Leave in refrigerator until dripping is solid. Pour off water and lift out block of dripping. Scrape off sediment on base with a knife. Wipe with paper towels then melt again if necessary to store more compactly in dripping container. Cover and store in refrigerator. The dripping is then ready for use as a frying medium, for oven roasting of vegetables, to add to lean meat when roasting or for making pastry.

Storage and care of dripping

Dripping should be stored in a covered container in the refrigerator. The absorption of odours from other foods and food particles left in it are factors which cause spoilage. Always strain dripping after use to remove food particles and clarify it again when necessary. When dripping darkens in colour and shows signs of rancidity (detectable by taste and smell), discard it.

Beef Stock

As the bones which come with your bulk beef order usually have a little meat on them, it should not be necessary to add gravy beef to the stock ingredients. Chuck bones are excellent for stock as they are very meaty. If a hindquarter has been purchased, add 500 g (1 lb.) of the gravy beef to the bones. Have butcher crack all the bones for you.

Simple Beef Stock

Put bones in a large boiler. Add 4 cups chopped vegetables (onion, carrot, celery and turnip), the diced gravy beef if used, ½ teaspoon whole peppercorns and salt. Bring slowly to the boil, skimming often. Cover and simmer gently for 4–5 hours.

Brown Beef Stock

This is a richer version of Simple Beef Stock and is an excellent substitute for stock cubes and tablets.

Place 4 cups diced vegetables (onion, carrot, celery and turnip) in the base of one or two greased baking dishes. Add diced gravy beef if used and put bones on top. Brush bones with a little dripping or put some strips of fat on top. Cook in a moderately hot oven, 190° C (375° F) for 30–40 minutes, turning bones once or twice to brown well. When sufficiently browned put bones and vegetables into a large boiler. Cover with cold water, bring slowly to the boil, skimming often. When no more scum rises, add ½ teaspoon whole peppercorns, salt and a bouquet garni (4 sprigs parsley, 2 sprigs thyme, leafy celery top, 2 bay leaves). Cover and simmer for 4–5 hours.

Storing Stock

When stock is ready, strain through a muslin or cheesecloth-lined strainer into a large basin. Chill until fat is set on top. Lift off fat and add to fat being clarified. Either cover stock and store in refrigerator or, if storage space is at a premium, reheat and reduce to half its original volume. Either store in small containers, allowing 2·5 cm (1 inch) headspace for freezer storage, or pour into ice cube trays and freeze.

Remove cubes when frozen and store in plastic bags. Use these in place of stock cubes or tablets. When using reduced stock for soups etc. add equal quantity of water to return it to original strength.

Note: If you are in the habit of having a bowl of stock in the refrigerator and adding liquid from vegetables to it, do not add water from potatoes as starch in the stock reduces its storage life considerably.

The Australian Standard metric cup and level spoon measures are used in recipes.

