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Editorial:

A Buffer for NR?

From pronouncements in recent weeks by the Ministers of Primary Industries and of Finance, we are encouraged to hope that the idea of a natural rubber buffer stock, previously mooted but incomprehensibly discarded, is to be seriously reconsidered.

We see two highly probable advantages which would follow the setting-up of a buffer stock: a degree of price control and the opportunity of ensuring a more stable income to producers, especially smallholders. This certainly would ensure adequate long-term supplies, which is imperative, while at the same time taking care of transient market imbalances.

The *modus operandi* will naturally have to be worked out by the experts, but we envisage that the buffer stock will all be technically specified rubbers. It would have to be agreed by the ANRPC*, and the stockpile perhaps held between them on a proportional basis in various consuming territories.

By carefully timed releases it should be possible to keep the price within reasonable bounds, say 45–60 cents per pound, ($0.99–$1.32 per kilo) and eliminate, perhaps forever, the anxiety and insecurity which go with the unpredictable fluctuations in price so characteristic of the existing market. There seems to be no way to remove these uncertainties as long as we cling to the present out-dated system.

Presumably governments within ANRPC would appoint marketing corporations which cooperatively would administer the buffer stocks, buying when the price drifted toward the lower level and selling when the opposite trend had set in. There will also be the opportunity of assuring supplies in the consuming territories to meet unpredictable spot demands.

In the initial stages rubber could be bought from smallholders at prevailing prices through national corporations such as the Malaysian Rubber Development Corporation. However, it is conceivable that ultimately a guaranteed minimum price to the smallholder can be introduced. The evolution of MRDC as the main public sector marketing system running in parallel with current commercially-dominated ones will certainly tend to make this concept not only desirable but feasible.

It is possible that in course of time, we may have three marketing streams; the public one and one each organised by consortia of the commercial (agency house) exporters and of the re-millers.

If all this led to the Malaysian Rubber Development Corporation handling 600 000 tons of rubber per annum, they would indeed be a force to be reckoned with and could call the tune instead of having to dance to somebody else's.

---

*Association of Natural Rubber Producing Countries.

Planter, Kuala Lumpur 48: 276–278 (1972)

Discovery in West Malaysia of *Bellucia*, a cultivated fruit tree from South America†

BENJAMIN C. STONE*

ABSTRACT

Bellucia axinanthera Triana, a South American fruit tree of the family Melastomataceae, has been found in Malaya for the first time, growing in belukar by Sungei Dua near Gua Batu, Selangor, probably persisting from old garden plantings. The trees produce an edible fruit with a flavour resembling that of the guava (*Psidium*) and some species of *Eugenia*, hence like the latter it is called 'jambu' locally. It was probably introduced here from Java, where it has long been in cultivation.

Recently that inveterate and itinerant plant collector, Dr. J. B. Lowry of the Chemistry Department, University of Malaya, brought in a specimen of a fruit tree collected not far from Batu Caves along the Sungei Dua. After a brief inspection it was clear that the plant belonged to the Melastoma family, although the stamens were all alike and not, as in most of our native Melastomataceae, of two kinds in each flower. Some further hunting in the literature showed that the tree was a *Bellucia*, a genus found only in South America, where there are about a dozen species in the tropical lowlands of the Amazon valley. From Backer's *Flora of Java* it was learned that a species of *Bellucia* was in cultivation there. Not yet certain of the specific identity, I wrote to John Wurdack of the Smithsonian Institution, who has devoted much of his research to the South American Melastomataceae. In a recent letter he has confirmed that our plant is a representative of the species *Bellucia axinanthera* Triana, which is fairly well known in Venezuela, Colombia, and Brasil, under a variety of common names. One of the most apt of these, it seems to me, is 'coronillo' (little crown), which very nicely describes the flower. In Java, and probably here as well, the plant is called *jambu*, a word normally used for fruits of various species of *Eugenia* and also for the guava (*Psidium guajava*), both of the Myrtle family (Myrtaceae). The name *jambu* is appropriate, for the fragrance and flavour of these fruits is very similar to other true *jambu* (*Eugenia*) fruits, such as *E. aquea* (*jambu ayer*) and also to the guava. In Venezuela one of the common names is 'Guayabo de danta' also indicating a resemblance to the true guava.

The plants of *Bellucia axinanthera* become small trees up to about 12 m tall, and form a rather dense crown. The leaves are large and more or less ovate, drawn out to an acute tip with a slight 'drip-tip' extension, and the blades are dark and rather glossy green above and paler and dull beneath; the veins are very conspicuous, with usually a prominent midrib and two other major veins on each half of the blade, while joining these are numerous almost parallel nerves set at right angles to these major veins. The flowers are borne on the twigs in old leaf axils, usually after the leaves have fallen; thus the flower clusters appear on the older parts of the twigs behind the leafy tips. The flower clusters are rather short, with usually

*Herbarium, School of Biological Sciences, University of Malaya, Kuala Lumpur.

† *Additions to the Malayan Flora, IV.*

three flowers together, or sometimes two or only one. The flowers are rather large, the bowl-like calyx about $\frac{1}{2}$ in. (6–10 mm), the petals up to 1 in. long and rather more than $\frac{1}{2}$ in. wide, white or flushed with pink on the outside, with a few delicate dentations at the tips. There are usually five or six petals, but some flowers with seven or even eight may also occur. The calyx-lobes are somewhat irregular and rather shallow, and not always the same number as the petals. The stamens form a closely packed ring around the style: the best way to describe them is to say that they strongly resemble the business end of a golf club! Each is about $\frac{1}{2}$ in. long, with a thick stalk, the anthers yellow and quite large (about 8 × 4 mm). The stigma is disc-like but divided radially into between eight and fifteen lobes, and is positioned at the end of a rather long and slightly curved style (20 mm), which is somewhat deflected so that it protrudes from one side of the ring of stamens.

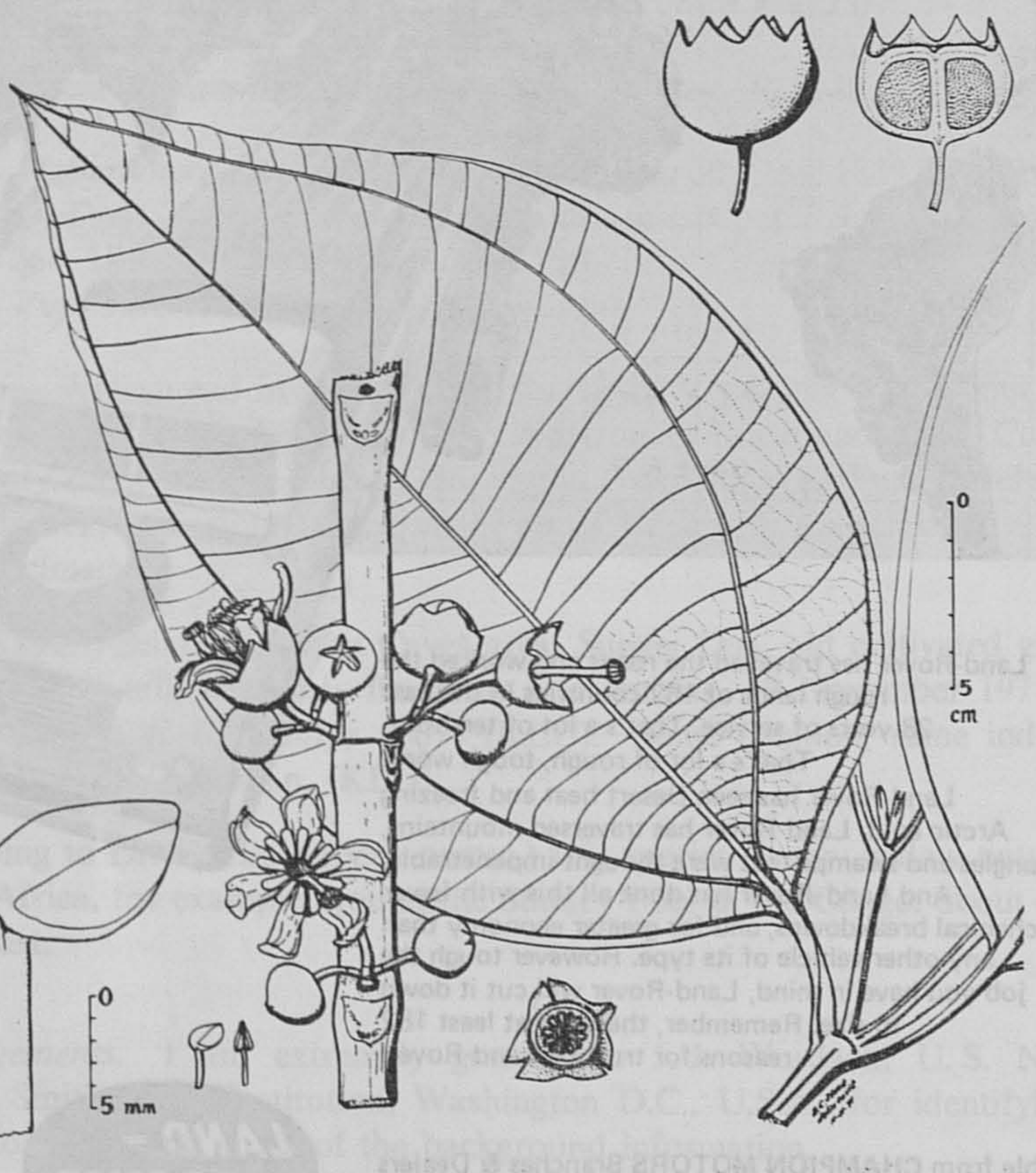

FIG. 1. *Bellucia axinanthera:* apex of leafy branch (right), part of flowering twig (centre), greatly enlarged view of stamen (left), top view of flower with petals removed (lower centre), fruit and longitudinal section of fruit (upper right).

The fruits rather seem like guavas; the flesh is pale yellow or reddish, and is quite soft when ripe, and with a fresh, appealing fragrance. The flavour is mild. There are numerous small seeds.

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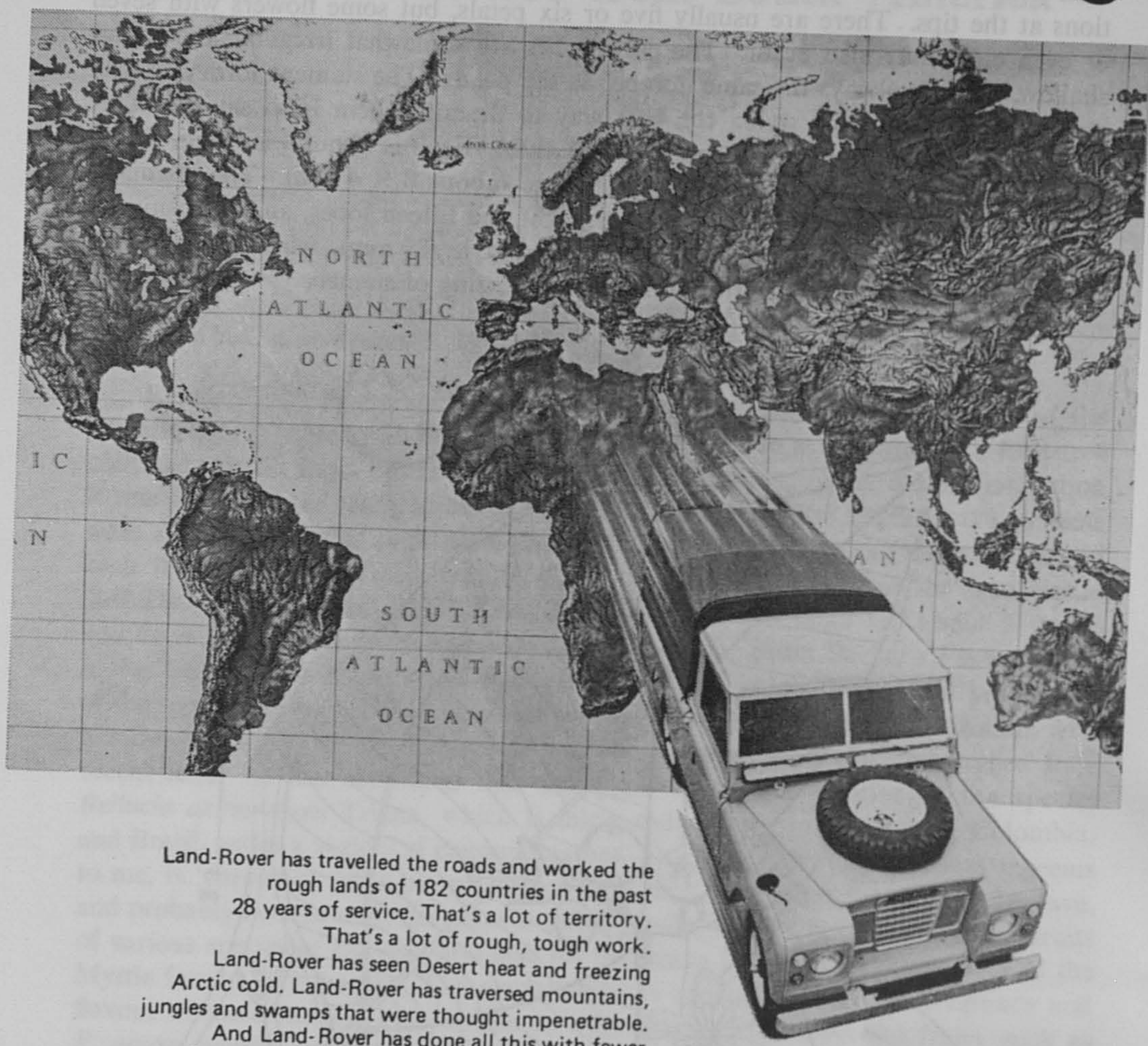

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The tree is quite attractive and was growing very well at Sungei Dua, and there were some naturally-produced seedlings around it. The fruit is probably not a major one but is pleasant, and the tree, and its large flowers, would make a delightful addition to Malaysian gardens.

Concerning the date of introduction, I have no information. It would probably not be very long ago; perhaps 20–30 years. Whether there are other trees in this country, I am unable to say.

Technical Data

Family: Melastomataceae.

Genus: *Bellucia* Raf., *Sylv. Tell.* **92**. 1838 (nom. cons.).

Species: *Bellucia axinanthera* Triana, *Trans. Linn. Soc. Bot.* **28**: 142, 1871.

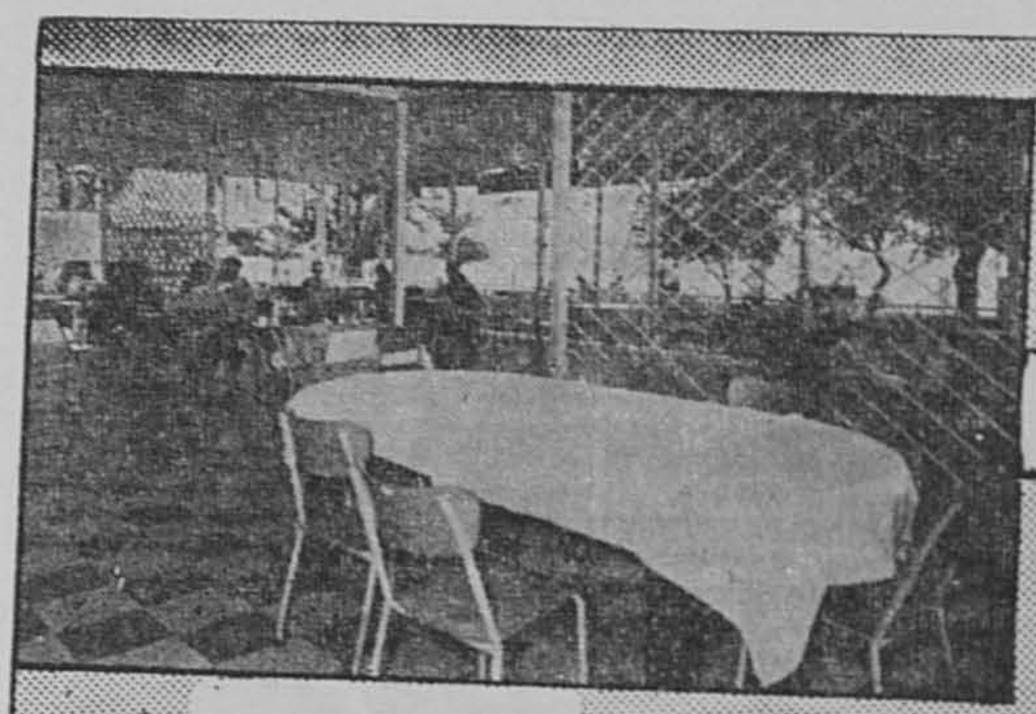
Synonyms: *Axinanthera macrophylla* Karst., *Linnaea* **30**: 157, 1859 (non *B. macrophylla* (D. Don) Triana). = *Bellucia costaricensis* Cogn., *Bull. Soc. Bot. Belg.* **30 (1)**: 264, 1891. = *B. aricicuazensium* Pitt., *Expl Cuenca Maracaibo* 40, 1923; *Pl. Us. Ven.* 349, 1926 (as *B. aricuaicensium*).

Distribution: Widespread in lowland rain forests of Venezuela from about 65–810 m alt., elsewhere from southern Mexico to Amazonian Brasil and Peru. Cultivated in Java; newly reported here also in cultivation from Malaya. Further references: Cf. J. J. Wurdack, Melastomataceae, in *Flora of Venezuela* (in sched.).
Malayan specimens:

MALAYA: Selangor: Batu Caves area, Sungei Dua, old cultivated grounds, small tree c. 10 m tall, copiously flowering and fruiting, 10 November 1971, *B. C. Stone, J. B. Lowry, R. B. Phillips* 10677 (KLU). Some location, same individual, October 1971, *J. B. Lowry* s.n. (KLU).

According to Dr. F. Halle (pers. comm.) this species is now widely naturalized in parts of Africa, for example around the Stanley Pool in the Congo, about 400 km from the coast.

Acknowledgements. I am extremely grateful to J. J. Wurdack, U. S. National Herbarium, Smithsonian Institution, Washington D.C., U.S.A., for identifying our plants and for providing much of the background information.



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Work Study

J. S. BALLARD*

INTRODUCTION

Work Study is a term which is being used more frequently by people in all walks of life. It is accepted as a means of making work more effective, more reliable and safer. Although many people every day unconsciously apply some principles of work study, many still associate it with shop-floor situations in industry, not realizing that it has application in the field, the home, the office and the boardroom—in fact in all walks of life where work is done.

The application of work study techniques to agriculture is the main concern of the planter. As labour costs increase there is a greater urgency for cutting costs by improving existing methods so as to increase productivity, both in the field and in the factory.

It is important to remember that *production* is not the same as *productivity*. In fact an increase in production does not necessarily mean an increase in productivity; productivity may actually decrease as production increases. Productivity is the difference between input and output. Work study is the analytical study of all methods of working so as to obtain the highest productivity at a satisfactory quality with the lowest production costs, and also to ensure a fair remuneration for the employee. It deals with land and buildings, plant and machinery, materials and men. It is not a substitute for good management.

This paper gives an introduction to the techniques of Method Study and Work Measurement which have the greatest application at estate level. It includes examination techniques and methods of recording. Method Study is more important than Work Measurement since greater benefit will accrue from its application on estates. However, certain forms of Work Measurement, such as activity sampling, group timing technique and estimating, can be very useful, especially in factory situations, and will also be considered.

WORK STUDY

British Standards Specification No. 3138 lists *Work Study* as a generic term for those techniques, particularly Method Study and Work Measurement, which are used in the examination of work in all its contexts and which lead to a systematic investigation of all factors which affect the efficiency and the economy of the situation being reviewed, in order to effect improvement. *Method Study* is the systematic recording and critical examination of existing and proposed ways of doing work as a means of developing and applying easier and more effective methods of reducing costs. (BSS. 3138). *Work Measurement* is the application of techniques designed to establish a time for a qualified worker to carry out a specified job at a defined level

* Lamerika Plantation, Kavieng, Papua and New Guinea.

of performance. (BSS. 3138). Although Method Study and Work Measurement can be applied separately they are complementary and can be applied concurrently (*Fig. 1*).

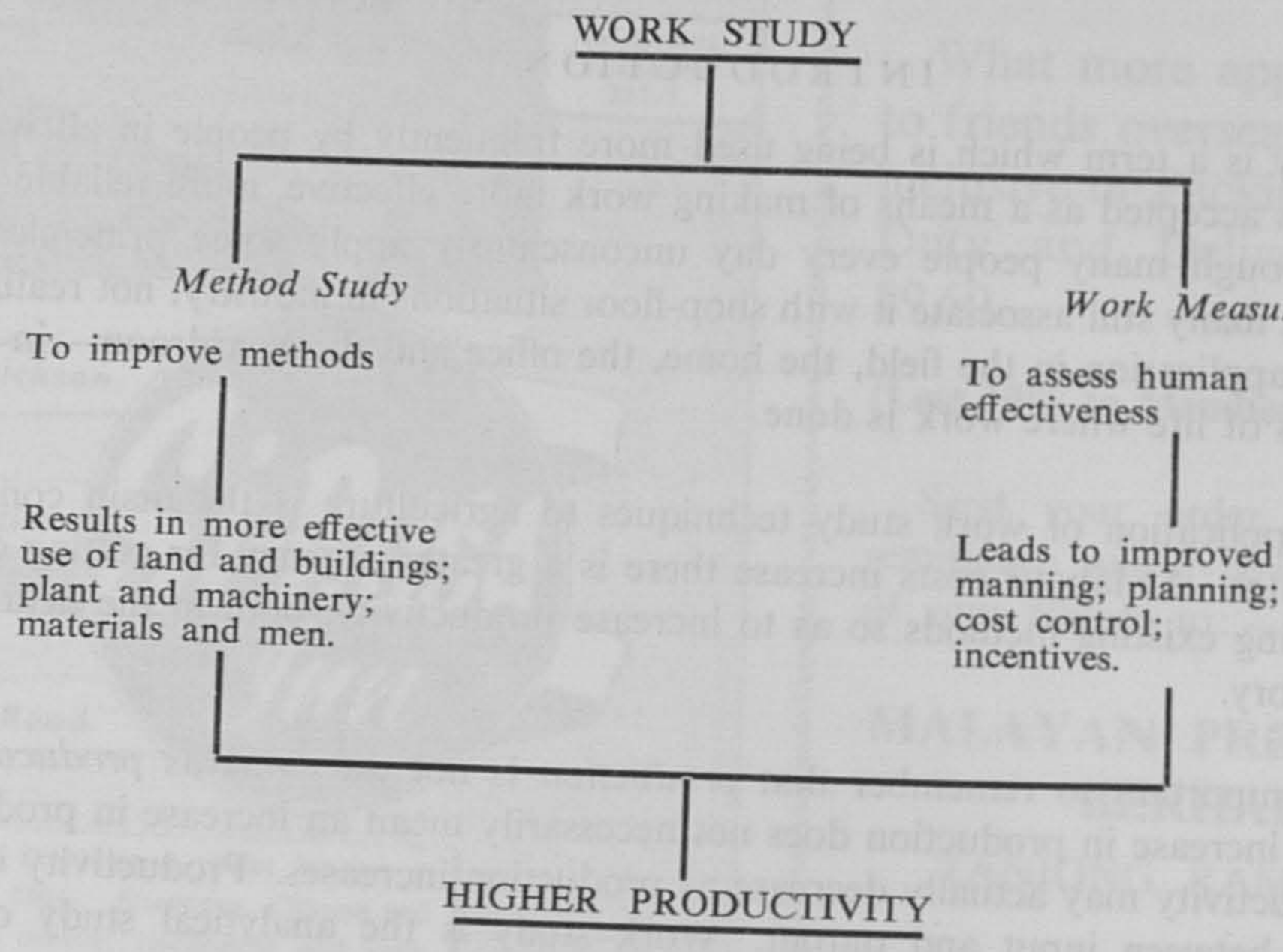

Fig. 1. Components of work study

"Put them on day work, see how much they do, double the amount done and put them on piece work". This, or similar phrases, heard and applied so often, are no longer appropriate. It is imperative that lines of thought in this vein are cast aside and replaced by scientific management principles.

WHAT IS WORK?

All work can be divided into Effective and Ineffective Time. Effective Time can be sub-divided into Basic Work Content (B.W.C.) and Excess Work Content (E.W.C.). (*Fig. 2*). Basic Work Content is the irreducible minimum time it takes to do a job of work, providing that all conditions are optimal and there is no loss of working time.

EXISTING WORKING TIME				
Basic Work Content	*Excess Work Content*		*Ineffective Time*	
Irreducible	Work content increased by inefficient methods of operation and manufacture.	Work content increased by defects in design or specification of the product.	Due to management	Due to operator
Under the control of management				

Fig. 2. Components of existing working time

The Basic Work Content involved with a spray pump operator may be to fill a 4-gal pump with a mixture of herbicide from a pre-positioned 45-gal drum, charge the pump with air, discharge the chemical along a harvesting path, and return to the 45-gal drum to fill the pump. The time taken to complete the whole operation will be increased by Excess Work Content and Ineffective Time. For instance, Excess Work Content may result from a heavy ground cover which requires more chemical; the pump may not function properly; the chemicals may not easily be mixed in the drum and may need agitating, or the decanting equipment may be of poor design.

Ineffective Time may result from the management not having issued correct instructions to the tractor driver placing drums at the roadside, or to the spray-pump operator. The pump may be malfunctioning, due to bad servicing, or the operator may sit down too often, may be careless and spill chemicals, or may damage the equipment through misuse.

The greatest loss of time is most clearly visible in the Ineffective Time as a result of inefficiency of management and/or the operator. The aim is to cut out all Ineffective Time and reduce the Effective Time to its Basic Work Content. Although this ideal is rarely, if ever, achieved, some improvements can always be made. (*Table 1*).

Table 1. How management techniques can reduce Excess Work Content and Ineffective Time

Excess Work Content
Process planning and research. Ensures correct selection and operation of machinery and processes.
Method study. Reduces bad layout.
Operator training. Reduces bad working methods.
Product development. Reduces design defects and excess material.
Specialization and standardization. Enables higher production processes to be used.
Market, consumer and product research. Ensures correct quality standards.
Ineffective Time
Marketing and standardization. Reduces product variety and short runs.
Product development. Reduces changes in design.
Material control. Prevents lack of raw materials.
Maintenance. Reduces breakdowns.
Improved working conditions. Enable workers to work steadily.
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There are three short-term lines of attack which can result in an immediate return without requiring much capital expenditure:

1. Improve methods of operation/work/activity.
2. Improve organization, planning and control.
3. Increase manpower effectiveness.

The assault can be launched by commencing Method Study.

METHOD STUDY

Method Study is methodical, and a basic procedure must always be followed. Simple and complex problems must be treated alike. The basic procedure consists of six steps:

1. *Select* the project/study/problem. The selection is limited by the *Terms of Reference, (i.e. where the investigation is to commence and to finish; the capital available; the duration of the study and the degree of technical limitation imposed; the availability of labour)* and these terms must be strictly adhered to.
2. *Record* the present method exactly. The whole outcome of the study depends on the accuracy of the recording. ALL relevant facts must be assembled.
3. *Examine* all the facts critically by questioning the purpose, place, person, sequence and means of the operation.
4. *Develop* a better method and define it as clearly, accurately, comprehensibly and concisely as possible.
5. *Install* the new method.
6. *Maintain* the new method and avoid drifting back to the old one by conducting constant checks.

These six steps will now be examined in more detail.

1. Selection

Before a study is commenced a decision must be made as to whether the time required for it will be justified by the potential returns. The main considerations for carrying out study feasibility are Economical, Technical and Human, and questions of the following nature should be asked:

Particulars of the work

(a) How much is produced/handled per day/week?
(b) What percentage is this of all produced and handled by the plant?
(c) How long will the work continue?
(d) Will production increase or decrease in the future?
(e) How many workers are directly or indirectly employed on the work?
(f) What sex and age of workers are required?
(g) What are the religious and ethnic states of the workers?
(h) What is the output per man per day?

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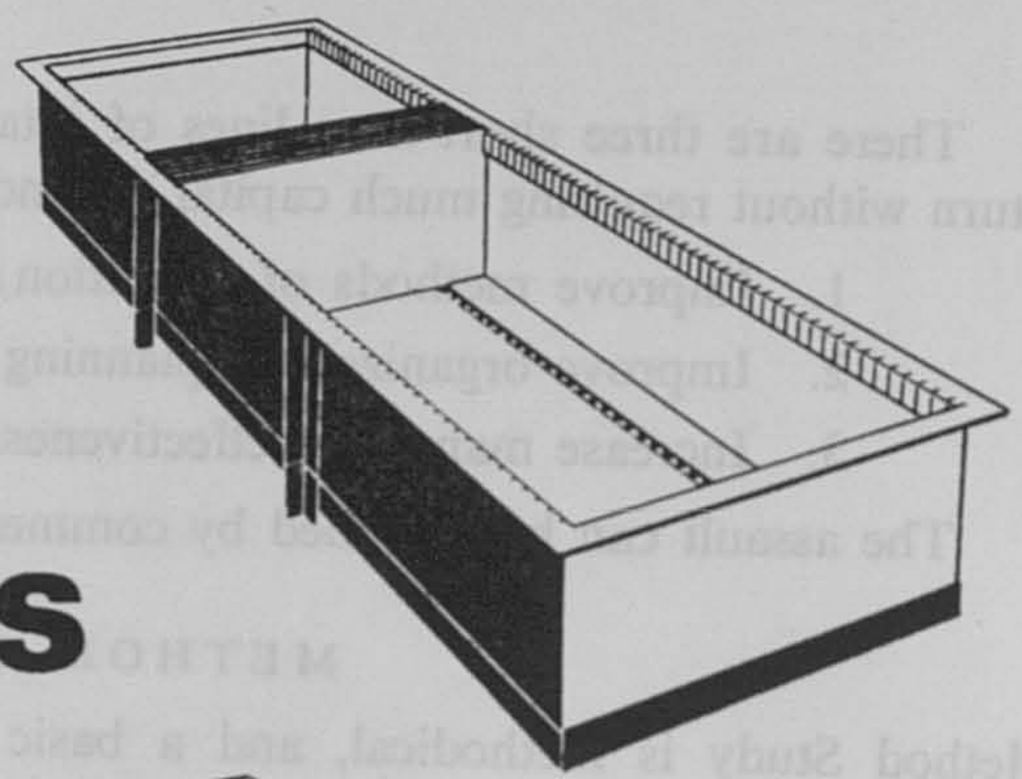

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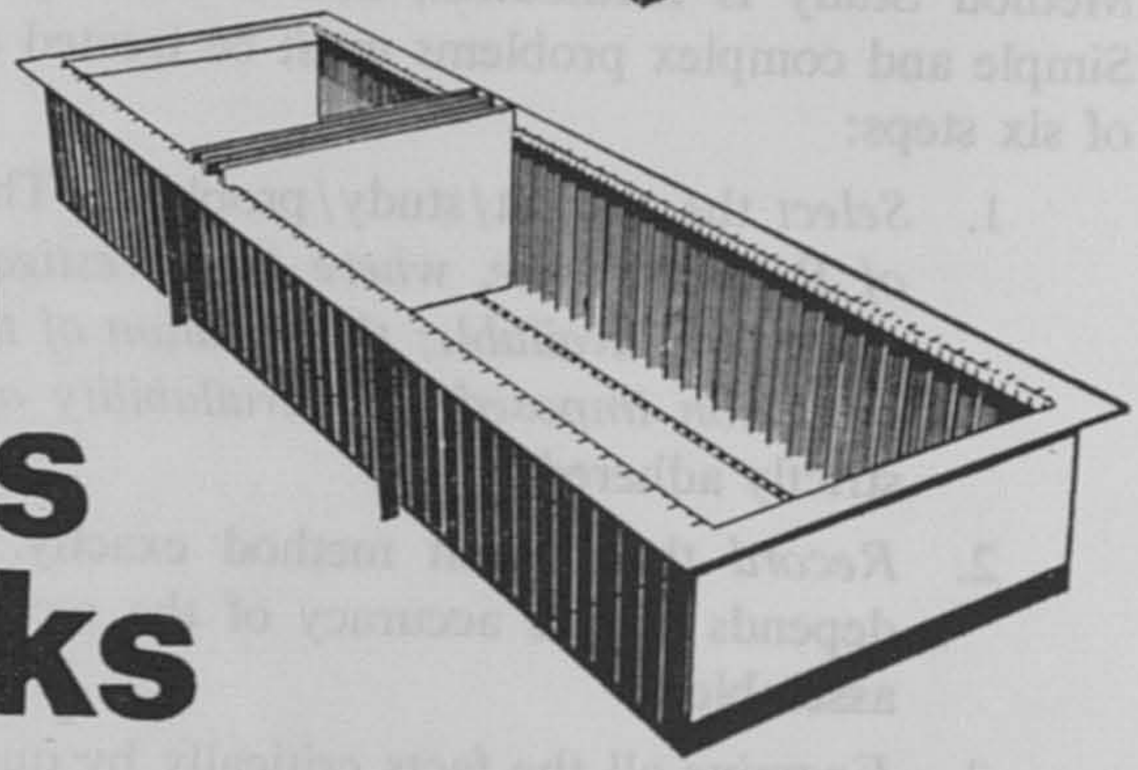

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(i) What is the output per man per day compared with output over short periods?
(j) What is the output per day of the best and worst workers?
(k) How is payment made?
(l) When was the present method introduced?
(m) Has the work any unpleasant or objectionable features?
(n) Is it unpopular?

Particulars of the equipment

(a) What is the cost of plant and equipment?
(b) What is its present efficiency?
(c) How long is it likely to remain usable?
(d) Can it be replaced?
(e) Are spare parts readily available?

Particulars of the layout

(a) Is the area well laid out?
(b) Are there adequate roads, rails, drains and bridges?
(c) What is the terrain?
(d) Is there enough space?
(e) Do area sizes need re-adjustment?

Particulars of the product

(a) What is the product?
(b) Can it be altered for easier manufacture?
(c) Can it be partially processed in the field?
(d) What is the minimum/maximum time that it should remain in the field/factory before processing?
(e) What quality standards are required?
(f) Where and how is the product inspected?
(g) Is the product seasonal?

Savings in productivity

(a) Reduction of work or process.
(b) Better machine effectiveness.
(c) Better efficiency of workers.
(d) Savings on cost of raw materials per man per acre.
(e) More efficient use of materials.
(f) Higher quality produce.
(g) Higher premium payments.

2. Recording

To enable the true effect of any improved method to be seen, the present productivity of the work should be raised to its optimum level before any recording of the present method is commenced. This avoids any confusion as to whether the improvement is due to better method or to better supervision. Thus if a copra harvester brings only 300 lb of copra per day when 400 lb is considered to be optimal on the present method, there is no point in commencing recording until 400 lb per man per day is achieved. However, if after 2 weeks the output is static recording should nevertheless be commenced.

Table 2 shows how a false impression is given by recording at sub-optimum outputs.

Table 2. Comparison of old and new output rates

Output under present method = 300 lb	Potential output (*via* increased effort and supervision) = 400 lb
Output under new method = 360 lb	Potential output of new method = 360 lb

The output from the new method is better than that from the old one, but its potential is lower.

Any means of obtaining an accurate, overall picture can be utilized as a means of recording, provided that it is consistent and will provide a comparison between pre- and post-improvement methods.

Recording techniques are of three types, but only those having application on estates will be given in detail. The nature of the work to be studied and the purpose for which the record is required, determine which recording technique is to be used.

Charts

(i) Multiple Activity (Bar) charts
(ii) Outline Process charts
(iii) Flow Process charts

Diagrams and models

(i) Flow diagrams
(ii) String diagrams
(iii) Two-dimensional models
(iv) Three-dimensional models

Photographic techniques

Multiple Activity charts

These are charts on which the activities of men and/or machines are recorded on a common time-scale to show their inter-relationships. They are useful in organizing teams of workers where expensive plant and equipment cannot be allowed to remain idle. They can also be used to determine the number of machines which a worker can handle.

An example of a Multiple Activity chart is given in *Fig. 3*, where one operator is working two sterilizers in an oil palm factory. (The shaded areas show active periods). The cycle time is governed by the length of the sterilization process, and can be reduced by cutting the actual period of 'pressure maintained' to within the 40–55 minute range at the risk of increasing the number of hard bunches—which in turn leads to waste. The idle time of the operator could be reduced by giving him another sterilizer to look after.

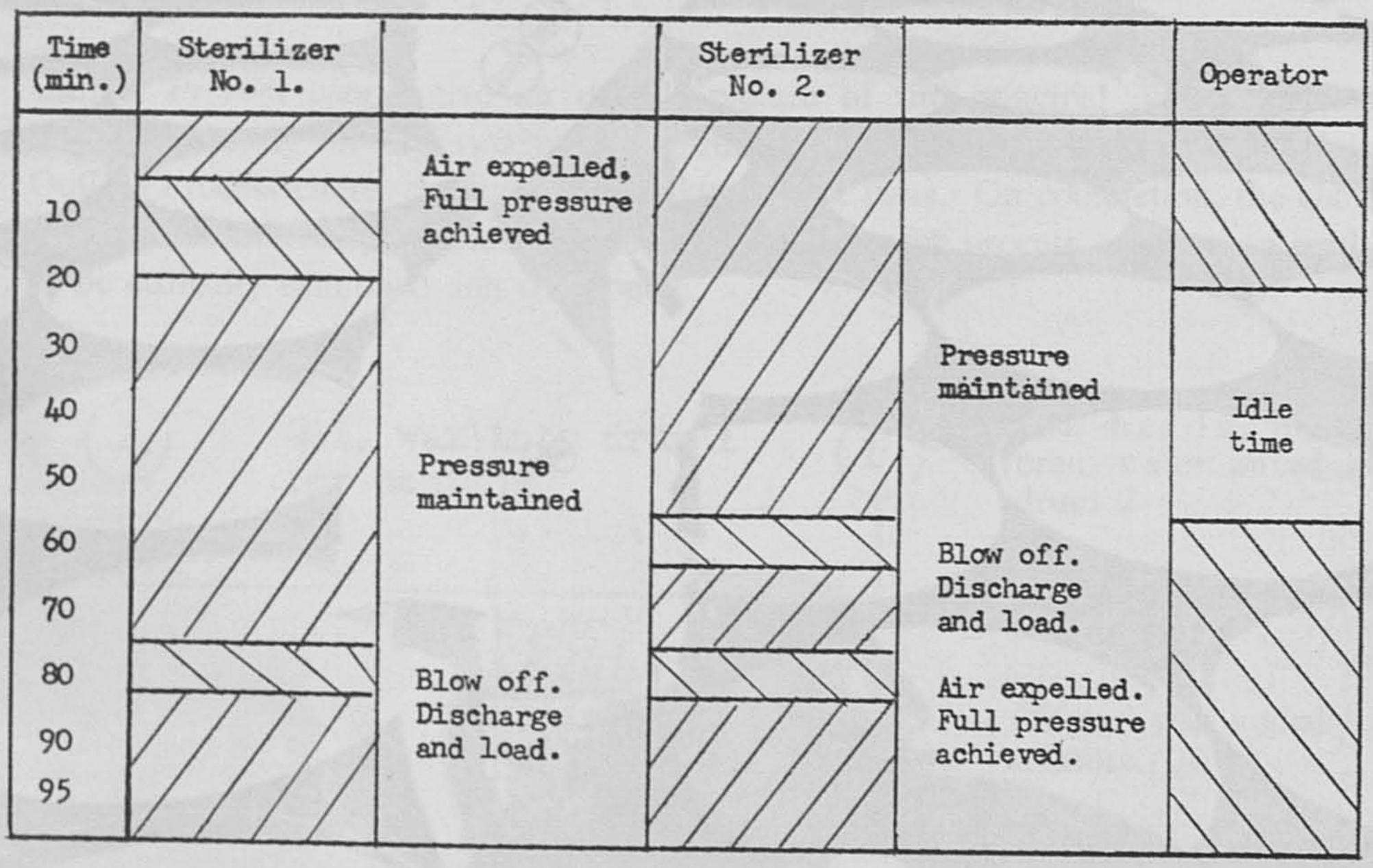

Fig. 3. Use of a Multiple Activity Chart

Outline and Flow Process charts

These two more advanced recording techniques will be described together because they make use of the following symbols, designed to simplify recording and obviate the use of words.

○ Operation. Indicates the main steps in a process, method or procedure. Usually the part, product or material is changed during the operation.

□ Inspection. Indicates an inspection for quality and/or a check for quantity.

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Transport. Indicates a movement of workers, material or equipment from place to place.

Temporary storage. Indicates a delay in the sequence of events.

Permanent storage. Indicates a controlled storage in which material is received into, or issued from a store, or retained for reference purposes.

Combined symbol of Operation and Inspection.

Outline Process charts give an overall picture of the principal operations and inspections using the first two symbols outlined above. *Fig. 4* is an example of an Outline Process chart relating to the making of rat baits. On completion, the chart must be summarized, in terms of time employed for each process, and is then ready to be critically examined and developed.

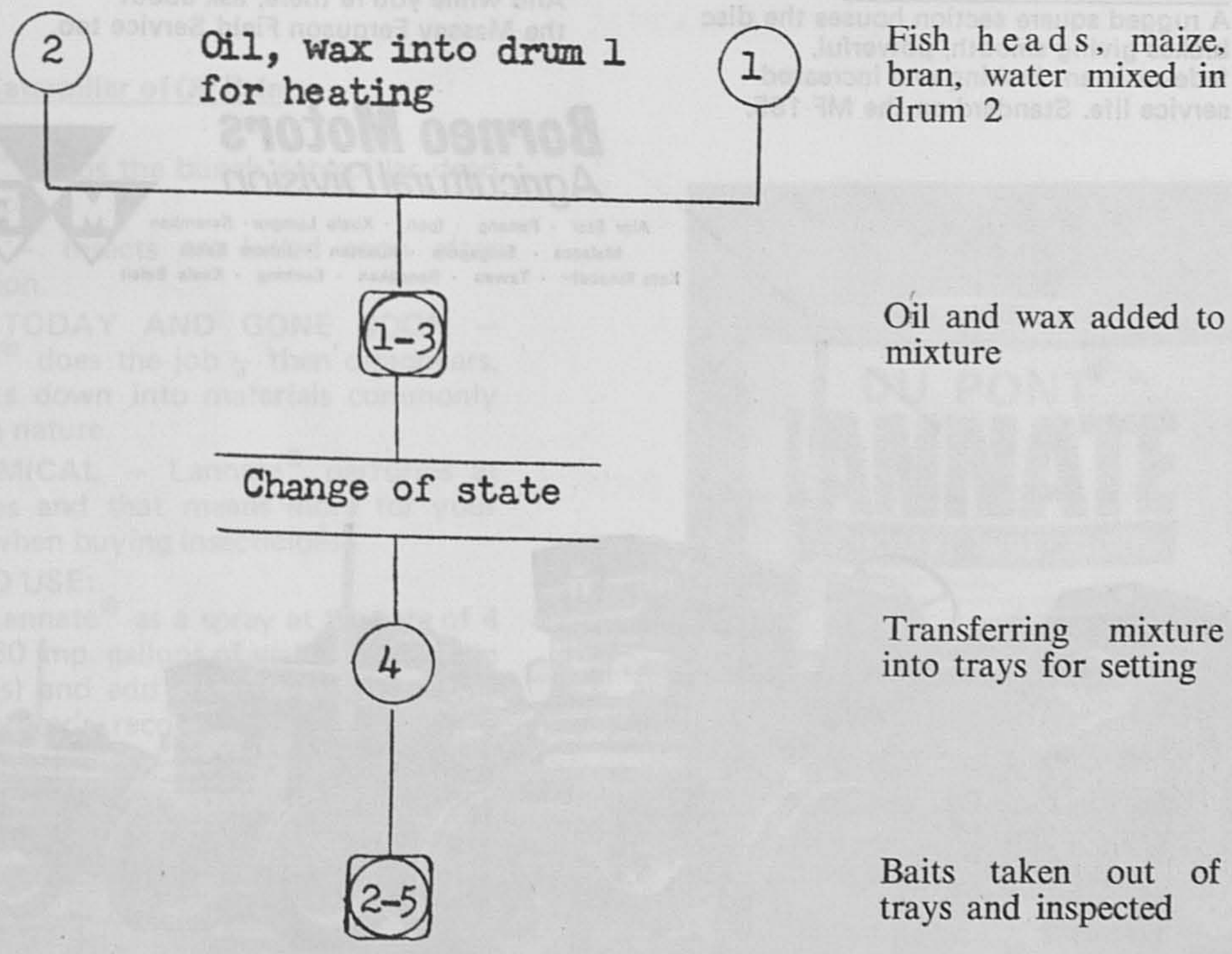

Fig. 4. An Outline Process Chart

Here's what the new Massey Ferguson tractors have for you.

Bigger horsepower

The proven, reliable Perkins diesel engines now have increased horsepower to handle jobs, at economical costs.
MF 135 — 47 hp. Maximum Torque: 131 lb/ft @ 1,300 rev/min.
MF 165 — 62 hp. Maximum Torque: 173 lb/ft @ 1,300 rev/min.
MF 185 — 75 hp. Maximum Torque: 219 lb/ft @ 1,300 rev/min.

8 speed transmission

Now standard on all models is the gearbox with 8 forward and 2 reverse speeds, carefully selected for greater versatility in varying operating conditions.

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Stronger heavy duty lower links and top links are interchangeable to suit Category I or II implements on both the MF 165 and MF 185.

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A rugged square section houses the disc brakes giving smooth, powerful, fade-resistant braking and increased service life. Standard on the MF 185.

Exclusive pressure control hydraulics

Massey Ferguson's most advanced Pressure Control Hydraulic system is now standard on all models. The system increases power output, gives better braking, extends work capacity up to 40% and reduces wheel slip at the touch of a lever.

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The new heavy duty, dual element, dry air cleaner has a 3 stage filtration technique which gives longer engine life.

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ECONOMICAL – Lannate® performs at low rates and that means more for your money when buying insecticides.

HOW TO USE:

Apply Lannate® as a spray at the rate of 4 oz. per 80 imp. gallons of water (6 grams in 4 gallons) and add a wetting agent at the manufacturer's recommended rate. Use a conical nozzle and adjust the spray until coarse. Use a high pressure to obtain good penetration into the bunches and spray to run-off.

WHEN TO APPLY:

Begin application when the first signs of insect attack are apparent on the bunches. Repeat at 14 day intervals as long as needed.

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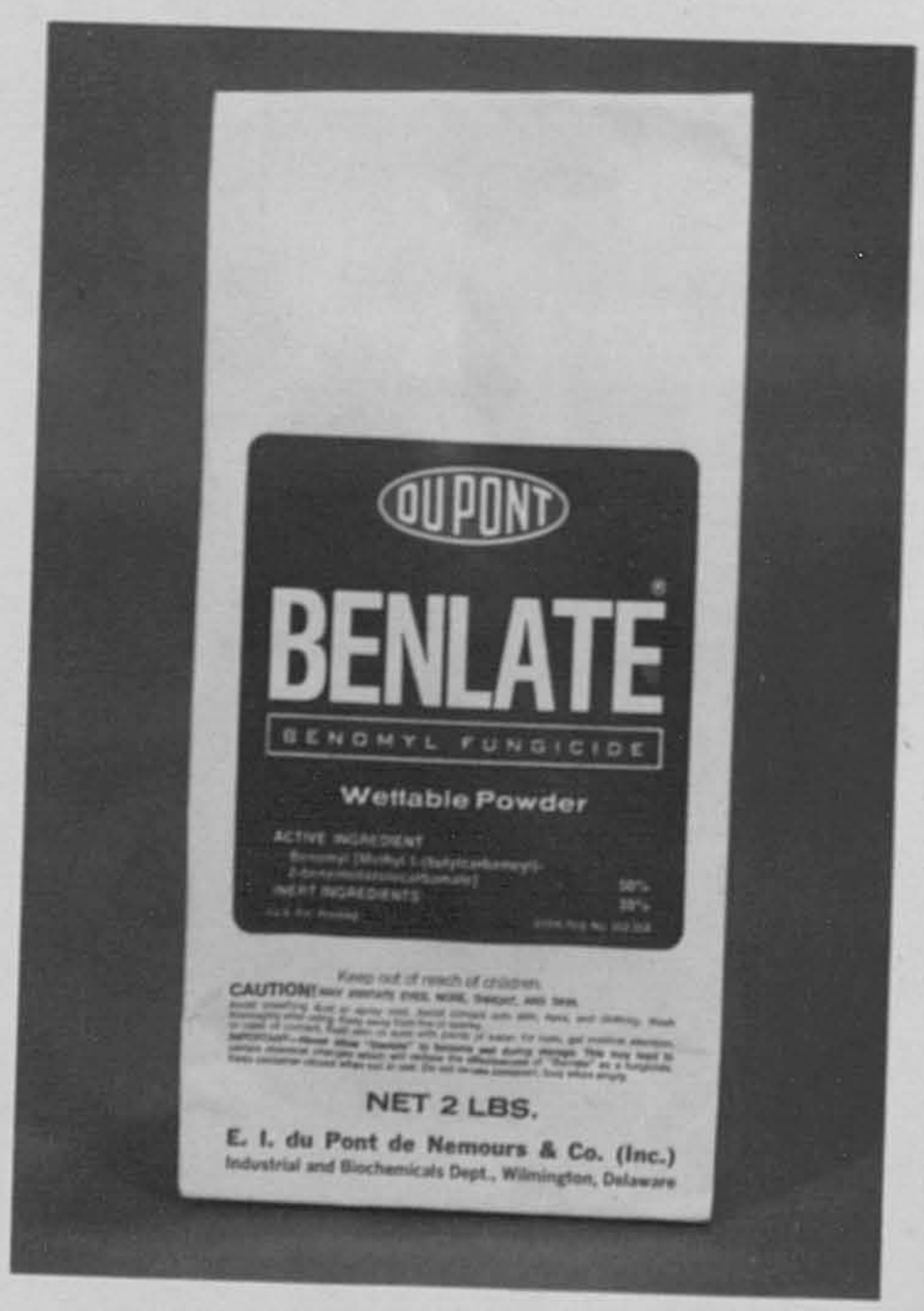
BENLATE®

BENOMYL FUNGICIDE



Mouldy Rot of Rubber.

Du Pont Benlate® Benomyl Fungicide is recommended for the control of Mouldy Rot (Ceratocystis fimbriata) on rubber tree tapping panels.

HOW TO APPLY:

Apply Benlate® at 8 oz. per 80 Imperial gallons of water (6 grams in 2 gallons) either as a spray with a flat fan nozzle or with a brush at 4" above and 2" below the tapping panel.

WHEN TO APPLY:

Begin application when disease first appears on the tapping panel and repeat treatment at 7 day intervals as long as needed. Spot treatment may be necessary in case of re-infection.

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Flow Process charts are extended Outline Process charts which set out the sequence of flow of a procedure or product. *Fig. 5* gives two examples of Flow Process charts, one for manual operations, the other involving equipment.

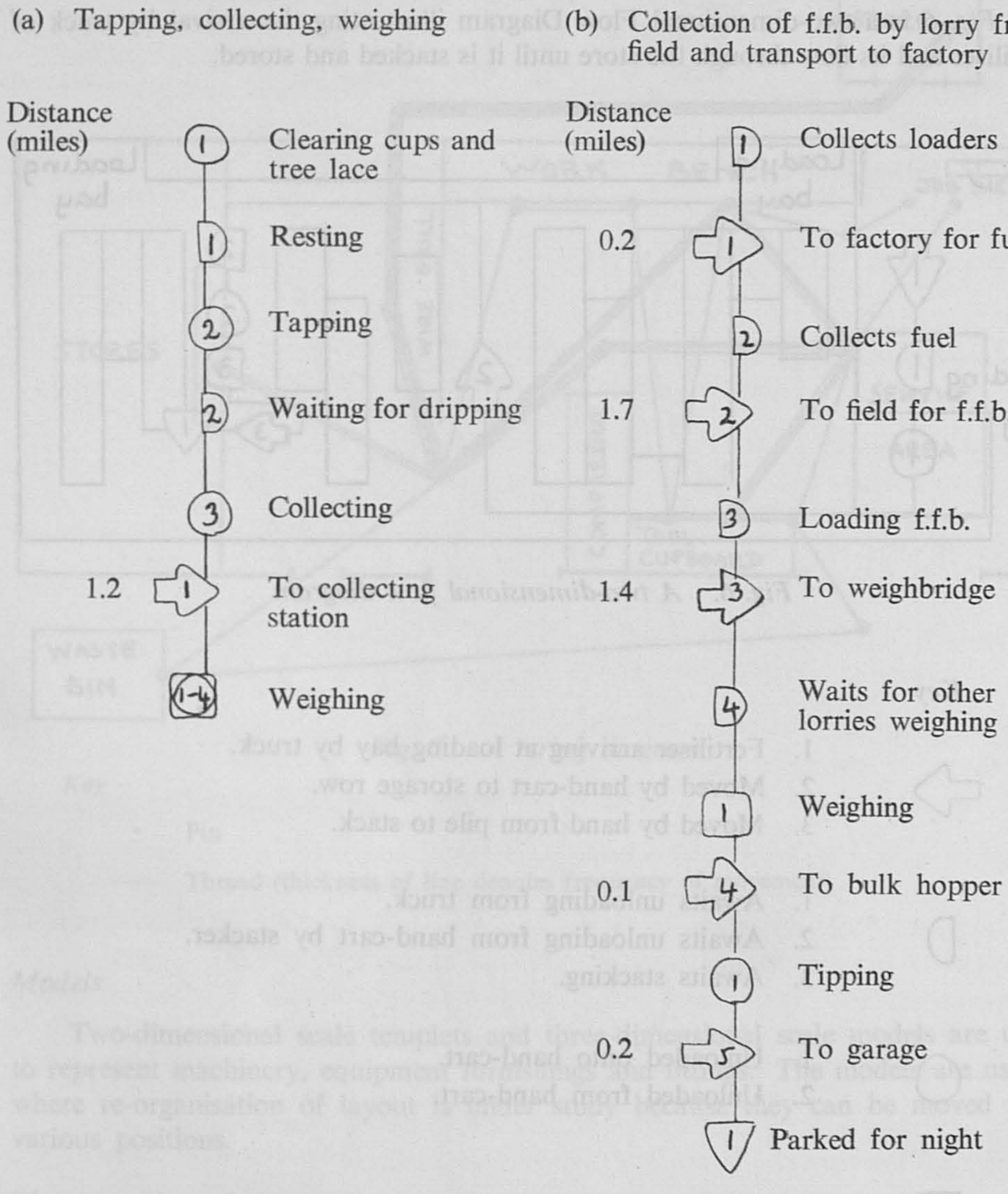

Fig. 5. Two Flow Process Charts

The aim of a Flow Process chart is to reduce transportation, storage and delay as much as possible. Although Process charts show the sequence of events, they do not show the actual paths of movement, for which Flow Diagrams are needed.