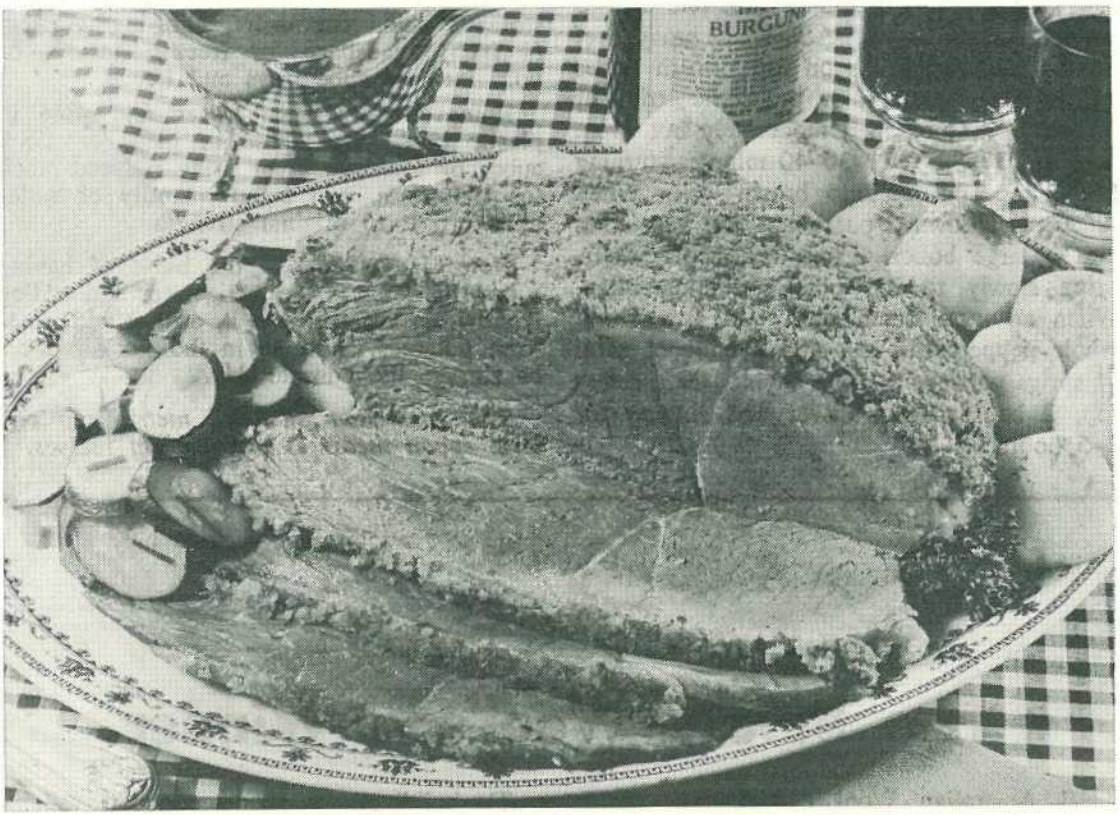
Fire Safety—Wool's a Winner

THE Australian Wool Corporation, deeply concerned with the problems of fire safety in institutions, has developed a range of garments, bedding materials, carpets, screens and curtains designed to reduce the risk of injury or loss of life through fire in hospitals.

In a dramatic demonstration in Melbourne during Fire Prevention week, at a simulated ward erected at the Royal Park Psychiatric Hospital, Parkville, wool passed the fire test with flying colours.

The building, which had been made available by senior officers of the Mental Health Authority, had been furnished on one side in the latest fire safety wool products whilst the other was furnished in synthetic and cotton. A fire which broke out in an "accidental manner" was easily extinguished when it reached the wool furnishings but the others burst into flames and if it had been an actual accidental fire then the occupants would have had little chance of survival.

Corned Beef wins



(by Mrs. TESS MALLOS, Food Consultant, Australian Meat Board)

In February, Adelaide was the centre of a State-wide Beef Week Promotion campaign. The Australian Meat Board, in conjunction with Kelvinator and the Sunday Mail, ran a competition for the best beef recipe—the prize being a freezer, donated by Kelvinator, filled with prime beef provided by the Australian Meat Board and the South Australian Meat Corporation.

Mrs. C. E. Atkins of Port Lincoln, S.A., won this excellent prize with her delicious receipt for corned beef cooked in burgundy—South Australian burgundy, of course.

CORNED BEEF WITH BURGUNDY SAUCE

Ingredients

1·5 kg (3½ lb.) piece corned silverside
1 cup burgundy
¼ cup white sugar
1 cup soft breadcrumbs
2 tablespoons brown sugar
2 tablespoons chopped parsley
Melted butter

Burgundy Sauce

30 g (1 oz.) butter
30 g (1 oz.) flour
1 cup burgundy
¼ cup red current jelly
1 teaspoon powdered or ready-mixed mustard
Salt and black pepper

Method: Wash meat, put into pan with burgundy, white sugar and enough warm water to just cover. Slowly bring to the boil, skim surface and simmer, covered, for 1½ hours or until tender. Transfer beef to a greased baking dish. Combine breadcrumbs, brown sugar, parsley and enough melted butter to moisten. Press evenly over fat surface of beef and bake in moderate oven 180°C (350°F) for 30-40 minutes. While meat is cooking make the sauce.

Melt the butter, add flour and stir for two minutes. Slowly stir in the burgundy and cook, stirring, until nearly boiling. Add jelly, mustard, salt and pepper and simmer, stirring until jelly has melted. Serve with meat.