Flow Diagrams

These are scale diagrams showing the location of specific activities and the routes followed by men, materials and equipment.

Fig. 6 is a two-dimensional Flow Diagram illustrating the arrival by truck of fertiliser and its flow through the store until it is stacked and stored.

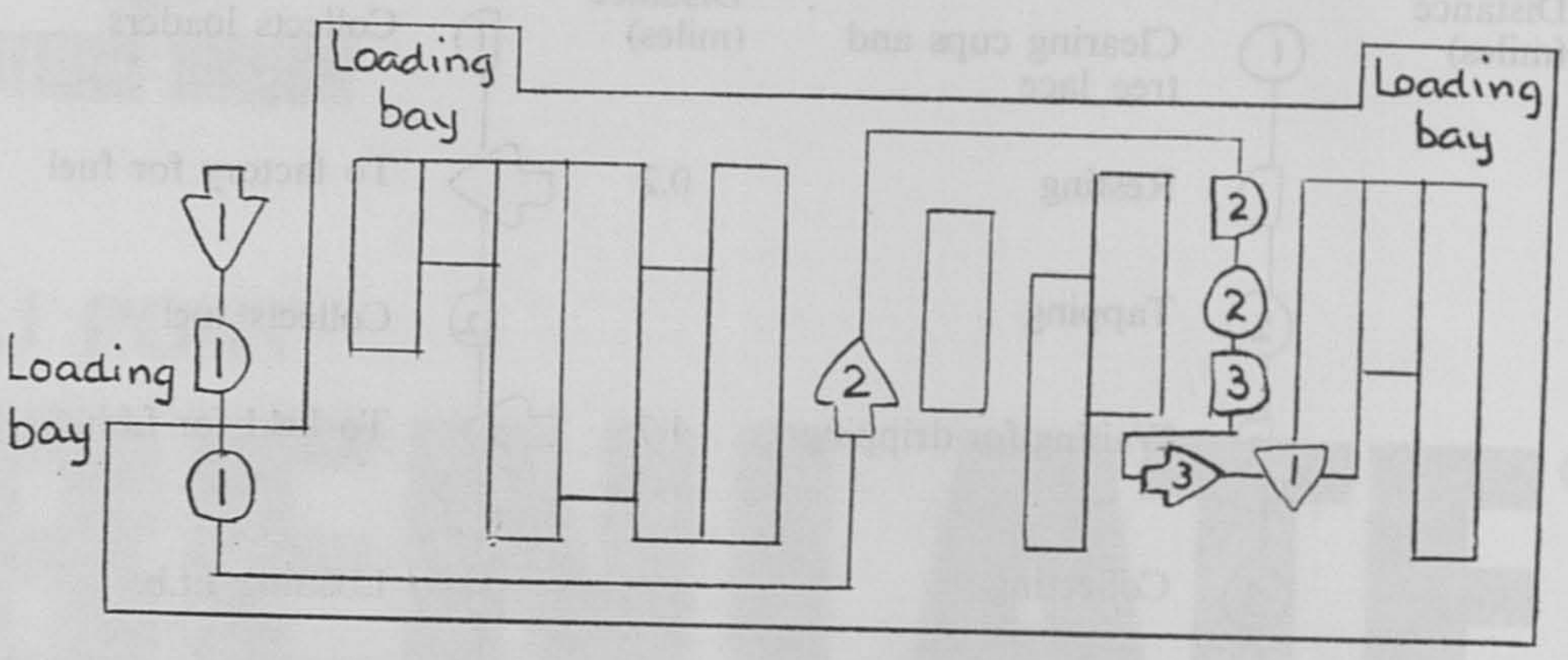

Fig. 6. A two-dimensional flow diagram

Key

1. Fertiliser arriving at loading bay by truck.
2. Moved by hand-cart to storage row.
3. Moved by hand from pile to stack.

1. Awaits unloading from truck.
2. Awaits unloading from hand-cart by stacker.
3. Awaits stacking.

1. Unloaded onto hand-cart.
2. Unloaded from hand-cart.

1. Stacked and entry made on inventory.

String Diagrams

These are scale diagrams with the paths of movements indicated with coloured thread. The diagrams are useful for showing volumes of movement, bottlenecks and routes of irregular journeys. By measuring the length of the thread, the distance moved can be measured.

Fig. 7 illustrates a string diagram of the movements performed by a mechanic changing the oil and filter of a truck in a workshop.

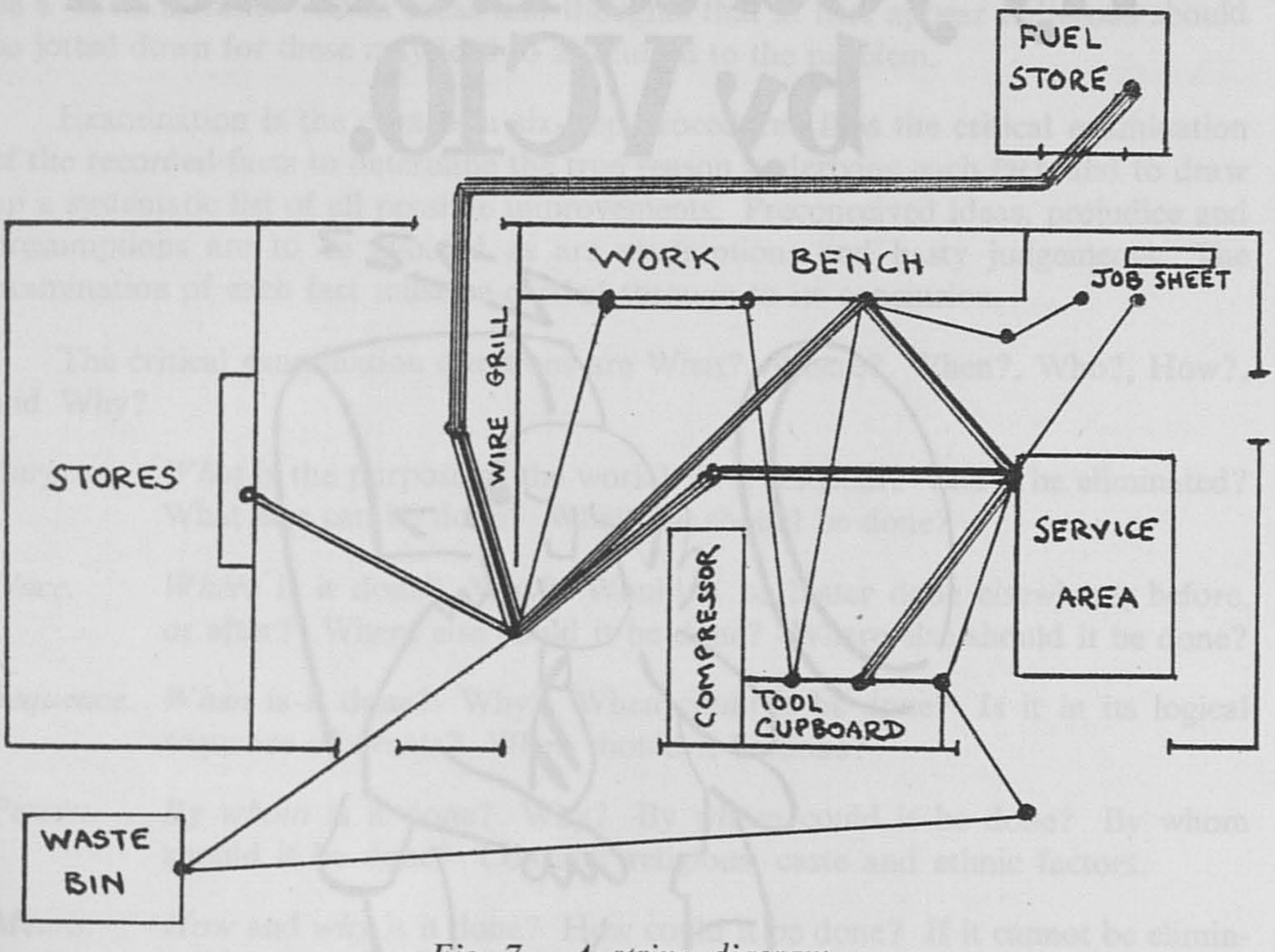

Fig. 7. A string diagram

Key

• Pin

—— Thread (thickness of line denotes frequency of movement)

Models

Two-dimensional scale templets and three-dimensional scale models are used to represent machinery, equipment furnishings and fittings. The models are useful where re-organisation of layout is under study because they can be moved into various positions.

Photographic techniques

Whether the picture is still or in motion it will supply a wealth of information that would otherwise require many words of description. Pictures are very useful for comparing 'before and after' situations, especially in small areas such as benches and stores.

After deciding which recording technique or techniques will provide the most details of what is required, the present method is recorded. After this, all the relevant facts can be critically examined and an improved method designed.

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3. **Examine**

Without creative thought the whole exercise of Work Study on a problem would be a waste of time.* Even ideas and thoughts that at first appear ludicrous should be jotted down for these may lead to a solution to the problem.

Examination is the crux of a six-step procedure. It is the critical examination of the recorded facts to determine the true reason underlying each fact, and to draw up a systematic list of all possible improvements. Preconceived ideas, prejudice and presumptions are to be avoided as are assumptions and hasty judgements. The examination of each fact must be carried through to its conclusion.

The critical examination questions are What?, Where?, When?, Who?, How?, and Why?

Purpose. *What* is the purpose of the work? Is it essential? Can it be eliminated? What else can be done? What else should be done?

Place. *Where* is it done? Why? Would it be better done elsewhere; before, or after? Where else could it be done? Where else should it be done?

Sequence. *When* is it done? Why? When could it be done? Is it in its logical sequence of events? When should it be done?

Person. *By whom* is it done? Why? By whom could it be done? By whom should it be done? Consider religious, caste and ethnic factors.

Means. *How* and *why* is it done? How could it be done? If it cannot be eliminated can it be simplified? How many other ways can it be done? Consider them all and select the best.

Questions should be asked concerning *plant and equipment:* Is a machine essential? Is it the best machine for the job? Is it in good working order? Is it in the best position? Is the machine linked efficiently with the operator? Can holding devices be used? Can gravity aids help? Will cheaper materials be more satisfactory for the purpose? Will a change of material give a longer life? Can the objective be achieved by using less material? Can the waste material be used elsewhere or be recovered? Is the method safe? Does it conform to safety regulations?

Thus a comprehensive account of what is actually done now, what could be done, and what should be done in future, is built up. Having carried out the critical examination to its conclusion, the next step is to develop an improved method.

4. **Develop**

When developing a new method, only those parts of the present method that the critical examination has shown to be essential are retained. By applying four basic principles of improvement, *viz* eliminate, re-arrange, combine and simplify to those essential parts and to ideas generated during the examination, an improved

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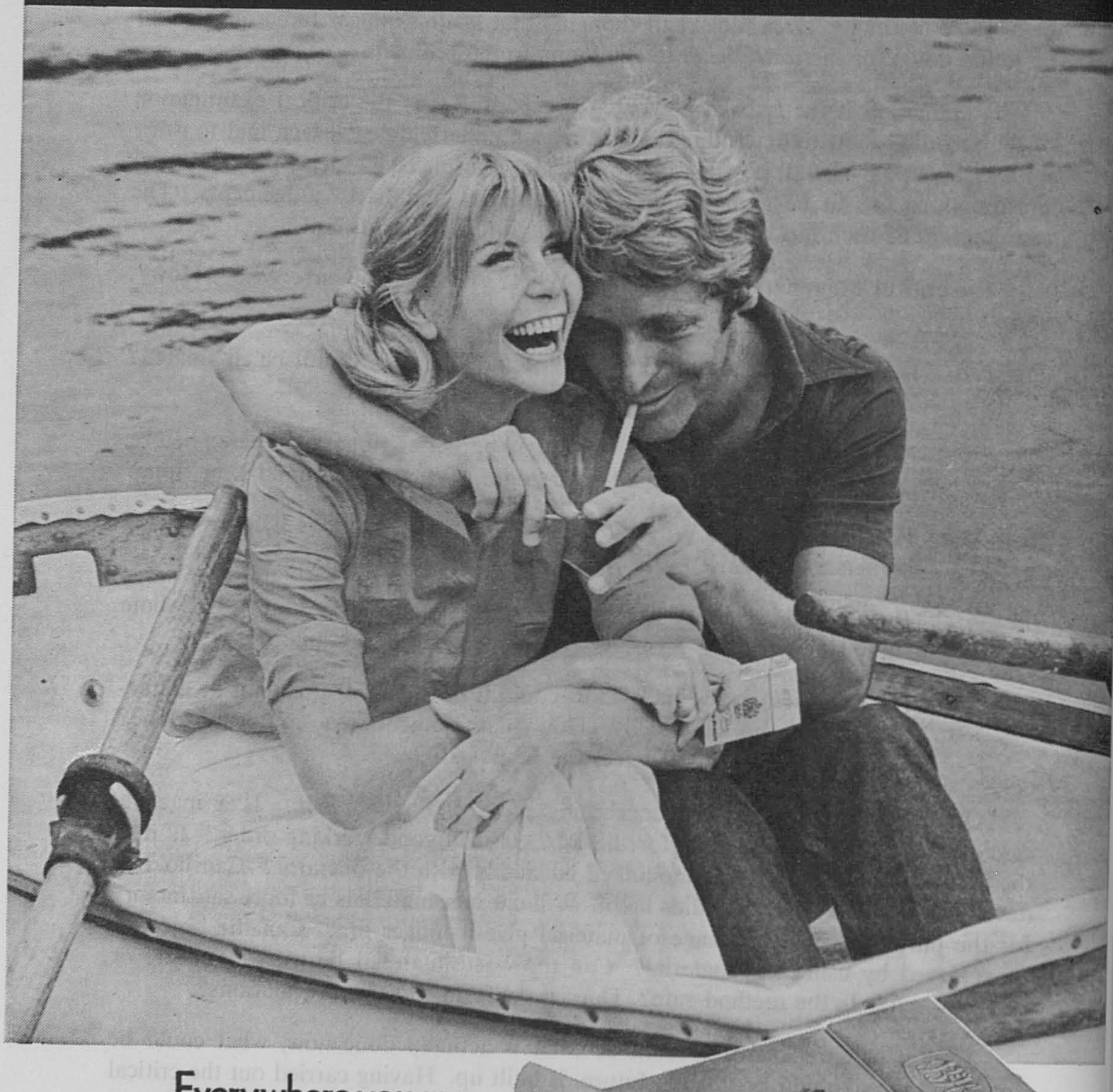
* Further reading may be of interest: 'The Psychology of Thinking' by R. Thomson; 'The 5-day Course in Thinking' and 'Practical Thinking' by Edward de Bono.

See what's happening in the world



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method can be designed. For example, by applying the basic principles to material flow and position of equipment in the layout, much of the movement of material can be eliminated. Movement that cannot be eliminated may be combined with the process itself or may be simplified by the use of mechanical handling devices such as pallets, trucks, nets, boxes, etc.

The human factor must be given serious consideration, especially in diverse and polyglot societies such as those found in Malaysia and Singapore, where racial, religious, and caste factors weigh heavily in human relations as a whole. Also, it must be remembered that the person conducting a study is not running a one-man-show. Help from seniors, associates, subordinates and workers must be sought at this development stage, just as at other stages.

The improved method must be subjected to a critical examination as was the old method before it; thus the pre- and post-improvement methods are given the same scrutiny, thus providing a consistent comparison of the two methods. If the new method stands up to the scrutiny of the critical examination, the next step in the procedure is to install it.

It is recommended that a full report be made of the whole method study. This provides a permanent record for future reference, as well as being a necessity if the study has to be passed to higher management levels. A good report might make the difference between acceptance or rejection of a new method by senior management.

Report writing and presentation of a statistical information will be covered in a separate article. (As most studies carried out on estates might only involve the manager and his assistant, comprehensive reports are not vital. However, where study information has to be passed to higher levels, it is imperative that clear, accurate, comprehensive and concise reports are presented).

5. Install

The installation of a new method is time-consuming and requires patience, tact and diplomacy. It can be considered the most important step in the whole procedure. Care should be taken to ensure a smooth introduction, and major changes should be made over weekends or during holiday periods. Trial runs may be necessary to familiarise the labour force with the new system prior to its full implementation. During the installation it is important to maintain supervision at maximum levels to ensure that the workers follow the new method correctly and become fully conversant with it.

All layouts should be checked in detail and the necessary tools and equipment provided. Old stocks should be run down and new ones built up. The availability and continuity of supplies should be checked, and any additional clerical records that may be required for the purpose of control or comparison should be set up. The workers for the new method should be chosen with care, the necessary training provided and likely wage and payment problems anticipated.

A rehearsal is often beneficial and should take place while the old method is still in operation—outside working hours if necessary. The first few days of operating the new method are crucial and require intimate supervision.

If the new method does not turn out as well as anticipated, the operating instructions must be modified accordingly. A close watch should be kept for any prejudice against the method by the workers. Weak links should be improved by extra training. It may be necessary to replace unsuitable personnel, or to increase temporarily the labour allotted to parts of the method.

Tact and diplomacy are required throughout the installation period.

6. **Maintain**

It is essential that the correct method of working is maintained. Malpractices and drifts back to the former method can be avoided by having frequent checks to see that the new method is being followed. When alterations, additions and improvements are made, the new method should be reviewed at intervals to make allowance for the changes, and a watch should be kept for changes in output, attitudes and relationships.

To avoid any confusion concerning the correct method, Work Specifications and Method of Work sheets should be made out so that management and labour can refer to them. These specifications should consist of details of the duty of the worker, and the supervision employed; any assistance given to the worker, *i.e.* indirect labour; the quality standards required, and any clerical procedures necessary.

To obtain an insight into work specifications the reader is recommended to refer to Chapter 10 and Appendix 2 of Bevan & Gray's *The Organisation and Control of Field Practice for Large Scale Oil Palm Plantings in Malaysia* (published by the ISP).

In the preceding pages no attempt has been made to offer solutions to problems. Each problem is unique, and guidelines only can be given as to how it can be tackled. Once a new and better method has been installed it is not the time to sit back and relax: a still better method should be sought.

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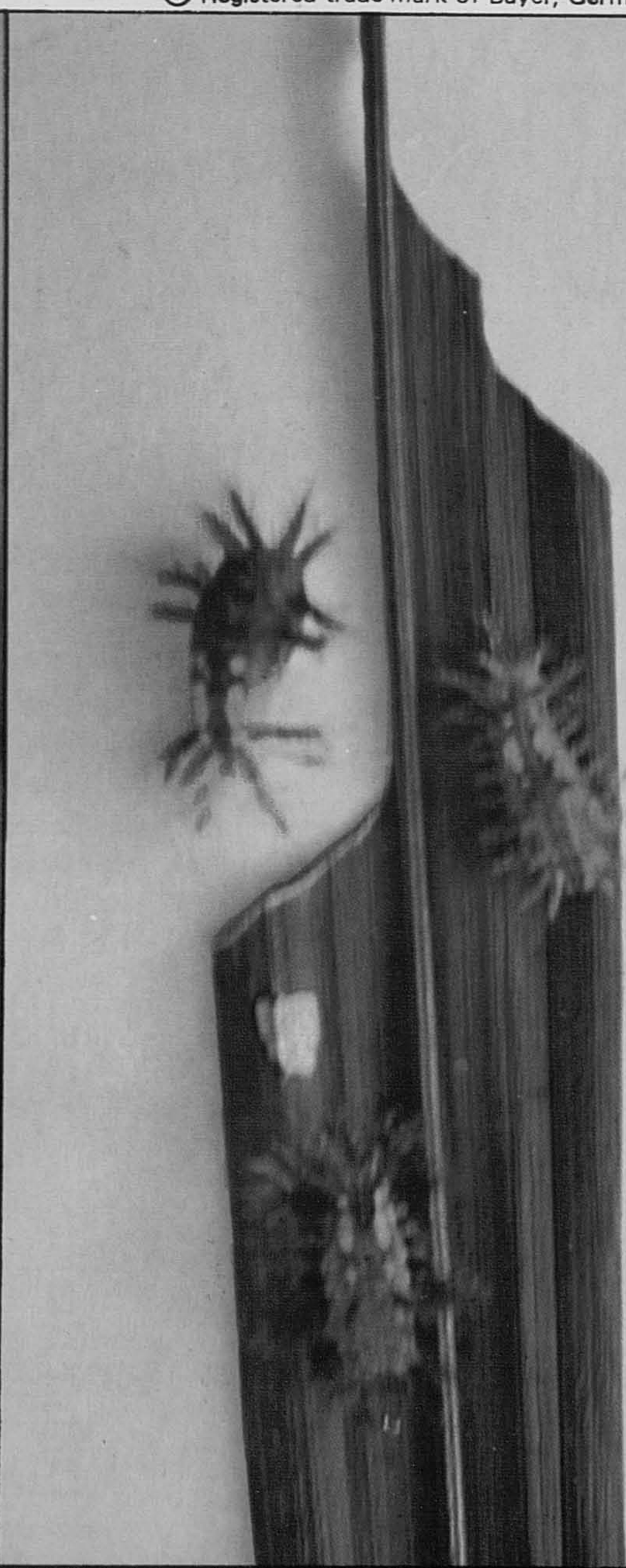
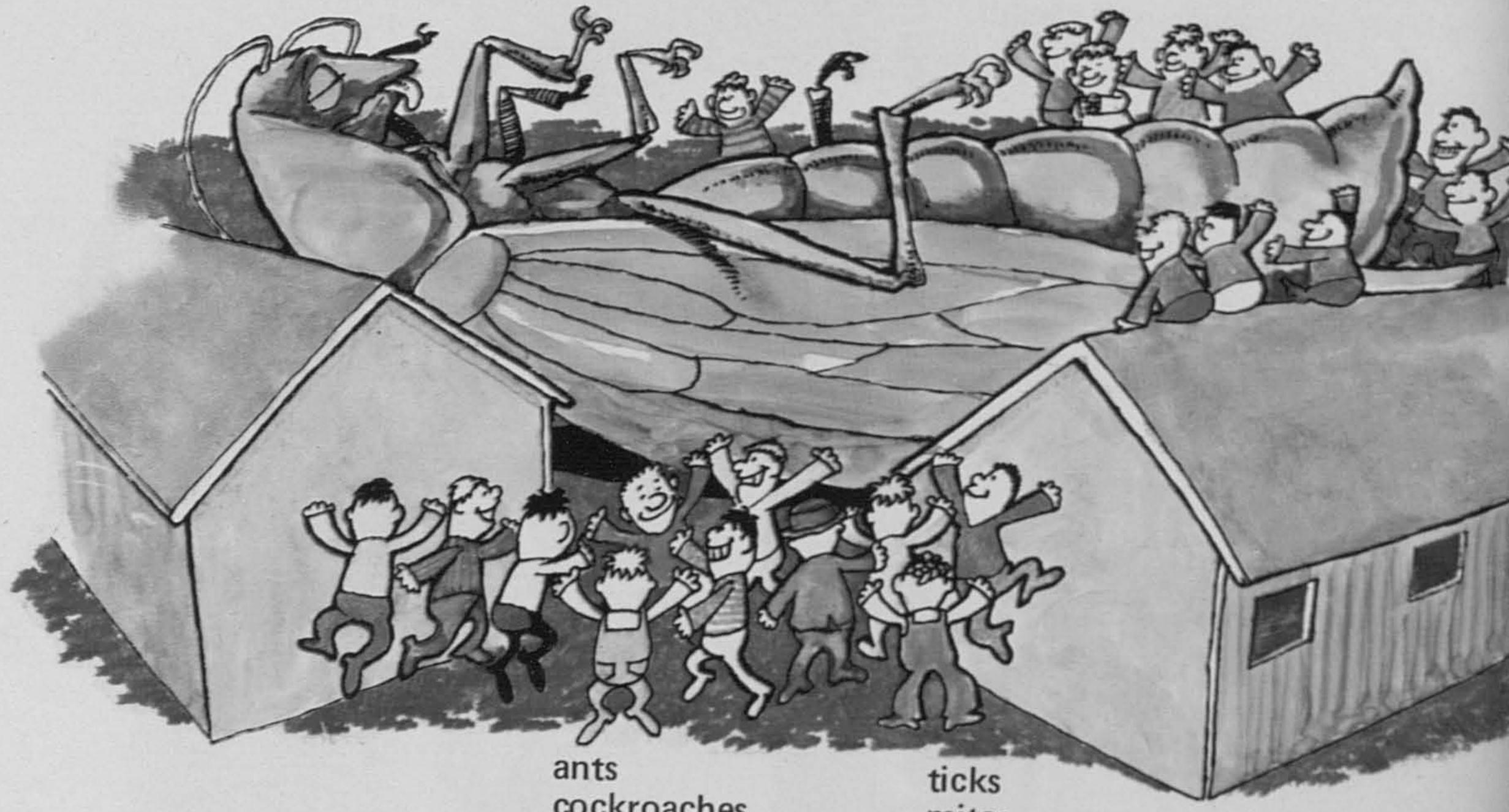


The end of the line for these pests



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Conservation in Malaysia

P. R. WYCHERLEY

PART FOUR — AGRICULTURE (2)

Insecticides

Insects and other arthropods, such as mites and ticks, are harmful to mankind and his domesticated animals in three main ways, as pests of crops, thus competing for food, as parasites especially blood suckers and as vectors or carriers of diseases. Insects also destroy timber and *atap* thatching materials. Some insects and other arthropods such as spiders, scorpions and centipedes can inflict painful stings, which are seldom fatal except when someone is unfortunate enough to get multiple stings from wasps or hornets. Such venomous invertebrates or their nests are usually destroyed individually, they are not controlled by regular chemical applications and do not pose the kind of problem discussed here, which is the routine or extensive use of insecticides under rural conditions for agricultural or medical purposes.