(The Australian Standard Metric cup and level spoon measures are used in this recipe).

While on the subject of corned beef, more queries are received by the Australian Meat Board relating to the treatment and storage of this particular meat cut than any other cut. As the trend is to buy hind and forequarter beef in bulk, the purchaser is confronted with a large quantity of corned silverside or brisket and the query is, basically, to freeze or not to freeze; and, if you do freeze, should it be frozen raw or cooked.

As further tests are being carried out with regard to the freezing of salted meats, the following information is a safe guide for the handling of corned beef, going on what facts are available at the present time. If anything changes, it will only be the length of storage time in the freezer.

UNCOOKED CORNED BEEF

1. Corned beef can be frozen raw, but should only be stored in the freezer for a maximum period of 1 month. After this time, though the meat will still be quite safe to use, there could be problems with flavour as the curing process accelerates the oxidation of the fat, thus causing rancidity.

2. To minimise this oxidation, trim off as much fat as possible, leaving only a 5 mm (¼ inch) layer on the meat. Air should also be removed from around the meat surfaces by close-wrapping in a moisture and vapour-proof material such as clear plastic clinging-type wrap.

3. Put close-wrapped meat in a high density plastic freezer bag and draw out air with a vacuum pump or a straw. Twist end of bag and seal with an elastic band, doubling over the end of the bag to ensure air does not enter. This second protection is most important as the first wrap is not sufficient protection against the cold of the freezer.

4. Only store in the *refrigerator* the amount of uncooked corned beef which can be used within 1 week. Kept longer, though the meat will still be safe to use, it will dry out. Place meat on a rack in the meat drawer, or put on a *stainless steel* rack in a deep dish in the coldest part of the unit, covering top of meat with sterilised cheese cloth or waxed paper to prevent excessive drying. If no suitable rack is available, drain off any drip daily.

5. There is no need to thaw corned beef before cooking. It will only take fractionally longer to cook than normal.

COOKED CORNED BEEF

1. Simmer corned beef in usual way. When cooked cool in liquid as quickly as possible by placing pot in a sink of very cold water.

2. Drain meat and trim off as much fat as possible.

3. If corned meat is to be reheated at some later stage, place meal portion in a plastic

container (an ice-cream container from a well-known manufacturer is suitable). Cover with cooking liquid, skimming off as much fat as possible. Leave about 2·5 cm (1 inch) head space in container for liquid expansion and seal. Chill in refrigerator then place in freezer and freeze as quickly as possible. Store for up to 6 weeks.

4. If corned beef is to be used for cold service, drain, pat dry with paper towels and cut into meal portions or slice. Wrap closely and store in freezer bags, following directions given for uncooked corned beef (points 2 and 3). Store for up to 6 weeks in the freezer.

5. Always thaw cooked corned beef in the refrigerator if it is to be used for cold service. It can be sliced, or slices separated while partly thawed, when used for sandwiches for lunch boxes or for salads.

6. Sliced corned beef can be reheated by wrapping slices in foil in a flat package. Heat in a moderate oven or place under a grill, turning package carefully to heat evenly.

7. Cooked corned beef which has been frozen has the same shelf life in the refrigerator as freshly cooked corned beef, providing it has been thawed in the refrigerator. Store in an airtight container or in moisture-proof wrap.

And please, when cutting any meat in the home for food preparation or freezing, make sure cutting boards and knives are clean.

Always use scrupulously clean containers and *new* wrapping materials for freezer and refrigerator storage.

When we talk about freezer storage, this means storing food in a freezer which runs at minus 18°C (0°F) or lower. If in doubt, buy a freezer thermometer and check temperature. If your unit does not run at that temperature, halve the length of storage times given above.

Molesters

AT any time of year, in any location, children need protection from molesters. At country shows or similar functions, the need becomes even greater.

In a milling crowd it is all too easy for an unsuspecting child to be lured away from safety. Few people would take any notice of a child being taken to look at a sideshow, or given a ride on a merry-go-round. Who would know whether or not the child was with its own parent or parents?