Malaysia is fortunate that sleeping sickness and yellow fever do not occur here, although the mosquito which transmits yellow fever is common, which is why it is important that anyone suffering from yellow fever should be kept out of South-east Asia. Bubonic plague, carried by rats and transferred from them to humans by fleas, has troubled many countries at one time or another, it is still a terrible shadow which may fall across Asia. Typhus is transmitted by lice and ticks. Flies carry enteritis from faeces to food. Mosquitoes transmit the painful but seldom fatal dengue, the disfiguring and weakening filariasis or elephantiasis in East Malaya and the arbor viral encephalitides beginning to cause concern.

Although there was a heavier incidence of malaria during wartime conditions and occupation, it is difficult for many to realise the terrible effects of endemic and epidemic malaria 70 years ago on the Selangor coast. The victims were anaemic, the children were unable to concentrate on their lessons or enjoy their games, the men were unable to work hard and get a good living for their families, the women bore few children alive. The under-nourished died. In rural areas before malaria eradication began to take effect, an insidious intermediate condition prevailed which sapped the energy of the village people, who as a result were said to be lazy and their children stupid. Although the use of insecticides in malarial eradicant campaigns has had undesirable side-effects in certain cases, it is essential to realise what a great benefit freedom from malaria is for the progress, health and happiness of the rural people.

It is difficult to get the maximum yields from certain short rotation crops without the use of insecticides, for instance from the protein rich soya bean or from maize, which is an important constituent in cattle and poultry feed, and so an indirect source of high grade protein. Owing to the short period of growth to harvest there is some risk of harmful residues being consumed by humans or the animal intermediaries under these conditions of intensive usage. Plantation crops on the other

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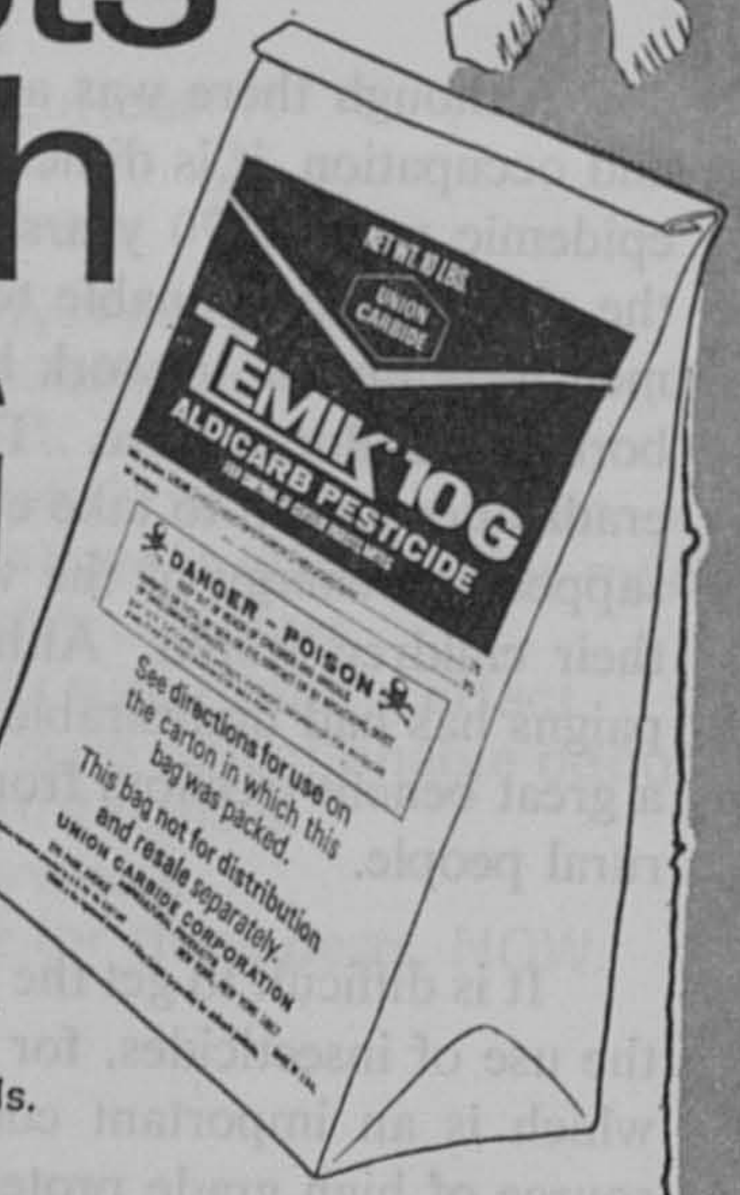

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hand present possible occasion for extensive usage and upset of conditions over a wide area.

The natural means of pest control and the various roles of insects as a whole must be reviewed before considering the action, benefits and risks of the various groups of insecticides. The effect, if any, of the vast majority of insects on human life is unknown. The harmful insects constitute a very small yet important minority among the group as a whole. There are perhaps somewhat more beneficial than harmful insects. Some insects pollinate fruit trees and many vegetables, especially the protein rich beans. Other insects provide the natural controls of pests, many are involved in processes of decay and re-circulation of nutrients. The two main types of biological control of pests effected by insects are through predation and parasitism.

Predators

These are the animals which prey on other animals, kill and eat them. Mosquito larvae are eaten by small fish and a wide range of freshwater invertebrates, this may not establish absolute control but it does reduce the number of larvae considerably. These natural predators are seldom able to operate in man-made mosquito breeding niches such as empty cans and jars. Adult flying mosquitoes are eaten by a wide variety of larger insects, spiders, birds, toads, lizards and bats, but again this is not absolute control.

Insect-eating birds consume both larvae, such as caterpillars, and adult insects in large quantities, especially when the rapidly growing nestlings must be fed. Many animals of different orders eat insects. Other insects are by no means the least important predators of pests. Among the better known in Malaysia are the Praying Mantis, which remains motionless until its prey wanders within its grasp, and the Ant-lion larvae which make traps in sandy soil. Others which do not move far in search of their prey are the larvae of the Hover-flies and Lacewings, also both larvae and adults of some Ladybirds and Thrips. One species of Ladybird and some Thrips are pests of crop plants, attempts at their control may kill off their beneficial cousins.

Dragonflies hunt down their prey on the wing, while various ants, beetles and assassin-bugs are predators on the ground. The wasps hunt other insects and spiders to feed to their young larvae. A few solitary wasps and all the social wasps and hornets carry food to their young larvae and feed them regularly. 'Social' means living together, these are the wasps and hornets which live in colonies and build large nests. The solitary wasps live alone (except for mating), and make a nest, stock it with caterpillars and similar live food, which has been paralysed by the wasp's sting, lay their eggs (sometimes directly on the host) and seal the nest. When the larvae emerge they feed on the living store of food. These are sometimes called parasitoids, because although the adults are hunters, they do not immediately kill their victims, which are parasitised by the larvae. As noted in the following section, parasitoids form a large proportion of insect parasites of insects in Malaysia.

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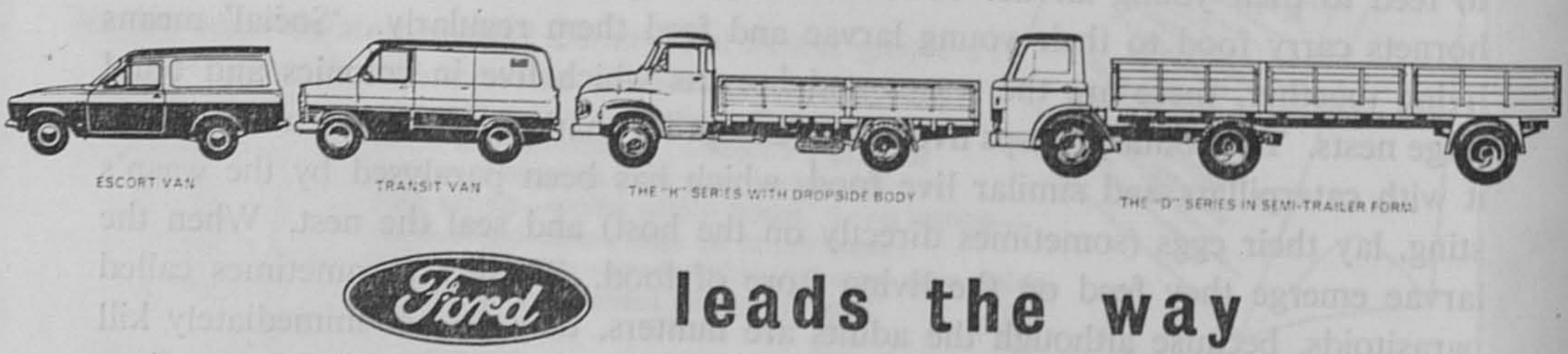

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Parasites

Insects, including mosquitoes, are subject to many diseases caused by other organisms, including bacteria, fungi and nematodes, which parasitise them. The majority of the insect parasites of other insects are laid as eggs in the eggs, larvae, pupae or nymphs of their hosts. The eggs of the parasites hatch and their larvae feed on their host until they eventually kill it, sometimes pupating within the pupa of the host. The adults are usually free-living and the females often roam far to find hosts for their eggs.

In Malaysia the scale insects and mealy bugs are often parasitised by small wasps. The grubs of cockchafers, which feed on the roots of many crop plants, are parasitised by digger wasps, which dig down into the soil to find the grubs, and by the maggots of parasitic flies emerging from eggs laid in the soil near the cockchafer grubs. Some other cases will be considered under the effects of contact insecticides.

Classification of insecticides

Insecticides may be classified by their mode of action. The stomach poisons are those which are ingested by biting insects as they consume the sprayed plants. Contact insecticides are those which penetrate the insect's body when it touches a solution, suspension or deposit of the poison. Systemic insecticides are absorbed by the plant so that sap sucking pests are poisoned. Fumigants are insecticides whose vapours kill the insects which breathe them, they are most effective in enclosed spaces such as stores, greenhouses, the soil or within enclosed leaf bases. Some insecticides have more than one kind of action.

Insecticides may be classified according to their chemical composition, or according to the pests they are intended to control, but these classifications often coincide with the mode of action classification. Other important considerations are the toxicity of insecticides to vertebrates, including fish, birds, mammals and man himself, and the persistence of this toxicity either on the plant or in the soil.

Inorganic insecticides

Most of these have been known for many years. Sulphur is used mainly against mites; it is not very effective, but since it has so little effect on other forms of life, it helps to tip the balance to bring the mites under natural control. Lime-sulphur has not been much used in Malaysia.

Termites used to be controlled by putting white arsenic in the runs and treating the attacked plants with dilute corrosive sublimite (mercuric chloride). These substances are both very toxic and dangerous. They are no longer used for this purpose.

Lead arsenate is a stomach poison of both insects and mammals, but it has relatively little contact effect. Lead arsenate is still the most satisfactory selective insecticide, when it is necessary to kill leaf-eating pests without harm to predators and parasites alighting on the foliage. Animals eating sprayed foliage or people handling it carelessly are in danger, stomach poison insecticides without contact effect but of low mammalian toxicity are much needed.

Fluorine and copper-based insecticides have been little used in Malaysia. Infrequently copper aceto-arsenite has been used in malarial control. Fluorine compounds are very hazardous. Some substances are on the borderline between the inorganic and organic compounds. The most dangerous is cyanide gas, but it is seldom used except for fumigation under strict control. At the other end of the scale soap and mineral oils, such as kerosene, are virtually harmless to vertebrates. Kerosene-soap emulsions suffocate scale insects, mealy bugs, lac insects and to a lesser extent aphids without any appreciable harm to beneficial insects. Often one round of spraying with emulsion will enable the natural enemies of these pests to re-establish control.

Oil has long been used spread in a thin film, one thousandth of an inch thick, over water to stop the breeding of anopheline mosquitoes, which transmit malaria. The females are discouraged from laying and the respiratory tubes of the larvae are unable to support them at the surface with lowered tension. Unfortunately this is a relatively expensive method where there is a fast flow of water. There is no definite evidence of damage to fish, birds or mammals from this practice, although it has been widespread for many years.

Vegetable extracts

Nicotine is a contact and stomach poison as well as a fumigant. It is not persistent but it is very dangerous to man and animals while its action lasts. It is not used much in Malaysia.

Rotenone is the active ingredient in the roots of *Derris elliptica* or *tuba* as it is called in Malay. The ground *tuba* root or derris powder stupefies fish if it is put into a river or pond and if the concentration is too great the fish are killed. Fishing by means of *tuba* is a royal prerogative in most Malay States. Despite the sensitivity of fish to derris, birds and animals have to consume very large quantities before they suffer any serious ill effects. Pure rotenone is much more poisonous, but the normal preparation of the ground root involves a manifold dilution factor.

Derris is a contact insecticide, but it does not persist. It is applied as a dust or as an emulsion. Repeated use on a plantation scale might harm beneficial insects and stupefy or kill fish in streams, although most of it would be broken down in the soil before reaching streams. Derris probably has a potential use on many short term crops, especially market garden vegetables, for which an insecticide of low persistence and toxicity to humans is needed. Unfortunately derris has been almost driven off the market by the synthetic insecticides. There is a case to re-investigate derris and perhaps to revive its cultivation in Malaysia, both to save foreign exchange and to provide this and other countries with a safe insecticide.

Pyrethrum is obtained from a plant in the Daisy or Sunflower Family. It is a relatively expensive material and cultivated in the rather drier tropics. A small amount knocks down or paralyses flying insects, a slightly higher dose kills them. Pure pyrethrum is only marginally poisonous to man and warm-blooded animals, accidental poisoning is unlikely. It is not persistent, but breaks down in sunlight

or in contact with the air or soil. As with all contact insecticides there is some risk to beneficial insects, but if cheap enough it could have application in market gardening. Unfortunately due to the cost, more persistent synthetic insecticides such as DDT are often added to effect kill after knock down by the pyrethrum. The main usage of pyrethrum in Malaysia at present is in aerosols for domestic control of flies, mosquitoes and cockroaches.

The chlorinated hydrocarbons

The first of these was DDT, first used in Malaysia to deal with the vectors of human diseases, lice and mosquitoes after the war. It later found agricultural applications. The toxicity of DDT when eaten by mammals is moderate, about half an ounce or more would kill a man. It is much more persistent than the contact insecticides of vegetable origin discussed in the previous section. This persistence occurs on plants, in the soil and in animals.

DDT is still the preferred insecticide in the residual spraying campaign against malaria. A thin film of DDT is deposited on the inside walls of the village dwellings by spraying every 6 months. Most insects coming into contact with the DDT are killed. The number of anopheline mosquitoes in the area is not usually much reduced, but the life span of those coming into houses is shortened so that few of them have opportunity to first bite someone with malarial parasites in their blood, then to incubate and multiply these through the next phase in the parasite's life cycle and, finally, to infect a new human victim.

In conjunction with chemical therapy and prophylaxis by means of chloroquine and amodiaquine, these campaigns have over the years been successful. Strains of mosquitoes have developed resistance to DDT and it has been necessary to change the insecticide in such cases. Resistance has not developed as fast as might be expected, possibly owing to a large proportion of the breeding mosquitoes never coming into the sprayed dwellings and so giving a chance for selection in favour of resistance to operate, as is the case when an attempt is made to exterminate an insect population by exposing them all to insecticide. In malarial eradication campaigns the majority of mosquitoes which survive to breed are susceptible. Strains of mosquitoes and other insects have developed which are resistant to synthetic insecticides, but not to vegetable extracts like pyrethrum. Malarial parasites resistant to synthetic drugs such as chloroquine, but not to natural quinine, have arisen also.

Most flying insects alighting on the walls sprayed with DDT are killed, including those which parasitise the caterpillars living in *atap* roofs. As a result an *atap* roof thatched with palm fronds, which might be expected to last for 2 years, has holes eaten in it and begins to leak within 2 months of residual spraying of DDT. This was one of the first undesirable side effects noted.

DDT has been used to control a wide range of agricultural and horticultural pests. However, owing to its persistence it cannot be used on materials which will be consumed soon. There is no doubt that bagworms have appeared as a new pest on oil palms due to the use of DDT and similar insecticides. DDT was used against cockchafers in one case and almost immediately an infestation of bagworms appeared.

WHY YOUR CROPS NEED SUL-PO-MAG

NUTRIENT REMOVAL CHART
Pounds of nutrient per acre used by various crops

	Nitrogen	Phos-phate	Potash	Mg.	Sulphur
Banana plants/ acre (1200)	400	400	1500	156	*
Coffee lbs/acre (1784)	27	4	43	61	16
Oil Palm lbs/acre (13382)	80	18	120	18	*
Pineapple plants/acre (15000)	134	170	535	53	*
Corn bu/acre (100)	150	60	125	33	22
Tobacco lbs/acre (2000)	75	15	120	18	14
Grain Sorghum lbs/acre (8000)	260	110	220	36	38
Rice lbs/acre (6500)	135	51	18	15	18

*No information

The Sul-Po-Mag nutrients

(nature's natural combination of magnesium, potash and sulphur)

While most farmers are familiar with the needs for nitrogen, phosphate and potash, they are sometimes surprised to learn how important other nutrients can be in the diet of a growing plant.

SPM SUL-PO-MAG ®

Magnesium and sulphur often deserve special consideration. As the chart above shows, some crops need *more* sulphur than phosphate and some crops need more magnesium than nitrogen. All crops need both sulphur and magnesium and if these needs cannot be provided by your soil, crop yields and quality can be seriously reduced. Here's why:

Stimulates Growth

Proper magnesium balance stimulates growth. If a plant is deprived of magnesium, all growth processes will be slowed, and the plant will be unable to produce high yields.

Improves Quality

The addition of sulphur can improve the quality of crops. Without sulphur, proteins cannot be formed, thus, crop quality can suffer.

Deficiencies are Widespread

Magnesium and sulphur deficiencies have been observed in every major crop and in most crop-production sections of the world. And in many cases Sul-Po-Mag has been used to help correct these deficiencies.

Use Sul-Po-Mag

Sul-Po-Mag is a natural combination of available magnesium, sulphur and potassium, and it is essentially chlorine free. Although it is 100% soluble, Sul-Po-Mag does not leach out even in sandy soil. This means the nutrients are available for plants throughout the growing season. It can be mixed with your regular fertilizer or it can be applied directly to the soil. Sul-Po-Mag will not affect the soil pH.

Please check with your local IMC Representative about the best methods of application and proper application rates for your area.

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In another oil palm plantation the contact insecticide was added quite needlessly as a precautionary measure to a fungicide being sprayed for a different purpose, the bagworm infestation began and grew from that date. In an experiment a small area was deliberately sprayed with DDT and bagworms reached serious numbers in the sprayed area and the surrounding area, but fell off at some distance beyond. There is little doubt that the mobile females of the species which parasitise bagworms were killed in the sprayed area and their numbers reduced over a much wider area owing to their movements in and out of the sprayed area.

Since the first edition of this manual, there has been growing concern about the accumulation of DDT in the seas and its possible hazards on a worldwide scale. As far as possible the affluent countries are being encouraged to halt the further use of DDT, and to use instead methods or materials which have less persistent effects, although more expensive in themselves or because of the need for repeated application. However, DDT is still recognised as the most economic and effective insecticide for most malarial control programmes in developing countries.

BHC or *gamma* benzene hexachloride is another contact insecticide of this group. It has a limited use in malarial control. Many domestic formulations contain BHC. It is used often to kill soil-borne pests or others which strike close to ground level, both as a seed dressing or dusted along the drills. Although not so persistent as DDT, it often imparts taint to root and short rotation crops. Taint may survive the feeding of the products containing insecticide residues to poultry and appear in the eggs. This may serve as a reminder to the public that the chlorinated hydrocarbons are passed on from one animal to another, often concentrating in the fatty tissues. Quantities inadequate to cause taint are also transmitted and these may accumulate to harmful proportions somewhere in the food chain.

There is at least one case of BHC causing a minor pest of coconut palm to become very serious. *Artona* is a small moth, whose caterpillars feed on the undersides of the older coconut fronds giving them a scorched appearance. It is parasited heavily by a Tachinid fly and to a lesser degree by an ichneumon fly, also a Clerid beetle eats the pupae. If an outbreak is allowed to take its natural course, within about 3 months the tachinid has established control, the majority of the moth caterpillars being parasitised. However, when a few acres were sprayed with BHC to try to eradicate a small outbreak, the *Artona* spread rapidly until some hundreds of acres were out of bearing. Parasitism was at only a fifth of its normal level for some months. The mobile flies had been killed over a wide area and took a long time to recover.

Cyclodienes

The cyclodiene group includes aldrin, dieldrin, heptachlor and endrin. They are all persistent, even if not in their original form, for example aldrin is converted to dieldrin in the soil. They are all very poisonous, endrin is extremely dangerous, only one hundredth of an ounce could kill a man; the others would require about ten times as much. Birds are relatively more sensitive and fish even more so. As successive plants and animals in the food chain absorb the poison from the earlier link so it becomes more concentrated in their fatty tissues.

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Dieldrin has been used in anti-malarial spraying, but its use is now confined to proven cases of resistance to DDT, because so many domestic animals and poultry died after absorbing dieldrin through the skin as well as ingesting it. Cats are particularly sensitive, perhaps because they rub themselves against walls and clean their coats by licking the fur so often, and were almost exterminated in some villages in Sabah when dieldrin was first used. Rodents increased when the cats were lost. Needless to say this damaged the image of the anti-malarial campaign. It has even been suggested in Africa that the end result might be an outbreak of plague or typhus.

The cyclodiene group, except for endrin because of its extreme hazard, are recommended for the both preventive and curative treatment of termite attack against rubber trees and other plantation crops. A diluted solution is poured round the bole of each tree. The soft bodied termites are particularly sensitive, although they seem to carry the insecticide to their nests before death, because the incidence of termites in the whole area often falls drastically. Such soil applications are sometimes made to control cockchafers. Apart from the natural controls of cockchafers, few of the flying predators and parasites of other pests are liable to alight on the small area of treated soil. The risks to birds and mammals are probably small. It is tempting to assume that because the termites are soft-bodied and sensitive, only they will be affected. Only a minority of termites are pests of the trees, the remainder being concerned with the reduction of plant debris and circulation of nutrients in the soil. Nobody really knows what effect this treatment has on the soil fauna. Until some observation indicates harm, this economic method of controlling termites is hard to deny, but there is need for investigation.

Several potent chlorinated hydrocarbon contact insecticides, including dieldrin and endrin, were sprayed regularly on the cocoa bushes in Sabah in order to control a wide variety of pests attacking the stems and leaves. It was decided to give natural control a chance and to stop spraying, within 1–2 years the Branch Borer caterpillar, one of the more serious pests, had disappeared following parasitism by ichneumon.

Spraying of these insecticides was therefore an unnecessary expense, because it was inadequate to control the pests and prevented the development of the eventually successful parasitism. Moreover, spraying or fogging these poisonous chemicals requires precautions such as respirators and goggles, which are unpleasant to wear in a tropical climate. In some cases alternative formulations or modes of application are possible.

Granular forms of these insecticides may be shaken out of disposable plastic dispensers, so that the hands do not come into contact with the granules. The volatility from the granules is only slight, so that there is no inhalation risk to workers in the open air. These granules can be shaken inside the cone of leaves of a maize plant, where their slow contact and fumigatory action keeps out stem borers. Another promising method is to shake the granules onto the ground under trees and palms infested with caterpillars. When healthy caterpillars drop to the ground to pupate, they come into contact with the granules and are killed, but the parasitised caterpillars and their parasites remain out of contact on the foliage. Eventually the

new generation of pests fails to emerge. This method can be used also to reduce the number of ants which farm mealybugs and aphids on the crops and drive away their natural enemies.

Birds are not very common in rubber plantations, but are plentiful in palm crops and gardens. Birds eat large numbers of insects, but are very susceptible to poisoning by accumulation of insecticides from the many pests they devour. Fish are also sensitive. Now that the dangers of these chemicals are known, it is desirable to use them only in ways which can do the least harm, otherwise birds and fish may be killed over a wide area as sometimes happens to the insects which are natural controls of pests.

Many hoped that these insecticides would be broken down very rapidly in the warm humid climate of Malaysia. Experiments have shown that the relatively small, dilute applications of chlorinated cyclodience insecticides to control termites, retain their activity and effectiveness for up to 4 years on the sandier soils, for over 2 years on most soils and only in the case of peaty soils is there markedly reduced activity (not necessarily destruction) within 3 months. There are cases of snakes and birds of prey being killed or reduced in numbers and activity in areas where these insecticides have been used to poison rodents and other supposed mammalian pests. This example is discussed elsewhere, but the conclusion remains, namely that the widespread destruction of wildlife including migrant raptors (birds of prey which travel seasonally) far beyond the place of application and for long periods is possible under Malaysian conditions. There is abundant evidence of this from other countries, where there have been heavy losses of economically valuable birds in the chain of natural pest and rodent control and of fish, when these chemicals have been used indiscriminately or on a large scale. It is the small scale of usage and the very proper attention to methods of application by manufacturers, selling agencies and users, which have spared Malaysia the worst consequences to date, rather than any special advantage in the environment.

The organic phosphates

The organo-phosphorus insecticides have several different modes of action. The more poisonous are directly dangerous if inhaled, the more volatile have a fumigatory effect in enclosed places. They are all stomach poisons if the deposit is eaten. Most have an immediate contact effect, but this diminishes with time in many cases. The most interesting discovery is that some are systemic in their action, that is they are absorbed into the plant and translocated through it, insects sucking the sap are poisoned. The organic-phosphates break down quite rapidly, especially in the soil. Therefore they present virtually no residue problems if an adequate interval is allowed between spraying and harvest. Similarly there is rarely much build up in soil or rivers.

Parathion was one of the first organo-phosphorus insecticides on the market or to be employed in South-east Asia. It is very toxic at about the same level as endrin. It should only be applied by operators wearing full protective clothing, that is a complete waterproof covering, gloves, mask, goggles and respirator, which is quite

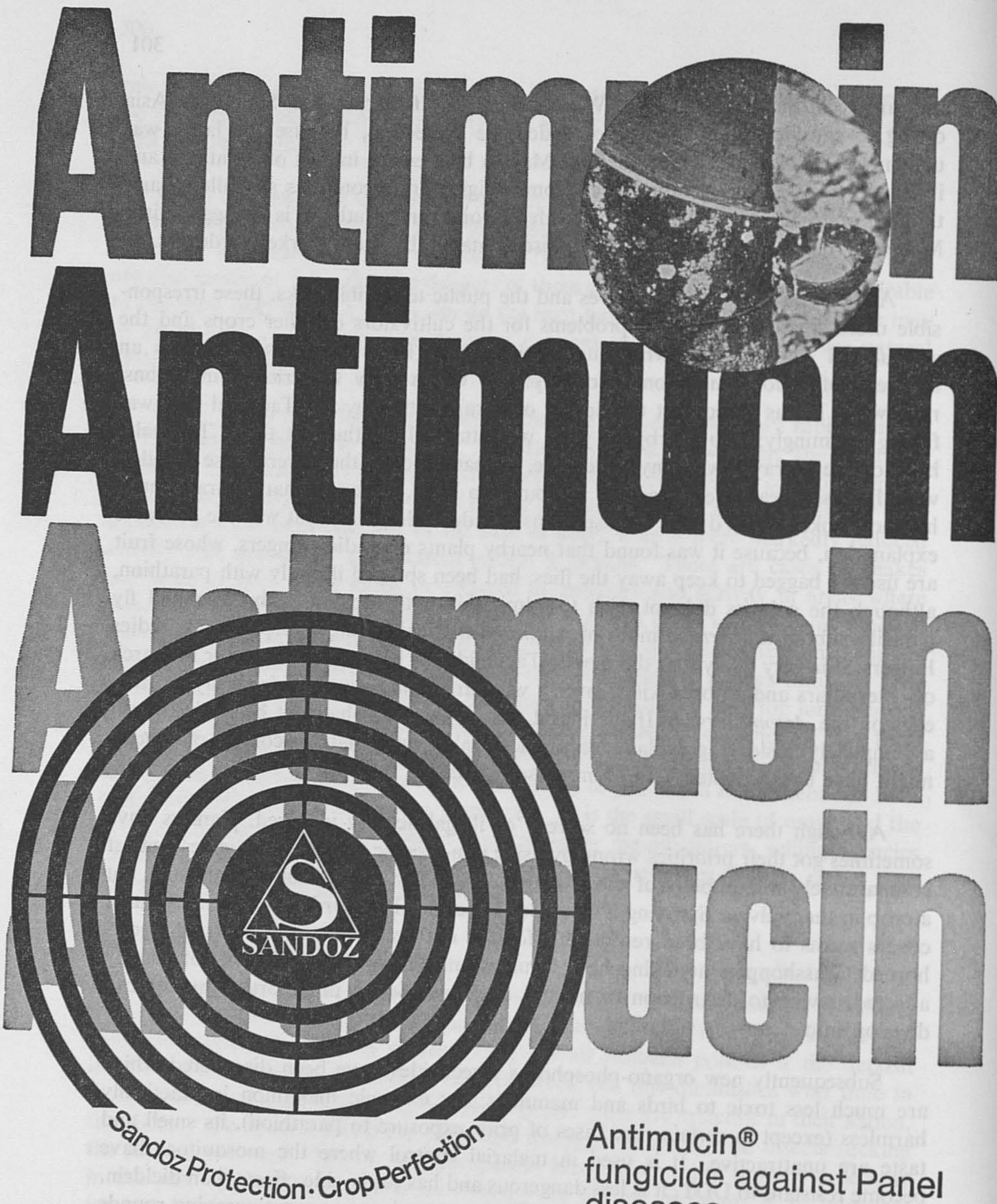
unbearable in the humid tropics. When human deaths occurred in South-east Asia owing to spraying parathion without adequate protection, because the latter was uncomfortable, the then government of Malaya banned the import of parathion and its use in this country. Unfortunately some neighbouring countries still allow parathion despite further loss of human life. Moreover parathion is smuggled into Malaysia and still used illegally and indiscriminately by some market gardeners.

Apart from exposing themselves and the public to terrible risks, these irresponsible users create very difficult problems for the cultivators of other crops and the agricultural entomologists who must advise them. Five years ago there was an outbreak of *Artona* moth on coconut palms, which grew to serious dimensions, meanwhile it was noted that the degree of parasitisation by the Tachinid flies was falling alarmingly; also nearby oil palm was attacked for the first time. The palm had not been sprayed with any insecticide, so that although there were close parallels with the case already described and attributed to BHC, it seemed that natural control had not broken down due to the use of insecticides. However, that was the probable explanation, because it was found that nearby plants of Ladies Fingers, whose fruit are usually bagged to keep away the flies, had been sprayed illegally with parathion, although the culprits did not wish to admit this until too late. The Tachinid fly parasitises both the *Artona* moth of palm and the leaf-rolling caterpillars of Ladies Fingers; it is very likely that the mobile Tachinid flies had visited the latter in search of caterpillars and so been killed over a wide area and prevented from laying their eggs on the *Artona* larvae. If the illegal use of parathion had not been discovered a completely misleading explanation of the breakdown in natural control of *Artona* might have been adopted with even worse results.

Although there has been no secrecy or illegal activity involved, planters have sometimes got their priorities wrong by using non-specific contact insecticides against comparatively minor pests of cover plants, which are an agricultural aid and not a crop in themselves. Spraying insecticides to control Ladybirds on creeping legume covers seems to have been responsible for the outbreaks in recent years of Short-horned Grasshoppers attacking both legumes and the rubber, which is not usually affected, owing to destruction of natural enemies. So an unimportant matter can develop into a serious situation.

Subsequently new organo-phosphorus insecticides have been discovered which are much less toxic to birds and mammals; for example malathion is practically harmless (except in certain rare cases of prior exposure to parathion), its smell and taste are unattractive. It is used in malarial control where the mosquitoes have become resistant to DDT, it is less dangerous and has fewer side effects than dieldrin, but malathion's lack of persistence is a disadvantage because more spraying rounds and higher costs result.

Trichlorphon is about twice as poisonous as malathion, but that is a hundred times less toxic than parathion. Its direct contact effect fades away quite soon, it is absorbed into the plant and translocated in the sap so that sucking insects are killed. This is called systemic action and is selective in that the sucking pests are at much greater risk than other insect visitors to the plants such as predators and



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parasites. Trichlorphon was applied to cocoa in Sabah to tide over the gap between the use of non-selective contact insecticides of the chlorinated cyclodiene type and the re-establishment of full natural control. This was particularly useful in the case of bagworms, at first parasites were almost absent, but after the change to trichlorphon Tachinid flies returned to the area and eventually all spraying could be stopped.

Carbamate insecticides

The best known is carbyral, a naphthyl-methyl-carbamate, of moderate or marginal toxicity to warm blooded animals, it is of limited persistence. Carbyral controls a number of pests on which hitherto the persistent chlorinated cyclodiene insecticides were used.

Cultural control and environmental modification

Before the synthetic organic insecticides were invented, the range of natural and inorganic chemicals available was limited. Recourse had to be made to cultural methods in agriculture and modification of the environment for preventive medical purposes, of which malarial control was the best known example. The primary objective was to prevent anopheline mosquitoes from breeding and the secondary objective was to prevent contact between the mosquitoes and humans.

Denial of breeding places to the mosquitoes requires a knowledge of the local ecology. In many cases drainage to remove open stagnant water or to get the water in motion is advantageous. Badly constructed drains or contour silt pits and roads too close to the dwellings to be protected often result in new breeding places. Some mosquitoes can breed in moving water, but these are sun-loving species. Thus sometimes clearing the land and uncovering the streams may increase the number of dangerous mosquitoes, in these cases bushes and shade should be left along the streamsides or the stream broken up into a series of pools by dams. A controlled degree of pollution with organic matter such as cut grass renders stagnant pools unsuitable for mosquito larvae.

The expert malariologist recognises the local conditions, including which types of mosquitoes are important, and adopts whichever methods are most suitable. It was perhaps because of this need for trained personnel and application to specific local conditions that natural control methods became unpopular when powerful insecticides were available. However, now that resistance to insecticides has arisen and to lesser extent, because they have inconvenient side effects which bring malarial eradication into understandable—even if misplaced—disrepute, the old methods are being reconsidered.

Mosquito nets and screens, or air-conditioning for the more sophisticated, are means of keeping mosquitoes from humans. Deviation of mosquitoes by alternative animal targets has been suggested, but this has little practical effect and some drawbacks, especially when other mosquitoes such as *Aedes* spread heartworm for example among dogs. The burning of incense coils is an old form of repellent.

Cultural methods in agriculture are varied. The growth of plants may be improved by fertilisation to help them get rid of minor pests such as Scale insects. Some advocate only natural manures for this purpose and consider that artificial fertilisers aggravate pest attack. That may have been true when unbalanced artificial fertilisers were given, but now much more is known about correct plant nutrition, and in any event there is not enough farmyard manure available.

Plantation sanitation prevents large pest populations from building up. Rhinoceros beetles are a serious pest of coconut and oil palms. The grubs breed in almost any debris, for instance old rubber stumps, palm logs or even sawdust. If these are distant from palms there is no risk, but in the vicinity of young palms especially, burning or deep burying of potential breeding material is essential. The growing of tall leguminous shrubs as covers is recommended also, because the Rhinoceros beetle does not fly strongly and its activity is restricted by such a barrier. Stem borers in maize are restrained by burning the trash after harvest. Crop rotation prevents the build up of pests in short lived crops. Different crops susceptible to different pests are planted in succession on the same ground, so that the pest population harboured in the soil after each crop will be without a suitable host to feed on during the next phase of the rotation. This is particularly important in sweet potatoes for example. Dust often kills off beneficial insects more than pests, therefore roads may be sealed against dust with advantage and needless tillage which pulverises the soil should be stopped.

Integrated methods

The integrated approach is to regard natural biological control, cultural and environmental methods, chemical insecticides and any novel means as partners, but not as exclusive alternative rivals. It is by no means a new approach, but it has been eclipsed in the quarter century during which the synthetic organic insecticides have been in the ascendancy. The disadvantages of the latter such as the development of resistant pests, the creation of new pests owing to the destruction of natural controls, the expense of repeated application, and the hazards in many cases to human and wildlife (all of which have been demonstrated on a small scale in Malaysia confirming what has happened on a large scale elsewhere) have led to a reappraisal.

If there were no natural or cultural controls the pests would have driven mankind from the face of the earth long ago. Nevertheless, the need to grow more food more quickly for more people than even before, makes it inevitable that man will create conditions of rapid crop growth ideal for an equally rapid build up of destructive pests before natural controls can catch up with the situation. The integrated approach starts with rotation of crops and plantation sanitation and other cultural methods to reduce the risk of rapid pest build up, but when this does occur complete eradication of the pest by chemical means is not attempted. An insecticide and mode of application are chosen which will have the maximum selective effect against the pest and least harm to its natural enemies. Usually the powerful contact insecticides, which temporarily wipe out a pest, have no such selective action. The

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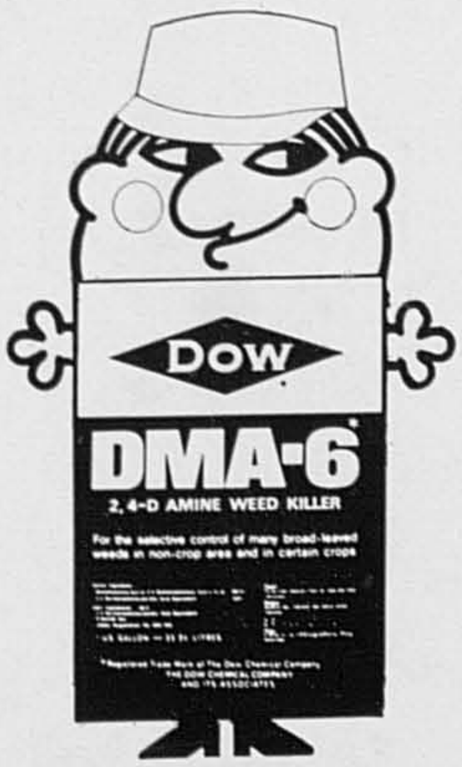

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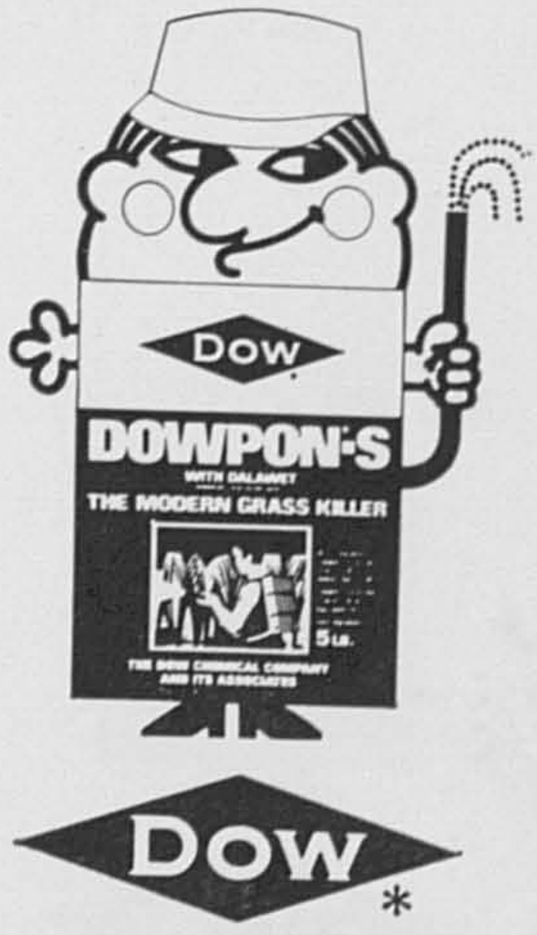

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initially less powerful but more selective treatments can arrest a pest outbreak long enough to enable natural predators and parasites to reduce it to negligible proportions and so maintain a population of beneficial insects in the area.

Certain baits or traps may be used to increase the specificity. Several night flying moth pests and cockchafer adults are attracted to ultraviolet light. Light traps are set up during the breeding season in threatened areas. Some traps are designed so that insects flying in cannot get out or a non-volatile insecticide or oil kills them or immobilises them until they can be destroyed. Mosquitoes are attracted by carbon dioxide, warmth and humidity, traps are now being designed on this basis. Sex attractants are now sought for specific insects.

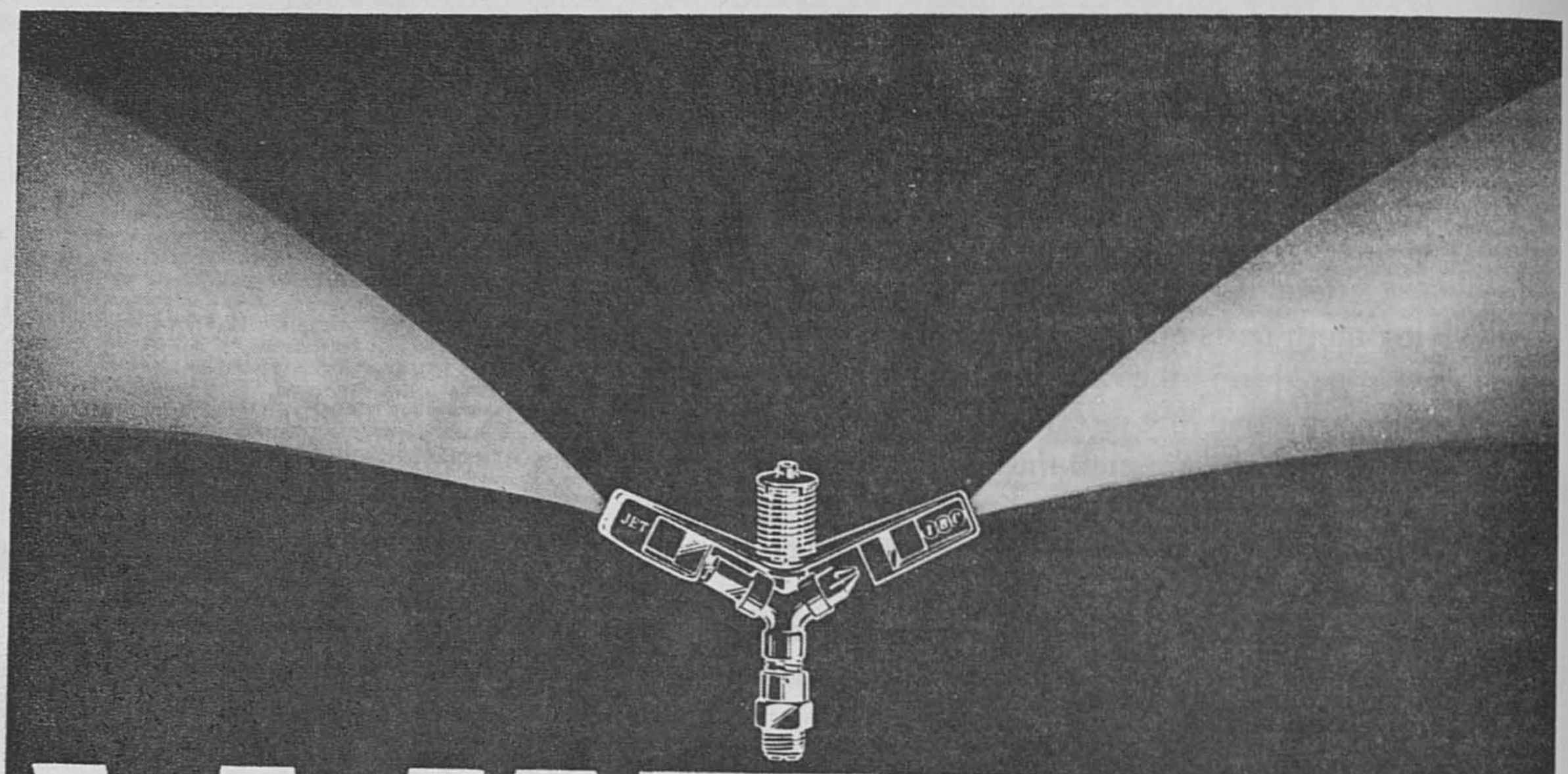
Other methods are under trial in different countries and may come to Malaysia later. Examples are the release of sterile males of the insect pests to reduce the number of fertile eggs laid. The bacterial and fungal diseases of insects should not be forgotten. *Bacillus thuringiensis* is the best known bacterial parasite of insects, which has been tried successfully as a spray against some pests. A fungus has been found on the migrant locust and another on the termite which attacks living trees. Some of these are quite specific in their attack and may be encouraged by cultural methods.

Malaysia has been fortunate in that the consequences of misusing insecticides have been realised before there has been any serious damage done. Agricultural and medical entomologists are alive to the need for integrated, specific control techniques. The understanding and cooperation of the public in the responsible use of insecticides at all levels and in all ways will help this object to be achieved, and also save individuals and their families from fatal hazards.

Rodenticides

Rodents such as rats can transmit dangerous diseases in urban areas, they consume large amounts of stored food and are serious pests in many crops. Rats do not evoke much sympathy from most people. However, when it is necessary to kill rats in or near human dwellings, man and domestic animals, especially pets such as dogs and cats, are at risk. Specific or selective poisons that will kill rodents or rats only are needed, which should be harmless to other mammals. True rodenticides of this type are unknown. Norbormide is perhaps the closest discovered yet, it is much more toxic to rats than to any other species, including mice. Some selective toxicity has been claimed for warfarin, but this is largely due to the baits used, which are more attractive to rats than to other mammals and are laid where they are more accessible to rats than to other mammals.

Nearly all other so-called rodenticides are poisons of equal toxicity to a wide range of birds and mammals including man. The best known examples are strychnine, fluoracetamide, barium carbonate, zinc phosphide, thallium sulphate, sodium arsenite and endrin, (the last was mentioned earlier as a very toxic insecticide). Any selective action depends entirely on the method of baiting, both materials and location. Of those mentioned zinc phosphide breaks down rapidly to phosgene gas, dangerous in confined places but not attractive to other animals. All the other poisons



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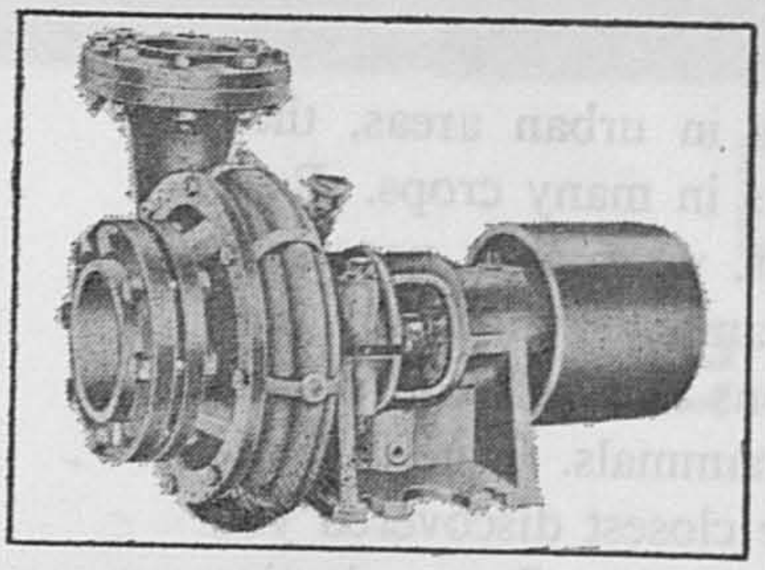

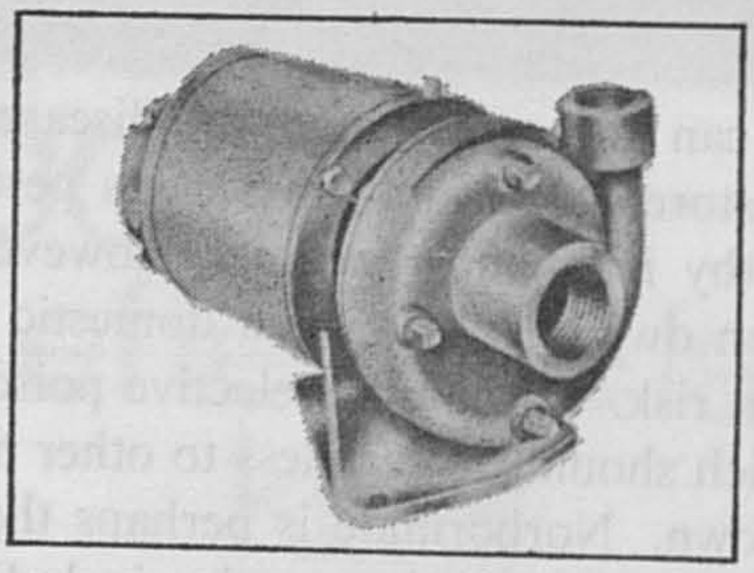

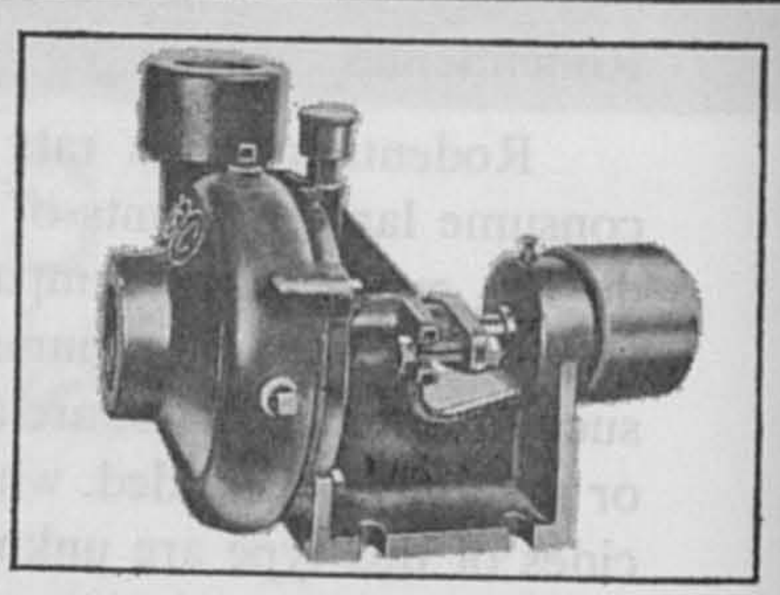

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mentioned in this paragraph are fairly stable and are hazardous to predators of semi-comatose primary victims or to scavengers of their corpses. Therefore discussion of the status and control of bird and mammal pests will consider alternatives to the use of poisons so dangerous to man and useful animals, both domesticated and wild.

Warm-blooded pests

The birds and mammals which damage cultivations may be considered in two groups, resident pests and temporary invaders from surrounding areas. The stocking of resident pests depends very much on the amount of food produced in the area. Although during the peak period of their growth, rubber trees increase in dry weight of timber at a rate among the highest recorded in any crop, the seasonal fall of seeds—seldom as much as 150 lbs per acre—is meagre fare for most of the larger animals. During the earlier phase the cover plants are also very high producers of vegetable matter, which may be grazed by herbivores, but the latter are usually kept out because of the damage they do to young trees and thus are relegated to the class of temporary invaders. Some rodents live in the covers and are pests of the trees. Seed-eating birds sometimes frequent the covers, but the rather poor avifauna in rubber plantations consists mainly of those eating insect pests of the covers and trees.

The resident mammal pests of rubber are mainly rats and related animals. Flying foxes, which are large bats, are very rarely troublesome in rubber. The natural controls of the rodents are snakes and birds of prey. Conditions in rubber plantations do not favour wild cats and other mammalian predators. When it is necessary to supplement natural control, traps of a selective design and specific poison baits may be used.

In oil palm the crop of fresh fruit bunches may be as much as 11 tons/acre/annum and the oil extraction may be as high as 22%, in addition there are considerable weights of foliage and stems in the palms and the covers. It is not surprising that quite heavy rat and squirrel infestations sometimes occur and that new pests have arisen, in particular wild parrots especially the long tailed parakeet have taken to consuming the fruit. At present shooting, trapping and selective poison baiting are attempted. There is an urgent need for research into the food chains and to encourage natural control by birds of prey, snakes and carnivores. The leopard cat, mongoose and other small carnivores control rodent populations in bamboo, secondary and primary forest, their possible role in oil palm plantations seems to have been neglected.

Judging by Malaysian experience with insect pests control measures must depend mainly on natural means with only temporary selective assistance from artificial methods and chemicals. In the humid tropics the climate is favourable to pest population growth throughout the year and traditional methods in the temperate regions of attacking vertebrate pests during the breeding season or when food is scarce in winter are less likely to succeed here.