Proper supervision is the only real safeguard, as an abduction can occur in a matter of minutes. Maintain your watchfulness—but be sensible about it. An over-protective attitude also can be harmful. Children should be warned that not all "friendly" strangers are friends. They should be taught from the earliest age not to accept the offer of ice-creams or lollies from strangers. But more particularly it must be stressed that they should never go for a walk or get into a car with a stranger.

While the child is very young, your care and watchfulness help keep him safe. When he is older, your teaching will do this when you cannot be there.

Remember that a child has no experience to enable him to judge sincerity. He usually takes people at face value—and this could be disastrous when dealing with a potential molester, who would no doubt be friendly and reassuring.

Having taught your child not to speak to strangers, not to accept lifts, tempting bribes or other overtures, be prepared for occasional embarrassment. You may have to explain to tradesmen, the postman, cab drivers or delivery men that you have taught your child not to speak to strangers because of possible approach by a molester. People genuinely concerned with the child's welfare will accept the explanation.

It is much better to adopt this procedure than to sacrifice your child's safety.

From the Queensland Health Education Council.

Tuberculosis-Free Cattle Herds (As at 21 February, 1975)

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
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
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
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
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
Hopper, G. T. & H. W., Ellendean Guernsey Stud, Maleny
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
H. M. Prison Farm, Capricornia Stud, P.M.B. 11, Rockhampton
H. M. State Farm, Palen Creek
Lau, J. F., "Rossallen", Goombungee, Toowoomba
McDonald, R. G., "Buffelvale", M.S. 807, Mundubbera
Paulger, S. & S. M., "Advale", Kenilworth
Postle, R. S. & G. C., "Yarallaside", Pittsworth
Queensland Agricultural College, Lawes
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

Journal Subscription to Rise

THE continuing pressures of rising costs, particularly with postage, has meant that the Queensland Department of Primary Industries can no longer maintain subscription rates at the present levels.

As from 1st January 1976, subscriptions to both the *Queensland Agricultural Journal* and the *Queensland Journal of Animal and Agricultural Sciences* will rise.

The new rates for the *Queensland Agricultural Journal will be* $6.00 per annum for ordinary subscriptions, with a concession rate of $2.00 per annum.

Persons eligible for concession rate include commercial farmers whose principal source of income is from primary production, students of agricultural courses, libraries and educational institutions (all resident in Queensland). Students' applications should be endorsed by the lecturer or teacher.

The subscription for the *Queensland Journal of Animal and Agricultural Sciences* will rise to $10.00 per annum.

While the Department regrets the need to apply these increases, the rise in costs since the last increase (in 1964) have meant that these journals still continue to be excellent value.

As in the past, the *Queensland Agricultural Journal* will continue to publish practical, up-to-date information for the man on the land.

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Loading can cause bruising

REMOVAL OF BRUISE TRIM at meatworks results in financial loss to the grazier. There are many causes of bruising and any action which prevents or reduces it is advantageous.

Two causes of bruising recently observed in the transport of stock were:

Side door loading
Height of top and bottom decks on double deck transports

Side door loading

While side doors assist in quicker loading of multi-unit stock crates, they can cause bad bruising in two ways:

(a) The doors are often too narrow, particularly for larger cattle.

(b) When entering transports stock must turn at 90°.

Severe bumping of shoulders, hips and butts can occur when side loading. Cattle should never be rushed when loading. They should be moved quietly and without haste.

Most single stock crate transports load via rear doors. These are usually wider and stock can walk straight into them and so are superior to side doors.

Height of top and bottom decks

Double deck transports with double deck trailers are extensively used to carry finished cattle to rail heads or direct to slaughter. They are restricted by Transport Regulations to a maximum height of 14 feet (4.26 m). This means that the height between the top and bottom decks is reduced.

If extra large or very tall cattle are loaded in double deckers, rubbing and bruising occurs. The areas affected are the rump, loin and back. This could lead to total carcass condemnation or rejection from slaughter. This type of animal is best left for the single deck stock crate to carry.

Compiled by B. Anderson, Slaughtering and Meat Inspection Branch.

BRUISING

loading onto transports can play a major part

Narrow doors can cause bad bruising.

Severe bumping of shoulders hips and butts can occur when side loading.

When tall cattle are loaded into double deck trailers, rubbing and bruising occurs (see above). This affects the rump, loin and back (see right).