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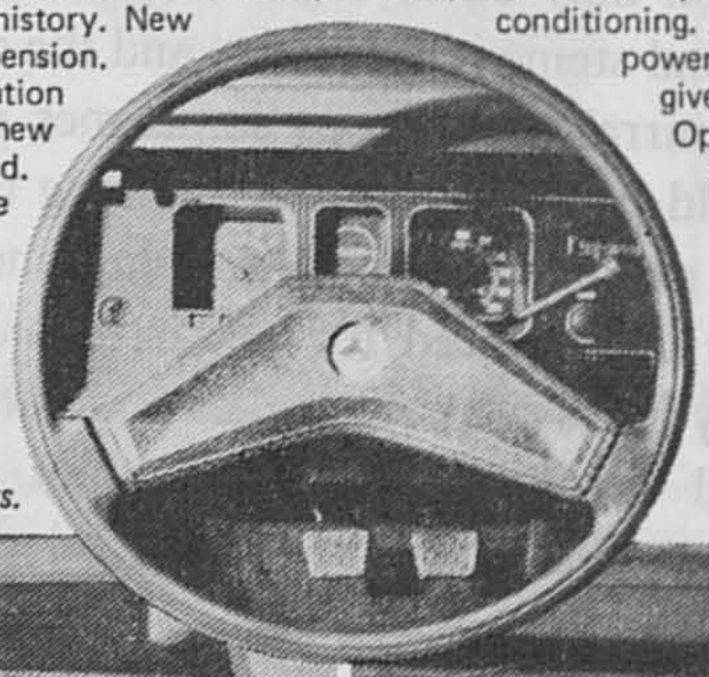

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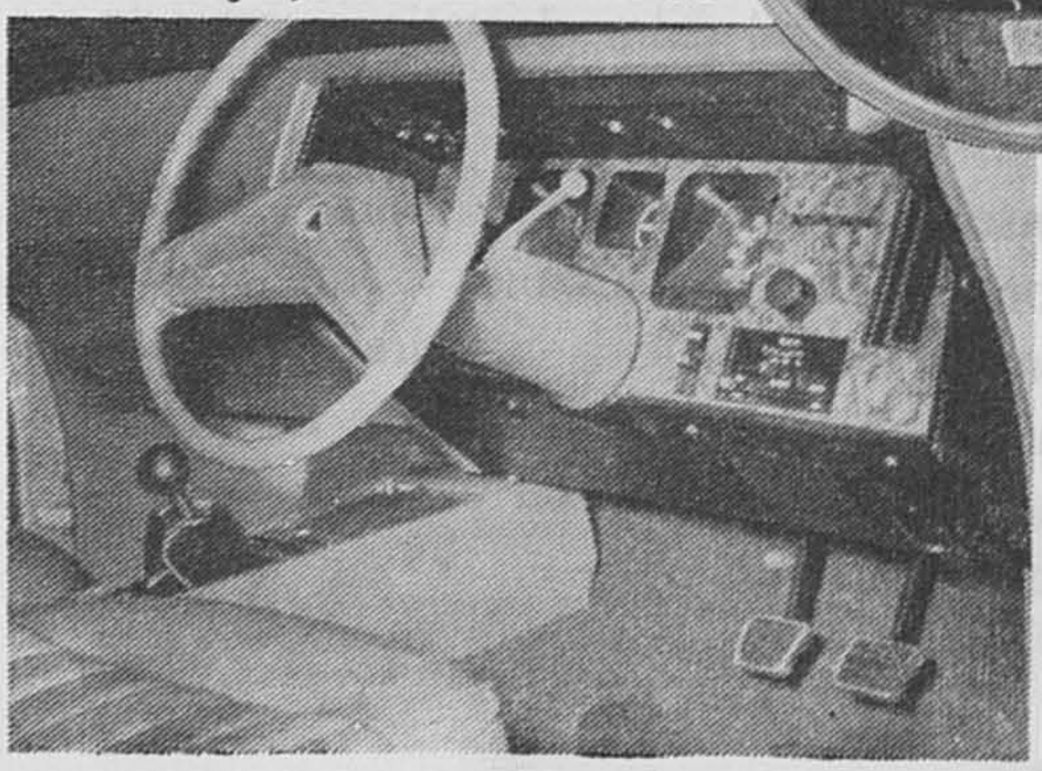

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Cocoa plantations are a relatively new venture in Malaysia. In Lower Perak cocoa is grown under coconut palms and rodent populations are again high, rats attack the cocoa and squirrels eat into young coconuts. In some areas musang or civet cats have been singled out for persecution by poisoning with endrin laid in banana baits. This is a risky procedure. There is evidence that excessive use of endrin in this way has led to birds of prey being killed and in the case of migrant raptors their loss may be felt elsewhere. In addition to this the campaign may be entirely misplaced; although catholic in their feeding habits, the civet cats and their relatives are carnivores and the young of rodents are a part of their diet. It is dubious how much of the damage done by mammals can be attributed to musang. This may be a case of trying to exterminate a relatively minor pest at the expense of upsetting all natural control including elimination of those which are in fact predators of real pests. These problems await proper investigation.

Padi is subject to bird attack during harvest, but if the padi areas are large enough, bird scaring can be made adequately efficient. In East Malaysia correct timing of padi planting and hence harvest reduces attack by migrant birds such as the Long-tailed Munia but in West Malaysia the main culprit is the White-headed Munia resident all the year round. Vegetable gardens have their share of rodents, often rats escaped from human dwellings and in turn domestic cats effect some control. Orchards are sometimes raided by flying foxes, squirrels and other fruit eaters, but these are not usually residents.

Cultivation's borders

In many developed western countries agricultural land, whether cultivated or grazed, planted woodlands and orchards, constitute the greater part; urban, industrial and mining areas are often large too and natural vegetation is reduced to fringe areas and isolated patches. Such a situation occurs in Java and the 'rice-bowl' of Thailand, but in most parts of South-East Asia extensive tracts of jungle remain yet. In Malaysia the forests still cover most of the land area despite the inroads of cultivation. In the long developed parts, such as Malacca, the jungle is restricted to a few outposts and beyond the boundary of cultivation there is often secondary forest or *lallang* where past cultivation has been abandoned. In the newly cleared areas agricultural development and primitive forest march side by side.

Inevitably wildlife crosses the boundary in places and feeds on crops or attacks livestock ranging from poultry upto cattle or even man himself. When this happens the animals are considered to be pests. However, before considering the relationships between man and invading wildlife seeking food after the destruction of the natural habitat, it is as well to repeat that many agricultural pests, especially rats, accompanied man or the extension of man-made *lallang* and bamboo dominated areas, they did not all come from the jungle. The most common pest in oil palm, *Rattus tiomanicus jalorensis* normally occurs in secondary forest; the second most frequent, *R. argentiventer* is naturally confined to grassland (*lallang*); both are of the *R. rattus* group, never found in deep forest.

Where large contiguous areas of plantations, whether estates or land development schemes, are bounded by forest, a barbed wire fence five feet (1.5m) high,

with wire netting for the bottom three feet (1m), will exclude the majority of deer, wild pig and porcupines. Hunting the larger deer, pigs and porcupines (the meat of which can be sold) using suitable heavy shot guns is a profitable additional control. Humane traps set within the margin of cultivation may be baited with vegetable food which is selectively attractive to the mammal pests. Porcupines seldom penetrate into the plantation more than 100 yards (100m) from the jungle. They can be caught in cage traps and then killed for fresh meat. Traps should be visited daily, because not only is it cruel to starve animals, but other porcupines will not enter a trap in which one of them has died. Porcupines are fond of salt meat. Poisoned baits are very dangerous, because of the risk to domestic animals and the hazard of secondary poisoning of predators and human scavengers. Various repellants work against deer, such as noise from banging scarers (operated by carbide) smell from foetid grease, or visual methods such as tinsel, aluminium paint bands, patterns of black and white dots. It is very dangerous to dig fall pits or set drop spears or sprung wire noose traps (the last mentioned are illegal) for two reasons. Firstly because the direct risk to humans is too great, even in or rather more so in the isolated places where these traps are usually laid. Secondly these traps are quite unselective and kill or maim useful animals as readily as pests.

The natural controls of pig and deer are mainly the larger cats, leopards or panthers, clouded leopards and tigers. These large cats are active animals and need plenty of food, a mother with cubs hunts over a large territory, as much as 50 square miles (13 000 hectares) is quoted for a tiger. Therefore the death or injury of a large cat so that it cannot hunt is likely to result in an increase in the unmolested population of wild pig over a wide territory. There is cumulative, convincing, well documented and circumstantial evidence that nearly every tiger or big cat which has turned man-eater or cattle-killer has been maimed by a steel wire snare, a shot gun wound or other man-inflicted injury. Several claws or whole paws may be lost or turn gangrenous so restricting the big cat's movements. No longer able to hunt, it must lie in wait until some unsuspecting domestic animal, a cow or goat, or a man, woman or child comes within easy range. Mankind earns just retribution for cruelty and ignorance of the natural balance, although innocent parties may suffer bereavement and the guilty escape.

There is evidence too, perhaps not so fully established as in the case of the big cats, that elephants which take to crop raiding are also victims of wounds inflicted by man's traps and firearms. An elephant with ulcerous sores on its ankle cannot support its great weight in comfort and travel long distances over its usual range. Usually it has been injured on the fringe of cultivation and there it remains, making raids into plantings of bananas, rubber and palms. Sometimes in old age an uninjured elephant may take to crop raiding, but this does not seem to be common perhaps because senile elephants normally succumb to natural causes. An ordinary fence will not keep out determined elephant, but electrified wires, with tension springs at intervals to prevent snapping by a sudden blow, supported on angle posts which are not easily pushed over, have been successful in some areas. The voltage should be adequate to shock, but not to kill, after a while the herd moves away. If a boundary is likely to remain static adjacent to jungle for a long time, an elephant belt can be felled beyond the ordinary fence against pig and deer. An elephant belt

consists of felling trees criss-cross, leaving the debris unburnt and allowing dense secondary jungle to grow up. Wild cattle sometimes enter plantations, these methods keep them out. Domestic cattle are kept out by fencing.

Monkeys, squirrels and flying foxes (large bats) can climb, jump or fly over fences. Locally they cause trouble. Monkeys are intelligent and often move away if some of their number are shot and the corpses hung up as a warning or psychological repellant. Elaborate cage traps defeat the monkey's ingenuity without risk to cats and are humane in operation if visited every morning. Squirrels are shot or trapped in fruit baited cages. Flying foxes can be deterred by nets and shooting. Smelly repellants can be used in many cases and it is probable that chemists will discover new nauseous but not noxious substances.

A well defined and fenced boundary with appropriate repellants just within the periphery does much to keep out mammalian invaders, who will in time adjust their stocking to suit the area of forest left to them without need to invade cultivation, especially if still subject to natural controls. The predators, such as large cats which hunt pigs and small cats which prey on rodents, are very easily depleted by indiscriminate trapping and poisoning. Traps should be regularly visited, humane and selective in action either by their construction or the nature of the bait. If poisoning seems to be the only solution, selective baits and methods and non-persistent poisons should be chosen as far as possible. Shooting reduces the numbers of some pests and is a deterrent to the more intelligent apart from being profitable and providing a means of taking a crop of meat (protein) from the jungle in the case of pig and deer. The boundary of cultivation can be managed, especially if the significance of natural balance, predation and stocking on the jungle side of the perimeter is understood, respected and protected. This is integrated pest control.

Artificial aids in agriculture

Agriculture from its definition to till the fields and from its history of converting natural vegetation is an artificial process, that is it is made by man. It is only natural in as far as man's dominance on the earth to the point of self destruction is a natural evolutionary process or divinely fore-ordained. Therefore unnatural or artificial practices and aids must be and have been introduced from prehistoric times to make agriculture more efficient. The rise of synthetic chemical pesticides and their impact on the Malaysian scene have been described in some detail. In other countries pesticide usage got out of control, especially where the consequences of non-selective action and persistence in soil and through the food chain were not understood. Quite rightly there has been a swing in public and scientific thinking, in some cases this counter reaction may have gone too far, where it has threatened to halt campaigns against the enfeebling diseases of mankind. Wherever thought is stimulated and research into specific and integrated control methods results, then this reaction has been beneficial. Man must examine his place in relationship with nature and work with instead of against natural processes.

Thirty years ago a writer on the benefits of chemistry to agriculture would have made little reference to pesticides. Artificial manures such as superphosphates and

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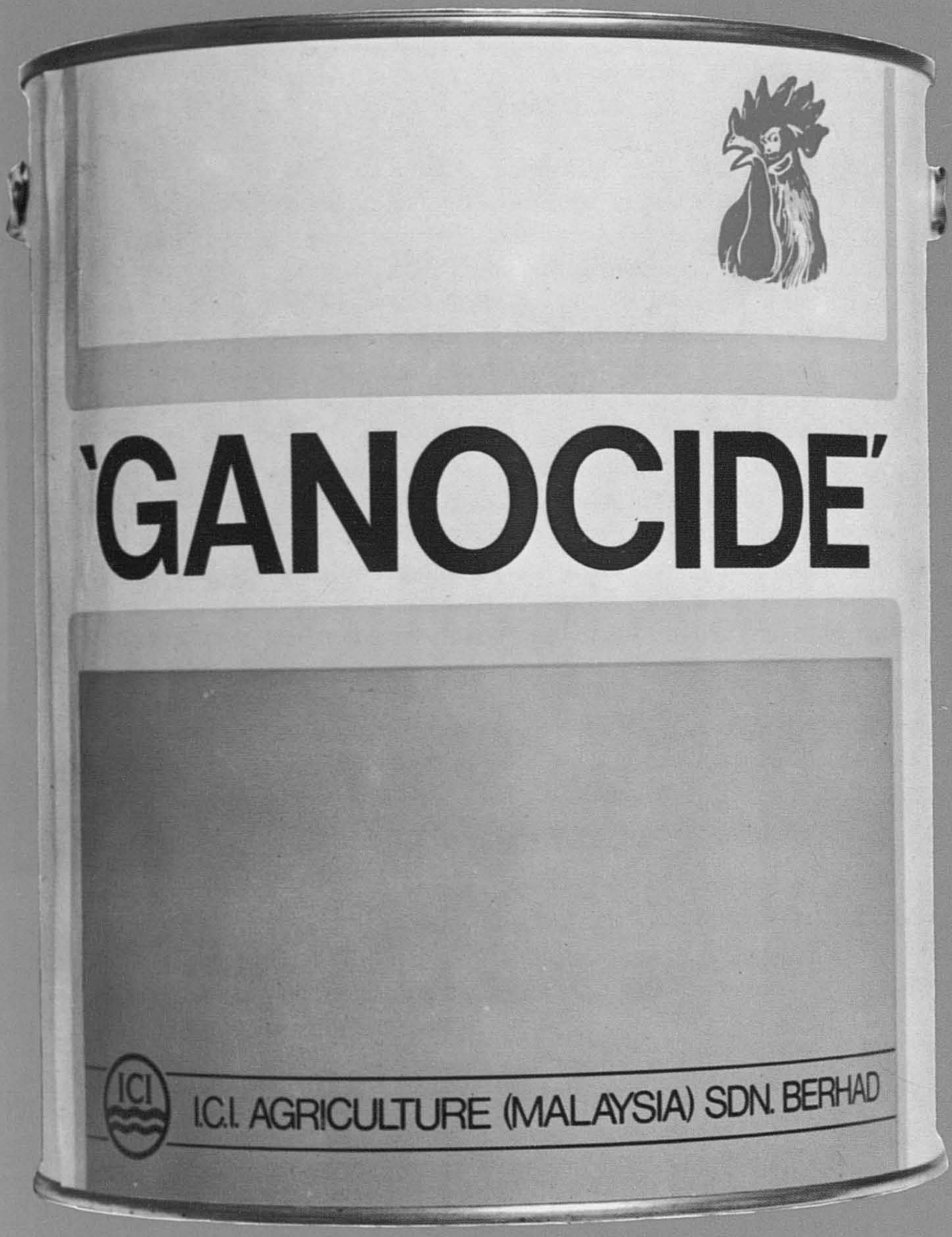
The new guard against red root disease



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Ganocide containing drazoxolon (a new ICI-discovery wide spectrum fungicide) checks the fungus that retards the growth of your trees.

Field trials at the Rubber Research Institute of Malaya showed that Ganocide gives effective protection against the disease for at least 18 months.

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in particular nitrogenous fertilisers made from atmospheric nitrogen would have commanded attention. The harvest of crops depletes soil nutrients, and the heavier the crop the greater the loss and more likely it is to exceed natural rates of replacement. The nutrients are not returned to the soil in many cases, for instance the waste from cities usually ends up in the sea. The provision of artificial fertilisers has been a great boon to agricultural food production.

Nevertheless there have been critics of artificial fertilisers. Many claim that lavish use of chemicals has led to lush growth prone to pest and disease attack, or led to deterioration in soil structure, although this is more often due to burning or removing plant debris from the site. Unhealthy growth may occur in some cases of excessive nitrogen application which depresses potash uptake. On the other hand if artificial fertilisers are given in the right amounts at suitable intervals and—equally important—in the right proportions of the different nutrients, the growth and health of the plants is improved. This implies that for each combination of soil type, crop species or variety and to a lesser extent climatic conditions, such as rainfall and solar radiation, there is an ideal combination of fertiliser composition, mode, rate and frequency of application. In the long run these are determined by fertiliser trials, but it takes many years to test every possibility. A less publicised revolution has been going on. Methods of analysing plant tissues, in particular leaves, have been improved in accuracy and automated for speed. These, in conjunction with better soil classification, enable the information gathered from one trial to be extended far more widely and accurately.

Synthetic plant hormones have been used to stimulate rooting and fruit set in a number of crops. There are signs that the next advance may be in the field of new discoveries and applications in the use of synthetic growth substances to control the growth, form and flowering of various crops.

The activities of the plant breeder are considered to be natural by some, since natural properties of the plant are used, although combined by controlled breeding. In other ways they are artificial. However, the genetic reserves, especially to provide disease resistance, are to be found in the wild. This brings us to consider the conservation of natural biological communities.

(Next month: BIOLOGICAL COMMUNITIES)

Bukit Takun

Banner headlines and a four-column spread on the leader page were accorded the following letter in *The Malay Mail* of 26 October. Our comments will appear next month; in the meantime we would welcome readers views.

Opinions were expressed in the *Malay Mail* in July and August over Bukit Takun.

Objections came mainly from the Malaysian Nature Society, the Friends of Templer Park, the Biology Club, the Tourist Association, the Incorporated Society of Planters, and the former chairman of the Batu Caves Protection Association.

The reasons put forward for the conservation of Bukit Takun are:

1. Bukit Takun is a natural landmark and a scenic spot.
2. It supports some form of rare animal and plant life.
3. It is the only sizeable limestone outcrop in Selangor apart from Batu Caves. Its destruction would deny Malaysian scientists materials to study the country's pre-history.
4. Quarrying will deter visitors to Templer Park.
5. Pollution.

I am surprised that no-one from the building industry has voiced his opinion. I would like to present the other side of the picture.

I agree with Datuk Harun that "there is great need for limestone in Selangor for development projects". The decision in granting the licence is timely and wise.

A review of present and future development needs should convince the most stubborn advocates for its conservation. We are in the second year of the Second Malaysia Plan. A large volume of development works has been generated.

Coupled with Government housing loans, a construction boom can be anticipated in the next few years in Malaysia generally. In fact, there is already a boom in Kuala Lumpur and its adjacent areas.

One just has to drive around these areas and will not fail to notice the amount of construction going on. Let us examine one of the basic construction materials—limestone aggregate—for concrete and road works:

It is estimated that the building industry in and around Kuala Lumpur requires an annual supply of 900 000 cubic yards. This includes road works.

The present supply comes from Batu Caves and Sungei Besi.

There will be an annual shortage of 300 000 cubic yards. This has to come from somewhere, or our development works will be greatly impeded, and hence affect the success of the Second Malaysia Plan.

Let us look at the alternative source of supply, bearing in mind that limestone aggregate is a comparatively cheap commodity.

The present price a cubic yard of limestone is approximately $7.50 on quarry. The transportation cost is about 14 cents a ton a mile. Cost is a governing factor in considering any alternative sources.

Granite aggregate: It is possible to use granite aggregate instead of limestone, but the price is 40 per cent more. The present source of supply comes from Damansara and Cheras, and some from Benting. The supply is again short.

Subterranean source. This is not feasible because the cost of production will be much higher due to:

(a) The blasting is not as efficient.

(b) Constant pumping is essential to keep the quarry dry.

(c) The opening should be large enough to permit a very mild slope between the ground surface and the quarry bottom or else blasting may cause slips in the embankment and endanger the workers.

(d) Everything has to be hauled up to ground surface by mechanical means.

(e) The distance should be within 15 to 20 miles from Kuala Lumpur (consumer).

Bukit Takun and the adjacent area offers an excellent quarry site. It has practically no overburden and it is close to the trunk road. It is 1150 ft high. In about four acres in plan area, the volume is about eight million cubic yards. If we take 500 000 cubic yards an annum, this will last 16 years.

Each unit of two-storey terrace house requires about 60 cubic yards of aggregate, therefore Bukit Takun can provide enough aggregate for 130 000 units.

If each unit houses six people, it is 780 000. This is close to Kuala Lumpur's population. Alternatively, it would provide enough material for 400 miles of six-lane highway.

In terms of monetary value, if the present average price of limestone aggregate is $7.50 a cubic yard, Bukit Takun is worth $60 million. The Government will have collected $4 million if the royalty is 50 cents a cubic yards. This is surely of public interest!

Nature provided us with various kinds of forces and materials. It is up to us to direct or use them for the benefit of our people. Landmarks come and go, are natural and some are man-made. Whatever they are, they must make way for development.

Our people's welfare and benefits come first. Bukit Takun reveals some geological history of the area, but then, every inch of Mother Earth depicts some chapter of the past. Bukit Takun has been there thousands of years. Hundreds of geologists must have visited the site, so all the historical evidence that can be read from the surface would have been read and recorded.

Bukit Takun supports rare plants and animal life. This is excellent if we do not need Bukit Takun for more constructive purposes. If Bukit Takun can provide more for people by destruction, then it will have to go.

It is like building a dam. Acres of low-lying land and valley will be flooded. Lots of history and geological evidence will be buried under water and animals insects and plants will vanish. Such are the Aswan Dam, the Upper Perak hydro-electric scheme, the Snowy Mountain hydro-electric scheme, etc.

Are we going to shout: "Look, this will destroy Nature and deny our scientists materials to study the country's pre-history"?

Another good example is the Iron Knot and Iron Duke in Australia. They are sizeable outcrops and also excellent landmarks, but they are being blasted down one by one and consigned to the furnace—for progress.

ENGINEER

Kuala Lumpur

I.S.P. Annual Golf Competition

SEREMBAN INTERNATIONAL GOLF CLUB

15 October 1972

Winner of the Jumbo Downs Rose Bowl Mr T H Ling receives the trophy from ISP Vice-Chairman Mr Tan See Yeok. In the centre is Mr M R Jayesuria who organised the competition.

Mr Jimmie Gilbert about to walk off with the Agency House Cup, which he won.

RESULTS

MAIN EVENT

Jumbo Downs Rose Bowl (nett)

Winner : T H Ling

Runner-up : F D Chandler

ADDITIONAL AWARDS

Agency House Trophy (gross)

Winner : J R Gilbert

Runner-up : N C Edward

I.C.I. Agriculture Trophy (Stableford)

Winner : D M Benton (on count back)

Runner-up : E C Mackie (on count back)

Tractors Malaysia Trophy (bogey)

Winner : R Khoo

Tiger Brewery Cup — Match Play

Planters *v* Agency Houses

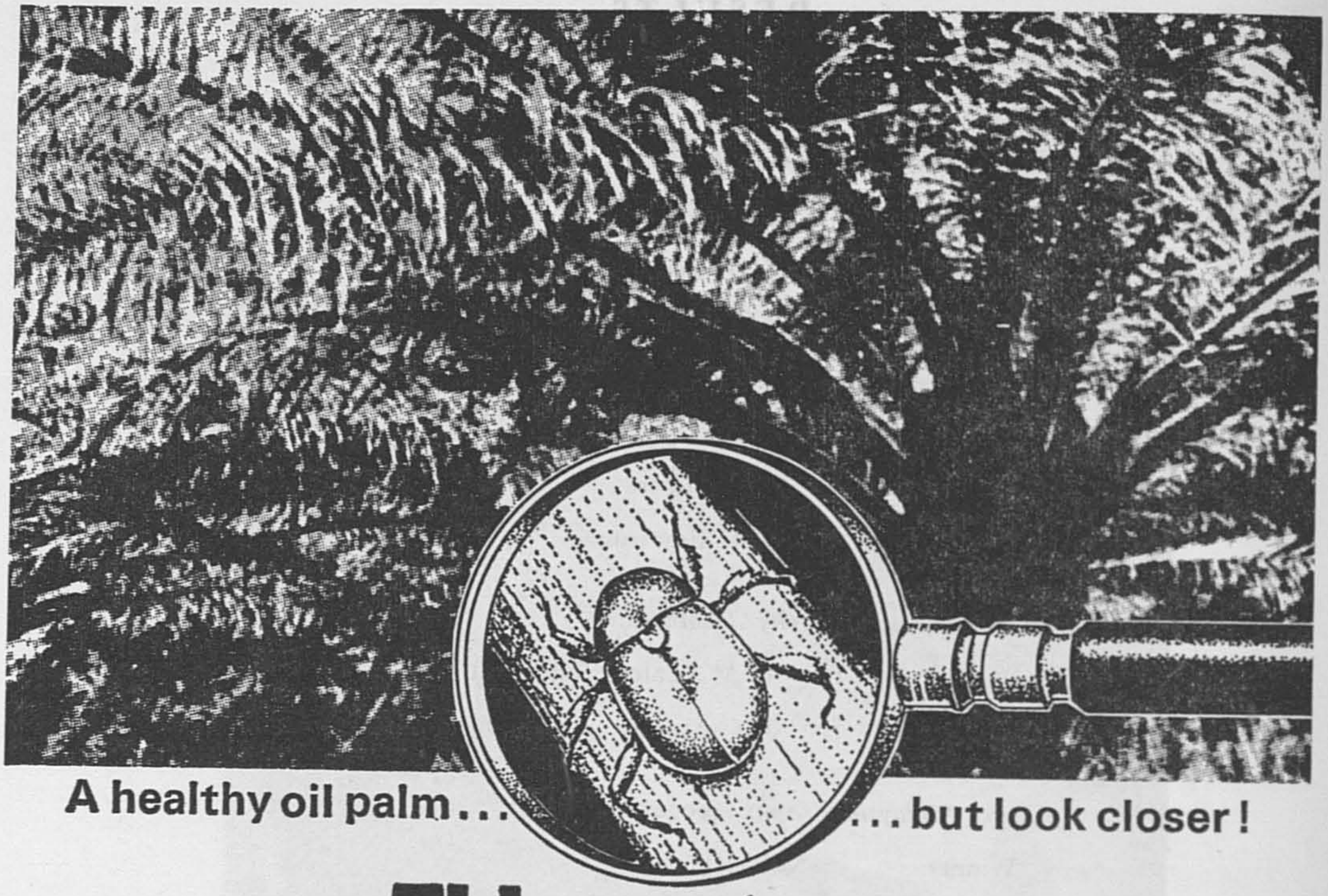
Winners : Planters, by 6:4

Shell Trophy — Invitation Entries

Winner : M W Lindsay

Runner-up : M F Vilvaratnam

Ball Sweep	*1st nine*	*2nd nine*
1st	D M Benton	M R Jayesuria
2nd	T H Ling	M F Vilvaratnam
3rd	M W Lindsay	R Khoo
4th	R Lee	F D Chandler
5th	J R Gilbert	T H Ling



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Sevin 85 Insecticide can stop him ...and more than 160 different pests.

Mealy Bugs, Beetles and Caterpillars which plague oil palms and cocoa trees. Fruitworms, Leafhoppers, Fleabeetles and Pod Borers which destroy fruits, vegetables and kernels. Sevin 85 is a synthetic organic pesticide with a low degree of toxicity to higher animals. Safe to handle. Economical and effective. Protects your oil palms and other crops from destructive pests. Helps increase oil yield and harvests.

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Sevin 85
Kills crop pests to help crops grow.

The monthly crop

This month's International Oil Palm Conference has attracted a record number of participants. There is no room in the conference hall for any more and 625 participants plus guests and VIPs are going to be there on the opening morning. Registrations have come from Australia, Brunei, East Malaysia, France, Hong Kong, Indonesia, Japan, New Zealand, Papua New Guinea, Singapore, South America, Thailand, the United Kingdom, United States and West Cameroon. The Society looks forward to renewing acquaintance with its many friends and colleagues at the Federal Hotel on 16–18 November.

Greeting cards are now available. There is a limited stock of those bearing the Society's crest and name, but unlimited supplies of an attractive card which we are selling for the benefit of the Rumah 'Amal Cheshire. This measures 5 in. square and shows, in black and gold on a turquoise blue background, a Malaysian fan. The artist is Sharifah binte Datuk Syed Hassan of the Senior Methodist Girls' School, Kuala Lumpur. *Seasons' Greetings* is inscribed in four languages and for both types of card the sender's name and address can be inscribed for an extra charge of $2.40 per dozen. If you want this done then orders must be received not later than 30 November please.

Both types of card cost $4.80 per dozen including postage, and there is an order form in the Supplement to this issue of *The Planter*.

A savage attack on one of our members is reported from Sungai Rengam Estate, Selangor, where the manager Mr Donald Crump was awakened by two unidentified men trying to rob him. A fight took place in the bedroom and Mr Crump was run through the right upper arm by a weapon the frightening size of which can be deduced from the very serious injury he sustained. The blade made a 6 inch wide cut where it entered and about 2 inches where it emerged at the back of the arm. After several hours of emergency surgery at the University Hospital the severed nerves and tendons were rejoined and Mr Crump is up and about though with still limited use of the arm. We very much hope that he will soon be completely well and congratulate him on the way he handled a very nasty situation.

Both assailants got away and the domestic staff heard nothing. Mr Crump's two dogs, a Labrador and a mongrel were found drugged, and remained comatose for 24 hours.

This attack points up one very considerable disadvantage of sleeping, as does Mr Crump, in an air-conditioned bedroom. Not only are all but the loudest outside noises 'blanketed' from the sleeper, but the exhaust roar from the unit likewise overlays any slight sounds made by the intruder getting in. It is probable that Mr Crump's dogs have become so used to this noise at night that they are no longer able to hear small sounds at a lower level.

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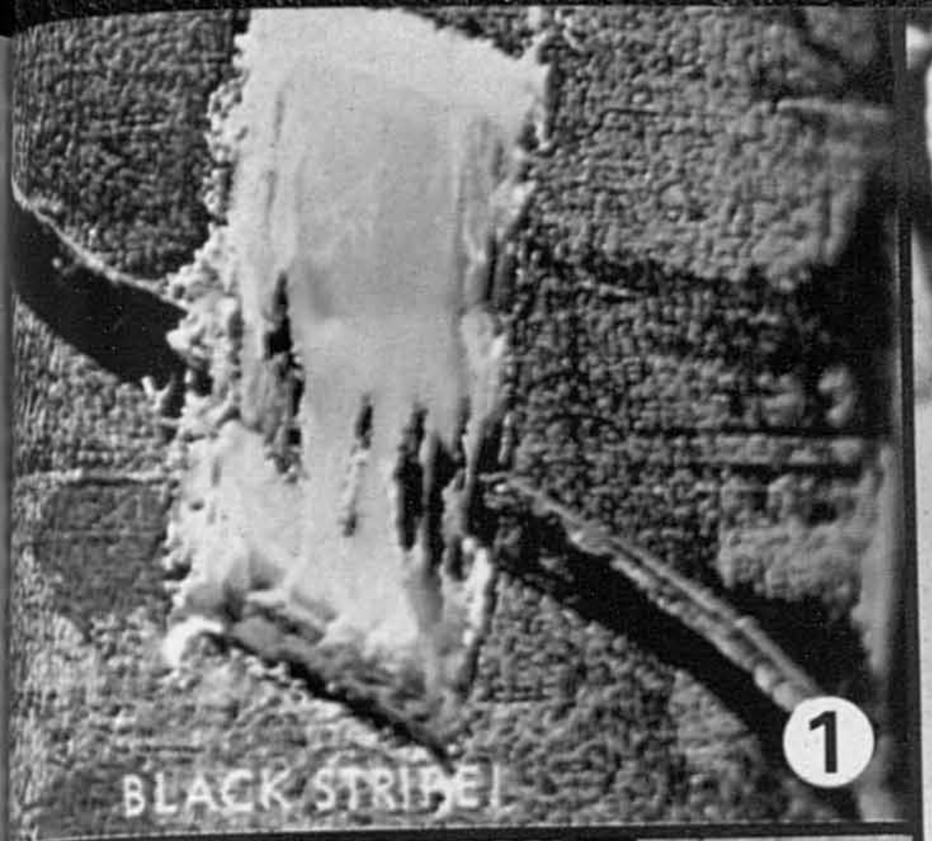

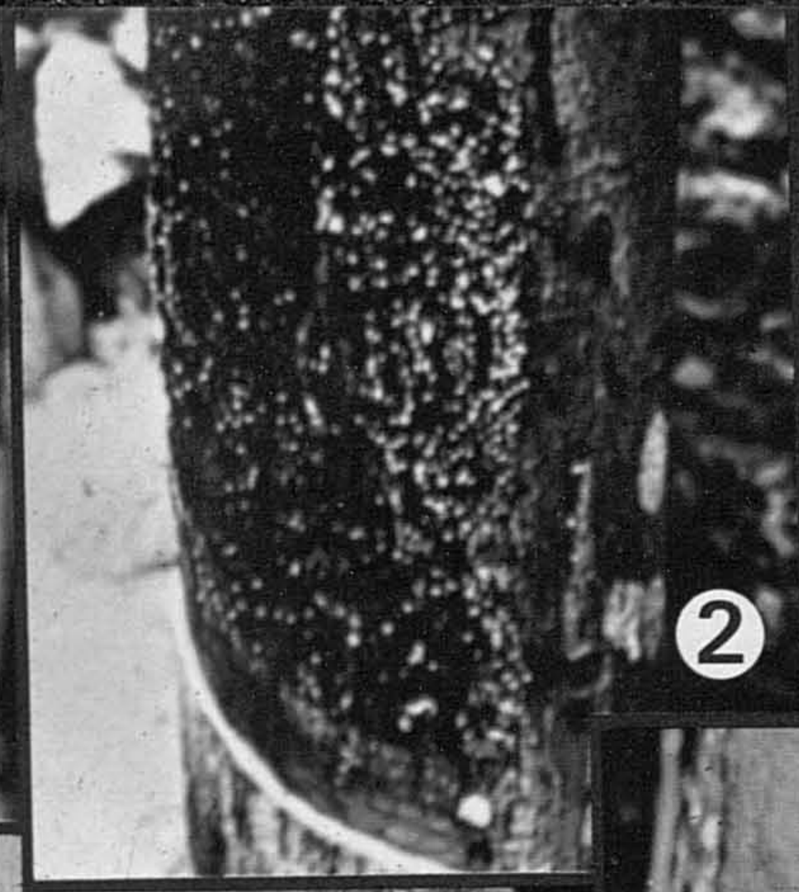

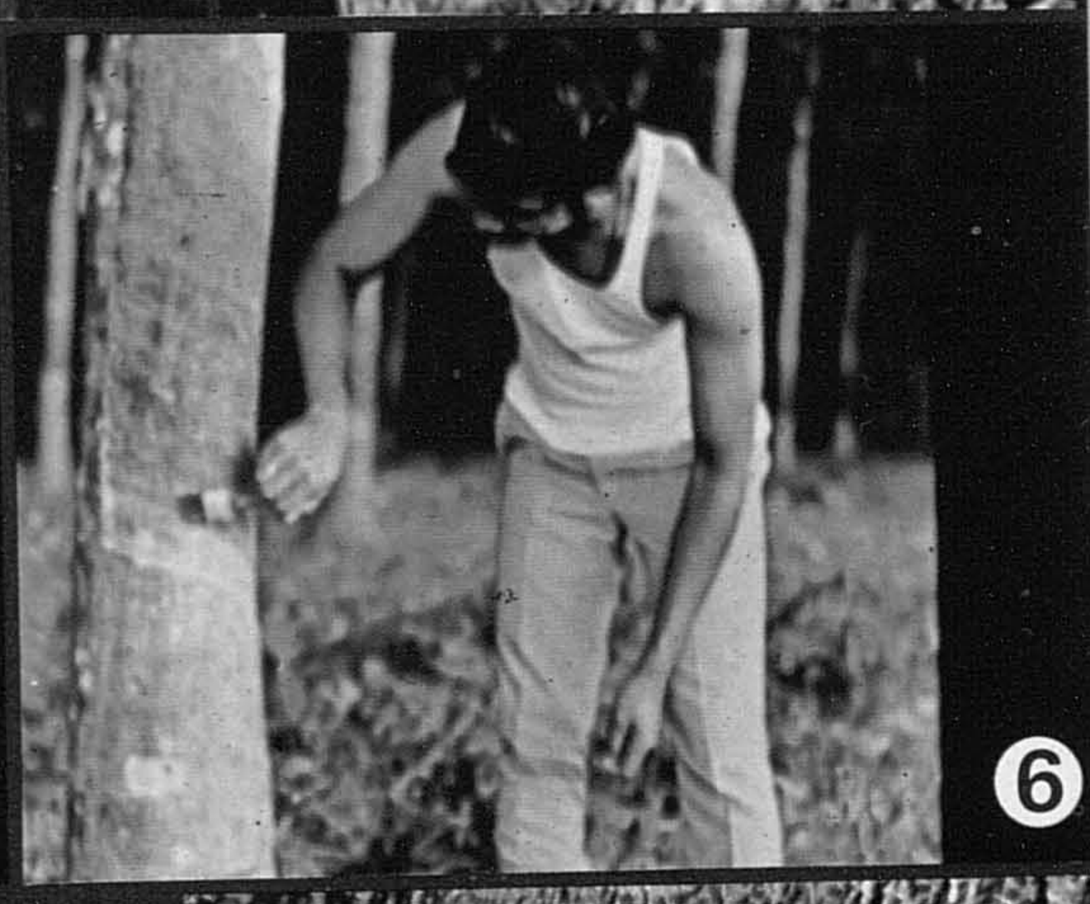

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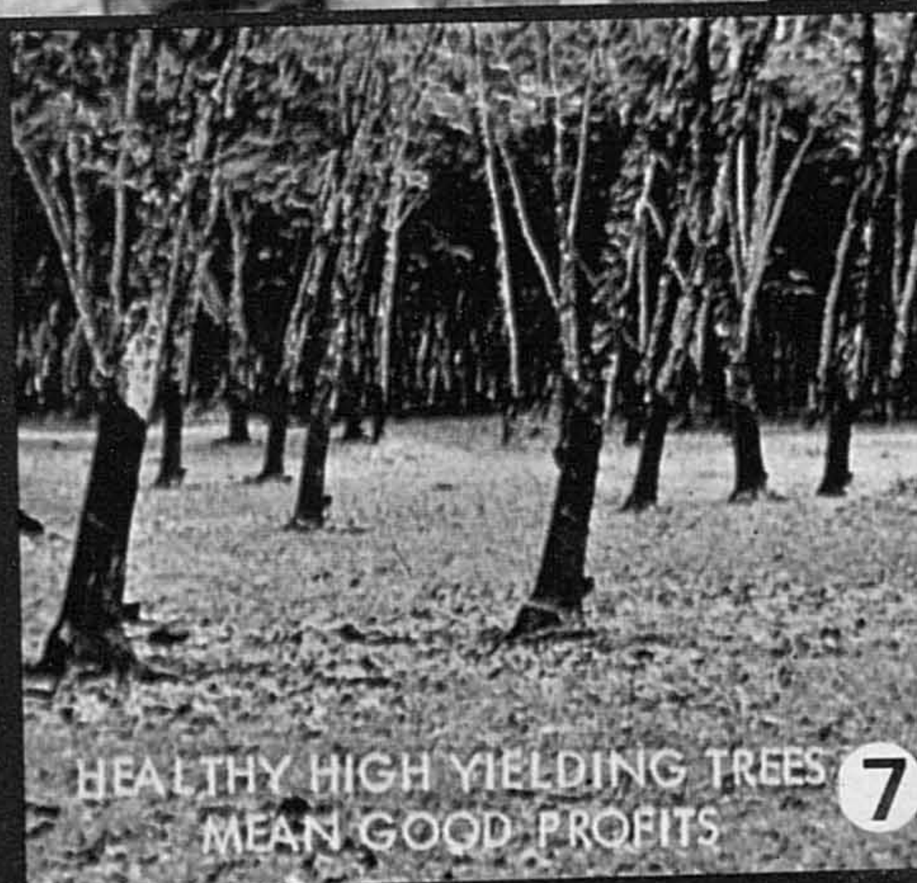

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We are now trying to find a tough, reliable watchman for Mr Crump, and if any reader knows of a good ex-Gurkha or other serviceman looking for a job, we would like to be informed.

The Labrador mentioned above, whom we hope has many more happy years ahead of him, (he is 5), has a long way to go before he can match the longevity of "Adjutant", a black Labrador gun-dog who was, according to the admirable *Guinness Book of Animals Facts and Feats*, 27 years and 3 months old when he died in 1963. His life-time owner was a Mr James Hawkes, a game-keeper at Revesby Estate near Boston in Lincolnshire. This is the greatest reliable age recorded for a dog. There is a less reliable claim of 28 years for an Irish terrier which died in 1951.

The Society's Hostel Project. Replies to the referendum sent to all Ordinary Members continue to trickle in, even though the closing date for their receipt (October 10) is long past. Not more than 35% of the 955 Members written to, have expressed their views, and most of these do not favour the project.

The ISP Annual Golf Competition went off very well. Played on the Seremban International Golf Club's attractive 9-hole course (and why don't they call them 'links' any more?) the event was well attended, with some good individual performances. Planters didn't exactly trounce the Agency Houses but they did beat them. Pictures and scores appear on another page, and we would like to record our appreciation of the welcome extended to the Society by the resident Club and of their very efficient administration. Incidentally they have ambitious plans together with the necessary land, for extending the course to a full 18 holes.

The monthly recipe did not appear on a detachable page last month as promised, but it does this month. From all accounts the series is proving popular and contributions are welcome from whatever source. Out of consideration for our 250 Life Members living in the U.K., who always relish a bit of noshtalgia, recipes listing ingredients likely to be obtainable there without much trouble. will obviously achieve a wider appeal. And when our Cantering Cooks run out of ideas there's always the editor's *Cod's Head in Aspic* which he is known to do rather well.

Taxis at Kuala Lumpur International Airport were the subject of a complaint in a sub-editorial we published last month. *The Malay Mail* quoted us freely—beneath an unhelpfully flippant headline—and a reply to our representations to the Tourist Development Corporation has been received. Their Director commends our traveller for the latter's correct handling of the situation and expresses the Corporation's gratitude to him for calling attention to the malpractice. The matter has been taken up with the airport authorities; not, it seems, for the first time.

One we missed. The *Punch Bedside Book*, just published, has a choice quotation from our own *Straits Times:*

> "During the last four days, plain-clothes policemen were sent to watch the dancers and many of them disregarded our earlier instructions not to strip and dance naked on the stage", said a spokesman.

And if we may steal another from the same book, this time from the *Birmingham Evening Mail:*

> Dr Colin Smith, Deputy Director of Education at West Bromwich said: "We have no hard and fast rules governing teachers' dress—but if a mistress turned up to teach in a bikini we would expect the headmaster to take her aside and point out where she had gone wrong."

House-breaking Aids read the advertisement in a Kuala Lumpur supermarket, and we hastened to inspect what we assumed to be the latest line in jemmies, skeleton keys and nylon ropes. Alas, a closer look revealed nothing more than various deterrents to dissuade your pets from doing their thing in the middle of the sitting room carpet.

Only here for the Bier is not the sort of headline usually found on the city page of one of London's more austere dailies. Their correspondent was reporting 'the grave news that one of Britain's biggest coffin-makers was entering the market'. In keeping with the occasion, solicitors to the share issue were Messrs Slaughter & May. The report stated that business was 'regrettably booming and that pre-tax profits for the year were estimated at £236 000 by dead reckoning'. 'Only a month after the Stock Exchange debut of Mothercare the report went on 'the Exchange can now boast that their investments range from Womb to Tomb'.

Heartening to learn that Zoo Negara continues to prosper. The 1971 Report by the council of the Malayan Zoological Society notes record gate receipts and for the first time the number of paying visitors exceeded half a million, over 55 000 more than the previous annual record in 1968. The amount received in donations was much higher at $119,502 compared with $85,934 in 1970. All this money qualified for the generous Government donation of $4 for every $1 collected by the Society who have now benefited by the full amount of $1 million following the collection of $250,000 from well-wishers. The zoo is now well in the black although overheads continue to increase and staff salaries, feeding, upkeep and maintenance are all costing more.

We quote extensively from the Report:

"Planning of exhibits for the new area continued rapidly and at the end of the year many features neared completion. The 22-acre site, which is divided equally into hill, slopes, and low lying ground will be fully used except for a 5-acre reserve portion in the north corner. Several acres were demarcated for a lion park into which 'safari buses' will be driven. A large complex of small mammal enclosures, most of them to be grassed and planted, will take the pressure off the existing primate cages opposite the office which currently house a range of other species."

"A steep site was selected for the future Orang Utan breeding centre so that the visitors can be at 'branch' level with the climbing animals. The enclosing wall is unobtrusively positioned lower down the slope and the animals will be seen against a back-drop of tree canopy which merges into the neighbouring hills. The visitors will look through plate glass which prohibits the projection of unpleasant missiles

from both directions, eliminates begging behaviour, and reduces the hazard of disease transmission to the animals."

"A severe loss was the death by natural causes of the cow giraffe which left the bull and two male calves. Efforts to obtain an early replacement have been held up by unacceptably high 'Conference' shipping freight rates. At the time of going to press it appears likely that an order for a female black rhinoceros, two cow giraffes and a few other African animals in a group shipment will justify the payment of the stipulated minima per shipment."

"The Society has long been aware of the need for a 'Children Zoo' or what is now popularly termed a 'Pets Corner'. Such an area started spontaneously by the Zoo office and now demands proper recognition and a home of its own. A site adjacent to the hospital has been chosen and it is hoped to incorporate a flexibility in the design which will allow children the opportunity to meet wide varieties of animals, yet offer the animals a choice of play or peace."

"The major project to be put in hand was Aquarium Negara, the budgeted cost of which was estimated to be $520 000, a figure which excluded the cost of the Rothmans Pavilion which the Malayan Agri-Horticultural Association generously agreed to donate to the Society. A 5-acre site, east of the main zoo, was selected with direct access to the main road and early in the year levelling etc. commenced. The massive task of dismantling the enormous structure, re-erecting it at Ulu Klang and converting it into Aquarium Negara has progressed at high speed and at 31 December most of the major construction work was completed."

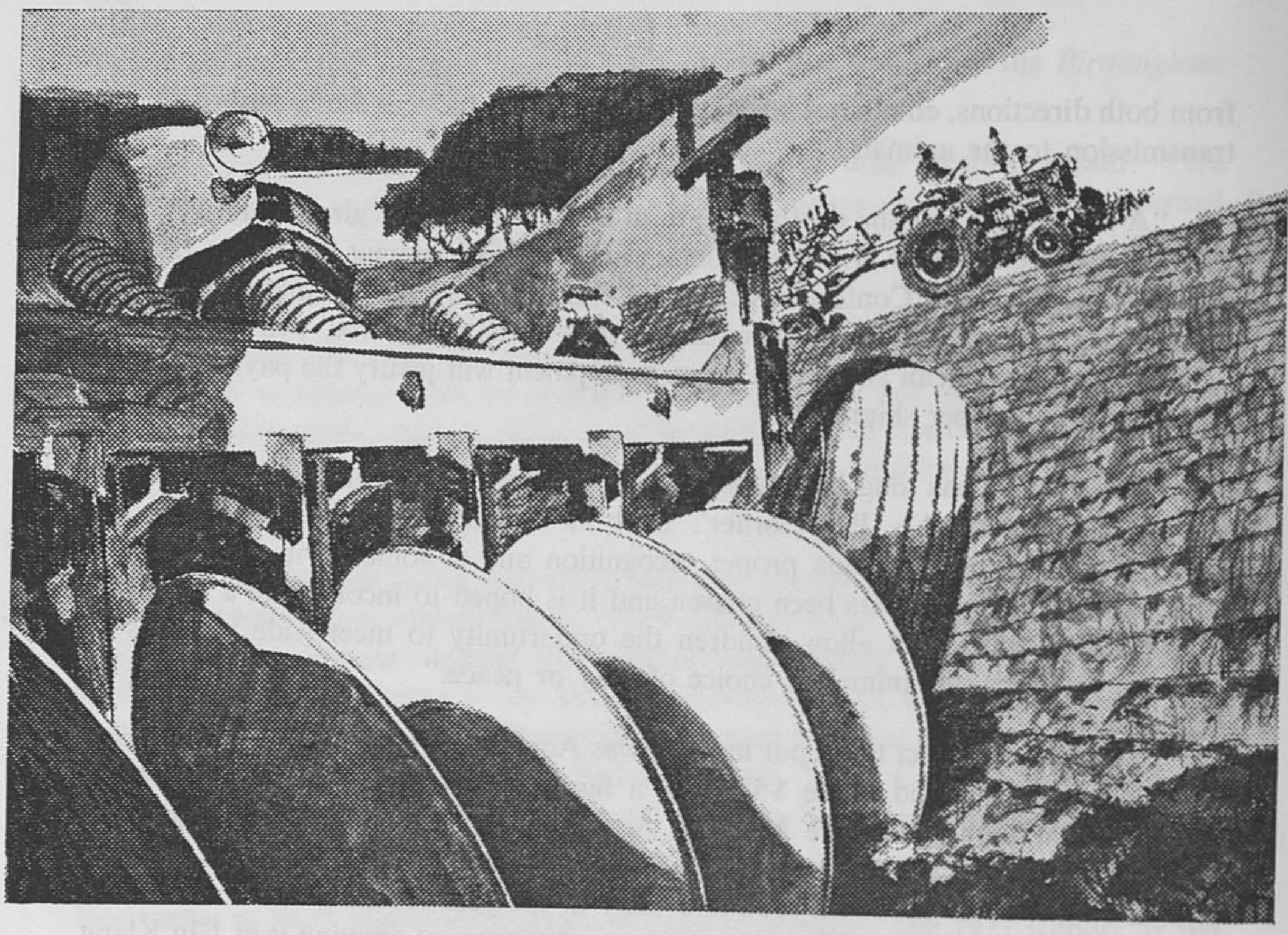
"Third on our list of major expenditures was the construction of the safari park, this is budgeted to cost $95 000 and at the end of the year $21 500 had been paid out in progress payments. Your Council believe that this park of five acres in extent will prove to be one of the biggest attractions to Zoo visitors. Work was also commenced on a seladang enclosure which is budgeted to cost $26 000 and will house, the first (to our knowledge) pair of these magnificent creatures to be kept in captivity. The Game Department are arranging for the capture of these animals and their arrival at the Zoo is expected sometime in 1972.

Other major works with the budgeted cost in brackets were: a sea lion enclosure ($26 000), small mammal enclosure ($40 000), new aviaries ($36 000), water, light, drains and roads in the area ($44 000).

Completed during the year and declared open to the public by our President, Y.B. Encik Mohamed Khir Johari on 28 August was the Orchid Garden the construction of which together with the collection of orchids cost $35 000.

All in all a sum of $404 568 was expended on development during the year and at the time of writing, work on all the projects enumerated above has either been completed or is in the last stages of completion.

The new area and the Aquarium Negara will be open by the end of 1972."



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Social and Personal

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Encik Ong Cheah Yee — Kedah/Penang

Examination successes

Surveying (written) Examination

25 August 1972

J L Anthony	(Selangor)	Passed
Andrew Ding Hong Sing	(Sabah-North East)	,,
Thomas Ong Hong Tong	(Negri Sembilan)	,,
Siow Heng Kin	(Lower Perak)	,,

Donations to Hostel Fund

P J Koshy, AISP	($100)
Maon bin Hj Dalip	($100)
Anonymous	($ 10)
Yee Teck Hsing	($ 50)
Hiew Fook, JP	($100)
P R Viswanathan	($101)
Anonymous	($ 50)
W H Morrison	($100)
Anonymous	($100)
Anonymous	($ 20)
D S K Das	($100)

Ineligible for membership

5599 Selvadurai, M.

On leave

4581 Inkster, T G B, SDA, "Benvue" 4, Kings Road, Grangemouth, Stirlingshire, Scotland.

5511 Morris, J M, "Brimfield", Lynwick Street, Rudgwick, Sussex, England.

4861 Sims, K J, c/o Mr & Mrs R C Sims, 69 Hunstanton Roaad, Dersingham, King's Lynn, Norfolk, England.

Returned from leave

4227 Barnwell, I M, AISP, Dusun Durian Estate, Banting, Selangor.

4853 Somasundram, K R (Senator), AMN, JP, Bukit Sidim Estate, Kulim, Kedah.

Change of address

5852 Ahmad Zaini bin Mohd Tahir, Tuan Mee Estate Group, Sungei Buloh, Selangor.

4941 Brown, G E M, Lanadron Group Estate, Panchor, Muar, Johore.

5782 Bridge, C J R, OBE, Lembaga Kemajuan Tanah Sarawak, P O Box 1433, Kuching, Sarawak.

3559 Connolly, L J, Plantation Agencies Sdn Bhd, P O Box 706, Penang.

4415 Cunningham, W McD, Highlands Estate, P O Box 203, Klang, Selangor.

2989 Collier, D R L Massy, 6 Royal Chase, Tunbridge Wells, Kent, England.

5875 Chai Hon Chee, 31 Pesiaran Bruas, Damansara Heights, Kuala Lumpur.

4830 Eastaugh, G C NDA, AISP, Kuala Selangor Estate, Bukit Rotan, Selangor.

5837 Goh See Hong, Pusat Latehan Tekam, d/a W/Pos Pusat Bandar Jengka, Temerloh, Pahang.

5521 Goldthorpe, C C, 11 Woodland View, Thurlstone, Sheffield, S30 6RQ, England.

5695 Joseph, P L, Lembaga Kemajuan Tanah Sarawak, P O Box 1012, Kuching, Sarawak.

4530 Johnson, R H W, BAL Estates Sdn Bhd, P O Box 135, Tawau, Sabah.

5814 Keane, P J, University of Papua & New Guinea, P O Box 1144, Boroko, Territory of Papua and New Guinea.

5570 Nair, K N S, Voules Estate, Segamat, Johore.

5493 Nair, N P, Sendayan Division, Port Dickson Lukut Estate, Port Dickson, N. Sembilan.

5278. Nicol, I M, Lambak/Elaeis Estate, Kluang, Johore.

4796 Silvester, R A, AISP, Bagan Sena Estate, Kulim, Kedah.

3973 Stephens, P R O, Glugor Estate, P O Box 1, Sungei Patani, Kedah.

4949 Sargeant, H J, Chembong Estate, Rembau, Negri Sembilan.

3798 Stuttard, G D, c/o Midland Bank, Henley-on-Thames, Oxon, England.

5591 Singh, Mukhtiar, Chin & Associates, 54-A Jalan Treacher, Kuala Lumpur.

5851 Tharmalingam, A, Nova Scotia Estate, Teluk Anson, Perak.

5806 Thomas, J S, 11 Jalan 4D, Ampang Jaya, Kuala Lumpur.

5320 Tan Han Chee, 60 Jalan Selangor, Petaling Jaya, Selangor.

5045 Tan Weng Chye, Peter, The Goodyear Orient Co Pte Ltd, P O Box 1712, Singapore 1.

4470 Wilkinson, A I, Firestone Plantations Company, Harbel, Liberia, West Africa.

4322 Walker, J A, Labis Bahru Estate, Segamat, Johore.

5425 Yapp Wui Hiong, Stephen, North Borneo Plantations Sdn Bhd, P O Box 333, Tawau, Sabah.

4789 Yap Thean Seng, Allagar Estate, Trong, Perak.

4954 Allen-Edmett, B, Gomali Estate, Gemas P O, Negri Sembilan.

5309 Visuvanathan, R K S, Selborne Estate, Kuala Lipis, Pahang.

New members

5899 Mohd Kamal b Abdul Salam, Sabah Land Development Board, P O Box 359, Tawau, Sabah.

5900 Menon, K A, Voules Estate, P O Box 506, Segamat, Johore.

5901 Rajah, Joseph, Seremban Estate, Sungei Gadut, Negri Sembilan.

5902 Nagedram, K, RRI Experiment Station, Sungei Buloh, Selangor.

5903 Ahmad Azly b Mohd Yusof, RRIM, Botany Division, P O Box 150, Kuala Lumpur.

5904 Nagalingam, P, RRIM, Botany Division, P O Box 150, Kuala Lumpur.

5905 Ooi Kiam Hak, Lendu Estate, Alor Gajah, Malacca.

5906 Singh, Gurcharran, Felda Regional Office, Temerloh, Pahang.

5907 Hainsworth, E, OBE, 255 Industrial Estate, Jurby, Isle of Man, U.K.

5908 Ong Si Teng, Raub Mining & Development Co Lt, P O Box 209, Raub, Pahang.

5909 Chandrasekharan, K, Fraser Estate, P O Box 102, Kulai, Johore.

5910 Tan Chong Suew, RRIM, Botany Division, P O Box 150, Kuala Lumpur.

5911 Vikkinerasa, R V, 34-D Jalan Scudai, Tampoi, Johore.

5912 Sowman, T J, Mosa Plantation, P O Kimbe, West New Britain, T P N G.

5913 Breure, C J, Dami Oil Palm Research Station, P O Kwalakessi, West New Britain, T P N G.

5914 Luckie, A T, Mosa Plantation, P O Kimbe, West New Britain, T P N G.

5915 Quinn, T W, Mosa Plantation, P O Kimbe, West New Britain, T P N G.

5916 Faith, D, Mosa Plantation, P O Kimbe, West New Britain, T P N G.

5917 Jakobs, H A J, 9 Kendall Street, West Pymbly 2073, New South Wales, Australia.

5918 Harper-Bill, P B, PNP–VI, Pabatu—Tebing Tinggi, Deli, North Sumatra, Indonesia.

5919 Chong Gong Gong, Federal Land Development Authority, Jalan Maktab, Kuala Lumpur.

5920 Marz, Hal R, 20 Bowmont Gardens, Singapore 15.

5921 Hor Tuck Fook, Tuan Mee Estate Group, P O Box 202, Sungei Buloh, Selangor.

5922 Wong Kai Choo, 78, Jalan 6/30C, Petaling Jaya, Selangor.

5923 Mu Chun Hain, North Borneo Plantations, P O Box 333, Tawau, Sabah.

5924 Murphy, T F R, Langkon Estate, P O Box 10, Kudat, Sabah.

5925 Nair, K P Gopalakrishnan, Langkon Estate, P O Box 10, Kudat, Sabah.

5926 Webb, B H, Faculty of Agriculture, University of Malaya, Pantai Valley, Kuala Lumpur.

5927 Ipkendanz, E W, Monsanto Far East Ltd, 116 Jalan Semangat, Petaling Jaya, Selangor.

Rejoined

5202 Enyong, V I A, Calaro Oil Palm Estate, Private Mail Bag 1042, Calabar, Nigeria.

Resigned

5232	Chew Wiman	(Overseas)
5785	Oung Cheng Hai	(Selangor)
5619	Sellappan, N	(Kedah/Penang)
5200	Lee Beng Hye	(North Johore)

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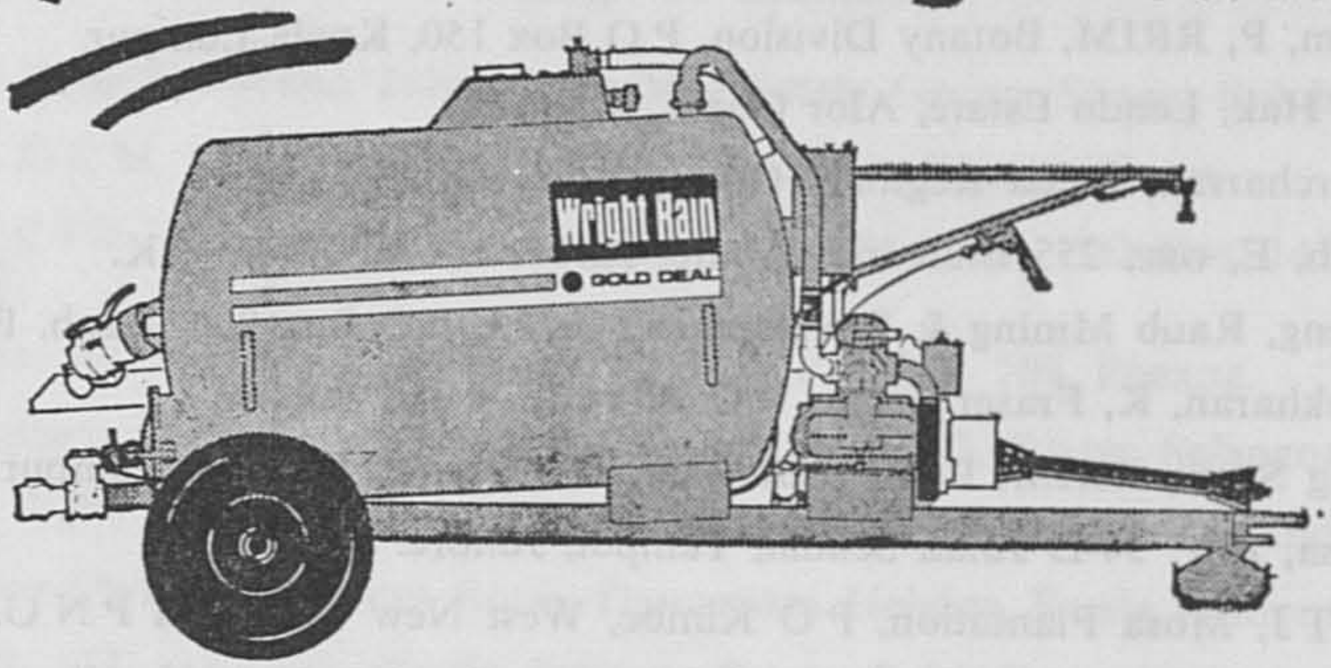

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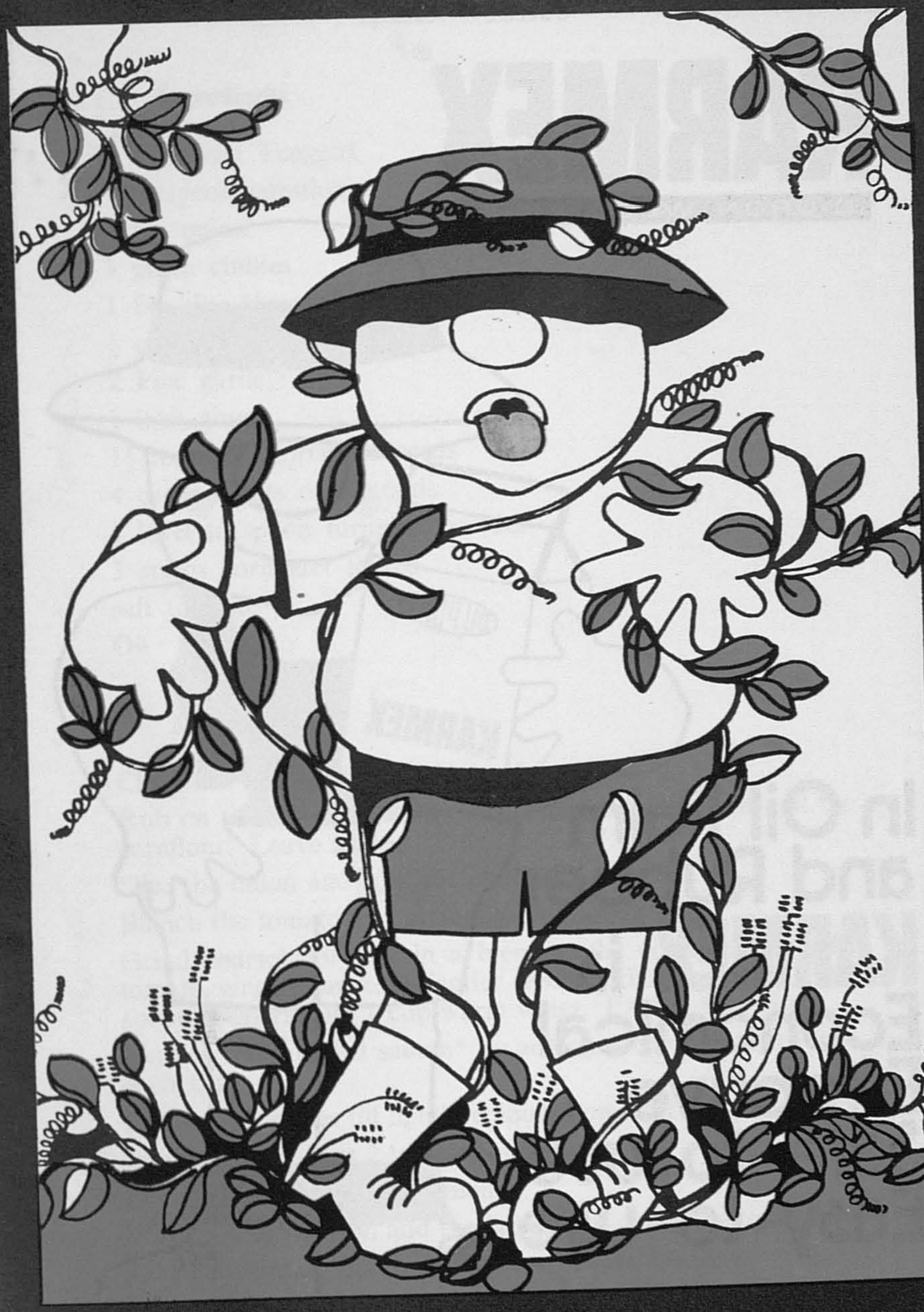

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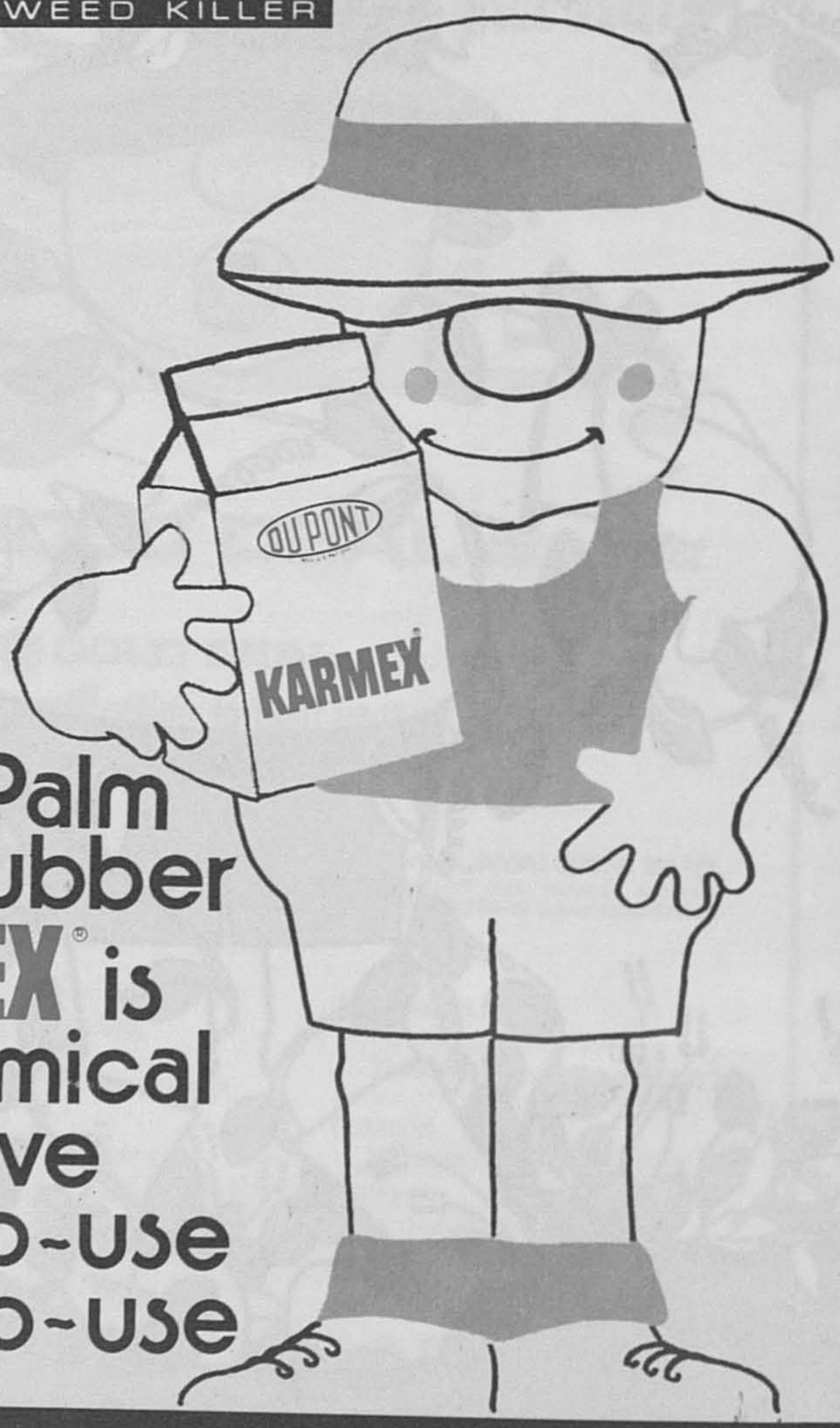

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Fish Mollee

Ingredients

1 kati Ikan Tenggiri
1 teaspoon cornflour
1 big onion
3 green chillies
1 big ripe tomato
½ coconut
2 Pips garlic
½ inch ginger
1½ teaspoon coriander seeds
4 cashew nuts or almonds
½ level teaspoon turmeric powder
3 sprigs coriander leaves
salt to taste
Oil

Method

Clean fish and slice into ½ inch thick pieces.

Rub on to the fish, ¼ teaspoon turmeric, a little salt and the cornflour. Leave aside.

Slice the onion and split the chillies in two.

Blanch the tomato and almonds. Remove skin.

Grind coarsely or mix in a blender, the coconut, almonds, tomato, ginger, garlic, coriander seeds, coriander leaves ¼ teaspoon turmeric and ¼ cup warm water. Extract the juice.

Extract 2nd and 3rd santan* by adding ¾ cup of warm water each time.

Fry the fish pieces till lightly coloured on both sides.

In a saucepan, heat 2 tablespoons of oil.

Fry in it the chillies and onion.

When it looks glassy, add the 3rd santan and bring to the boil.

Add 2nd santan. Keep stirring to prevent curdling.

When boiling add the fish and 1st santan. Bring to boil.

Take off fire. Be sure to stir the Mollee frequently throughout the cooking.

To garnish, slice 2 small onions thinly, fry till brown and sprinkle on top of Mollee just before serving.

Serve with rice.

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* milk pressings

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These roots were okay until the landslide.

But if soil pests had got at them, the tree would have been stunted: the size of a plant varies with the size of its root system.

Besides reducing yields, soil pests can waste fertilizer and may spoil crop quality and increase disease incidence.

We recommend **Aldrex 2** at two to four pounds to the acre as an economical soil treatment, effective for over a year against grubs, cutworms, termites and other soil pests.

Get more details. Remember: **if it's a chemical—or you think something like a chemical might help—call Shell Chemicals.**

For higher yields: aim low

Shell Chemicals

Some fungi cause disease. Blackstripe and Mouldy Rot in rubber trees. Stem Canker in cocoa. If let alone they spread. Fast.

Control these fungi and you control the disease. Acti-Dione does it. It is an anti-biotic fungicide. It's a localised systemic fungicide, acting on the infected plant tissues. The fungi cells are selectively destroyed by Acti-Dione. Fast.

But get more details from your nearest Shell office. And remember: if you need a chemical — or you think there may be a chemical that might help you — call Shell Chemicals.

Acti-Dione attacks fungi from the inside.

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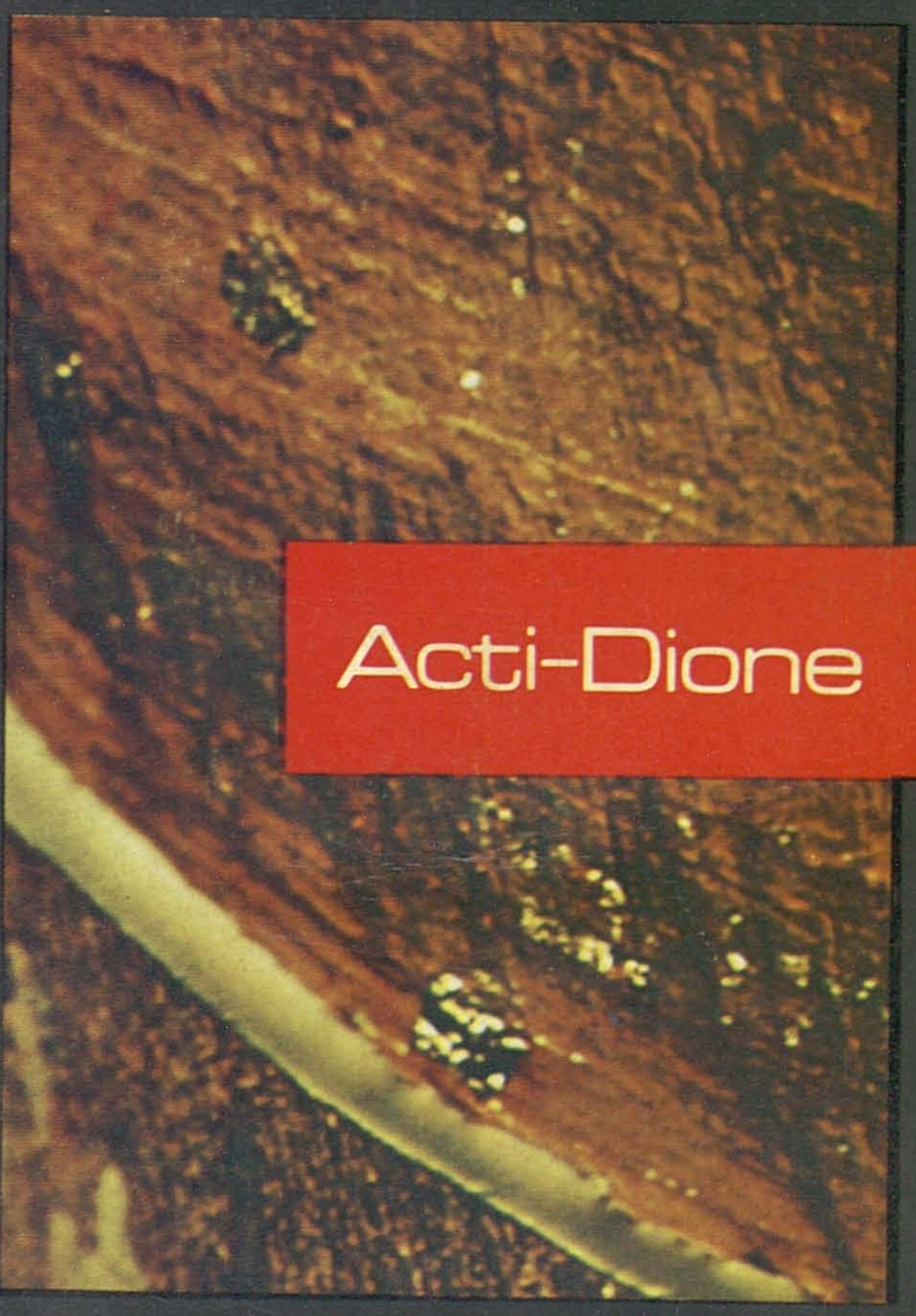
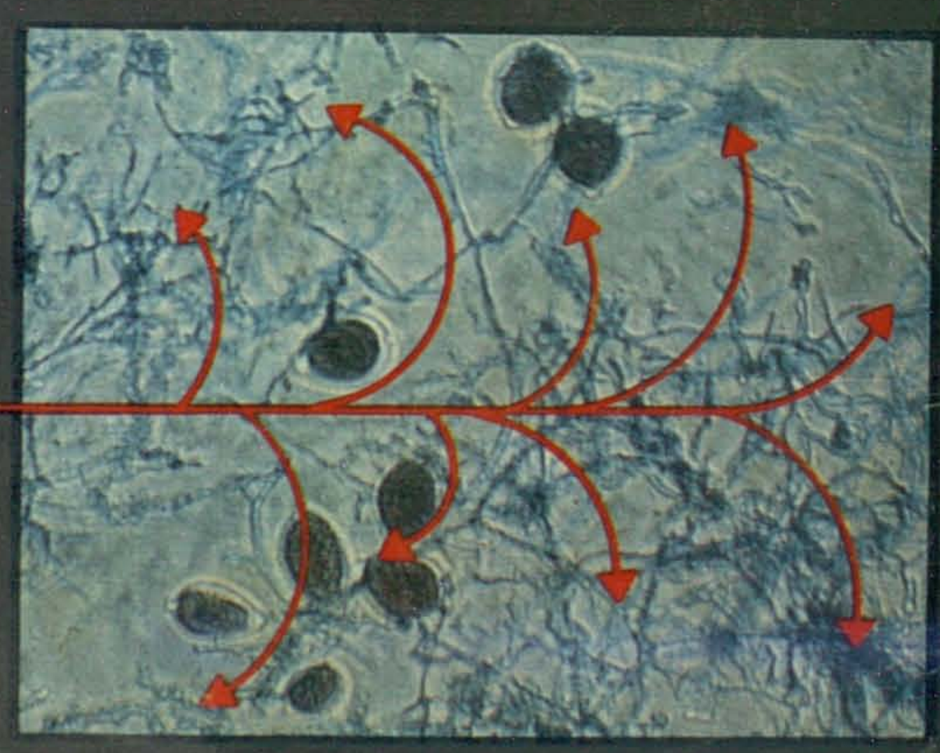
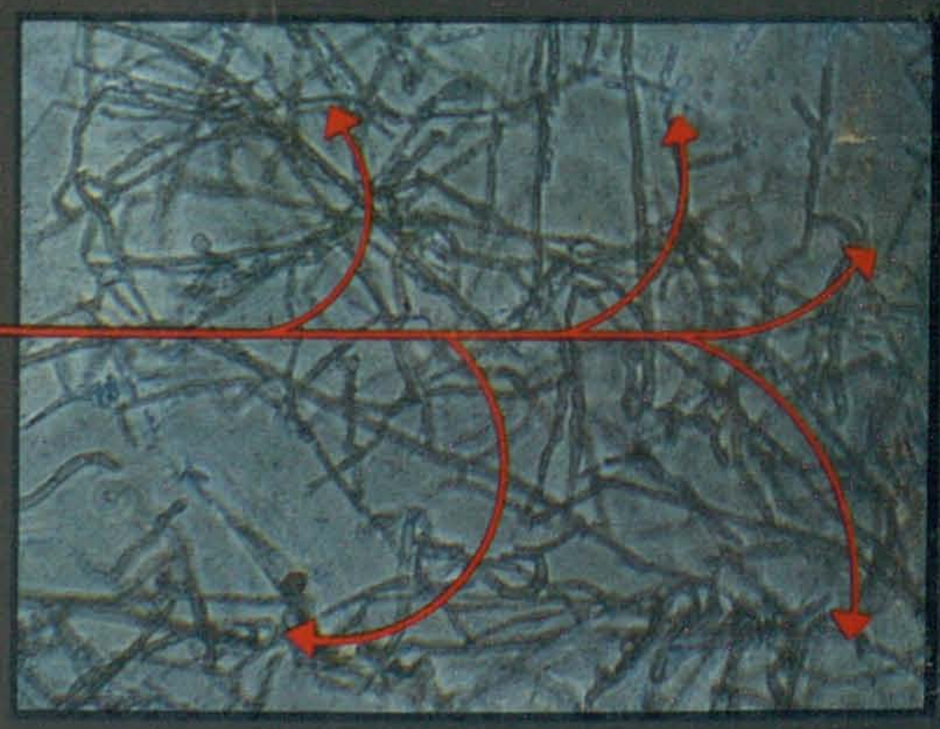


Acti-Dione



BLACKSTRIPE FUNGI—PHYTOPHTHORA PALMIVORA



MOULDY ROT FUNGI — CERATOCYSTIS FIMBRIATA

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